A THESIS SUBMITTED FOR THE DEGREE OF MASTER OF SCIENCE IN THE ELECTRICAL ENGINEERING COURSE

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TEST ON A 2250 K.W. COMBINED HIGH PRESSURE RECIPROCATING STEAM ENGINE AND LOW PRESSURE TURBINE UNIT AT THE PLANT OF THE WISCONSIN TRACTION LIGHT HEAT & POWER COMPANY APPLETON WISCONSIN

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The exhaust steam turbine, one of the most modern of all forms of prime movers for electrical generating stations, has come into very general use within the last few years. Its wide adoption is due to its ability to efficiently utilize the exhaust steam from compound reciprocating engines, and it is being installed in a great many places where the latter form of prime mover is used. In addition to its high efficiency, the combined unit permits the use of high pressures and high superheats, since the range of steam volumes is greatly increased by the addition of the turbine in which the steam is fully expanded. As a result this means a low water rate per unit output, the energy available per pound of steam being greatly increased. Such an installation may be made without any material increase of floor space or pipe connections; while the output of the plant is greatly increased without scrapping any of the old machinery, or increasing the boiler room equipment.

The two exhaust steam turbines were installed at the plant in which the present test was made, to increase the output of a pair of nominally 1300 H.P.

tandem compound Corliss engines. The plant was formerly equipped with two generating sets, each consisting of a 500 K.W. direct current railway generator and a 500 K.V.A. 3 phase, 60 cycle, 4000/2300 alternator. These sets were driven on one end by a Victor water turbine, utilizing altogether about 2400 H.P. at this point on the Fox River. On the opposite end of each generating unit, the tandem compound engines were connected through clutches. In time of low water, and at peak loads, both engines and water wheels were connected to the generators. The engines were operated condensing, the cylinders being 19" and 40" x 36". To meet the change of conditions in operation with the exhaust turbines, the engines have recently been modified by changing the high pressure cylinders to 22 inches. It was, however, the intention of the engineers to use the original cylinders, but due to the blowing out of one of the cylinder heads it was deemed advisable to replace the old cylinders by new ones which would conform with the new operating conditions.

The low pressure turbines installed are 1250 K.W. 60 cycle Allis-Chalmers machines operating at 3600 R.P.M., with alternators delivering current at 4000/2300