Homopolar Motor Instructions:

American Stirling Company
www.stirlingengine.com

Homopolar Motors are the worlds simplest electric motor. Originally invented by Michael Faraday in 1821, these motors are amazing easy to build and use.

This kit supplies neodymium magnets, batteries, copper wire and instructions. For other good ideas on how to build these motors do a search for homopolar motors on http://www.youtube.com

You will also need a needle nose pliers to cut and bend the copper wire.

Warning: This is not a TOY and should not be given to children. While these motors are reasonably safe, the chance of pinching your fingers between the magnets is fairly high if you aren't careful, and moderately high even if you are careful. These magnets we supply work well with size AA alkaline batteries.

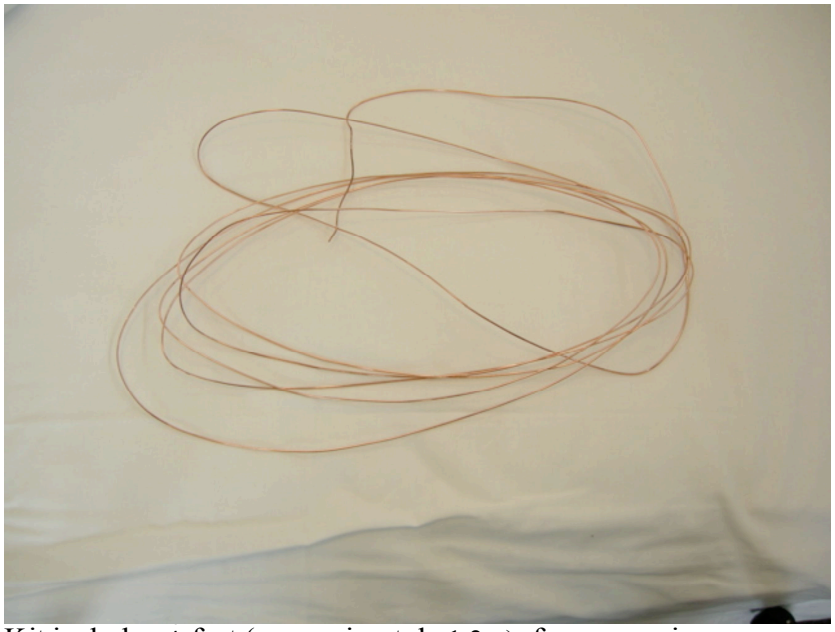
Warning: Do not attempt to build a motor like this using a re-chargeable battery, or any battery type other than alkaline. The chance of overheating a lithium battery, Ni-Cad batteries, or any other high energy battery is quite high.

Warning: Only Use Alkaline batteries!

Computer Warning: These magnets are strong enough to ruin computer hard drives if they come in contact with the outside of the computer. You will ruin your lap top's hard drive if you set these magnets on top of it. These magnets will also ruin iPods and other portable music players. Keep these magnets at least 3 feet (1 m) from computers mp3 players or magnetic media.

This kit supplies two (2) neodymium magnets, two (2) AA batteries similar to the ones shown, and approximately four (4) feet (1.2 m) of copper wire.

Batteries and neodymium magnets. Use only alkaline batteries!


Kit includes 4 feet (approximately 1.2m)of copper wire

Our magnets come packed in thin steel plates that reduce the field strength of the magnet to safe levels outside the box for shipping. Remove these plates and set them away from any computers or hard disks. The plates will become slightly magnetic during shipping.

Your first problem will be how to get the magnets apart.

Sometime it helps to use one of the batteries as a push stick to slide one magnet off the stack.

