

steady. In addition to the stand pipe relief, there are automatic relief valves on each turbine, which are also fitted with hydraulic servo-motors operating the distributors and compensating valves, thus shunting the turbines and maintaining a nearly constant flow in the main flume. The attendants say that the normal variation in level in the stand-pipe when operating is about 6 inches.

The generators are by Brown Boveri & Co., of Baden, 1,000 k.w revolving field 3,000 volts, direct connected, and with the switch-board and transformers from 3,000 to 26,000 volts, present no especial features. The transmission lines are described above.

Gavet Station, Romanche River.

The Romanche River has distinctive features, which are remarkable. Its flow is very small, in dry weather being only about 300 cubic ft.; normal for about 9 months about 700 cubic ft., and flood discharge about 6,000 to 9,000 cubic ft. per second. Its descent is very rapid, hence high heads are the rule in the seven plants situated within the 12 miles of its course. These plants aggregate nearly 40,000 horse-power, and are used for various purposes; mainly in electro-chemical industry. There are several carbide of calcium works, and at Livet, 24 miles from Grenoble, is the celebrated electric steel works of Keller Leleux & Co. At Livet is located also the municipal plant, generating light and power current for Grenoble. The transmission line of the latter is unique, for it is constructed with wood-concrete

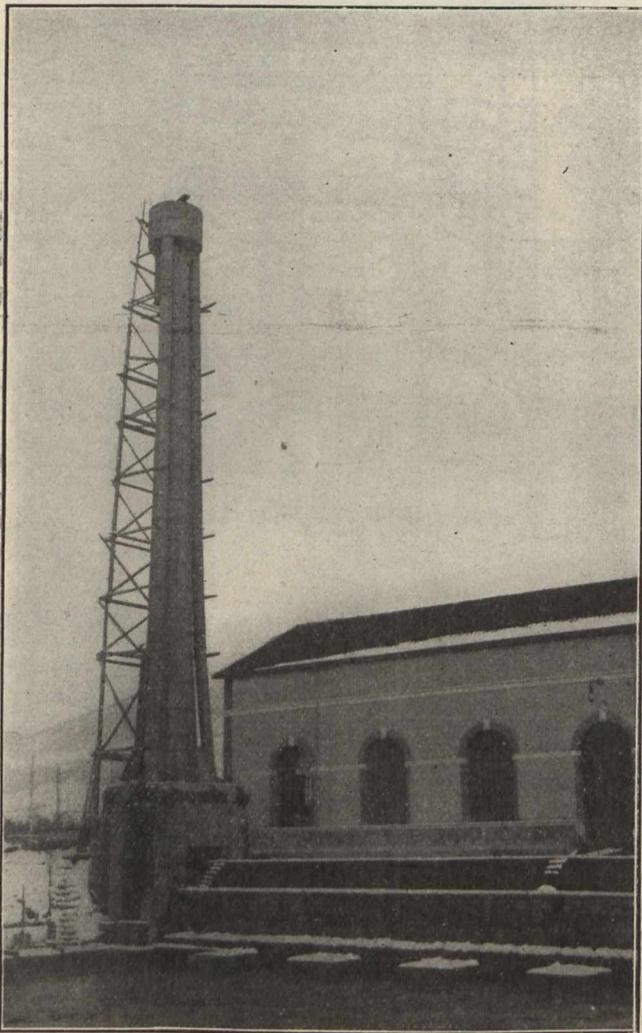


Fig. 5.—Terminal Overflow Pipe, Champ Station.

poles, that is, thin straight cedar poles encased in an envelope of concrete from 1 to 2 in. thick, which in the three years of operation appear to have given entire satisfaction. A careful examination of these revealed no serious cracks and it has occurred to the writer they might be tried with success in Canada, notwithstanding the cold weather conditions.

The Gavet Station, just completed, is situated about 8 miles above the Champ Station, or 16 miles from Grenoble. It also is owned by the Societe Grenobloise de Force et Lumiere, and commenced operations about March 1st, 1906. There are now three units installed, with a total output of about 5,000 horse-power, and provision for doubling this capacity. The low water period of the river, however (about 3 months), gives only about this amount. The power will be used for manufacturing; both mechanical and chemical.

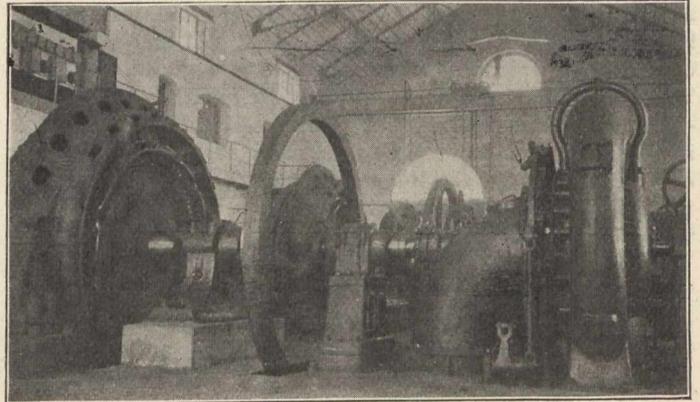


Fig. 6.—Interior Gavet Station.

The headworks are very ingenious, and a type of all plants on this river, which floods quickly and carries large quantities of gravel, etc. The head dam consists of piers and buttresses carrying two steel stony gates (counter-balanced), each about 30 ft. wide and 12 ft. deep, capable of being operated by hand by one man. In front of the dam is a weir parallel to the stream, with its crest about 2 ft. below the top of the gates; behind this is a settling basin having a sluice at the lower end and having a second similar weir on its opposite side. Water, after passing the first two weirs, enters a second elongated basin, having, at the lower end, a third sluice, and, in the side, the head screens leading to the head race, which is provided with a simple gate about 12 ft. wide, 10 ft. deep. This scheme offers two stony and two secondary sluices for normal flood water and permits the passage of abnormal floods over the whole; at the same time it provides settling or catchment basins for gravel. The flume to the generating station consists of a tunnel driven in the rock cliff about 10 ft. square and 7,000 ft. long.

The tunnel terminates in a small covered forebay high up the face of the cliff above the station, having outlets for two penstocks and one spillway. The penstocks—one of which is now installed—follow down the cliff, and are 7 ft. diameter by about 500 ft. long, and each branches to the three main and two exciter units at the rear wall of the station.

The station is of rubble stone, having a generating room, commodious switch-board gallery, wire ducts, transformer and arrester rooms. The writer had the pleasure of visiting the plant on February 14th with the consulting engineer, M. Poissonas, of Geneva, who pointed out many of the new features. On this occasion the units were started on their first long run, for the purpose of drying out the generators and transformers.

Each turbine develops 2,000 horse-power working under a head of 190 ft., and they are of the horizontal shaft, single spiral Francis type, built by Picard Pictet & Co., of Geneva. The distributor gates are swivel style, with an actuating gate ring carried on arms fitted with springs, to positively take up lost motion. The governors are by the same makers, arranged with a new device on the fly balls, to stop petty vibrations. The main shafts have fly wheels (see Fig. 6) and Zedel flexible leather link couplings.

The generators are by Schneider & Co., Champagne, revolving fixed type, three phase, 4,000 volts, 231 amp. per phase. The transformers step up to 26,000 line voltage the same as at Avignonet, with which this station will at times be run in parallel, 24 miles distant. The line is at present carried on wooden poles.