

**NINE-FOOT WOOD STAVE PIPE, FLORISTON PULP AND PAPER CO., FLORISTON, CAL.**

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The Truckee River, flowing out of Lake Tahoe and reinforced by various small creeks and streams, affords a fine opportunity for the development of water power on account of the rapid fall at certain points, the ease with which the water can be diverted, and the fact that Lake Tahoe itself can be used as a storage reservoir to increase the natural summer flow of the river.

Some small power plants near Reno, Nev., have been in operation for several years, but it was not until last year that the development of any large amount of power from the Truckee River had been attempted. The Floriston Pulp & Paper Co. acquired rights to the water of the stream for power purposes near Floriston and this company has since constructed a large paper mill which is entirely run by water power.

Water is diverted from the stream at a point where a timber crib dam could be economically built. The dam as built is 140 ft. long at the top,

At certain seasons of the year it is expected that the full flow of the river will pass through the pipe, at which times the total available pressure upon the wheels is figured to be about 54 ft., which with a velocity of water of 5 ft. per second, equivalent to a flow of 19,000 cu. ft. per minute, will deliver to the wheels water enough to furnish 1,940 HP. From this, in order to arrive at the net horsepower, the loss through the wheels should be deducted. During most of the year the flow through the river is in excess of the quantity named, and, as the increase of friction in the pipe is but a small percentage of the total head available up to velocities of 12 ft., the total horse power delivered to the wheels may at certain times come close to the aggregate horse power which the wheels are capable of developing.

The wood stave pipe was built of staves run from 4 x 6-in. redwood lumber, and having a net thickness of 3 3/4 ins., 64 staves being required to complete the circle. The redwood used was clear and free from all imperfections. The butt ends of the

Denver, and have a length of 8 3-16 ins. over all and a width of from 2 3/8 to 2 3/4 ins. The maximum pressure upon the wood at the tall end of the shoe, supposing the bands to be cinched to the breaking point, is 1,060 lbs. per sq. in. The bands are spaced at the upper end, 10 ins. apart, the spacing gradually diminishing towards the lower end as the pressure increases until they are 4 3/4 ins. apart at the lower end, where the pressure is 50 ft., and where the pipe is connected with the steel receiver.

The alignment of the pipe is on tangents, connected by sweeping curves, generally of 1,200 ft. radius, except that at a point about 400 ft. down stream from the dam a steel elbow, Fig. 2, was introduced, made of riveted steel, with large bells for the reception of wooden pipe. The joints were caulked in the ordinary manner with oakum and lead, and the ends of the wooden pipe were provided on the inside with steel reinforcing rings.

To protect the stave pipe from water hammer, two 20-in. steel standpipes were placed upon it, respectively 200 ft. and 1,000 ft., down stream

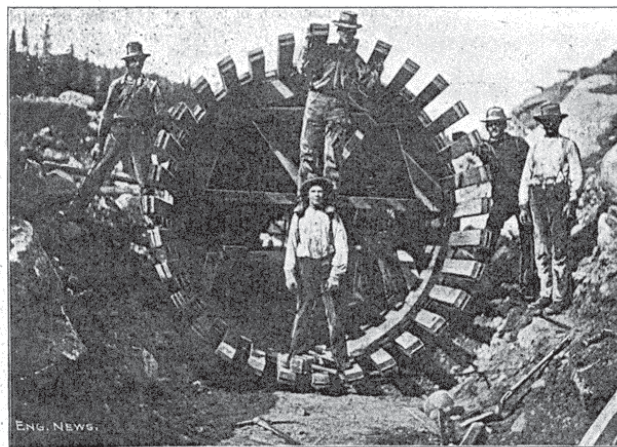


FIG. 1.—VIEW OF 9-FT. REDWOOD PIPE UNDER CONSTRUCTION, NEAR FLORISTON, CAL.

Mr. E. S. Cobb, Engineer; Excelsior Wooden Pipe Co., Contractor.



FIG. 2.—RIVETED STEEL ELBOW IN 9-FT. REDWOOD PIPE, NEAR FLORISTON, CAL.

and has a spillway over the center of the dam 68 ft. long at an elevation 16 ft. above the bed of the stream, which is bed-rock at this point. The height of the spillway above the river bed was limited on account of the main track of the Central Pacific passing through the canyon at an elevation, at the point of the dam, of about 24 ft. above the river bed. At the north end of the dam, an outlet and sluice gates are provided, while at the south end there is constructed in the dam the head gate leading the water into the pressure pipe. About 2,400 ft. down stream from the dam the paper mill has been constructed, consisting of a number of brick buildings, provided with the necessary machinery for manufacturing paper from pine, spruce, tamarack and cottonwood logs, supplied from the abundant forests in the vicinity.

The power used is taken from seven wheels, furnished by S. Morgan Smith, of York, Pa. The aggregate power of these wheels is 5,400 HP., which is in excess of the average power that will be used and that is ordinarily available, but which arrangement permits of the use of a large proportion of the entire power at hand for any one of the several departments.

The wheels receive their supply from a steel receiver, 9 ft. in diameter and about 300 ft. long, running parallel to the river, partly outside of and partly through the buildings. The wheels supplied from this receiver are placed away from the river and discharge their water into masonry tail races, which cross back under the receiver on their way to the river. The water is conducted from the dam to the end of the steel receiver through a 9-ft. wood stave pipe, 2,200 ft. in length, placed with its bottom at the upper end about 17 ft., and at the lower end about 48 ft., below the crest of the spillway. The total average fall with 2 ft. of water over the spillway is 58 ft., varying somewhat with the height of the water in the tail races.

staves are slotted and joined in the pipe by means of metallic concealed tongues, the slots for which are shown by the view, Fig. 1.

The bands around the pipe consist of two sections of 3/4-in. steel rods, united by two malleable pipe shoes. The steel of these rods has a tensile strength of from 58,000 to 65,000 lbs., an elastic limit of not less than 60% of the tensile strength, and shows an elongation on test of over 22% in 8 ins. The top section of the bands is provided with two square heads and the bottom section with cold-pressed threads, washers and nuts, the threads having a length of 7 ins. The shoes are similar to those patented by Mr. C. P. Allen, of

from the dam, extending 2 ft. above high water line above the dam. There are also two 30-in. standpipes placed upon the steel receiver, extending 4 ft. above high water line.

The method of construction of the stave pipe is illustrated by the accompanying views, Fig. 3 showing the character of the interior. The pipe is generally bedded to the center line in earth and boulders, only a portion being entirely covered over. It is the intention of the company to gradually cover the entire pipe with earth to prevent drying out of the lumber from the outside, which would eventually cause decay.

As stated, the plant was built by the Floriston Pulp & Paper Co., of which Mr. L. Schwabacher, of San Francisco, is general manager, and Mr. W. P. Hawley is local manager and superintendent. Mr. Ed. S. Cobb, of San Francisco, was engineer on the work, which was done under contract by the Pacific Construction Co., of San Francisco, except the wooden stave pipe, which was built by the Excelsior Wooden Pipe Co., of San Francisco. The works have been in operation since the middle of May, 1900.

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Fig. 3.—Interior View of 9-ft. Redwood Stave Pipe, Near Floriston, Cal.