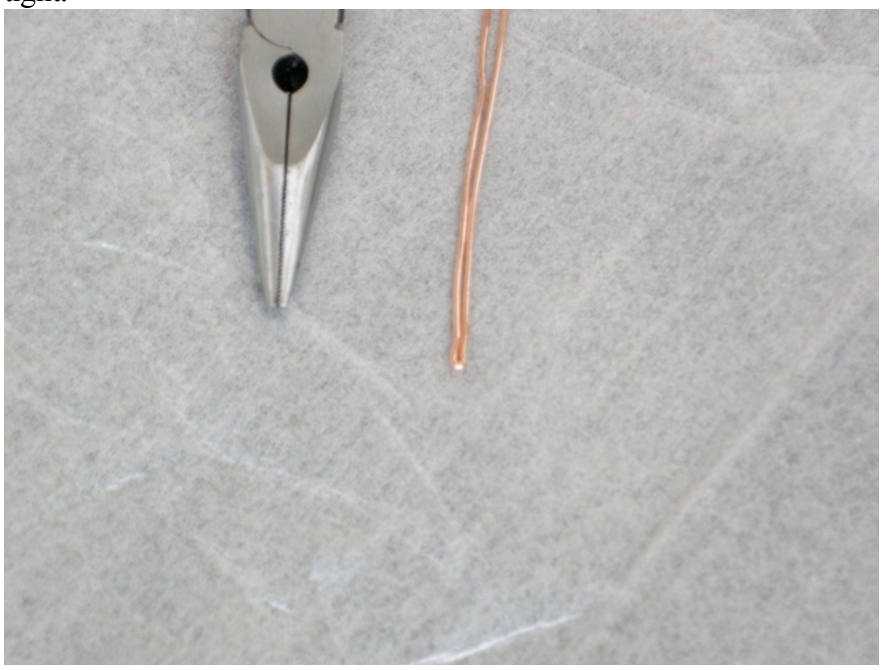
Either keep your fingers entirely clear of the magnets, or push your fingers all the way between the magnets. These magnets are sized that you probably won't hurt yourself if you put your fingers deeply between them, but if you only put a little bit of your finger between them, you will definitely get pinched.

With larger neodymium magnets you should always keep your fingers entirely clear of the magnets.

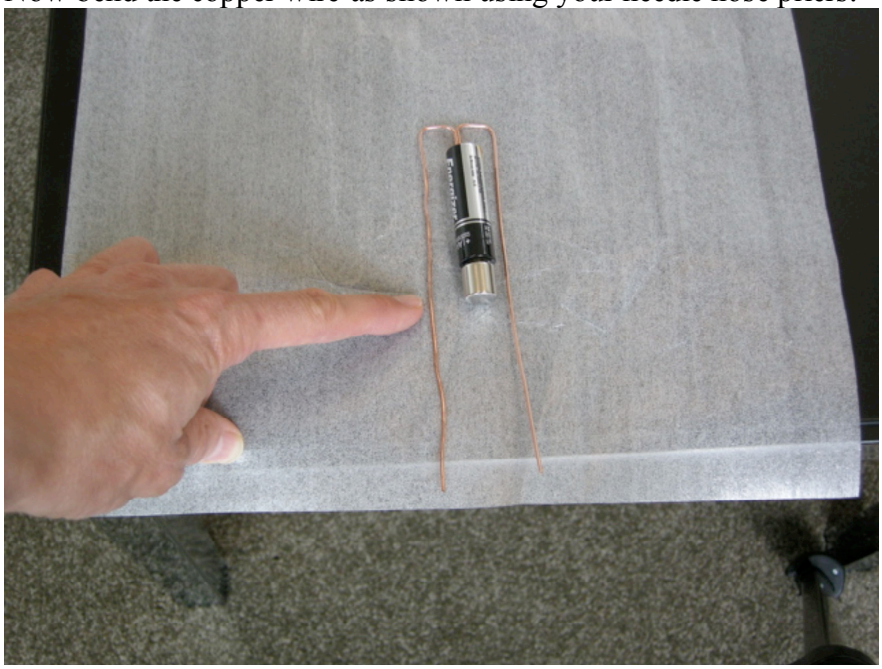
There is an amazing variety of motor designs that will work. Use these instructions as guidelines and then build your own designs.

First cut approximately 1 foot (1/3 m) of copper wire with your needle nose pliers.

