simple engine, belt connected to a Westinghouse, 75-k.w., D.C., compound-wound generator, operating at 250 volts and 750 R.P.M. This generator carries the night load, and supplies power for lighting, motor driving for special night work and the turntable. The night and day load generators are interchangeable at the switchboard. A 100-h.p., simple engine, belt connected to a Westinghouse, 60-k.w., two-phase, A.C. generator, operating at 2,200 volts, 7,200 alternations and 900 R.P.M. This generator furnishes power for lighting the yards, the Falls Creek station, the passenger and freight stations at DuBois and the DuBois car-shops. A 2½-h.p. exciter, operating at 125 volts and 180 R.P.M. An Ingersoll-Sergeant, steam-driven compressor, furnishing compressed air for the plant.

The results of the tests are given below. It is to be noted that the net power consumed by the several tools and by the line shafting was not obtained directly, but by subtraction. All measurements were made by means of a voltmeter and an ammeter in the motor circuit. These indicated the electrical horse-power delivered to the motor. The brake horse-power delivered by the motor at any given load was then determined by means of the motor efficiency curve. This is a source of considerable error at low readings, since the actual efficiency of the motor as installed may differ from that given on the curve sheet. The amount of power consumed by the shafts and belts being known, and then the amount consumed with the tool running being taken, the first quantity was subtracted from the latter to give the amount actually consumed by the tool. This probably gave very nearly the correct results, since the energy lost in shafting and belting is very nearly constant at various loads. The tests were made while the shops were in full daily operation, and it was for that reason impossible in many cases to make as direct measurements as might seem desirable. In order, therefore, to present the actual conditions of each test the log has been given below in full as recorded, except that all readings are translated into brake horse-power delivered at the tool. In explanation of the small loads allotted to some of the motors, it should be stated that when they were selected provision was made for the probable increase in the capacity of the shop. Experiments are, also, being conducted with high-speed cutting steels, which, if adopted, will considerably increase the demands for power. These tests, in addition to furnishing accurate data relating to the power required for various tools when starting, running light and cutting, also make possible some estimation of the merits of roller bearings for shaft-hangers. The line shafts are cold rolled steel, and are carried on Hyatt roller bearings and a shaft 200 feet long without belts could be turned by hand. But in spite of the unusual efficiency of the bearings, it will be noted that the power consumed by the tool is often less than that lost in transmission. Nevertheless, the capacity in motors required for the group drive is two to two-and-a-half times smaller than it would have been had each tool been provided with an individual motor. It is a question as to how far the low average power taken by large groups of tools in operation may be due to the fly-wheel action of the shafts and pulleys.

The locomotive-erecting, boiler and machine shop consists of a middle aisle for erecting, and two shed bays equipped with shafting for driving the machine tools. Two 50-ton, electric travelling cranes have a runway in the middle aisle. There are five lines of shafting driven by five shunt motors in the shed bays and the sections are designated as wheel section and boiler section in one bay, and lathe, tool and flue sections in the opposite bays. In the wheel section the shafting is driven by a 40h.p., shunt-wound motor and operating 42-in. car wheel boring mill, 48-in. car wheel lathe, two 79-in. wheel lathes, quartering machine, 60-in. by 60-in. by 18-in. planer, 84-in. boring mill, single axle lathe, 6-ft. radial drill, 18-in., slotter, band saw, No. 7 grinder, water tool grinder. The line shaft is 200 feet long, 2½ inches in diameter, and has 26 hangers. It was inconvenient in this instance to obtain a test of the line shaft alone. A test of the line shaft and counters only gave 1.5-h.p. A 15-minute test was made of a group of machines comprising a 72-in. and a 66-in. wheel lathe each with two cuts, a wheel press operated at 50 tons, and an 84-in. Niles boring mill, a band saw belt, an emery wheel, a Pond radial drill, and a 60-in. planer with one tool cutting cast iron, with an average result of 4.6-h.p., a minimum of .88-h.p. and a maximum of 10.43-h.p. The speed of the line shaft was 160 R.P.M. Two machines were then thrown in, a 42-in. wheel lathe cutting with one tool and an 84-in. boring mill—with the wheel lathe cutting—the boring mill on starting up took 6.9 h.p., and cutting 3 h.p. To the above two machines were added, a tool grinder and a 79-in. wheel lathe cutting, which starting up took 6.3 h.p., and running steadily 3.95 h.p.

