

fugal pumps to operate at 600 r.p.m. The turbine is of the impulse pressure-stage type and contains 14 stages. The gear is of the three-pinion bearing type and is connected to the turbine and to the pump shaft by flexible couplings. Both turbine and gear are lubricated by a

through the condenser. The air pump is of the wet vacuum type, the steam end being of the ordinary slide-valve type, controlled by a throttling governor. The steam for driving the air pump is taken from the main supply pipe between the separator and the steam turbine.

As no oil is allowed to reach the inside of the turbine, the condensed steam is passed into the hot-well and delivered to the boilers by a triplex, single-acting boiler feed pump driven by chains from the main pumping unit.

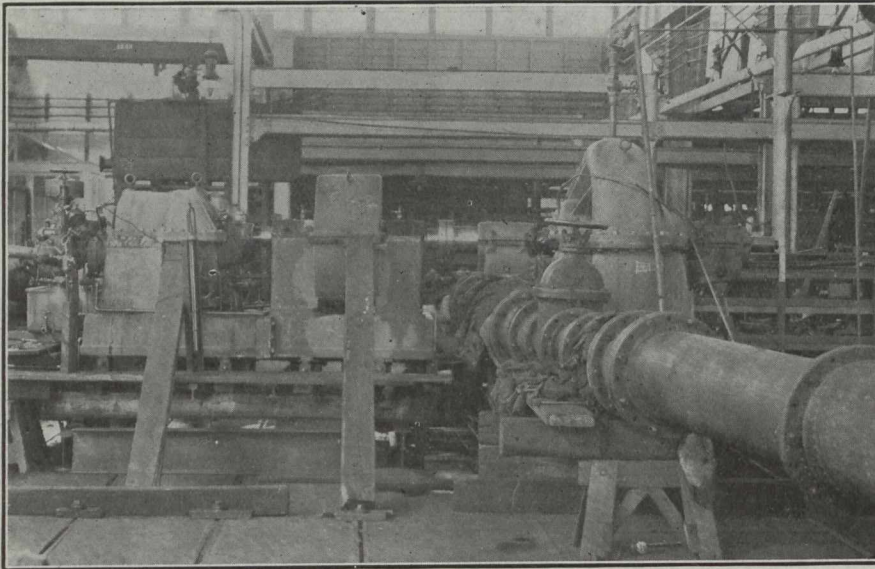
The acceptance test on this pump was run on November 30 and December 1, 1914, under the supervision of Prof. Robert W. Angus, of the University of Toronto, assisted by senior students from that institution. The contractor was represented by Mr. C. R. Waller, chief engineer of the DeLaval Steam Turbine Co., and the purchaser by Mr. McRae, chief engineer of the pumping station. Throughout the test, which was of 24 hours duration, suction and discharge pressures, Venturi meter and condensate weight readings were taken every 7½ minutes, while the steam main and nozzle pressures, vacuum, speed, and calorimeter readings were taken every 15 minutes. All gauges were calibrated both before and after the trial and the

scales examined and certified by a Government inspector. The barometric pressure during the test was obtained from the records of the Meteorological Office. The principal final results were as follow:

Steam pressure in main—148 lbs. per sq. in.
 Steam pressure at turbine nozzles—137.4 lbs. per sq. in.
 Absolute condenser pressure—1.06 in. of mercury.
 Pressure difference on pump—114.1 lbs. per sq. in.
 Moisture in steam—1.05%.
 Water delivered, Imp. gals. per 24 hours—18,373,000.
 Water horse-power—1,016.4.
 Steam per water horse-power per hour—15.18 lbs.
 Duty developed per 1,000 lbs. of steam used—130,499,000.
 Duty guaranteed—118,500,000.

Since placing the first contract, two more units, each capable of delivering 24,000,000 Imp. gal. per day against 260 ft. head have been ordered for the same station, from the Turbine Equipment Co., Ltd., also two De Laval pumps, one of 20,000,000 gallons capacity against 106 ft. head and one 7,500,000 gallons capacity against 266 ft. head, have been ordered for the high level pumping station.

The latter station is situated in the northern part of the city, about three miles in a straight line from the main pumping station, and supplies the district north of

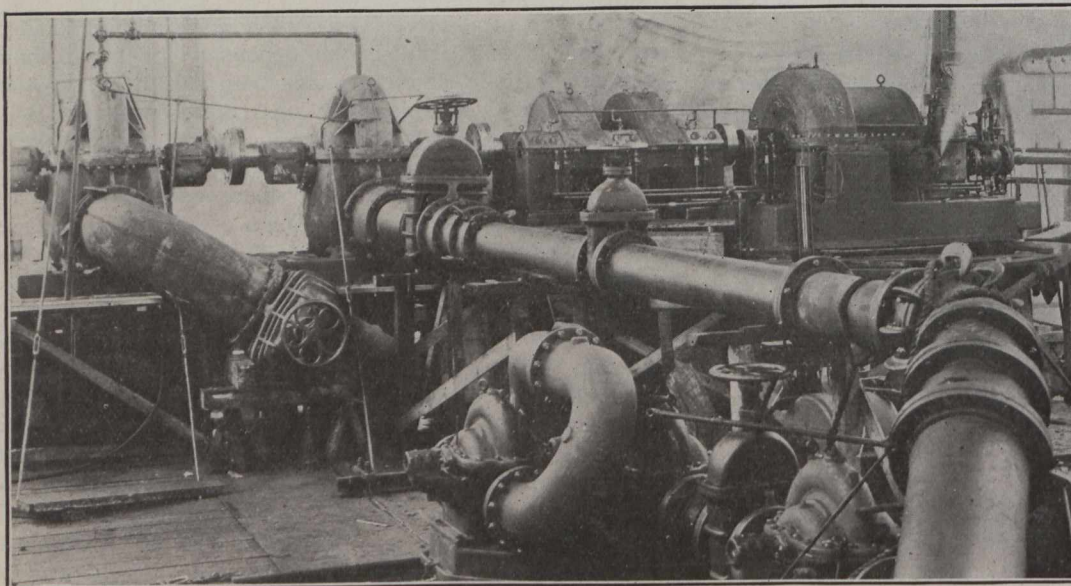


View of the 7,500,000-gallon Unit Now Being Installed at the High Level Pumping Station, Toronto.

gravity system, an oil pump attached to the governor shaft forcing the oil through a cooler to an overhead tank from which it runs to the bearings. The larger gear bearings and the pump bearings are ring-oiled.

The two pumps are of the single-stage double-suction type, and are operated in series; that is, the discharge from the first pump is carried to the suction of the second pump. The pumps are primed by a single steam ejector connected to the top of each pump casing.

The condenser, built by the C. H. Wheeler Mfg. Co., is of the waterworks type, in which the steam is inside the tubes and the water outside, and contains 1,500 sq. ft. made up of one-inch brass tubes each 7 ft. 2 ins. long. All of the water handled by the main pump passes



Shop Test of a 15,000,000-gallon-per-day Pump Installed in the John Street Station, Toronto.