

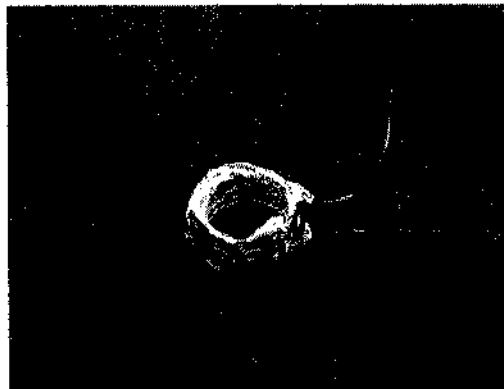
The Paper-Cup Speaker

Materials:

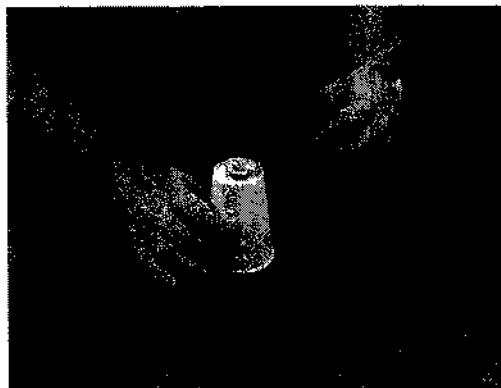
Four-foot length of No. 28 – 30 magnet wire
Hot glue gun/glue sticks
9 oz or larger paper cup
Masking tape
Sand paper
Light bulb (6.3 volts or lower)
Alligator clips
Tape recorder on CD player with external speaker jack
1/8" Jack plug with leads to connect to speaker
1/2" neodymium magnet

Procedure:

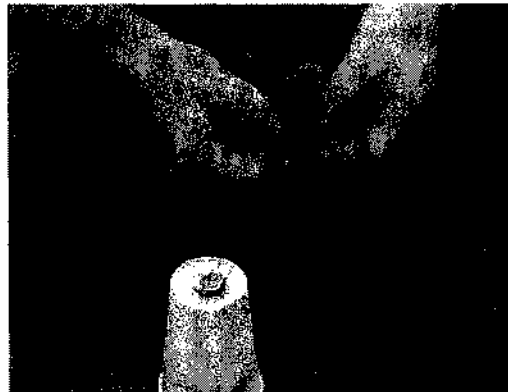
1. Wrap a four foot length of wire into a neat coil with a diameter of $\frac{1}{2}$ to $\frac{3}{4}$ of an inch. Leave at least 8 inches of wire free at both ends to use as leads.
2. Wrap tape around the wire to keep it from unraveling.



3. Carefully glue the coil onto the bottom of the cup as shown.



4. Scrape the lacquer coating off of the ends of the wire using the sandpaper.



5. Connect the 1/8" Jack plug with lead to the external speaker jack of the sound source, i.e. tape player, CD player or radio.
6. If you were to connect the paper cup/coil to the output leads of a radio or tape player, what do you think would happen?

Try it. What happened?

7. With the coil connected to the source leads, obtain a magnet from your instructor and place it near the coil. Now what happens?
8. Why does the speaker vibrate when the magnet is placed near the speaker and the wires are connected to a radio or tape player?

Teacher Resources:

Heller, PC (1997). Drinking cup loudspeaker-A surprise demo. *The Physics Teacher*, 35, 334.

Williams, Trinklein and Metcalfe, "Modern Physics 1984 Chapter 11, Sound Waves, Chapter 18, Heating and Chemical Effects, Chapter 19, Magnetic Effects, Chapter 20, Electromagnetic Induction, and Chapter 21, Alternating Current sources.

Tillery, Bill W. "Physical Science" 1991m Chapter 9, Electricity and Magnetism.

Giancoli, Douglas, "Physics" 5th edition, 1995, Chapter 20, Magnetism.

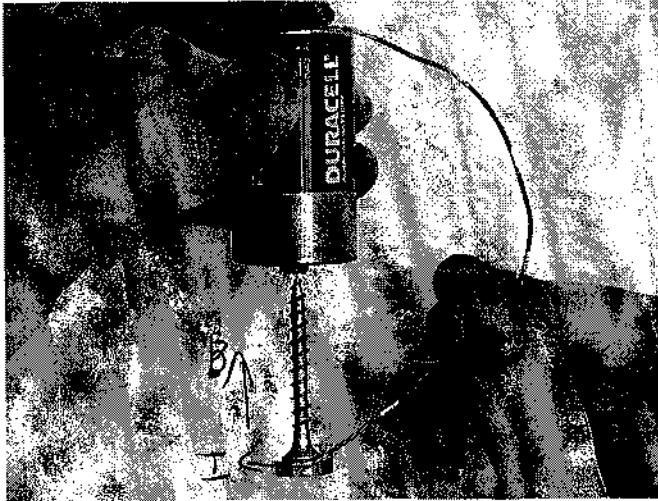
Murphy, Hollow, Zitsewitz, and Smott, *Physics, Principles and Problems* 1986, Chapter 25, Magnetic fields, Chapter 27, Electric and Magnetic Fields

Homopolar Motor

Materials:

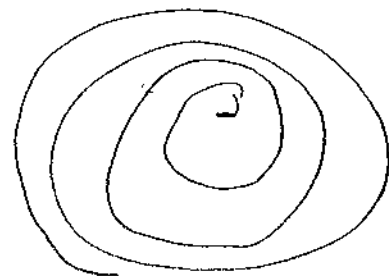
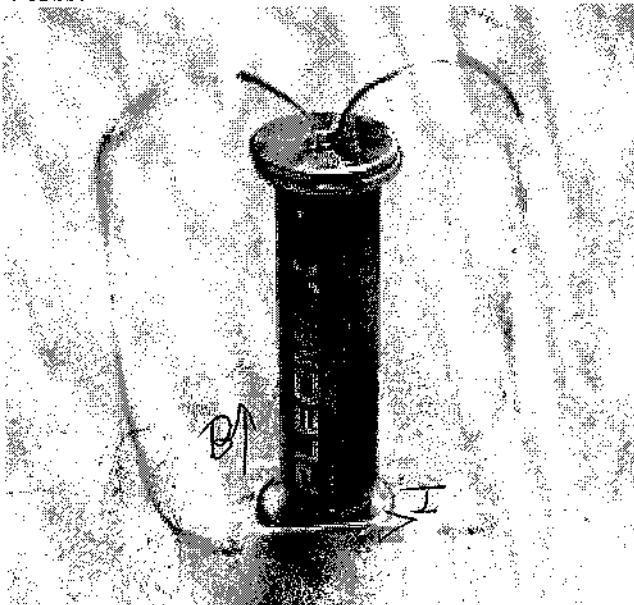
AA battery
Neodymium magnet
Copper wire
Steel wood screw

Version 1:



*touch bottom
magnet*

Version 2:



Can you figure out the right-hand rule for each version?