Volume 21. Toronto, August 31, 1911

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The Canadian Engineer

An Engineering Weekly.

THE ADAMELLO WATER POWER STATION

In 1907 a company was formed to develop the water power in the Province of Breseia from the Adamello mountain group. Messrs. Escher Wyss & Company, who were responsible for the construction of the pipe line and turbine installation on the site finally adopted, have recently issued a pamphlet, abstracted from a paper by Director K. Zodel, read before the Zurich Society of Engineers and Architects, describing the Adamello Power Station.

The development is in two parts The upper station, with a net head of 3,000 ft., is the one we have dealt with in the following abstract. The intake works is at Lago d'-Arno. There is a shaft sunk down to the pressure tunnel that runs to the penstock chamber, this tunnel being about 4,900 ft. long and roughly 70 inches in diameter. Here the tunnel connects with a surge shaft designed to regulate pressure surges in the tunnel. This surge shaft is nearly 23 ft. in diameter and is carried 45 ft. above forebay level—

Fig. 1—Inside View of the Isola Power Station.

total height of surge shaft being 230 ft. At 300 ft. beyond the surge shaft the water enters two steel penstocks through which it is carried to the power house, at Isola. These penstocks gradually change from 2 ft. 9 in. diameter at connection to tunnel, to 1 ft. 9 in. diameter at Power House. The thickness of the metal at power house, where the static pressure is 3,055 ft., is 1¼ in., a thickness just possible to weld satisfactorily with the water-gas process. In order to prevent freezing, since the plant is under load only eight hours of the day, the line of the pipes was located to secure a covering of earth of at least 6 ft.

The top section of the pipe line, down to the point where the static head reaches about 640 ft., consists of riveted pipes made in 20 ft. lengths in the shop. For the lower portion of the line, pipes of the same length, lap welded by water-gas, were used. These pipes were connected by an overlapped double riveted sleeve joint to a pressure head of 1,800 ft., and for the remainder of the line down to the power house were provided with flange joint. These latter have a welded-on flange end and with a recess containing a wedge-shafted groove to receive rubber packing. The two ends are pressed together by loose flange rings. All pipes were tested in the shops to one and a half times the working pressure and kept at this pressure for one hour, during which time the weld joint was thoroughly hammered; all pipes showing signs of sweating were rejected. The velocity in the pipes varies from 6½ ft. per sec. at the top, to 13 ft. per sec. at the power house.

Very special care had to be taken in the design and construction of the distributing pipes connecting to the power house. Both pipe lines are laid alongside each other as far as the middle of the power house wall, when they are joined together by a semi-circular bend, so that the lower turbines are fed from the second pipe round this bend. Sluice valves are arranged in such a way as to enable either pipe line to be closed at any time and the turbines to be run from the other; these valves are hydraulically operated. The flange bolts of the horizontal pipes near the power house have to withstand a considerable stress, since the hydraulic pressure acting on the cross section of the two pipes produces in each a thrust of 280 tons. A partial relief was provided for these joints, without interfering with their longitudinal motion during contraction and expansion, by a hydraulic piston acting on the semicircular bend from the last masonry foundation block at the end of the pipe line. The resulting relief amounts to about 61 tons. The semicircular bends and the special T-pieces which connect to the turbines are made of tough steel castings. Upon completion of the erection, each pipe line was filled with water and tested by pumps to one and a half times the working pressure. They were perfectly rigid and water-tight.

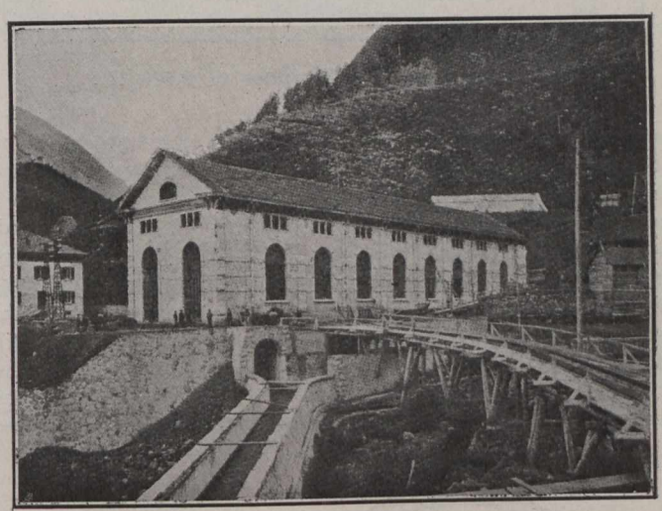

Fig. 2.—Outside View of the Isola Power Station.

The power house of the Isola central station has been built for receiving seven generating groups of 6,500 h.p. output each; its internal width measures 41 feet, with a length of 209 feet. The three-phase generators, built by Brown, Boveri & Company, of Baden, deliver current at 12,000 volts direct from the machines down to the transformer station at Cedegolo, which steps up for the long distance transmission to Milan. The switchboard arrangements at Isola are therefore, comparatively simple. Beside the main generator units, there is an exciter set of 500 h.p., and also an exciter