per revolution of spindle, and these are operated by means of a small crank handle at the left of the carriage. The spindle has a rack-feed, and is balanced. The worm wheel has a lever so that it may be disengaged and leave the spindle free to follow a tap when tapping. A further movement of this lever throws a quick motion into gear, so that the one-hand wheel, which is used for a fine adjustment of the spindle, may also move the spindle quickly up or down. The arm rests on a ball-bearing, and may be elevated, if required, for a distance of 12 in. The machine is driven through a belt running at a constant speed, and through a gear-box, giving nine changes of speed, operated by two handles. The spindle has thus eighteen changes of speed, ranging in geometrical progression from 630 down to 20 revolutions per minute. All these changes can be made instantly without moving the belt on to the loose pulley, and without shock. When the two handles on the gear-box are in a vertical position, the driving is at the lowest speed, and driving takes place through a silent pawl arrangement. When the levers are moved either to the right or left, clutches are operated, and quicker running wheels come into gear, and the pawls working in the slower running wheels are automatically disengaged, and run idly without any click or noise. The driving pulleys are 10 in. diameter, receive a 3½-in. belt, and run at 625 revolutions per minute. Under testing conditions the machine has been driven by a 30 horse-power motor to thoroughly test the driving power and stiffness of the machine. It has sent a 1-in. diameter drill through mild steel 3½ inches thick at the rate of 8 inches per minute, and through castiron 3 inches thick at the rate of 12 inches per minute. These were the limits of the drills and not of the machine. The weight of the machine is 3¾ tons.

A patent electrically driven 30-in. vertical boring and turning mill has the armature of the motor built into the body of machine (not motor attached). The special features of the high-speed pattern 8-in. self-acting sliding, surfacing and screw-cutting lathe are that the headstock and bedplate are in one, and the large spindle diameter and hole through to take 3-in. bars.

On another stand this firm show a 12-in. special pattern abnormal high-speed lathe in operation driven by a 35 horse-power direct attached motor. The headstock is of the all-gear type, giving sixteen changes of speed. This lathe will take a cut ½-in. deep, ⅛-in. feed at 70 to 80 feet per minute, removing material at the rate of over ten hundredweight per hour.

There are a number of other interesting exhibits which must be dealt with in another article.

ECONOMY TEST OF A 7,000 KW. STEAM TURBINE.

The following data comprise the principal results obtained during an 8-hour economy test on September 1st, of a turbine installed earlier in the year at Waterside Station No. 2 of the New York Edison Company. This test was conducted entirely by the New York Edison Company, under the direction of Mr. J. P. Sparrow, Chief Engineer. The various arrangements therefor, were carried out in accordance with a mutual agreement between builder and operator, entered into previous to the test, and the results, as herein given, were obtained by independent computation.

The turbine unit tested, is of a standard Westinghouse construction. It has a maximum rated capacity of 11,250 kw., and was built to operate on 175 lbs. steam pressure, 28 inches vacuum and 100° superheat. Under these conditions the turbine unit was guaranteed to have a minimum steam consumption of 15.9 lbs. per kw. hour at the generator terminals, with a normal speed of 750 r.p.m. Incidentally the electrical efficiency of the generator was guaranteed to be 97.8 per cent., exclusive of friction and windage, at a load corresponding to that sustained during the test. The results of the tests, detailed below, show an economy about 7.5 per cent. better than the guarantee.

METHODS OF CONDUCTING THE TEST.

Load.

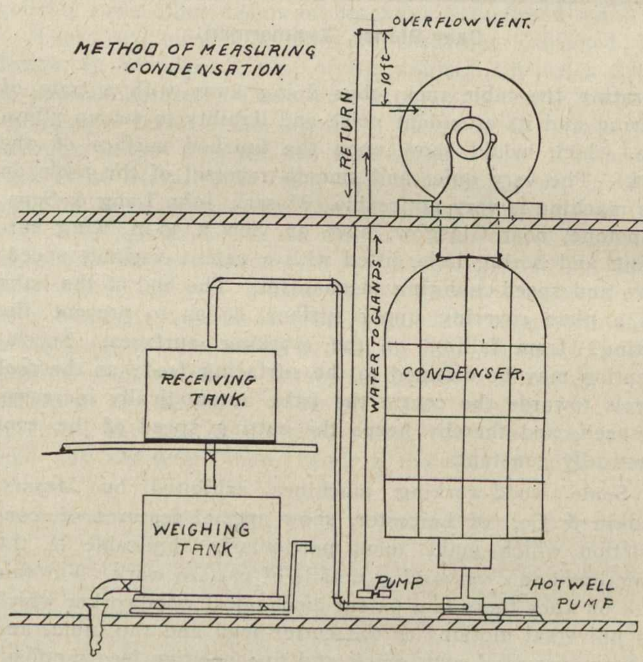
During the test period, No. 2 Waterside Station sustained practically all of the 25-cycle load on the system, of which the unit under test carried practically 70 per cent., the remainder by the other turbine units in the station. This load was maintained as constant as possible by remote control of the turbine governor by the switchboard operator. Between the first and the last hours of the test, the maximum variation in load was held within 4 per cent. above and below mean. Previous to the test, this turbine unit had been running on a load of 7,000 kw., which was increased to its test load ten minutes before the start.

Calibration.

Three-phase electrical load was measured by the two watt meter method, using two Weston indicating watt meters of the standard laboratory type. These instruments were calibrated at the New York Electrical Testing Laboratories immediately before and after the test. Power factor was maintained substantially at unity, and all electrical readings were taken at one-minute intervals.

Steam Consumption.

As a surface condenser was used in connection with this turbine unit, the water rate was determined by weighing the condensed steam delivered from the condenser hot well. This condensation was weighed in a tank mounted upon platform



scales, with a reservoir above large enough to hold the condensation accumulating between each weighing, as shown in the accompanying illustration. These weighings of 12,000 to 13,000 lbs. each, were made at intervals of five minutes.

Gland Leakage.

By the loop method of connecting the gland water supply, the necessity for correcting condensation by an amount equivalent to the weight of the gland water used, is avoided. It will be noted that continuous gland water circuit is used entirely outside of the weighing apparatus, and that all overflow from the standpipe returns to the hot well delivery.

Condenser Leakage.

As the circulating water is quite salt, any condenser leakage may immediately be detected by the salinity of the condensed steam, which should be pure distilled water. On this account, condenser leakage was determined entirely by chemical analysis, employing the silver-nitrate test with a suitable color indicator. This method proved extremely sensitive, and possessed a decided advantage over the ordinary method of weighing the leakage accumulating during a definite period when the condenser is idle and under full vacuum. As samples of circulating water and condensed