



Hand Powered Flashlight

James Dunigan

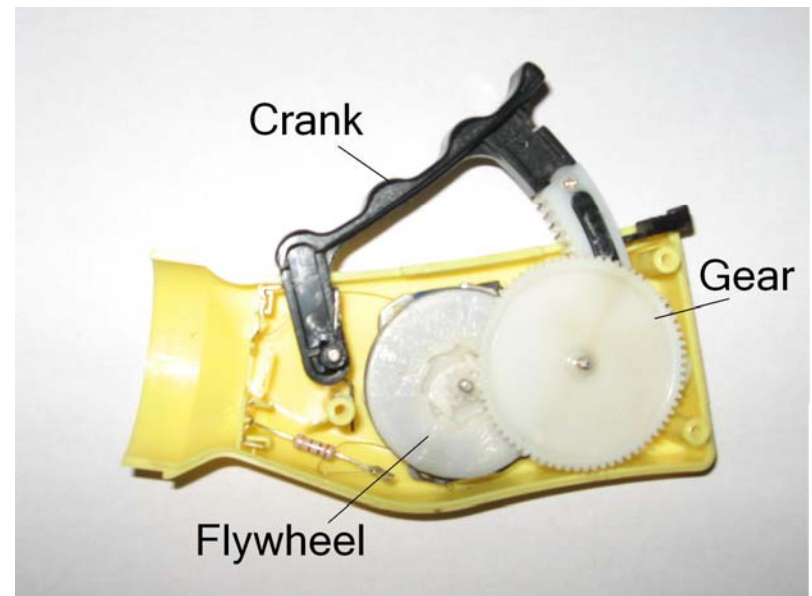
Dave Tennett

What it Looks Like



Background

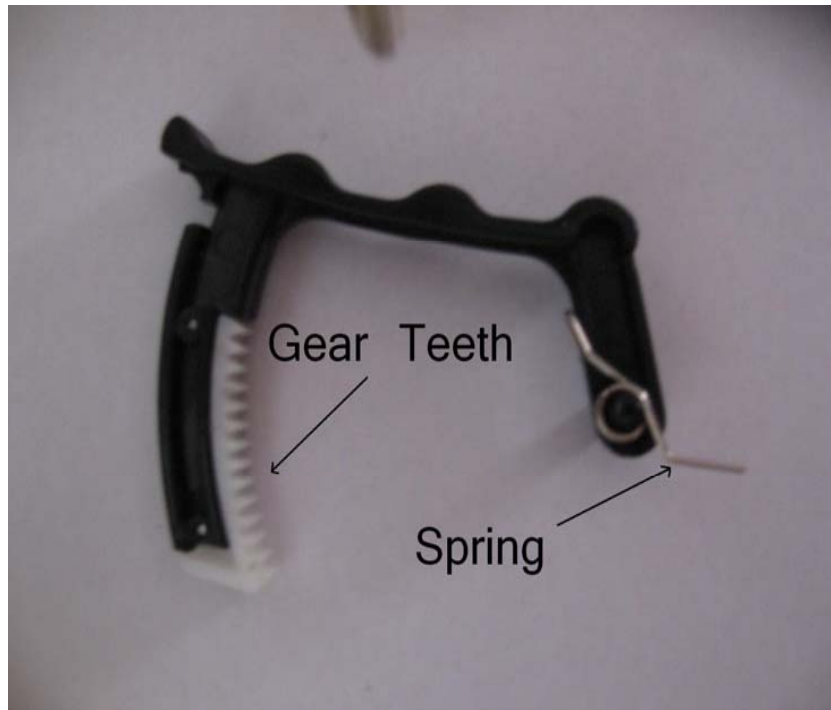
- No batteries required
- Operates by manually compressing handle to generate light
- Dynamo supplies electrical current to incandescent light bulb
- Very popular in World War II because of poor power supply to homes



Integral Systems

- Energy
 - Mechanical
 - Hand Crank
 - Internal Gears
 - Electrical
 - Dynamo
 - Copper Wire
- Light Production
 - Incandescent Light Bulb

