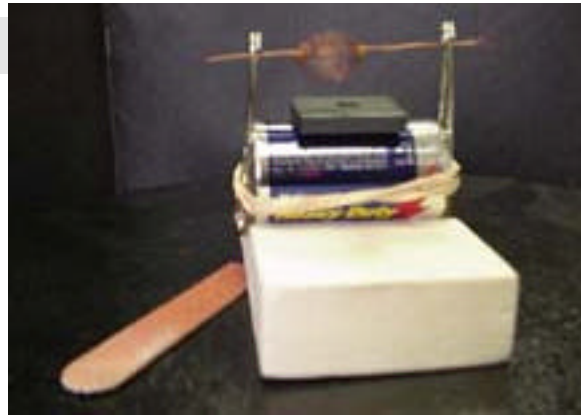


Build a simple electric motor! What makes this motor move?

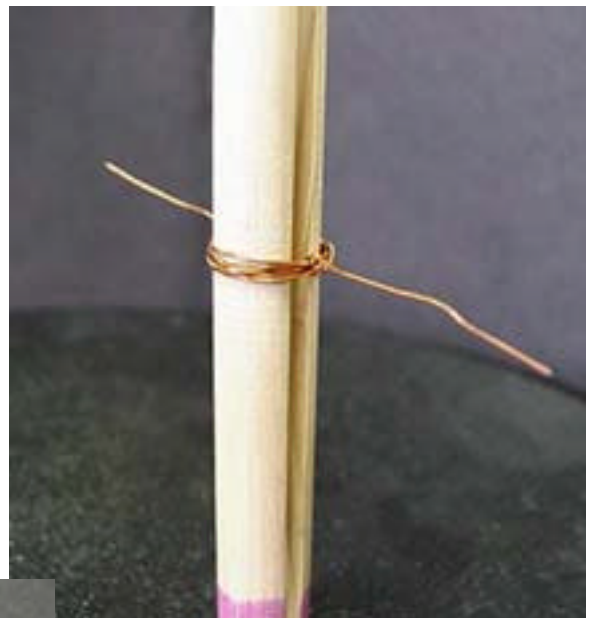


What you need:

- ❑ You will need
 - Two (2) #3 safety pins (these are the large 2 inch ones)
 - 36 cm of 24 or 25 gauge enamel wire (21 AWG wire is too thick and 28 AWG starts getting too thin)
 - Motor Making Jig - this is basically a $\frac{1}{2}$ inch diameter dowel, an emory board (for sanding the enamel of part of the wire) and a small board with a groove cut in it for the dowel to lay in. If you don't have a jig you can also use a marker to wind the coil on.
- ❑ You should also have
 - A permanent magnet and a battery (C size works well)
 - If you have already done the [Light Me Up](#) and [Stuck On Me](#) activities then you should already have these objects.
- ❑ Your group should also have the following community supplies:
 - Masking tape, Scissors and extra Batteries

What to do:

- 1 We need to make a coil (loop or circle) using the enamel wire. Leaving a 3 cm tail on either side, wind the wire into a coil with a diameter slightly larger than 1 cm ($\frac{1}{2}$ inch works well). Wrap each tail a couple times around the coil to hold the coil together. The tails should be on opposite sides of the coil (180° apart) pointing in opposite directions. The wooden spool allows you to coil and make the finish wrap using the slots cut in its sides.



- 2 Remove the



enamel from the top edge of both

Move Me Baby!

2

tails. If you place the spool with the wire coil on it in the groove of the wooden base you can scrape the enamel off of both sides using the sandpaper board.

IMPORTANT: Only remove the enamel from $\frac{1}{2}$ of the wire's circumference. Removing the enamel from the edge in-line with the coil allows the coil to switch on and off being an electromagnet at the right position to interact with the permanent magnet. This is the only "tricky" part and is the cause of most motor troubles.



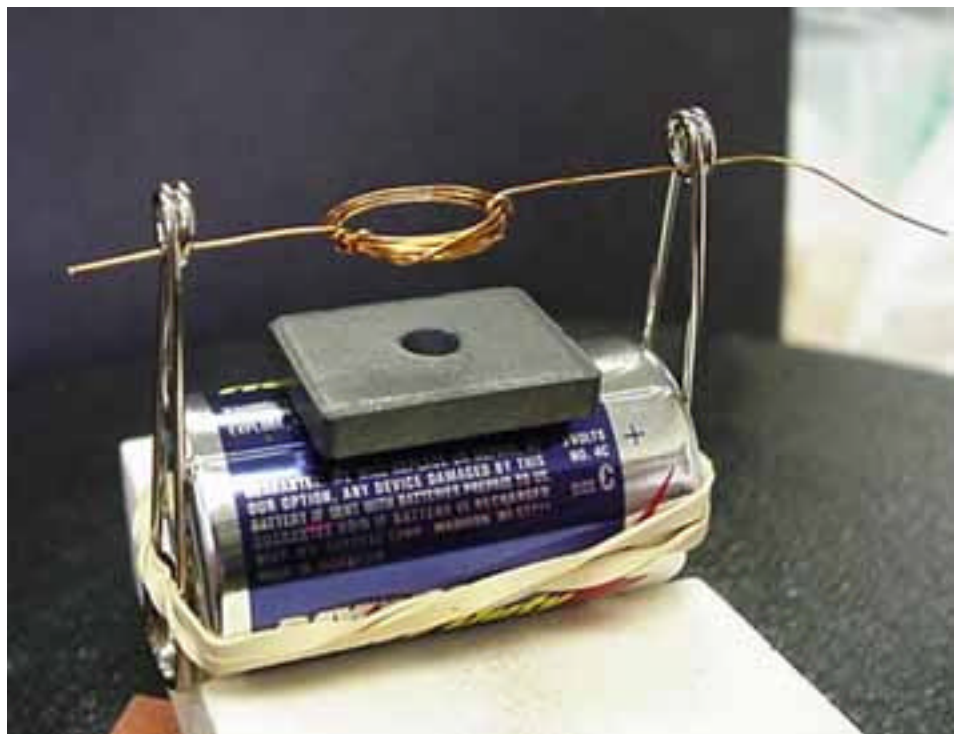
You see the complete motor making jig in the photo to the left. The $\frac{1}{2}$ inch diameter dowel is tapered slightly to allow the wire to slip off easily. The dowel also has grooves in the sides 180 degrees apart to allow the wire tails to be easily wrapped around the loop.

The matching base has a groove that allows the dowel to be placed in it to aid in the removal of the enamel from both top edges of the wire tails.

I like to use an emory board to remove the enamel, but you can also use sand paper - just don't use your teeth.

3

Secure the safety pins to the battery ends with tape or a rubber band. Place the magnet on top of the battery and position the wire coil through the hinged ends of the safety pins that should be sticking above the magnet.



4

Troubleshooting:

- If your wire just rocks

adjust the balance. Balance is crucial so try bending/straightening the coil and tails. You can also add a small piece of tape to the coil to adjust the balance.

- If your wire coil does not spin, make sure that enough enamel is removed from the tops of both tails. You may have to scrape the wire with the sandpaper some more.
- If your wire coil does not spin, make sure that the enamel is removed from just one side of each tail and that it is the same side. NOTE: If you took off too much enamel, you can use a permanent marker to replace the missing enamel. Just draw a mark where you want to replace enamel.

Challenge:

- Can you make the motor spin faster?
- Can you make the motor spin slower?
- Build motors with different numbers of coils. What do you notice about how they work?
- Take apart equipment that has motors in it. Old disk drives are good as well as old VCRs etc.

Safety Note:

- Drop anything that gets hot! (try again when stuff cools off)