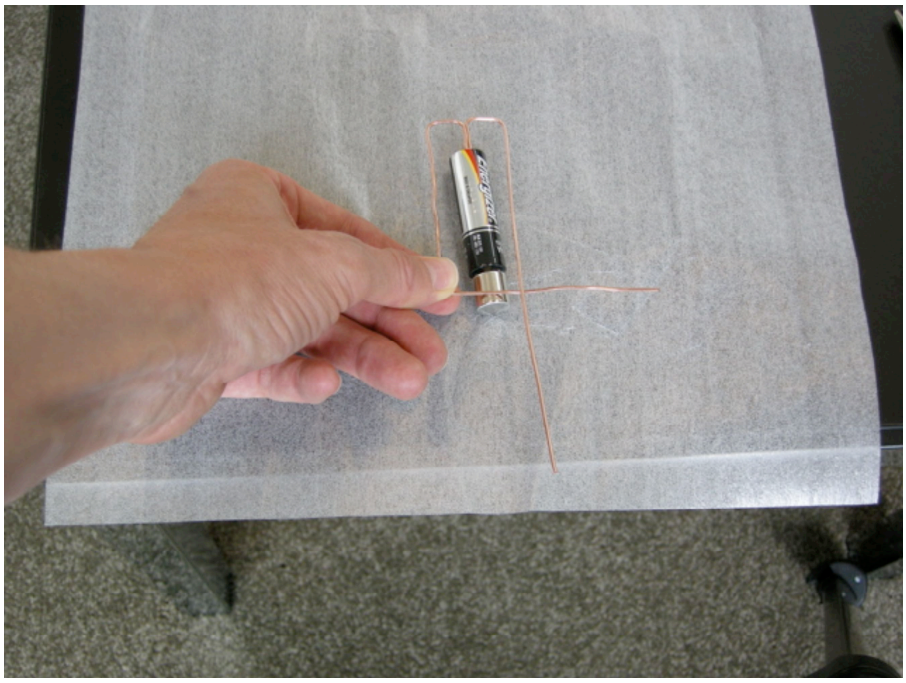
Next crimp your copper wire in the middle as shown. You want this crimp to be very tight.



Now bend the copper wire as shown using your needle nose pliers.

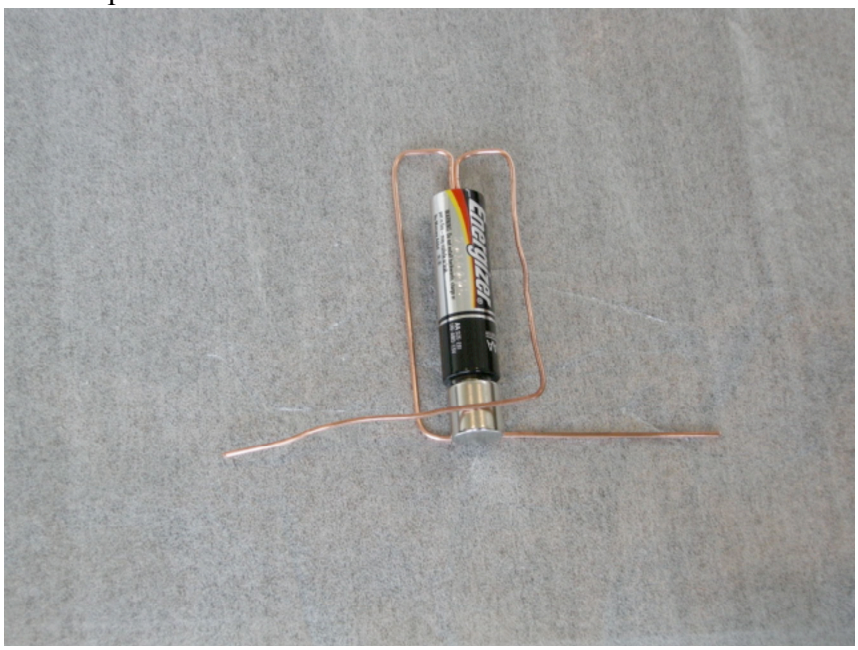


Now bend the bottom pieces into a box shape with the bend coming at the location of my finger in the photo above.

