HYDRO-ELECTRIC DEVELOPMENT IN CANADA

Largest Water Turbine in Existence.

The 10,500 H.P. turbine of the Shawinigan Water & Power Company, Shawinigan Falls, P. Q., Canada, is the largest and most efficient turbine wheel in operation to-day. It represents the highest type of American design and workmanship. Four and one-half months after the signing of the contract this turbine was delivered on board cars by the designers and builders, The I. P. Morris Company, of Philadelphia, Pa.

The official test of this wheel was made by experts representing both companies. The quantity of water consumed per second was determined by traverses taken in the penstock, by the pilot tube. This tube was checked by weir measurements, the results of which are slightly below the corresponding readings of the pilot tube, thus proving the accuracy of the test.

This wheel was guaranteed to have its highest efficiency at or near 9,000 H.P., and the efficiency was guaranteed to be 78%. The manufacturers received a bonus of $3,000 for excess efficiency.

The following is a brief summary of the results of the official test.

Head, 135 feet. Revolutions per minute, 180. Maximum H. P., 11,270.

Efficiency at 11,270 H.P., or 7.3% overload	84.7%
" " 10,500 H.P., or contract load	86.3%
" " 9,735 H.P., or 92.7% load	*87.3%
" " 9,000 H.P., or 85.7% load	86.5%
" " 7,500 H.P., or 71.5% load	84.5%
" " 6,000 H.P., or 57.1% load	83.0%
" " 3,000 H.P., or 28.5% load	73.5%

—* Maximum.

Checks on Pilot tube made by weir measurements.

	Pilot Tube	Francis Formula	Bazin Formula	Fteley and Stearner Formula
Quantity	204.7	200.3	200.3	201.4
of water	263.6.	257.3	261.3	262.3

The illustration gives one a good idea of the principal features of the design. It is of the horizontal shaft, "Francis" inward-flow type, with spiral (or "volute") casing. The water is discharged laterally from the centre of the wheel through two draft tubes, one on either side. The upper curved segment of one tube can be seen in the illustration.

The diameter of the volute at the intake is 10' 6", which decreases gradually along the spiral in proportion to the amount of water flowing at different sectional areas. The height of the turbine is 30 feet, is 22 feet wide, and weighs approximately 364,000 pounds.

The spiral casing permits the penstock to be received below the floor of the power house, thus leaving room for oil switches under the switch board gallery.

The wheel is controlled by a Glocker-White mercurial hydraulic governor, and also a hydraulic hand gear. The hydraulic cylinders at the top furnish power for moving the regulating apparatus.

The guide vanes are operated by a vane ring, controlled by pistons from the cylinders. The area between the guides is regulated by the movement of this ring, and, therefore, the quantity of water entering the wheel per second is controlled.

The 10,500 H.P. is transmitted over long distance lines 84 miles to Montreal, and there used for street railways, electric lighting and general power purposes. The current is "stepped-up" at Shawinigan Falls from the 2,200 volt, quarter-phase, to 50,000 volts, three phase, and carried to Montreal over three cables, each composed of seven No. 7 aluminum wires. At Montreal it is "stepped-down," with a loss in transmission of 18%.

THE TRINITY RIVER PLANT OF THE NORTH MOUNTAIN POWER COMPANY

Among the power transmission systems of the Pacific Coast, one of the most interesting is that of the Trinity River plant of the North Mountain Power Company, located in the central part of Trinity county, California, two miles below the town of Junction City, where Canon Creek, from which the water used for power is obtained, flows into the Trinity River. The nearest railroad point is Redding, on the "Shasta Route" of the Southern Pacific. Humboldt Bay, on the Pacific Ocean, with Eureka, the chief coast city of Northern California, lies almost due west, distant 59 miles in a straight line. The altitude of the plant is about 1,480 feet. All material, cement, and machinery were hauled in over 60 miles of the severest mountain roads, across three distinct divides or summits. It required 18 to 20 horses to pull each of the larger pieces, weighing 18,000 lbs., up the grades, and when mud was encountered it was necessary to hitch 18 horses to the fall of a block and tackle fitted with steel cables. Despite these difficulties, however, no mishap occurred to any of the machinery.

The water used at the plant is diverted from Canon Creek, which has a drainage area of 52 square miles above the diverting dam. The upper part of the basin is a rugged, glaciated granite country, extending up from an altitude of from 9,000 to 10,000 feet above sea level. The dam is small, and serves merely for diverting the water. It is of the usual rock-filled crib form. Part of the ditch is cut in solid rock, but most of it is dug in the hill-side soil. The flumes are 19 in number, and vary in length from 30 feet to 1,200 feet. The total length of the ditch, flumes and tunnel is 7¼ miles. The average grade of all is about 9.73 feet per mile. The penstocks are each 1,165 feet long. Under a total head of 604 feet there is an effective head of 600 feet, or a working pressure of 260 lbs., per square inch.

An 18-Horse Team Hauling the Lower Half of the Stator of an 750-k.w. Bullock Alternator Over 50 Miles of Mountain Road from the nearest Railroad Station to the Plant of the North Mountain Power Company.

The plant proper consists of the power house, two transformer houses and three high-tension switch houses. Each of the two hydraulic units consists of a pair of 44-in. Pelton wheels under one sheet steel housing. The nozzles are of the deflecting type. With the largest tips in service