On account of the uncertain weather conditions prevailing during the performance of the work on the last 800 ft. of the dam, and the possibility of further floods, a condition not unknown during the winter (the river in February, 1914, increased from 9,000 to 64,000 cu. ft. per sec. in a short time), every effort was made to expedite the work; and as a result, the unwatering, preparation of foundation and the placing of 3,300 cu. yds. of concrete were done in 46 days. Concrete was placed, on the average, at the rate of 160 cu. yds. a day, and the distance transported from the mixer to the forms was from 400 to 1,200 ft.

Concrete Materials and Placing

Two mixing plants were installed, one adjacent to the power house, serving that building and the forebay walls as far as the railway crossing, and the other near the end of the stop-log section of the dam.

In addition to these, a mixer was operated for a short time on the east bank of the river and supplied concrete for the side wall, also a short section of the dam at that point.

The two mixing plants were identical in construction and equipment. A steam-operated Smith mixer of ¾ cu. yd. capacity was located underneath the charging floor at the foot of the hoisting tower by which the mixture was hoisted and deposited into a distributing hopper having a capacity of 2 cu. yds. Two of these were in place, one at the top of the tower for distribution by a chute and the other at the foot for delivery into buggies for transporting the concrete to work not served by the chutes. Sand and gravel were used for aggregate. Some crushed stone was used with these in the power-house work.

The aggregate was contained in a bin at the back of the mixing plant, the material being delivered to the charging hopper above the mixer by chutes.

Sand and gravel were brought in by rail, and to deliver these materials into a stock pile as close to the work as possible, an extension of about one-quarter of a mile was made to an existing spur from the railway main line. From the stock pile the material was transferred to the bin at the mixing plants in 1 cu. yd. side-dump cars, operated by cable from a hoist at each mixing plant, the return being by gravity.

The cars were charged from loading bins placed adjacent to the stock pile. These bins were about 30 ft. long with a capacity of 30 cu. yds., and were elevated sufficiently to permit the cars to travel underneath, the loading being



POWER-HOUSE AND ENTRANCE TO FOREBAY

controlled by slide gates in the bottom of the bin. A ramp constructed of 2-in. plank on a timber foundation was placed between the bins and the stock pile. The material was conveyed up this to the bins by a scraper, similar to the ordinary grading scraper but of heavier construction, operated backwards and forwards by cable from a doubledrum hoisting engine. This worked very satisfactorily and the whole operation was controlled by the hoist runner. The scraper was adjusted so that it would trip automatically at the edge of the bin and the only attention the apparatus required was the moving of the back block from time to time, in order to keep the scraper working close to the face of the pile.

Concrete was mixed in the proportions of one of cement, three of sand and five of gravel or broken stone for all mass work, and proportioned 1:2:4 respectively for building walls, beams, columns and for the top finish of the dam. Samples for testing were taken from every car of cement and all cement used was in conformity with the standard of the Engineering Institute of Canada.

With the exception of the mass work around the draft tubes and scroll cases in the power house, which was poured direct from the hoisting tower through chutes, the distribution of concrete was done in buggies and cars.

Throughout the length of the dam above the stop-log section, the concrete was conveyed in Hudson, steel, Vshaped, side-dump cars of 1 cu. yd. capacity. These operated on a track of 24-in. gauge laid on a light trestle built along



SPEED RING AND SCROLL CASE

the upstream side of the dam. The track had a slight downward grade away from the loading hopper. Turnouts were placed at short intervals.

During the cold weather the temperature of the concrete mixture was brought to a point which would ensure its reaching the forms before freezing, by heating the waterused in mixing, also the sand and gravel. The latter was heated in the stock pile, steam pipes fitted with nozzles being introduced into the face of the pile and the whole covered with tarpaulins at night. As a further precaution against the concrete freezing after reaching the forms, these were thoroughly steamed before each lift of concrete was placed.

No Apparent Seepage

The concrete in the forebay walls and the dam was placed in sections 30 to 50 ft, in length. To key the adjoining sections, the bulkheads in between were provided with keystone-shaped boxes 12 inches deep, placed vertically for the full height of concrete. The number of boxes placed varied with the thickness of the section formed, the spacing generally being 3 ft. centre to centre. The junction between the various sections acted as an expansion joint and, in that portion of the spillway having a tunnel through it, these opened up during the cold weather. In order to prevent seepage through to the tunnel, these joints were caulked with oakum followed by cedar strips. The water has since risen, submerging the work, and from an inspection no seepage is apparent at these points.

Any water which may find entrance into the tunnel is taken care of by a drain emptying into a 10-in. tile pipe laid on the bed of the forebay and passing through the mass concrete at the power house into the tail race.

Forms were constructed of 1-in. dressed lumber, supported by 3 x 4-in. studding and waling. Studding was spaced 24 ins. and the waling 30 ins. centre to centre. The forms were held together by No. 20 gauge band iron, 34-in. in width, placed at each spreader.