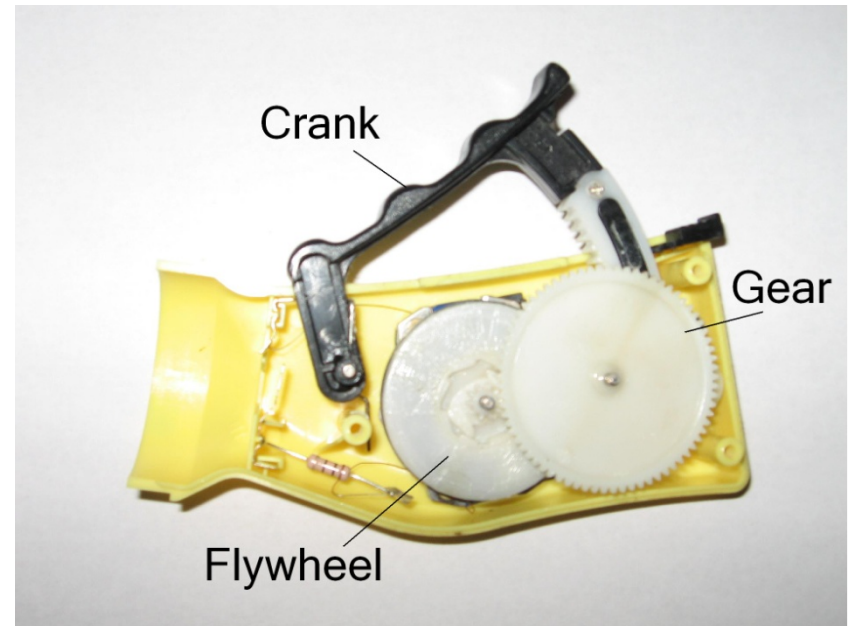
Mechanics - Crank



- Hand compresses crank several times to start rotation of gear
- The spring returns the crank to its original position, allowing for another squeeze
- The teeth spin the gear at an intermittent rate, transfer energy to the flywheel

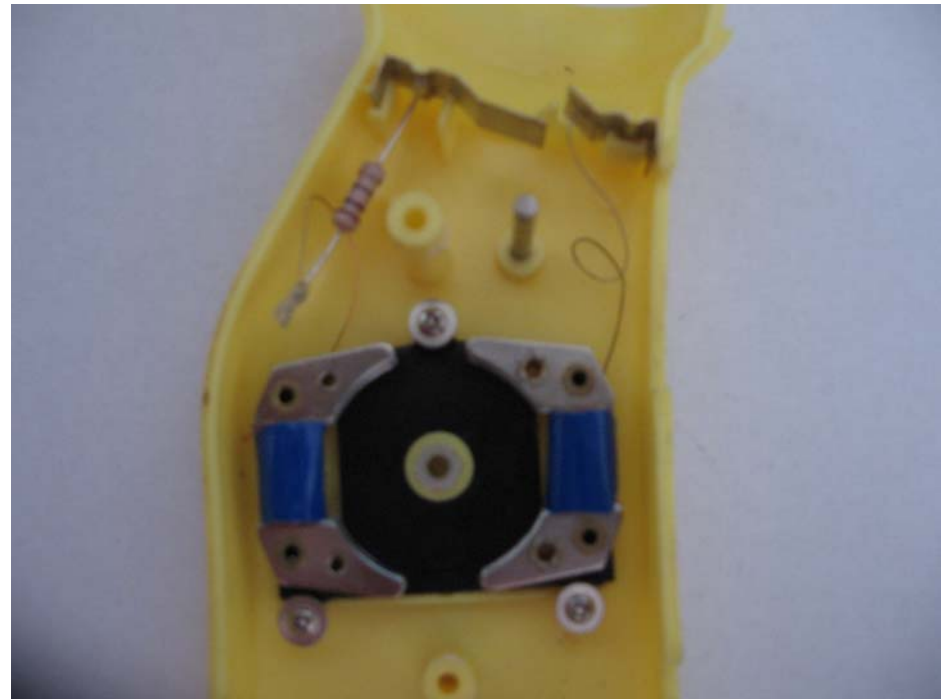
Mechanics- Gear and Flywheel

- As gear spins it meshes with another gear on top of flywheel which provides the flywheel's angular motion
- As the gear spins it transfers kinetic energy to the flywheel
- Flywheel is attached to magnet which rotates at the same velocity



