MOTORS

Motors are machines that convert electrical energy to mechanical energy. Instead of a current being generated by a rotating loop in a magnetic field, a current is supplied to the loop by an emf source, and the magnetic force on the current loop causes it to rotate (see **Figure 12**).

A motor is almost identical in construction to a dc generator. The coil of wire is mounted on a rotating shaft and is positioned between the poles of a magnet. Brushes make contact with a commutator, which alternates the current in the coil. This alternation of the current causes the magnetic field produced by the current to regularly reverse and thus always be repelled by the fixed magnetic field. Thus, the coil and the shaft are kept in continuous rotational motion.

A motor can perform mechanical work when a shaft connected to its rotating coil is attached to some external device. As the coil in the motor rotates, however, the changing normal component of the magnetic field through it induces an emf that acts to reduce the current in the coil. If this were not the case, Lenz's law would be violated. This induced emf is called the **back emf.**

back emf

the emf induced in a motor's coil that tends to reduce the current in the coil of the motor

The back emf increases in magnitude as the magnetic field changes at a higher rate. In other words, the faster the coil rotates, the greater the back emf becomes. The potential difference available to supply current to the motor equals the difference between the applied potential difference and the back emf. Consequently, the current in the coil is also reduced because of the presence of back emf. As the motor turns faster, both the net emf across the motor and the net current in the coil become smaller.

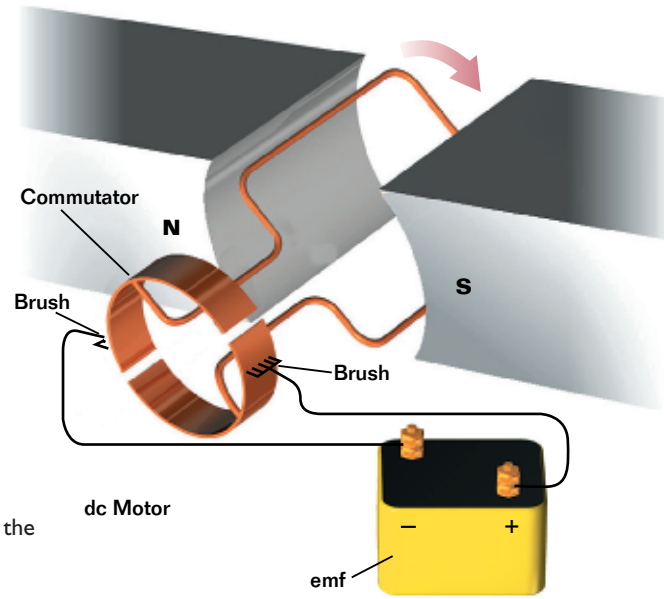

Figure 12
In a motor, the current in the coil interacts with the magnetic field, causing the coil and the shaft on which the coil is mounted to turn.