

# BUILDING A DIY ELECTROMAGNET FOR TELEVISION HACKING

## WHAT YOU NEED

- 3/8" diameter STEEL dowel rod (length depends on how many E-mags you want to make)
  - Steel works good, but it at least has to be a ferrous (magnetic) metal.  
(If your not sure, bring a fridge magnet to the hardware store and see if it sticks to it. If it sticks, you know its ferrous.
- Hand Drill
- Hack saw
- Wire clippers
- Electrical Tape and Scissors
- Small piece of sand paper
- Patience and Dedication
- Multi-meter (optional, but it helps to have one)



- Insulated Magnet Wire (jameco.com part #2098419)
  - 24 AWG seems to work best  
(AWG=American Wire Gauge, standards for wire thickness)

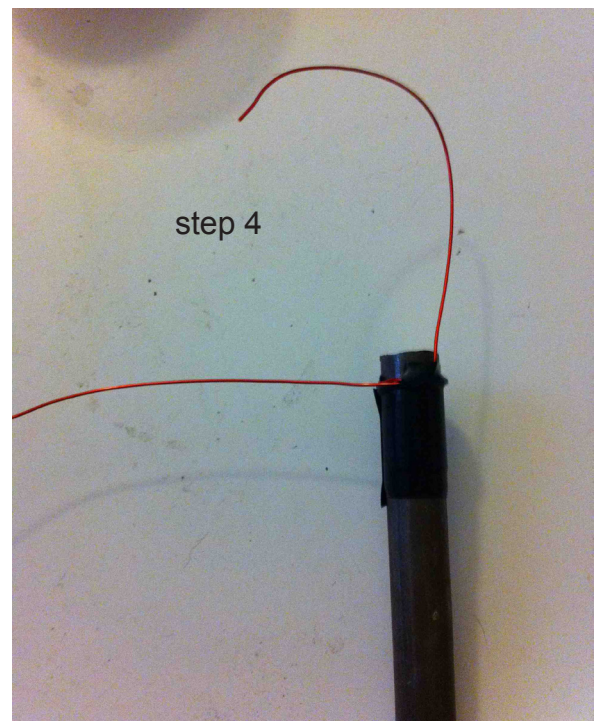
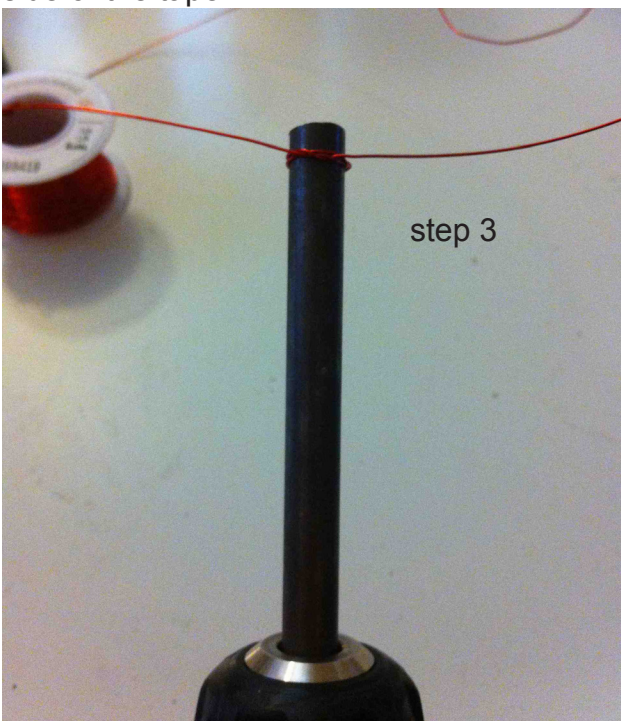


## BUILDING THE ELECTROMAGNET

1. Use your hack saw to cut off a ~4" length piece from your dowel rod.
2. Fit the small rod into the chuck of your drill, as if it's a drill bit.  
Note: You need as much of the rod as you can outside of the chuck so only put it in far enough so that it holds in place.



3. With the magnet wire, tie a knot around the top of the rod leaving about a 4" tail of wire. Tie the knot about 1/2" from the top.
4. Wrap electrical tape around the knot to secure it. Make sure both sides of the magnet wire are outside of the tape.



