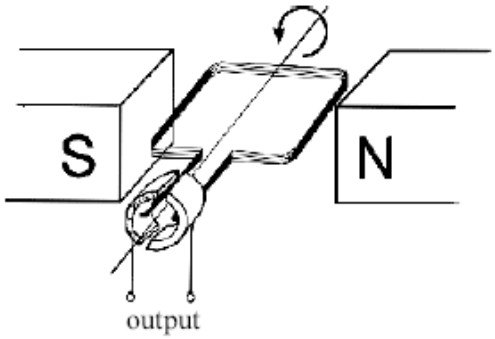
Electromagnetic Induction

1. A voltage (current) is induced in a wire that cuts across magnetic field lines

2. To make the voltage greater
    - Use more wire in the magnetic field
    - Move the wire faster
    - Use a stronger magnetic field

3. simple ac generator



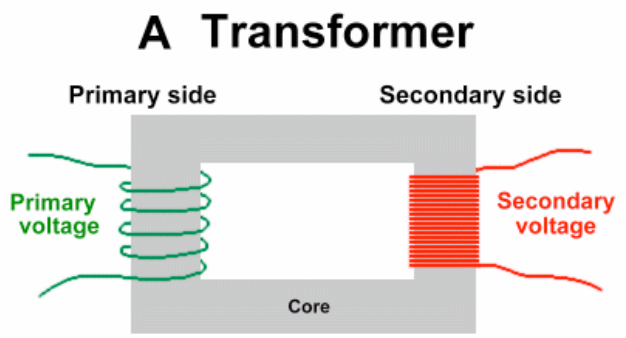
Greater voltage
- more turns on coil
- spin faster
- stronger magnetic field

Key features
- generates ac
- slip rings keep the coil connected to the circuit and allow it to turn

4. Fleming's Right Hand Rule
- First finger – field (points North to South)
- SeCond finger – current (points + to -)
- ThuMb – Motion (points way wire moves)

5. Modern generators
- Radial field – magnetic field in all directions coil always cuts field lines no matter what its position
- Several coils – at different angles with many more turns of wire
- Electromagnet – instead of magnet (lighter and produces stronger fields)
- Magnet spins – no need for slip rings (friction at slip rings results in energy loss)

Transformers



Features

- **Step Up** - More turns on secondary – larger secondary voltage
- **Step Down** - Less turns on secondary – smaller secondary voltage
- If twice as many turns – twice the voltage and half the current
- Core – made of soft iron; traps magnetic field so all field from primary coil is transferred to the secondary
- Core is laminated to prevent energy loss (by stopping eddy currents)
- Magnetic field around primary is moving; cuts across coil in secondary; induces a voltage
- Equation

$$\frac{V_1}{V_2} = \frac{N_1}{N_2}$$

V_1 is primary voltage V_2 is secondary voltage

N_1 is number of turns on primary coil N_2 no. of turns secondary

- Example:

  Transformer has 50 turns on the primary and 200 on the secondary. If the input (primary) voltage is 12V what is the output (secondary) voltage?

$$\frac{12V}{?} = \frac{50}{200}$$

$$\frac{?}{12} = \frac{200}{50}$$

$$? = \frac{200}{50} \times 12 = 48V$$