To these was added a 60-in. planer, cutting a cast iron cylinder, which at starting took 10.3 h.p., and running steadily 4.2 to 7 h.p., or an average of 6.1 h.p. during the whole time.

To these were added another tool grinder and an 18-in. slotter. The maxium reversals of the planer and the slotter at the same instant, gave 15.5 h.p. and steady running showed 5.2 h.p. The planer interfered somewhat with the readings.

Then a band saw cutting 4-in. oak, was added which took 5.6 h.p. Whether the saw was cutting or not seemed to make no difference in the reading. Tests of single machines were then made; that is, of the power consumed by the one machine tool thrown in at a time. A 42-in. wheel lathe with one tool cutting on starting up 4.6-h.p., and on steady running .5-h.p. An emery wheel took .7-h.p. A 79-in. wheel lathe, with two tools making roughing cuts on a pair of drivers, took 4-h.p. An 84-in. boring mill boring an 8-in. cylinder took 2-h.p. A 60-in. planer cutting a cast-iron cylinder took 2-h.p., and a maximum at reversal of 8.5-h.p. An 18-in. slotter with tools of ¾-in. face, cutting steel, took .3-h.p., and a maximum at reversal of 1.2-h.p. A band saw starting up took 6.3-h.p., and running light or cutting 4-in. oak, 4-h.p. A group run of an 84-in. boring mill, a 79-in. wheel lathe, a 6 ft. radial drill, a 60-in. planer, and an 18-in. slotter, gave at steady running 6.9-h.p., and with the planer at reversal took 14-h.p.

The boiler section had shafting driven by a 30-h.p., shunt-wound motor and operating a 12-ft. bending roll, bolt cutter, stay bolt cutter, drill press, tool grinder, Brooks plate planer, horizontal punch, shear and punch, 6-ft. bending rolls, 6-ft. straightening rolls, 6-ft. radial drill.

All the counter-belts were thrown off, and the line shaft tested alone, with a result of .3-h.p. This line shaft is 170 feet long, 2½-in. in diameter, and has 19 hangers. The speed of the line shaft was 158 R.P.M. A test of the line shaft and countershafts, only, gave an average of 2-h.p. The machines, comprising the first group tested, were: A stay-bolt cutter and a bolt cutter, a No. 4 Hilles & Jones punch and shear. The No. 4 punch and shear was punching 13-32-in. hoes in 3-16-in. steel plate. A 15-minute test showed an average of 1-h.p., with a minimum of .2-h.p., and a maximum of 3.5-h.p. A single tool, the No. 4 Hilles & Jones 48-in. punch and shear was thrown in, and starting up light took 6.9-h.p., settling down to .4-h.p. Shearing 5-16-in. steel plate, it required 3-h.p. A 6-ft. radial drill was then added, and at starting up light took 3.6-h.p., settling down to 1.1-h.p. A 1½-in. drill cutting in steel gave 1.5-h.p. A 6-ft. radial drill and bolt cutter required 1.1-h.p. The 12-ft. rolls were then added, and starting up light showed 7.3-h.p., settling down to 4.75-h.p. Rolling steel plates, ½-in. by 8-in. required 5.3-h.p. A test of line shaft and counters with the 6-ft. radial drill cutting steel with 1½-in. drill, and a punch and shear running light showed 2-h.p. A 1-in. stay-bolt cutter added to the above took on starting up 4.5-h.p., and cutting 12 threads per inch gave 2.1-h.p.

The lathe section was operated by shafting driven by a 30-h.p., shunt-wound motor and taking care of a 24-in. crank planer, 36-in. by 36-in. by 20-ft. planer, 51-in. boring mill, 16-in. shaping machine, 24-in. lathe, 24-in. drill press, 37-in. boring mill, two 22-in. lathes, three 16-in. lathes, two 18-in. lathes, 28-in. lathe, 43-in. lathe, 2-in. by 24-in. flat turret lathe, two 26-in. by 26-in. by 10-ft planers, 60-in. horizontal boring machine, water tool grinder, centreing machine.

The line shaft and counters gave 4.1-h.p. A test of the line shaft with counterbelts off gave .7-h.p. The speed of the