



Building a motor

Ages 6 and up

Supplies you will need:

- ★ Large rubber band (goes around the battery to hold the leads)
- ★ Magnet
- ★ 2 jumbo-sized paper clips
- ★ Small gauge magnet wire (enameled wire)
- ★ Marker
- ★ Connecting wire
- ★ D-cell battery
- ★ Packing foam or rubber eraser to use for the base
- ★ Sandpaper (medium grit)

Instructions

1. Wind the wire around the marker between 10 and 20 times. Be sure to leave two inches of wire free at each end.
2. Remove the marker. You will be left with a spring of wire.
3. Squeeze the coil together so it's flat. Wrap the ends of the wire around the coil. It should look like —O— .
4. Leave two leads on each side of the coil.
5. Sand the top half of each lead. Be sure the paint is completely removed from the top half of each lead. The sanded top half should shine. Do not sand the enamel on the bottom half of each lead. Be sure the area where the lead meets the coil is well sanded.
6. Now that the coil is finished, find the two jumbo sized paper clips and unfold each one. Insert the ends into the eraser or foam block.
7. Set the coil so the leads rest on each paper clip.
8. Give the coil a gentle tap or twist to get it started. Watch it spin!



How the motor works

This motor is actually a half-motor.

Half of the time the coil is an electromagnet. This happens when the sanded side of each lead is in contact with the paper clips.

To show this, put a compass near the coil. The compass needle should move and point at the coil. This shows that electricity is flowing through the coil and that the coil is an electromagnet.

When the enameled side of each lead is pressed against the paper clips, the coil is not an electromagnet.

You can see this for yourself by holding the enameled side of the coil's leads against the paper clips. No electricity will flow through the coil. The coil will not move the compass needle. The compass will point north.

This is how the on again/off again of the coil creates motion. When the coil is an electromagnet, it turns to line up with the bar magnet and the motion begins. Just as this happens, the enameled halves of the leads touch the paper clips. Electricity stops flowing through the coil. The electromagnet is off, but the coil is moving and it keeps moving long enough for the cycle to repeat.

So half the time the coil is an electromagnet that moves to line up with the permanent magnet below and half the time the coil is just coasting. Hence you have made a half motor. In a full motor the coil is never off.

Motor not working? Try these steps:

1. Check the sanding on the coil. Is the top half of each lead sanded?
2. Is the coil centered and straight?
3. Are the paper clips lined up evenly?
4. Is the battery working?
5. Do all the connections have good metal-to-metal contact?
6. Is the coil as close to the magnet as possible without touching it?
7. If the bar magnet hits the paper clips, put a rubber band around the magnet and foam.