Stripped Down Motor

(View hyperlink above of a motor)

As motors go, this is about as simple as it gets.
A coil of wire becomes an electromagnet when current passes through it. The electromagnet interacts with a permanent magnet, causing the coil to spin. Voila! You have created an electric motor.

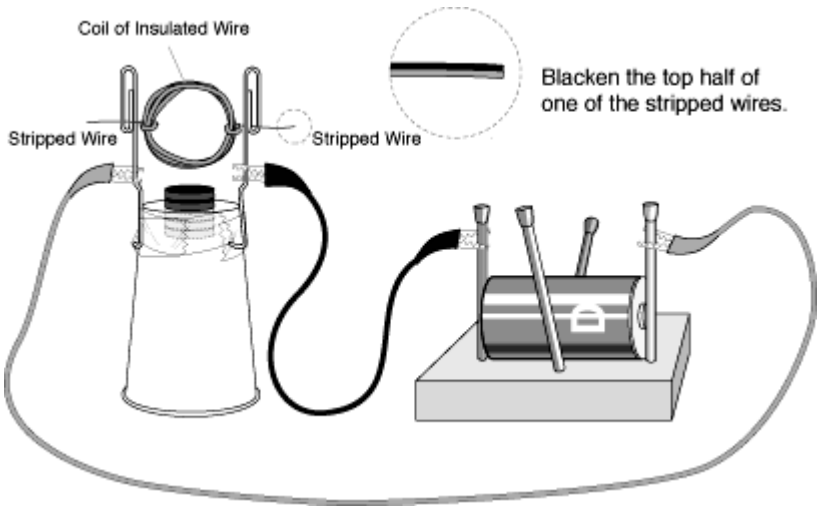
materials

- **5 small disk or rectangular ceramic magnets** (available at Radio Shack).
- **2 large paper clips.**
- **A plastic, paper, or Styrofoam cup.**
- **A solid (not stranded) enameled or insulated 20-gauge copper wire,** about 2 feet (60 cm) long.
- **Masking tape.**
- **A battery or power supply.** We have successfully run motors on one 1.5 volt D battery; additional batteries seem to make it easier to get the motor to run. You may want to try 6 volt lantern batteries. We have also had excellent results using a power supply (battery eliminator) set to about 4 volts. The advantage of the power supply is that it will supply a substantial current over a period of time. Unlike batteries, it doesn't have to be replaced. Experiment with what you have, and use whatever works!
- **2 electrical lead wires with alligator clips at both ends** (available at Radio Shack).
- **Wire strippers** (if you are using insulated wire).
- **Sandpaper** (if you are using enameled wire).
- **A black, waterproof marking pen.**
- **A battery holder.** (See "Assembly" for instructions.)
- **Adult help.**

assembly

(30 minutes or less)

Wind the copper wire into a coil about 1 inch (2.5 cm) in diameter. Make four or five loops. Wrap the ends of the wire around the coil a couple of times on opposite sides to hold the coil together. Leave 2 inches (5 cm) projecting from each side of the coil, and cut off any extra. (See diagram.)



If you are using insulated wire, strip the insulation off the ends of the wire projecting from the coil. If you are using enameled wire, use the sandpaper to remove the enamel. Color one side of one of the projecting ends black with the marking pen. (Note: It is very important that the orientation of the painted side corresponds to the orientation shown in the drawing. If the coil is held in a vertical plane, paint the top half of one of the wires black.)

Turn the cup upside down and place two magnets on top in the center. Attach three more magnets inside the cup, directly beneath the original two magnets. This will create a stronger magnetic field as well as hold the top magnets in place.

Unfold one end of each paper clip and tape them to opposite sides of the cup, with their unfolded ends down. (See diagram.) Rest the ends of the coil in the cradles formed by the paper clips. Adjust the height of the paper clips so that when the coil spins, it clears the magnets by about l/l6 inch (1.5 mm). Adjust the coil and the clips until the coil stays balanced and centered while spinning freely on the clips. Good balance is important in getting the motor to operate well.

Once you have determined how long the projecting ends of the coil must be to rest in the paper-clip cradles, you may trim off any excess wire. (The length of the projecting ends depends on the separation of the paper-clip cradles, which in turn depends on the width of the base of the cup you are using. See diagram.)

If you are using a battery, place it in a battery holder. You can make your own from a block of wood and four nails, as shown in the diagram. Use the clip leads to connect the battery or power supply to the paper clips, connecting one terminal of the battery to one paper clip and the other terminal to the other paper clip.

Give the coil a spin to start it turning. If it doesn't keep spinning on its own, check to make sure that the coil assembly is well balanced when spinning, that the enamel has been thoroughly scraped off if enameled wire has been used, that the projecting end has been painted with black pen as noted, and that the coil and the magnet are close to each other but do not hit each other. You might also try adjusting the distance separating the cradles: This may affect the quality of the contact between the coil and the cradles.

Keep making adjustments until the motor works. Have patience! The success rate with this design has been quite good.