BIG BEND WATER POWER DEVELOPMENT OF THE FEATHER RIVER IN CALIFORNIA.

One of the largest hydro-electric power developments in the West has been partially completed by the Great Western Power Company, of San Francisco, Cal. The development is on the North Fork of the Feather River, a branch of the Sacramento River, which rises in the Sierra Nevada Mountains in the Northeastern part of California. The power house is at Big Bend, 18 miles above Oroville, and 160 miles from San Francisco, where most of the power is used.

At Big Bend, as the name would indicate, the river makes a long detour of a horseshoe shape; the distance around the bend is about 11 miles, but the distance across the neck of land is only 3 miles. The natural fall in the river in this distance is 413 ft. By means of a dam at the upper end of the bend the flow of the river is diverted into a pressure tunnel 3 miles long, across the neck of land, to the power house at the lower end of the bend where the total fall in this length of the river can be obtained. Here there are at present 4 units installed, each of 15,000 horse-power or 60,000 horse-power in all. The station is only one-half the size to which it will ultimately be built, but the tunnel is large enough for 4 more units.

In a paper before the Brooklyn Engineers' Club Mr. H. P. Rust describes the Big Bend power development in detail. An abstract of the paper follows:

Big Bend Development.—The development consists of a concrete diverting dam 40 ft. high, which will finally be raised to 130 ft. in height above the original water level. This dam turns the flow through a concrete lined pressure tunnel three miles long. Part of this tunnel is an old mining tunnel, formerly used to drain the river bed around the bend, which has been enlarged and lined. At the outlet there is a riveted steel header pipe securely concreted into the end of the tunnel. This branches into four smaller penstocks down the side of the canyon and connects with each of the four turbines in the power house below. The end of the harder pipe is turned up the hillside to a level 35 ft. higher than the crest of the dam and forms a surge pipe, or vent, and prevents any excessive pressure of water hammer in the tunnel due to quick closure of the turbine gates. The problem of the development was a peculiar one and there are several conditions which make it unlike any other in the West. First, there was the old mining tunnel which had to be used. This had a steep grade and a fall of 70 ft., too much to be wasted by using a gravity tunnel, so this necessitated a pressure tunnel. A new tunnel or extension was necessary from the exit of the old one in Dark Canyon to the main river, 3,400 ft. long, to obtain all the head available with the shortest possible head-race. With a pressure tunnel and pipe lines, all enclosed, the quantity of water flowing could be quickly changed, thus allowing for changes in the load on the generator without having to waste water over spillways, as would be necessary with a gravity conduit, in which the flow would have to be constant nearly all the time.

The pressure tunnel allowed the use of a high dam at the intake to increase the head and to form a balancing reservoir to carry daily peak loads or store water over Sunday. With such a reservoir no water need be wasted on account of any load factor which may be obtained for the plant, and the average flow during the day could be stored when the load was light and used when the demand for power was at its greatest. By means of the reservoir and pressure tunnel the amount of water which could be obtained from the low flow in the river is increased from 50 to 60 per cent.

The chief disadvantage of a pressure tunnel in such a case is the difficulty of taking care of the water hammer and providing for close regulation, but by special precautions afterwards described this may be safely taken care of.

This design necessitated engineering and construction work of a high character, much more so than is customary with most power plants in the West.

In order to get the plant started as soon as possible and cheapen the first cost, only half the power was first built and the high dam has been deferred. But the tunnel has been made large enough and all connections provided so that the power house may be doubled and four more units installed without interfering with the operation of the first installation.

Construction Plant and Camps.—The main problem before the railroad was completed, as far as the work, was transportation. This had been promised for early in the summer of the first year's work, but the railroad engineers also had their trouble and it was not in operation as far as the power house until the following spring. During this time all supplies and plant had to be hauled 20 miles from Oroville. About 25 miles of new roads were built into the different camps and the saw mills.

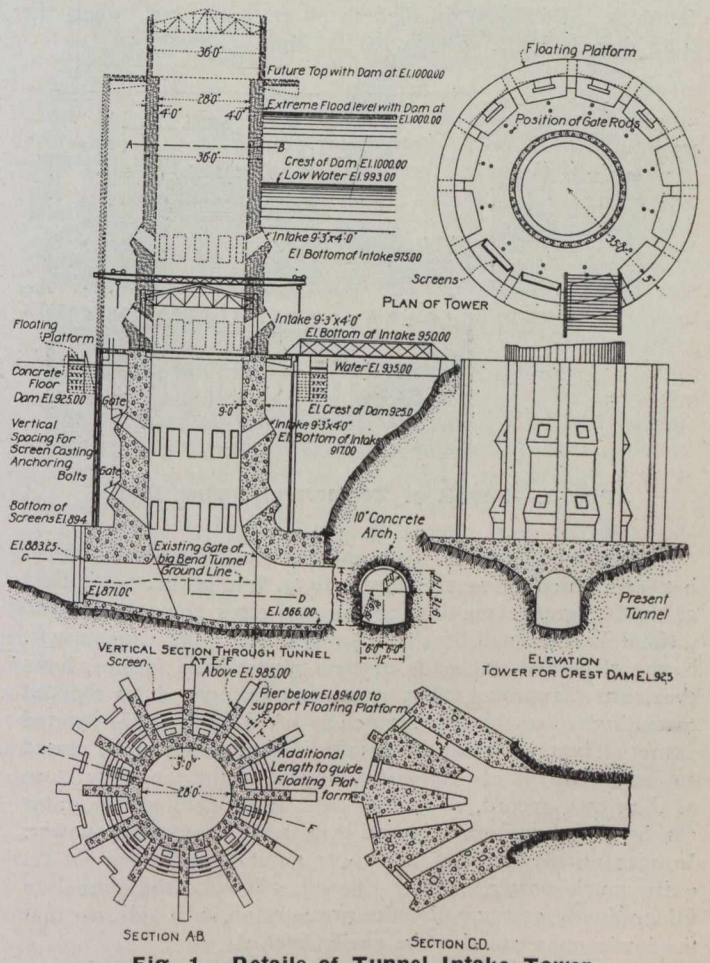

Fig. 1.—Details of Tunnel Intake Tower.

Work was started in the fall of 1906, and the weather during the first winter was very bad. There was a great deal of rain and snow and the roads were almost impassable. However, sufficient plant, boilers, compressors and supplies had to be hauled in to start the tunnel excavation. At the intake there was a camp (Camp No. 7) accommodating about 300 men. Besides the concrete plant here, there was a 1,250-cu. ft. steam-driven compressor and boilers, etc.

The principal camp (Camp No. 3) was in Dark Canyon, at the exit of the old tunnel. Here there were accommodations for about 600 men and the principal repair shops, etc. The camp at south portal above the power house (Camp No. 4), had accommodations for about 300 men. Besides these, there were two saw mills, Camp No. 6, and Camp No. 8, each with a capacity of 10,000 ft. of lumber per day; and also the headquarters, Camp No. 1, and the various storehouses, commissaries, etc.