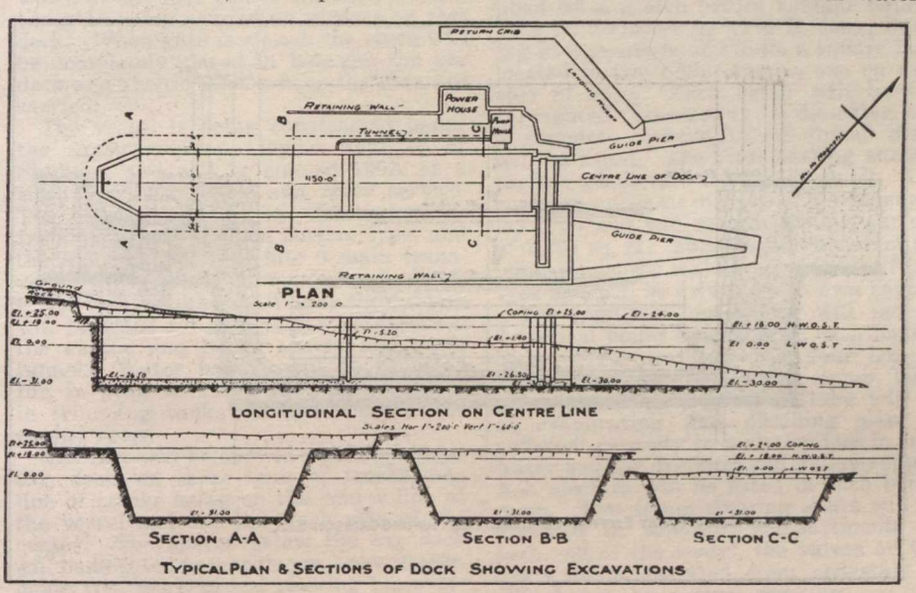
of 3,600 h.p. furnish the steam at 200 lb. pressure to run the three direct current turbo generators of 1,500, 750 and 300 kilowatts respectively, which furnish the current at 550 volts to run the pump and other motors. A direct current generator of 100 kilowatts at 220 volts, driven by a steam engine, will furnish the current for the lamps around the dock and in the buildings. There are 24 lamps of 500 watts, hung from poles around the dock. The poles are made of gas pipe, with the lower end set into sockets fitted with electric connections, and made removable in case of necessity. All electric wiring for lamps and motors outside of the buildings is placed underground. The approximate quantities of the materials in the principal items entering into the construction are:

Rock excavation above and below coping	342,000 c. yd.
Submarine rock excavation in channel	65,000 c. yd.
Dredging entrance channel	530,000 c. yd.
Concrete	100,000 c. yd.
Granite steps, altars and quoins	140,000 c. ft.
Steel beams, reinforcing bars and manhole covers	150,000 lb.
Cast iron for roller casings and sluice valves	125 tons
Cast steel for caisson rollers	65 tons
Gun metal for caisson roller and valves	4,500 lb.
Cast iron in keel blocks and bollards	990 tons
Forged steel spindles for rollers	11,000 lb.
Bricks for chimney and flues	345,000
Fire bricks	125,000
Cribwork in approach piers	63,300 c. yd.
Concrete in approach piers	13,300 c. yd.
Steel in rolling caisson	930 tons
Total weight in rolling caisson and machinery	1,125 tons
Steel in floating caisson	960 tons

The work was started in May, 1914. The concrete retaining walls on each side of the dock, specified to be built from the natural rock surface to elevation +24 and intended to prevent seepage through the filling, were completed during the season's work, as well as the cofferdam between the outer ends of these walls. Rock drilling in the prism of the dock was also carried on in the part not affected by tides. The largest part of the drilling was done by two well drillers, the holes being sunk down to grade and plugged for future blasting. The average depth of perforation for each drill was about 80 ft. a day, although as much as 130 ft. was done occasionally. Ten or 12 ordinary steam drills were also used on the work. The rock consisted of hard shale, irregularly stratified, at an angle of about 45°. Considerable rock slides occurred on the west side of the cut, which necessitated a much larger quantity of concrete for the dock wall on that side, also the use of rock bolts, to prevent the sliding tendency of this wall. Steam shovels and dump cars were used to remove the blasted rock, which was used for filling, wherever required, on the government property.

