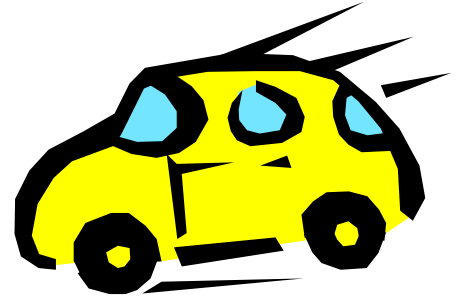


Simple Electromagnetic Motor

Nick J. Rahall, II Appalachian Transportation Institute
<http://www.marshall.edu/ati/dfv/kids/active/motor.htmlx>



Objective: Students will build a simple motor to understand how it works.

Materials:

- 1 reed switch (may be purchased for \$1-2 at electronic stores)
- 2 1/2in. diameter round magnets
- 1 spool medium gage magnet wire
- 1 cork
- 1 needle (must be longer than the cork)
- 1 6-volt battery
- 3 push pins
- 1 roll electrical tape
- 1 roll duct tape
- 1 long nail (4-6in.)
- 1 large plastic building blocks
- 1 4-6in. piece of sturdy cardboard
- 1 piece fine sandpaper
- 1 piece rough sandpaper
- 1 soldering tool
- 1 pair scissors
- 1 bottle wood glue
- 2 pencils
- Several thick books or cardboard shirt boxes

Procedure:

1. Creating the Rotor. Insert the needle lengthwise through the center of the cork. About 1/4in of the needle should stick out of each end of the cork. Make sure the needle is inserted directly in the middle of the cork because the cork must balance for the motor to work properly.
2. Use the rough sandpaper or scissors to shave two flat, parallel sides in the cork. Do not shave more than 1/4in. to create each flat side on the cork.
3. Identify the same poles on the magnets. Like poles (North + North or South + South) will repel each other, but opposite poles (North + South) will attract each other. Identify two repelling sides and glue one magnet to each flat side of the cork so the repelling sides face outward

4. Creating the stator (building the base and electromagnet) Make a small dent in the middle of the end of each push pin with the soldering iron.
5. Set the books in two equal stacks with the spines of the books facing each other. Leave a space a little longer than the needle between the books. Insert one push pin each stack of books at the same height so the dented ends of the push pins are facing each other. Balance the needle in the cork between the two push pins. Adjust the push pins or the books if necessary. The needle must sit vertically in the push pin holders to balance properly, and the cork must be able to rotate freely.
6. Wrap electrical tape around the nail to make a 1/2in. thick layer in the center of it.
7. Wrap several layers of magnet wire up and down the wire between the layer of electrical tape and the head of the nail. Start wrapping the wire at the layers of tape and stop wrapping it at the same end of the tape. Secure the ends of the wire to the layers of tape, but leave about 1 ft. of wire at both ends.
8. Tape the sharp end of the nail to the plastic building block. Attach the plastic building block to the piece of cardboard with duct tape.
9. Remove about 2in. of insulation from the ends of the wire with the sandpaper. Wind one bare wire end tightly around the sharp post of the remaining push pin to make a coil. Slide the coil off the push pin without straightening the coil. Repeat with the second wire.
10. Set the building block a few inches in front of the magnets with the flat end of the nail facing the magnets.
11. Cut two 2 ft. pieces of wire. Remove about 2in. of insulation from the ends of the wire with the sandpaper. Wind one bare wire end tightly around the sharp post of the remaining push pin to make a coil. Slide the coil off the push pin without straightening the coil. Repeat with the second wire.
12. Insert one of the outside contact ends of the reed switch in one of the wire coils. Wrap the end of the wire coil tightly around the reed switch to secure it if necessary, but do not bend the reed switch. Repeat this step with the other end of this wire and both ends of the other 2 ft. piece of wire.
13. Wrap the middle of the first wire around one of the pencils a few times to create handles for the reed switch. Leave 8-10in. of the end of the wire free. Repeat with the other piece of wire.

14. Wrap the free end of one piece of wire to the positive battery post. Wrap the free end of the other piece of wire to the negative battery post.
15. Use the handles to hold the reed switch directly in front of the battery on the opposite side of the nail head. Bring the reed switch close to the magnets and the motor should work immediately. Be careful and do not touch the reed switch; it will get very hot as the battery turns.

Review questions:

1. Name some kinds of motors vehicles use? What kind of motors do most cars and trucks use?
2. What is the fuel source for the motor in this experiment?
3. Name some current models of vehicles that use electric motors.
4. Why must the magnets repel each other?
5. Why does the reed switch get hot?