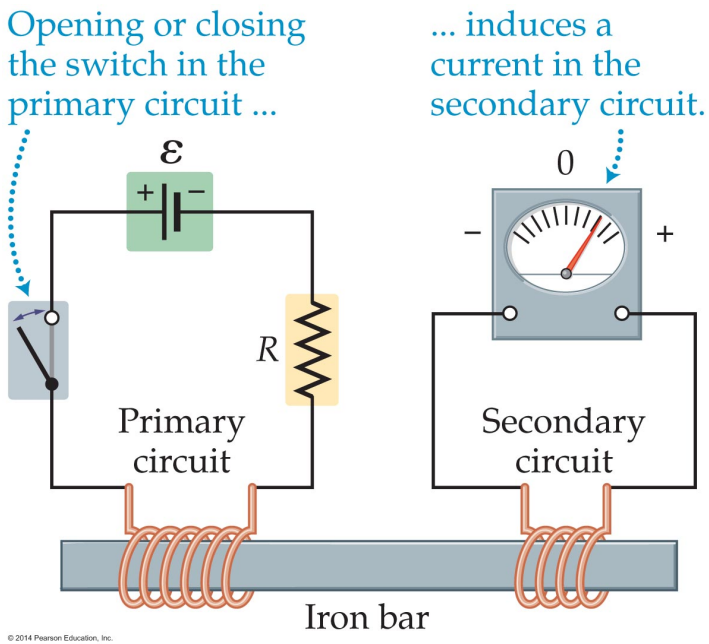
Chapter 23 Electromagnetic Induction

Revised 7.24.2020 Some diagrams from Pearson Physics by Walker. Used with permission

A moving or changing magnetic field causes an electric field (which causes a current in a circuit.)



Turning on the current in the left circuit causes a changing magnetic field in the primary coil. The magnetic field propagates through the iron bar and the changing magnetic field causes a current to flow in the secondary circuit.

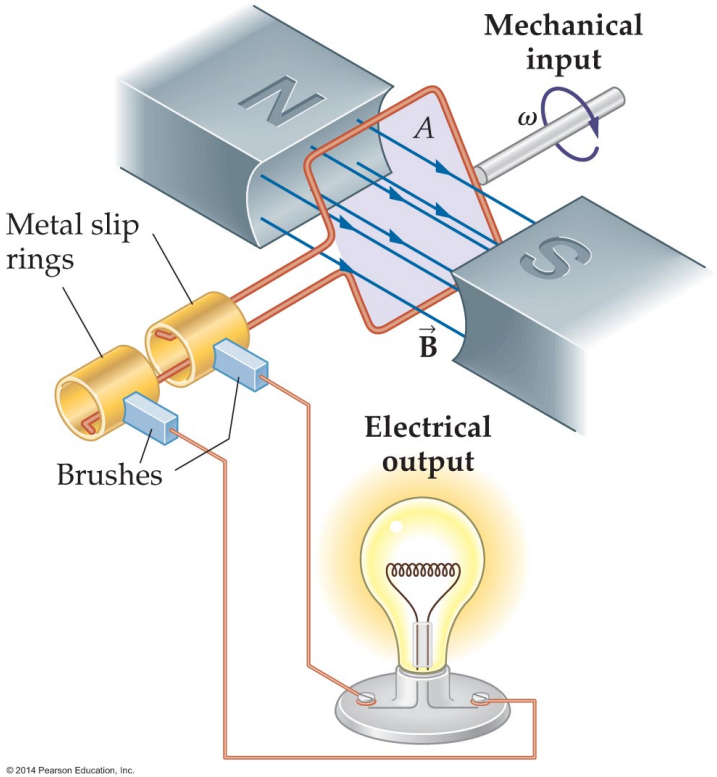
Important note: A STATIC magnetic field does not cause current. Only a moving/changing magnetic field will cause a current to flow.

