Curiosity Guide #804
Electric Motors

Accompanies Curious Crew, Season 8, Episode 4 (#804)

Spinning Wire

Investigation #1

Description

Round and round the wire goes!

Materials

- AA or D-cell battery
- 3-4 large Neodymium magnets of similar diameter as the battery
- Copper wire
- Needle nose pliers

Procedure

1) Stack the magnets together and place them on the negative end of the battery.
2) Stand the battery upright so the magnets are on the positive end.
3) Cut a length of wire about 8-inches in length.
4) Bend the wire in half, then fold each side back in the original direction, leaving a small u-shaped bend in the wire.
5) Pinch the bend a bit more with the pliers to make the bend pointy.
6) Lay the battery flat on the table.
7) Bend the wire so that the point can touch the top of the battery and the sides arc around the top of the battery.
8) Run the wire the length of the sides and find the point at which the wire is in line with the center of the magnet.
9) Stand the battery upright.

10) Bend one wire leg at that marked point so that the wire wraps in front of the magnet stack, while the other wraps around the back of the magnet stack, making slight contact.
11) Try to fine tune the bends in the wire to make the wire as symmetrical as possible.
12) Cut off any excess wire.
13) What will happen when the wire is placed on the negative end of the battery?
14) What do you notice?
15) What would happen if the batteries were flipped over?
16) Can you make some other wire shapes and still make the assembly work?

My Results

Explanation

This is an example of a homopolar motor. The first homopolar motor, which looked very different, was made by Michael Faraday in 1821. A homopolar motor is designed to use direct current, or DC, that results in rotational movement. Rotational movement happens because the magnetic field moves vertically through the battery, while at the same time, the current from the battery moves into the center of the magnet stack and then turns horizontally to spread out toward the outside edge of the magnets. At this point, there is current that is perpendicular to the magnetic field, which creates a new horizontal force, called the Lorentz Force. The Lorentz Force runs perpendicular to the vertical magnetic field and the current, which acts on the wire conductor and causes the wire to spin. This is a short circuit that will drain the battery charge quickly. The wire can get hot, so be cautious.

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