

Muscle Powered Generators

By Billy Whippet and the Chinaman



There can be no understanding of motors without knowledge of generators and how they work. We all know that generators produce electricity when they are spun. Power out equals power in minus some loss. Our concern here, however, is how to produce power that is best suited for our application. That application is a muscle powered generator suitable for charging 12 volt batteries.

Such a system requires a source of voltage in the range of 13.6 volts DC and some type of regulation or voltage

monitoring. The operator of our muscle powered machine can be trained to monitor output voltage, at least that is the hope. Our task then is to supply the voltage.

The motor shown here is chucked in a drill press and securely clamped to the table so that the motor can be spun open circuit. It is a permanent magnet, brush commutated dc machine designed to spin a fan mounted on a truck radiator. It is not a particularly rugged motor but the windings are such that it will not self destruct due to overheating or overspeed. The greatest risk this motor faces in its operational lifetime is imbalance caused by the fan blade itself. When spun at 1500 rpm with the drill press, this device produces 4.5 volts DC. Measure this directly with a voltmeter.

This voltage is known as back emf. Not all motors create a back emf. Motors in household appliances are series wound and will not act as generators. A coil of wire spinning in a coil of wire is a simplistic but accurate description of series winding. The motor chosen for use as a muscle powered generator will have permanent magnets.

The voltage to rpm ratio is important as the back emf is a linear function. The voltage will double if the revolutions per minute increase by the same amount. Our motor currently produces .003 volts per rpm.

Our assignment is to modify this PM machine so that it produces 13.6 volts at 400 rpm or .034 volts per rpm. By doing so, the requirements for gearing are manageable. Before tearing down our drill press set up, let's go ahead and collect at least one more data point.