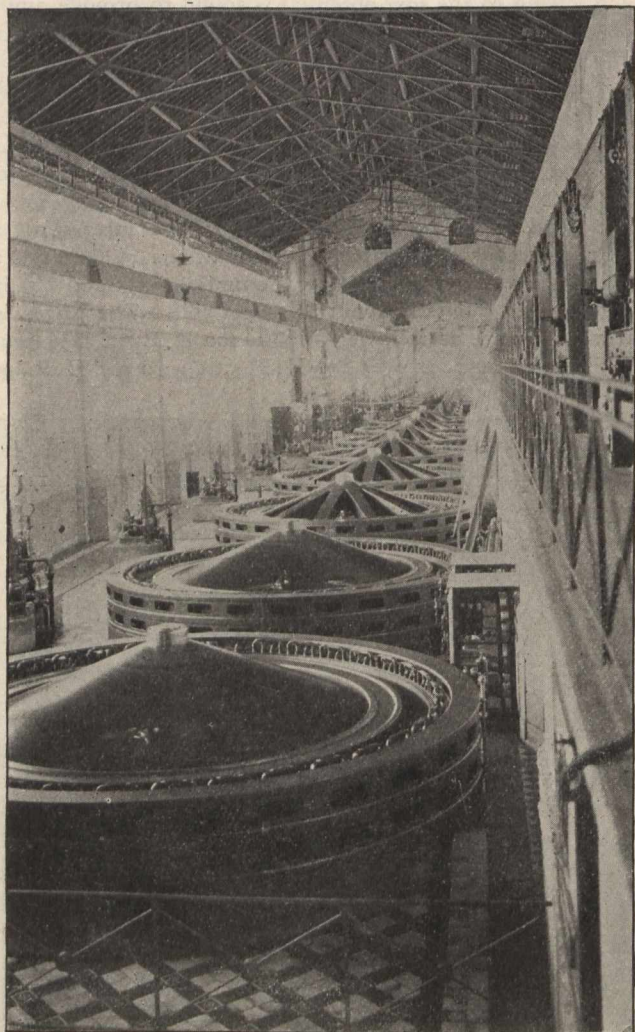


est, not only because of some of the constructive engineering features, but because it must come into competition with steam in the heart of a coal producing district.

The generating plant is situated about 20 miles west of the city, in a narrow valley at a high elevation. The available water from the river in continuous flow is upwards of



Lyons: Interior of Generating Station on the Rhone.

2,000 cubic ft. per second under normal conditions; but by means of a storage reservoir the natural flow is increased during dry periods. The working head varies between 65 and 78 feet, depending upon the water level in the head (storage) reservoir. The head is secured by a dam in the gorge about 100 feet total height and 370 feet long on the crest, which is curved upstream; the dam is of concrete and contains about 50,000 cubic yards. The water thus impounded forms a reservoir about 5 miles long and about $\frac{1}{8}$ mile broad on the surface.

The power station is built as a part of the dam on the lower side, as shown in the sectional sketch, and the penstocks, 5' 2" diameter, are carried through the dam proper directly from the reservoir without any intermediate forebay. The spillways for high water, are situated one at each end of the dam, either side of the power station.

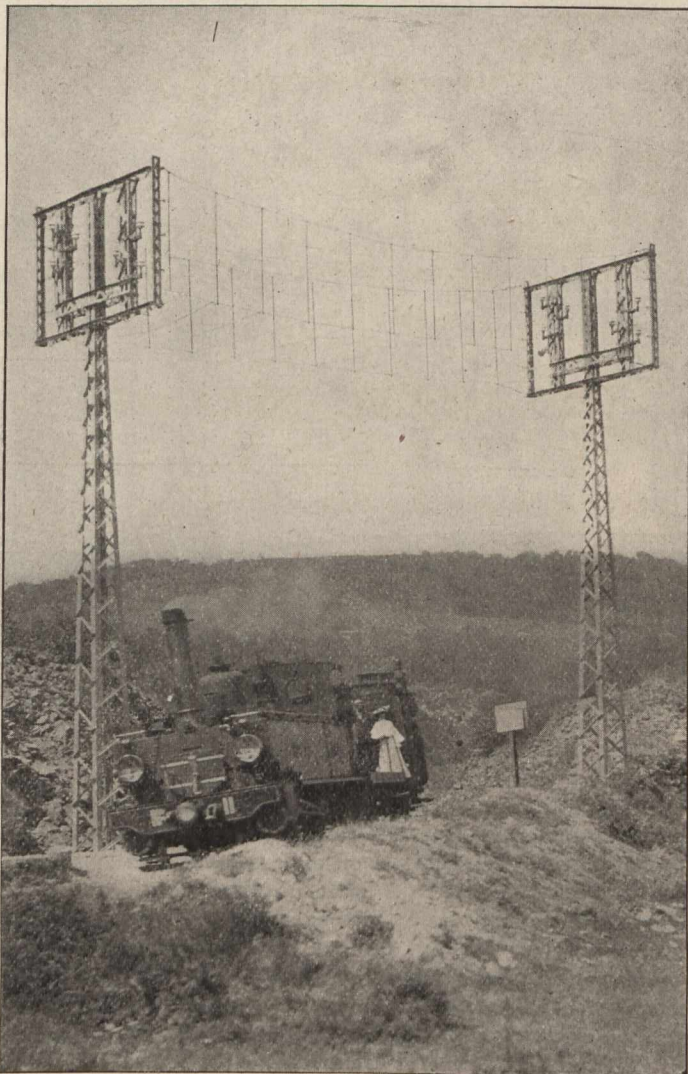
The turbines are of horizontal shaft, double, spiral, Francis type, directly connected to the generators, and have two draft tubes. They are rated at 1,200 H.P. under 65 ft. head (considerably too small for the capacity of the generators) and are said to attain an efficiency of 76 per cent. at full and 80 per cent. at three-quarters load. The governors are of the same general type as at Lyons, with about the same refinement. All the hydraulic apparatus was constructed by Escher Wyss & Co.

The generators are three phase of 1,000 kilowatts capacity wound for 1,000 volts, at 50 cycles, and revolve at 333

R.P.M.; they are claimed to have an efficiency of 94 per cent. at full load. They are built and installed by the Societe Anonyme Westinghouse of Havre, who also supplied all other electrical apparatus. The station is designed for six units, but at the present time only three are installed, with two exciters.

Switchboards are arranged so as to operate the whole station in parallel, or so as to make any combinations of units, and in a general way, are identical with the latest practice of the Westinghouse Company. A feature of station detail, is the admirable isolation of circuits, and of other means of preventing shorts and maintaining continuous operation. The transformers from 1,000 to 2,000 volts are oil cooled 375 kilowatts each, with 97.7 per cent. efficiency at full load.

The transmission line about 20 miles in length, to Clermont-Ferrand, is of special interest, as illustrating some of the latest French practice. The pressure is 20,000 volts and the two circuits now erected with copper wires of 8 min. are each designed to carry 2,500 kilowatts with a loss of about 7 per cent. The line follows a tolerably straight course over the mountains and is most substantially built with structural steel towers about 40 ft. high, set in concrete and normally spaced about 330 ft. apart. The insulators are carried on built steel framework and wires on one circuit are spaced about 34" apart, the circuits being separ-



Transmission Line: Clermont-Ferrand, Railroad Crossing.

ated so as to permit repairs on one while current is on the other. The insulators are of a special pattern similar to those used on the Paderno-Milan line, the main line being two-piece, six petticoat. At railroad crossings special wire cradles are erected, as shown in the accompanying view.