THE STAVE FALLS HYDRO-ELECTRIC PLANT OF THE WESTERN CANADA POWER CO.

THE second largest producer of hydro-electric power in the province of British Columbia at the present time is the Western Canada Power Co., Limited. The British Columbia Electric Railway Co., Limited, leads with some 112,500 h.p. developed in three plants—3,000 h.p. on Vancouver Island at Goldstream, 25,000 h.p. on the Jordan River and 84,500 h.p. at Lake Buntzen, Burrard Inlet. The Western Canada Power Co. is at present developing 26,000 h.p. at Stave Falls, about six miles north from the junction of the Fraser and Stave Rivers. At this site it has under construction at the present time an addition of equal capacity. It has storage rights to the extent of 50,000 h.p. in Stave Lake,

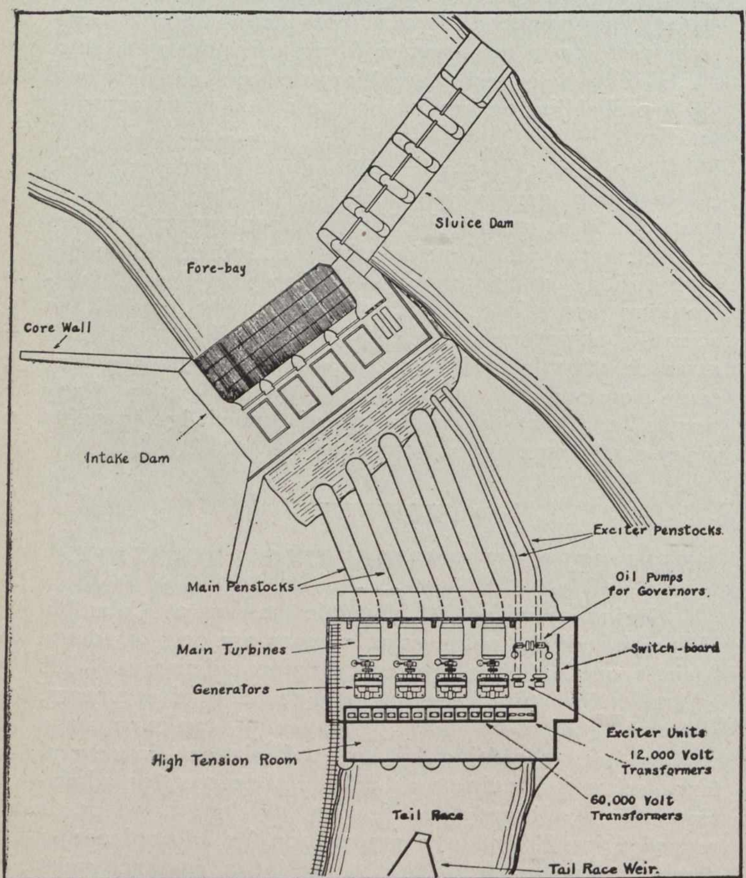

Fig. 1.—General Plan of Power House and Intake.

and rights to develop a second power site of 50,000 h.p. at the mouth of the Stave River.

The initial development was commenced in 1910, and the first installation, consisting of two 9,000 kw. units, was put into service in January, 1912. This installation was described in *The Canadian Engineer* for February 15th, 1912, and March 20th, 1913. The entire development, however, forms the subject of a very comprehensive paper to be read in Montreal before the Canadian Society of Civil Engineers on October 7th. The author is Mr. R. F. Hayward, chairman of the Vancouver branch of the Society, and general manager of the Western Canada Power Company. When the company determined, in 1909, to undertake the development, Mr. Hayward was made chief engineer and manager. Accordingly, it has been under his careful guidance that the enterprise has been carried to a successful issue.

The paper under consideration strongly brings out the principles essential to power development, *viz.*: (1) Far the most important consideration in western development is the determination of the conditions governing the amount of storage capacity required for the economical development of the watershed. (2) Until this determination has been made, no power plant plans can be intelligently laid out. (3) When this determination has been made it will nearly always be possible to lay out a progressive plan of development so that the unit cost of the initial plant does not bear too high a proportion to the unit cost of the complete development.

In illustrating and emphasizing these points the author necessarily dwells in great detail upon the preliminary investigations of the river and watershed. The present company purchased the property in 1909 from the Stave Lake Power Company, formed in 1899. Proceeding at once with the contemplated development, questions of location, topography, rainfall, run-off, flood discharge and storage were fully investigated, and are accordingly described in detail in Mr. Hayward's paper. The calculation of available power and of the economic height of the dams are also dealt with. We extract the following notes concerning the constructional features of the development:—

Generating Plant.—The hydraulic conditions governing the choice of turbine units are as follows:—

Maximum head—reservoir full	120 ft.
Mean head	110 ft.
Minimum head—reservoir empty	100 ft.
Maximum variation in tailrace level	2.5 ft.
Maximum velocity of water in penstocks	8 ft. per sec.
Mean flow to be utilized for generating power	3,000 c.f.s.
Maximum flow to be utilized for generating power	5,000 c.f.s.

The power house was laid out for four turbines, each to develop 13,000 brake h.p. under mean head; with a penstock 14 ft. 6 in. diameter. The general arrangement of the plant is shown in plan and elevation in Figs. 1 and 2. The turbine chosen was of the double horizontal Francis type, with central discharge, running at a speed of 225 r.p.m., and enclosed in a cylindrical flume with penstock connected axially. Had this plant been designed three or four years later the vertical type of single runner Francis wheel would, without doubt, have been adopted, not only on account of its higher efficiency, but because it would have made possible a very material saving in the cost of the power house. The turbines were built by the Escher Wyss Company of Zurich, Switzerland. In them there is no intermediate bearing, the shaft (14.2 inches in diameter) being stiff enough to need no support between the outer bearings, thus removing the obstruction of a middle bearing to the discharge of the water in the draft tube.

The casing is 18 ft. in diameter and built of ¾-in. steel plate with very heavy forged steel flanges. It is divided along the horizontal diameter, to admit of easy erection and repair. The end plate of the casing is of cast steel designed to withstand a total thrust of nearly 1,000 tons which may come upon it when the governor suddenly shuts the gates, under full load and head. The runners are 63 inches in diameter, and built of steel plates cast into cast steel hubs. The bearings are water cooled, the larger one being 15¾ inches in diameter.

The draft tubes are built in concrete to a carefully designed expanding section commencing with a circle 10