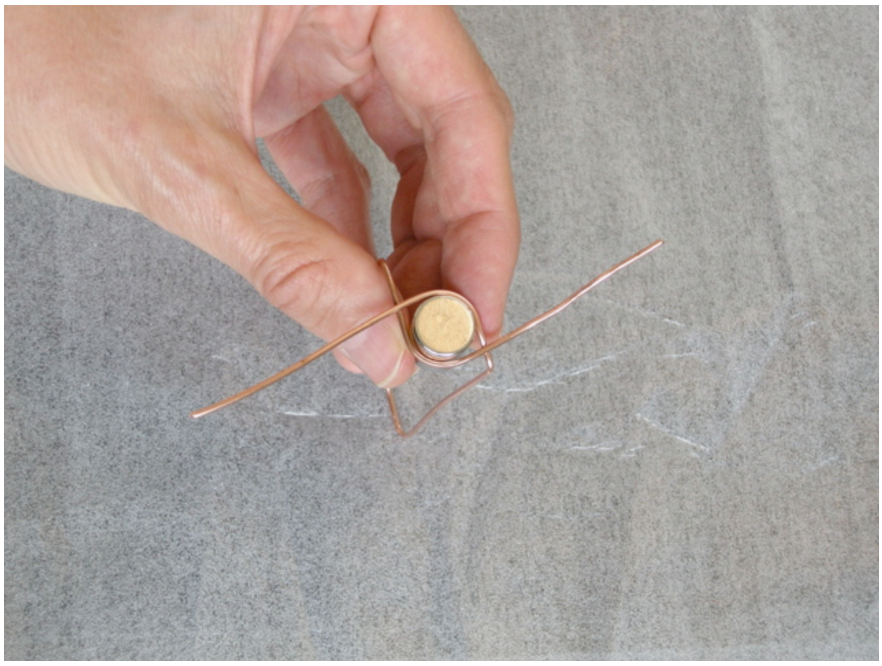


Then do this:

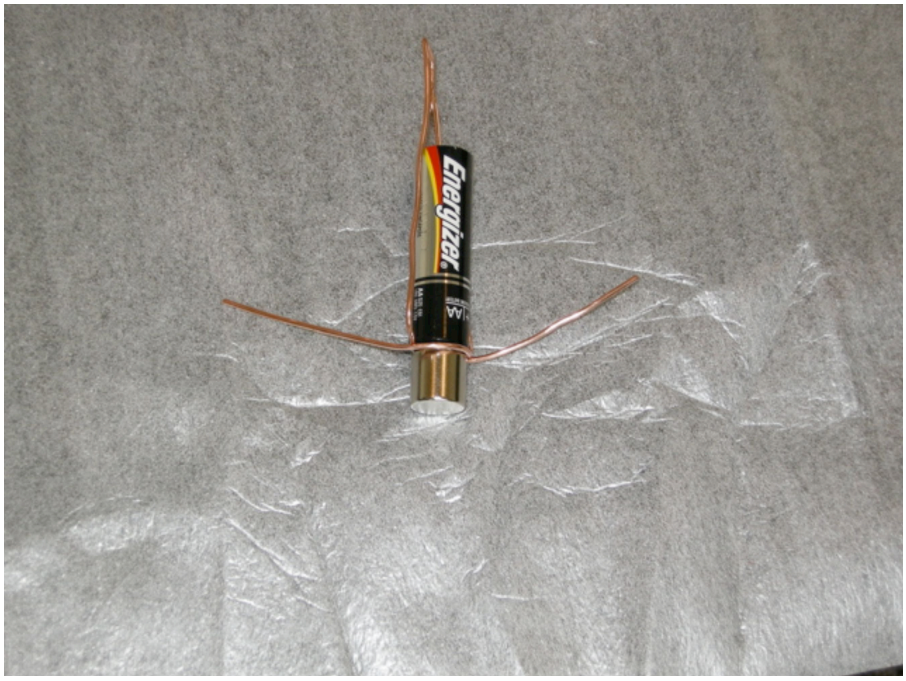
The idea is to build something like this, then use the magnet as a forming block to bend a wire loop around it.



