

a wall from the upper end of the station upstream about 1,000'-0", forming with the shore a canal about 100'-0" wide, the upper end terminating at an intake provided with gates, thus permitting of the unwatering of the turbine inlets. In the same manner a training wall was inserted in the lower river, parallel with the station and about 50'-0" distant, forming a separate tail race. In order to further increase the head in the summer by slightly lowering the tail water, the ingenious scheme was adapted of placing the openings in this wall and creating an outward draft toward the main river, due to the high velocity of the latter.

By the new intake arrangement the first line of defence against ice, debris, etc., is now far upstream from the

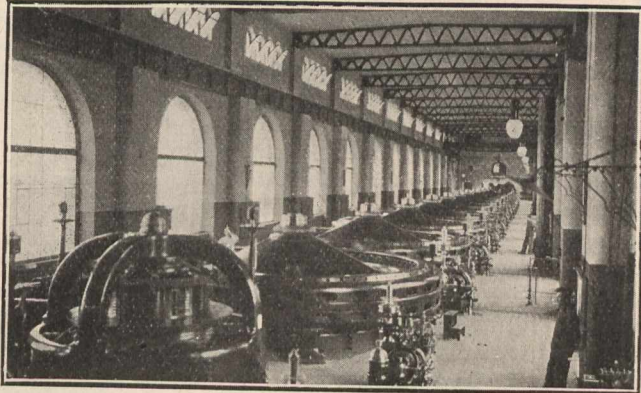


Fig. 5.—Beznav: Interior of Generating Station.

power house, instead of in a congested forebay in front of the building, an arrangement which has contributed in a large measure to the recent success of the plant, in securing continuous operation.

The generating station is 450'-0" long, and 41'-0" wide, and accommodates 15 vertical type power units and three exciters, as well as a complete oil pumping and filter plant, a workshop and offices. All the building foundations and other works are built of concrete, resting upon sandstone ledge.

Of the fifteen units, ten are of relatively modern design, having been installed in 1899. The turbines, by Escher Wyss & Co. and the generators by Brown, Boveri

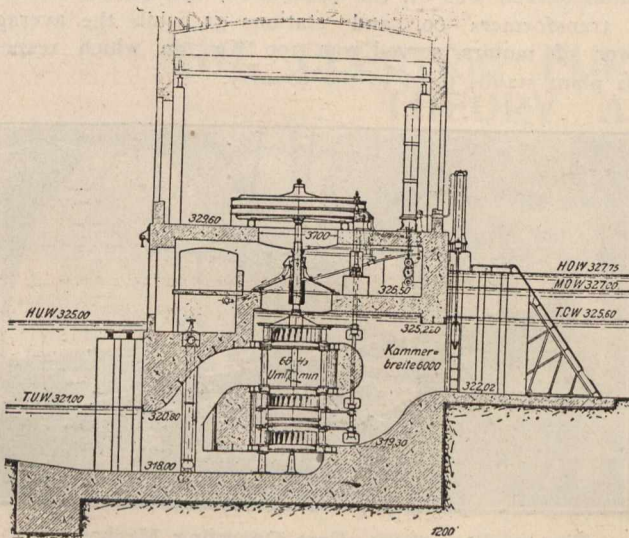


Fig. 6.—Beznau: Section through unit.

& Co. These turbines are multiple-centrifugal, or outward discharge type, having four runners on each vertical shaft, specially designed for the high speed of 120 R.P.M. to obtain from 900 to 1,200 H.P., depending on head. They are designed so as to secure the best distribution of available water at any time by the variations of water areas, and are moreover arranged so that five of them will be used with the high winter head, and the other five with the low summer head. These turbines have ordinary thrust bearings, three in number, and a foot bearing, all undue weight being supported by water pressure acting on the turbine wheels themselves. Regulation is done by oil pressure gov-

errors, actuating cylinder gates through vertical rack and pinion mechanism. Fig. 3 shows a section through one of these units.

