



Use a hand-turned generator (see Note) equipped with a heavy flywheel. A white index mark on the wheel facilitates the student's judgment of speed. A control box allows the generator to be operated either open-circuited or with four 2.5-volt, 0.5-amp lamps connected in parallel across its terminals. (See WARNING.)

With the lamps connected, turn the generator at a relatively high speed. The lamps glow brightly. When glowing brightly they consume 5 watts. This is approximately 1/150 hp.

The fact that energy in some other form, mechanical in this case, must be spent to produce electrical energy can be shown effectively as follows. With the generator open-circuited, bring its speed up to as high a value as convenient and release the handle. As the generator continues to turn, leisurely explain how you did work in setting the generator into motion, a little in overcoming friction and a great deal more in storing kinetic energy in the rotating wheel, and how the wheel slows down gradually as kinetic energy is spent in overcoming friction. After the wheel stops (approximately a minute is required), again bring its speed up to a high value, duplicating roughly the speed attained previously. Simultaneously connect the lamps and release the handle. The generator stops in a relatively short time (roughly 8 seconds). Thus kinetic energy of the wheel was spent at a rapid rate in generating electrical power for the lamps.

It is also worth-while asking a student to operate the generator as follows. With the generator open-circuited, have the student turn it at a constant, moderate to high speed. While the student attempts to maintain a constant speed, alternately connect and disconnect the lamps several times. The student can easily feel the increase in torque, and therefore in power (5 watts or 1/150 hp), required to maintain the speed constant when the lamps are connected.

Note: Although it is of no importance for this demonstration, the generator will deliver 115 volts, 200 watts, at 400 cycles/sec when rotating 5000 rpm.

WARNING: Do not operate the generator with less than four good lamps in place. Any smaller load will allow the generator to develop more than 2.5 volts, thus overloading the remaining lamps. (Spare lamps are stored in the control box.)