A steady current in a coil will produce a magnetic field, as shown in the following demonstration.

https://micro.magnet.fsu.edu/electromag/java/compass/index.html

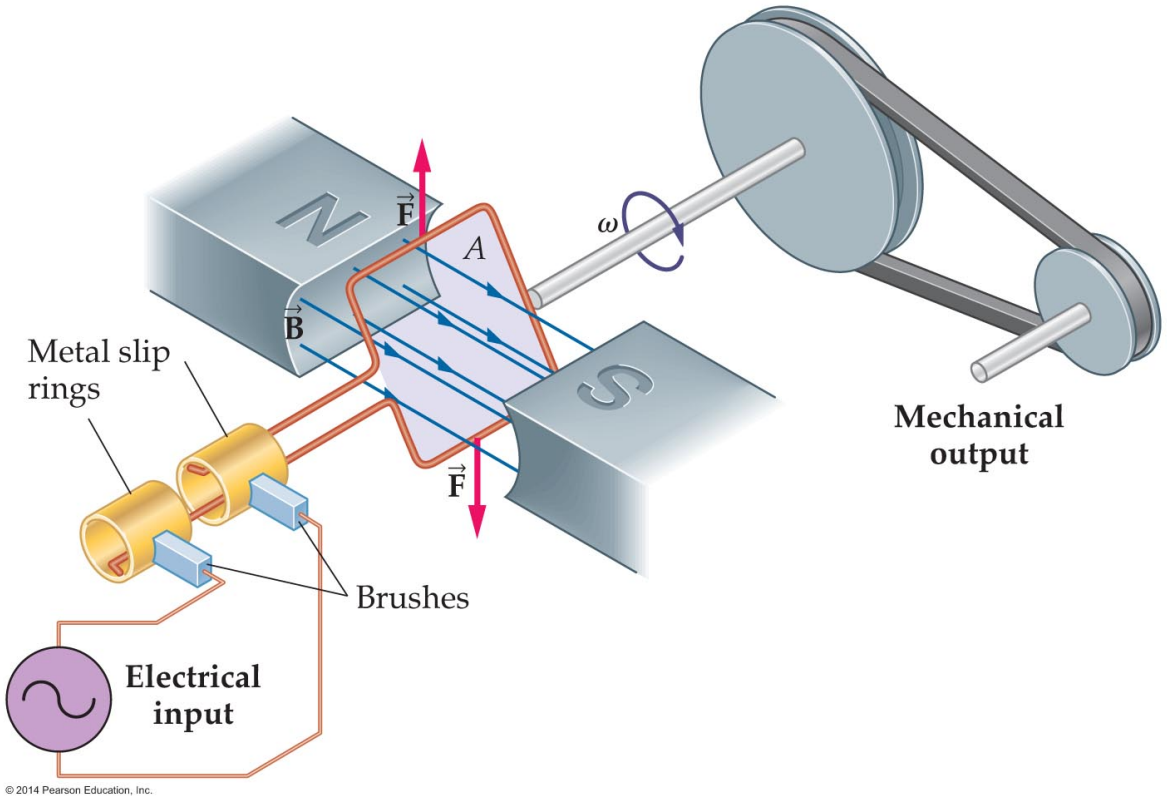
The Electric Generator

An electric generator uses the input mechanical energy to move a wire with respect to a magnetic field, the movement causes a current to flow in the attached circuit.



The electric motor

The electric motor is the opposite of the generator. The current in the coil produces a magnetic field. The interaction of the two magnetic fields causes the coil to spin. That motion is used to move external equipment.



The transformer

Transformers work on alternating current. The constantly changing current in the primary coil causes a constantly changing magnetic field. That constantly changing magnetic field interacts with the secondary coil, producing a voltage.

Np = Number of turns in the primary
Ns = Number of turns in the secondary
Vp = Voltage in the primary
Vs = Voltage in the secondary

Np/Ns = Vp/Vs
And, assuming 100% efficiency
VpIp = VsIs