Next bend the copper wires around the magnets as shown to form a loop.



Now bend the long wire edges up as shown below so they clear the table.



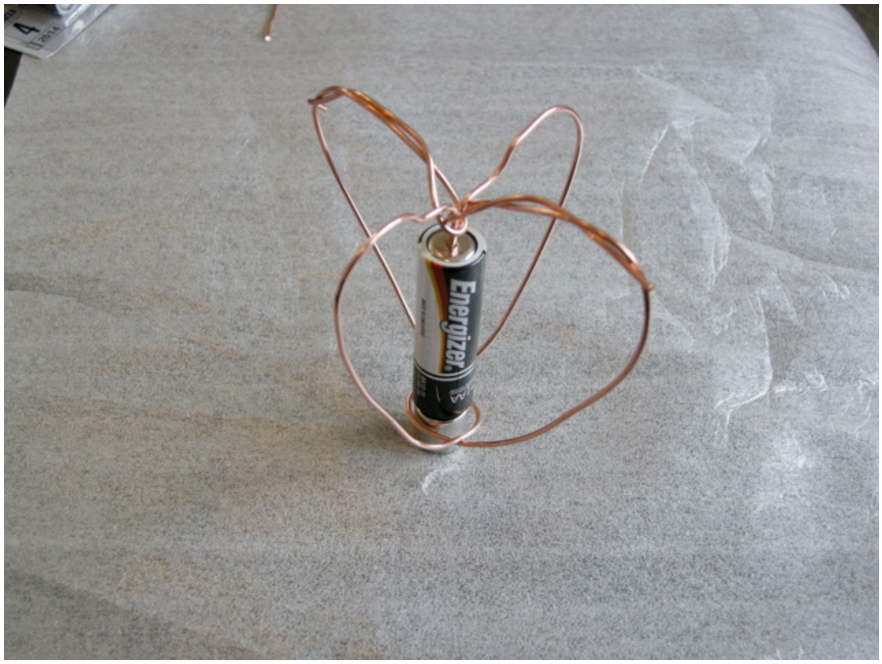
Extremely important: Adjust the wires so that they form a loop around that battery but do not quite touch it. The ideal amount of gap is about 1/16" or about 1.5 mm. If the wires pinch the battery, there will be too much friction for the engine to run.

I have found it easier to put the plus side of the battery (the one with the knob) down and the flat side up.

The Energizer batteries I used for testing had a nice little dimple in the flat side that made a good support for the motor to spin on.

Now cut off the ears with your needle nose pliers after you have the engine running well. The engine will run better the better it is balanced.

There is an amazing variety of things that can be made to run. Here was my attempt at making a homopolar motor heart:



Use your creativity and resourcefulness to build lots of new motor designs.

Why does this motor work? Funny you should ask that. I really don't know. The text books say that if you have a magnetic field and an electric field, and you use the proper right hand rule (or was it the left hand rule) then you get a force that pushes in the right direction to make the motor spin.

The people who write electrical engineering text books may not have the only model that explains why these motors work or even the best model. It's important to remember that the physics of a electric motor is not the same as our mental model of the motor.

If your model of electricity is that it is like water flowing through a pipe, then that doesn't explain why the motor spins.

Most motors have one obvious magnet that pushes on another obvious electromagnet. This motor has none of that, so your theory of why it works, might be just as good (or better) than any theory printed in any text book.

I don't think that models of how physical systems work should be thought of as either true or false but rather as useful or not useful in a particular situation.

The idea that electricity is like water down a pipe is clearly useful for some things but clearly not useful (at least not very useful) in explaining why this motor spins.

I do know this about the motor. If you flip either the battery or the magnet over, the motor spins in the opposite direction.

So get out there and learn more about the physics of electric motors.

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