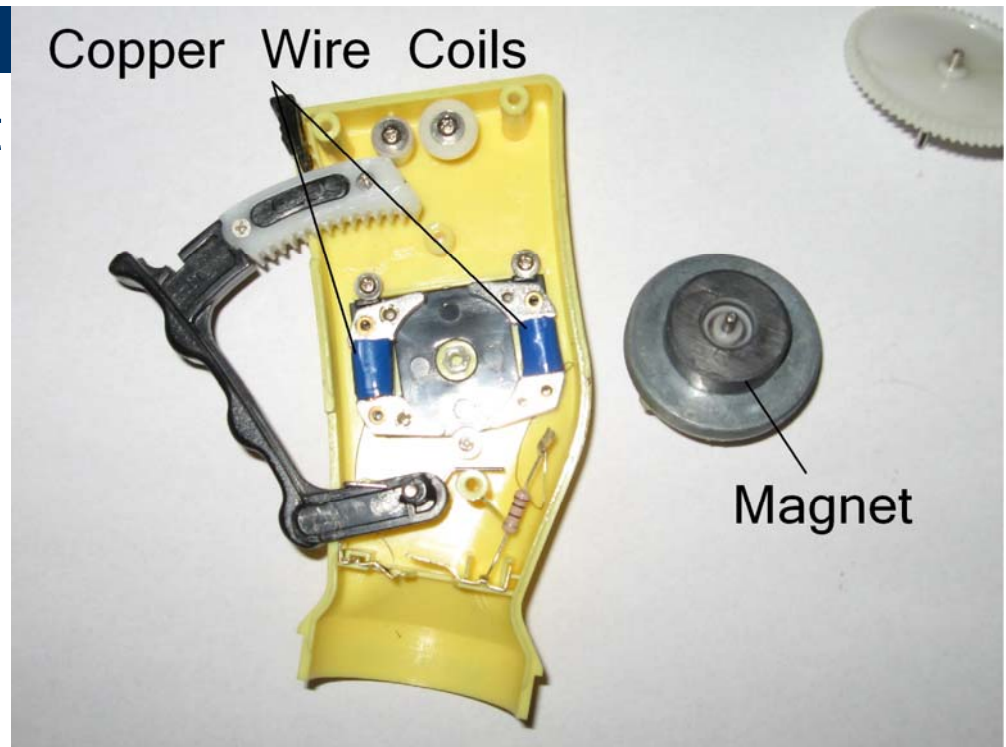
Dynamo Operation

- Based on electromagnetic principles
 - Changing magnetic field produces electric field
- Converts mechanical rotation into pulsing direct current



Energy Exchange

- The spinning magnet induces an electrical current in the copper wire coils.
- This induced current is caused by the changing magnetic flux produced by the rotating magnetic field
- Induced current flows to bulb producing light



Current

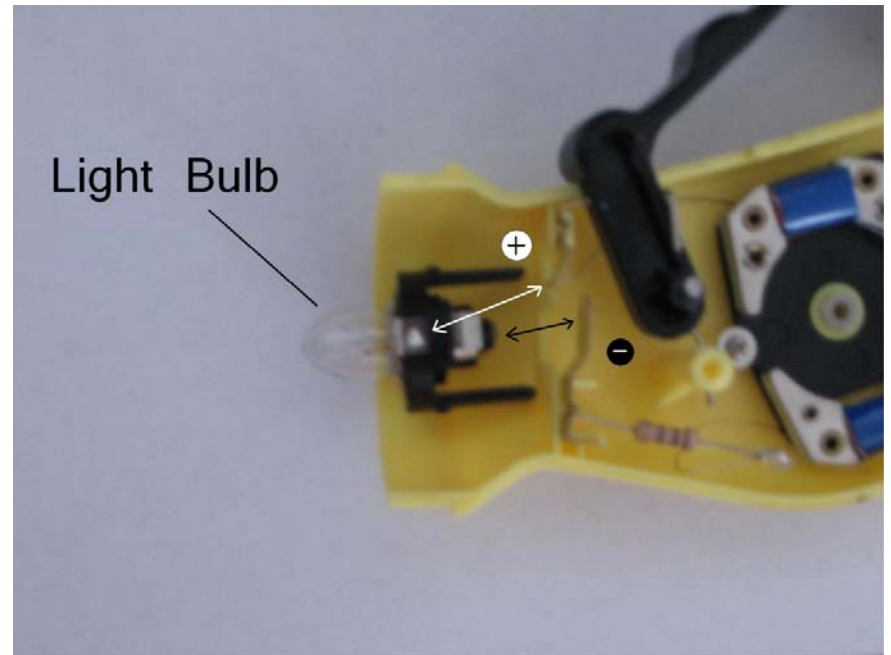
- Current flows through the copper wires
- A resistor is placed in the system to limit the current which passes through to the light bulb
- The resistance is 20 ohms, +/- 5%



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Let there be Light

- Current passes through the light bulb and heats the filament producing light



Faraday Flashlight



- Similar principle to mechanical powered flashlight
- No batteries, light produced from shaking flashlight
- Uses magnet and copper coil to induce electrical current

Faraday Flashlight Internals



How it Works

- While shaking flashlight, a magnet slides back and forth inside copper wire
- As magnet goes back and forth through copper wire, an electric current is induced according to Faraday's Law of Induction
- Current charges capacitor so flashlight does not have to be continuously shaken
- Stored current in capacitor is used to power an LED

Advantages

- Does not have to be continuously pumped or shaken because of capacitor which acts as a short term battery
- LED lamps are much brighter and more efficient than incandescent bulbs
- 30 seconds of shaking provides up to five minutes of light