The cofferdam was built of timber cribwork, 20 ft. wide, sunk in an average depth of 1 ft. of water, at low tide, and built to the elevation of 3 ft. above high tide; a layer of concrete was deposited along the bottom of the outer face and this face was sheathed with plank. The floor and walls of the dock are built of concrete, the mixture being 1-3-5. All exposed faces are finished with a fine concrete of 1-2-4 mixture for a thickness of 6 in. The concrete for the walls and the floor was cast in alternate sections of approximately 30 ft., with expansion joints. All the cement used was subjected to a laboratory test; apart from other requirements the tensile strength was required to be 600 lb. a sq. in. after 27 days immersion, for neat briquettes, and 275 lb. a sq. in. for 1-3 mixture.

The steps at the top of the walls are built of granite, with treads and risers of 12 in.; the altars are 2½ ft. wide and consist of granite 12 in. thick, tailing 9 in. into the concrete. The caisson stops of both entrances and all culvert openings are built of granite. The floor is 5 ft. thick and finished level from end to end; the sides slope down 6 in. to the side gutters. The floor is provided with three strips of granite slabs, 18 in. thick, intended to receive the cast iron keel and bilge blocks. The middle strip is 10 ft. wide and level; the side strips are 9 ft. wide. In order to prevent the possibility of hydrostatic pressure under the floor and behind the side walls, a system of drains is provided, that will take the seepage water to the sumps. There are 12 stairways from the top of the walls to the floor of the dock, two at each end of the two compartments and two half-way between the ends of each compartment. Four timber slides, built of granite slabs, 18 in. thick, are provided alongside the last set of stairways. There are also 8 ladders, 4 on each side of the dock, that may be used to reach the floor. These are built with galvanized iron gas pipe, and set in recesses in the walls. The coping of the walls stands at elevation +25, or 7 ft. above high tide. They are provided with the ordinary cast iron bollards, set in concrete blocks, 60 ft. apart. There



Champlain Drydock, Lauzon, Que.

are 9 electrically driven capstans with 15 h.p. motors, 4 on each side of the dock and one at the head.

The keel blocks are each built of three pieces of castings; the middle piece being wedge shaped so that it may be knocked out and the block removed from under a ship, when in the way of repair work; the upper part of the top piece of casting is provided with a piece of white oak tenoned into the casting. All rubbing faces are planed true and smooth. The keel blocks are 4 ft. 4 in. long and 2¼ ft. high. On top of these are placed temporary hard wood timber blocks to obtain the required height above the floor. It had been intended to build bilge blocks, so arranged as to slide under the bilge of vessels. However, this was objected to by the British Admiralty, which insists on having all blocks made of the same pattern, so as to enable building a bed that will conform to the bottom of the vessel.

Caissons.—The outer entrance is closed by a rolling caisson built of steel and operated by an electric motor of 125 h.p.; the bottom is provided with two heavy scantlings of steel, resting on flanged rollers, 3 ft. in diameter, placed at 8 ft. centers. These are made of cast steel and bored to receive bronze bushings. The forged steel spindles, 4 in. in diameter, are also provided with bronze sleeves. The cast iron casings, containing the rollers, are set in the concrete altars, on each side of the caisson berth and chamber. At an elevation of 15¾ ft. above the sill of the dock the rolling caisson is provided with 6 culverts, 42 in. in diameter, closed by sluice valves that are operated from the upper deck by a 15 h.p. electric motor, driving a longitudinal shaft provided with the necessary gearing; and, by means of clutches, any one or all of the valves may be worked. The culverts are used for flooding the dock. The caisson is divided horizontally by a water-tight deck at the elevation of 23½ ft. above the bottom, forming the ballast and tidal chambers. As the tide rises the sea water comes on this deck through valves in the outer face of the caisson, which are kept constantly open during the summer to prevent the caisson from floating. A sufficient quantity of ballast is provided, so that the total weight of the structure resting on the rollers is approximately 150 tons. During the winter, when the dock is not in operation, the lower or ballast chamber of the caisson is filled with water, which is kept from freezing by a constant jet of steam. The tidal chamber is then kept dry by closing the valves. The caisson is closed and opened with heavy chains, supported on altars on each side of the caisson recess, and passing over pulleys worked by worm gears connected with the motor. The top of the caisson is provided with a folding bridge for light traffic across the dock; as soon as the caisson starts to open, the apron and railings of the bridge are automatically lowered to allow them to pass under the flooring over the caisson recess. The middle entrance of the dock is closed by an ordinary floating or ship caisson. When in place, the deck is used as a bridge across the dock. This caisson may also be used to close the outer entrance by placing it immediately outside the rolling caisson, where the necessary stop is provided for it. This, however, will be necessary only in cases of repairs being required to the submerged parts of the rolling caisson. These caissons were built by the Dominion Bridge Company, under a subcontract.

Boilers and electric power.—Six water tube boilers of 500 h.p. and two of 300 h.p. furnish steam at 200 lb. pressure to