With the five turbines of earlier type, however, when there is a high head, that is when tail water is low in winter, only the lower pair of runners is in operation, which when full open, develops 1,200 H.P. In summer with high tail water level and low head, both pairs are in operation, when each delivers 400 H.P. These turbines run at 80 R.P.M., and are conical in general shape with three guide rings to ensure even distribution of water to runners. The

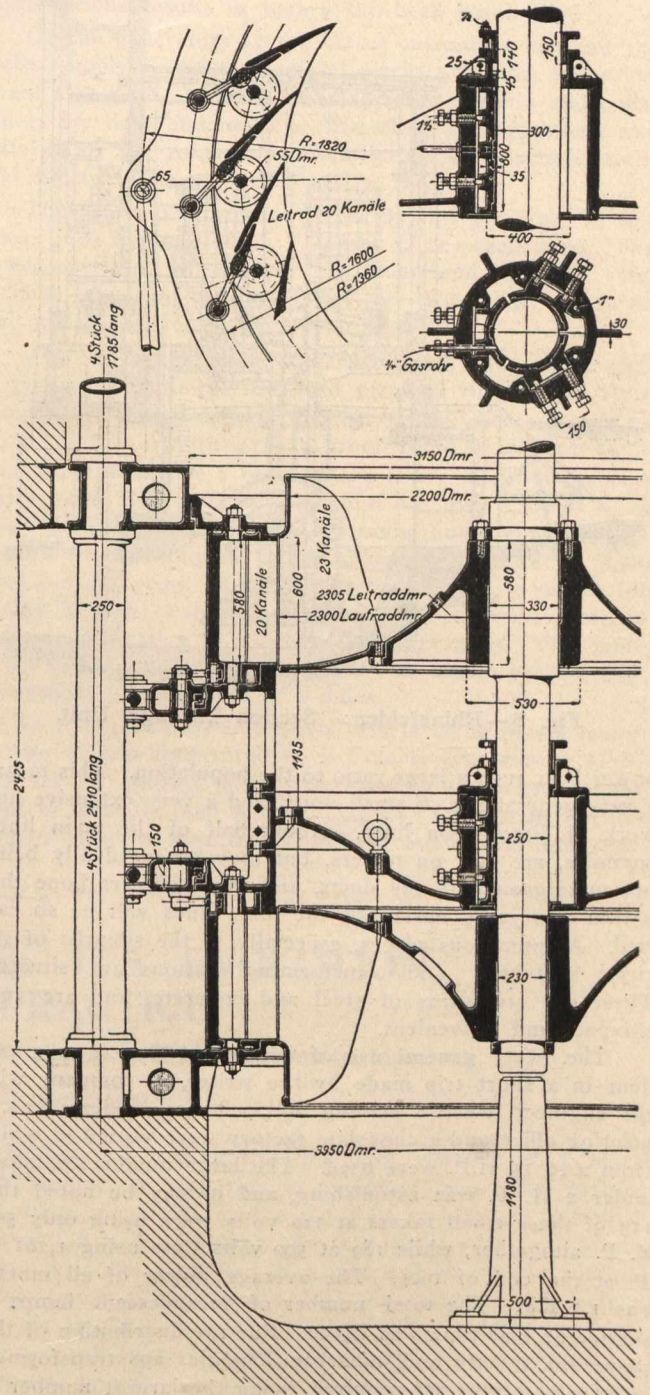


Fig. 7. Beznau: Details of Turbine Unit.

weight of the revolving parts is balanced by high pressure oil acting on the collar thrust bearings.

A peculiarity of these turbines is in the method of governing by a hydraulic servo motor, which provides that when the upper pair of wheels is not working, only the lower gates are operated, and when both pairs are working, regulation is obtained by the gates of the upper pair only. The wheel gates are moved in a rotary direction about the shaft by means of rocker and link motion.

The electric generators installed at the different times are of the same general umbrella type, but are of various windings. Eleven units are two-phase, 750 Kw., 2,750 volts at 45 cycles, five of which (earlier) have fixed fields, and six have revolving fields. Three units are two-phase, 5,000