- 5.** Hold the magnet wire taught to one side of the rod and slowly begin to spin the drill.  
-You can hold the wire however feels most comfortable and use whichever rotation direction for the drill you like, just be sure to keep it tight.  
-The wire will start to stack one on top of the other as you guide it into position. If you mess up, just reverse the drill direction and pull the wire off until you reach the point of your mistake.



-This first layer is very important and will affect the winding of the following layers, so try to be as clean as possible. Also, the closer the windings are together, the more powerful the magnet will be.

- 6.** Continue winding the wire making sure that you hold it tight. Once you reach the bottom, the top of the cuck will force the winding in the opposite direction and do the same process all the way back up.



**7.** Once you reach back to the top, hold the wire tight and wrap electrical tape around the whole length of the rod. Don't cover up the very tip of the metal rod with tape, and be sure to leave  $\frac{1}{4}$ " to  $\frac{1}{2}$ " exposed.

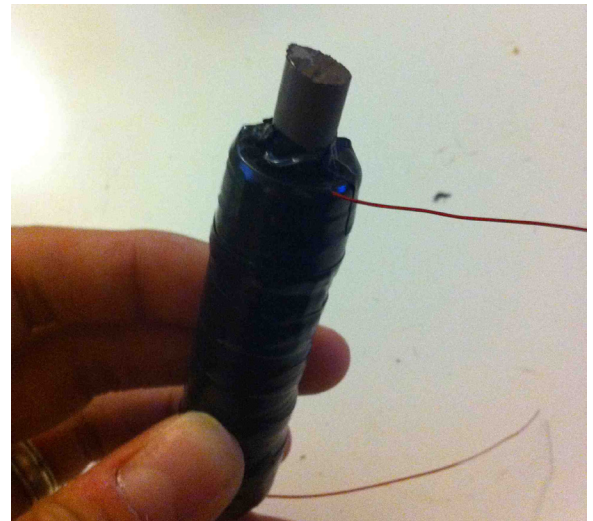


**8.** Repeat this process a few more times. The more wire you wind will result in a more powerful magnet but greater overall resistance. I usually wind my mine until I reach 5 Ohms of resistance. A good rule of thumb is that each up and down wind = 1 Ohm. So going up and down about 5 times is usually sufficient. But anything around 4 – 8 Ohms is good. If none of this makes sense, don't worry and just experiment.

To test the resistance of your magnet so far, find a stopping point at one of the ends and tape down the wire. Take your sand paper and rub off the insulation on both ends of the wound wire. This removes the colored insulation and exposes the bare wire. Take your multi-meter and test the resistance between the two points. If it is sufficient then snip off your wire, but if it's not, keep on winding.



**9.** When your finished winding, tape up length of the rod one last time and snip off the remaining wire leaving a few inches for a tail. Remove the magnet from the drill chuck and turn it over. You may notice that the bottom side closest to the chuck is not very well secured. Place some tape around the bottom covering the exposure to secure it.

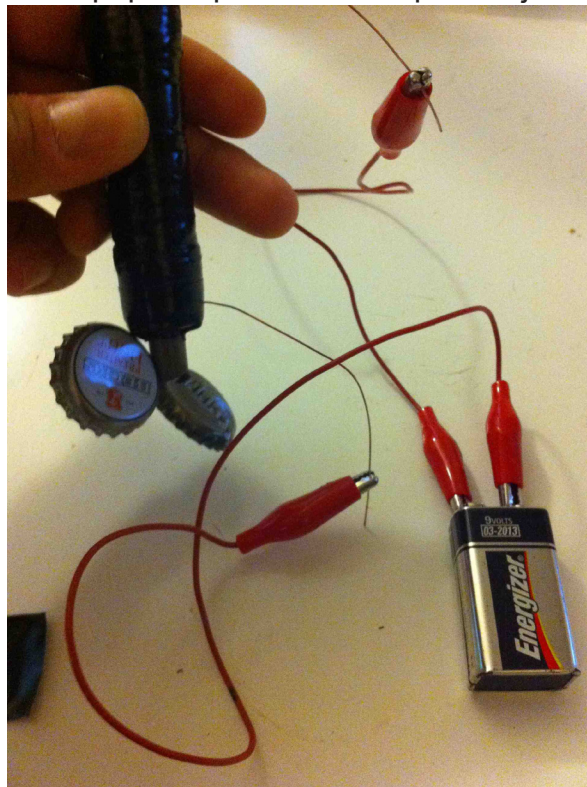


The finished magnet should look something like this. Make sure everything is secure with tape, but be sure to leave the top and bottom ends of the metal rod exposed.



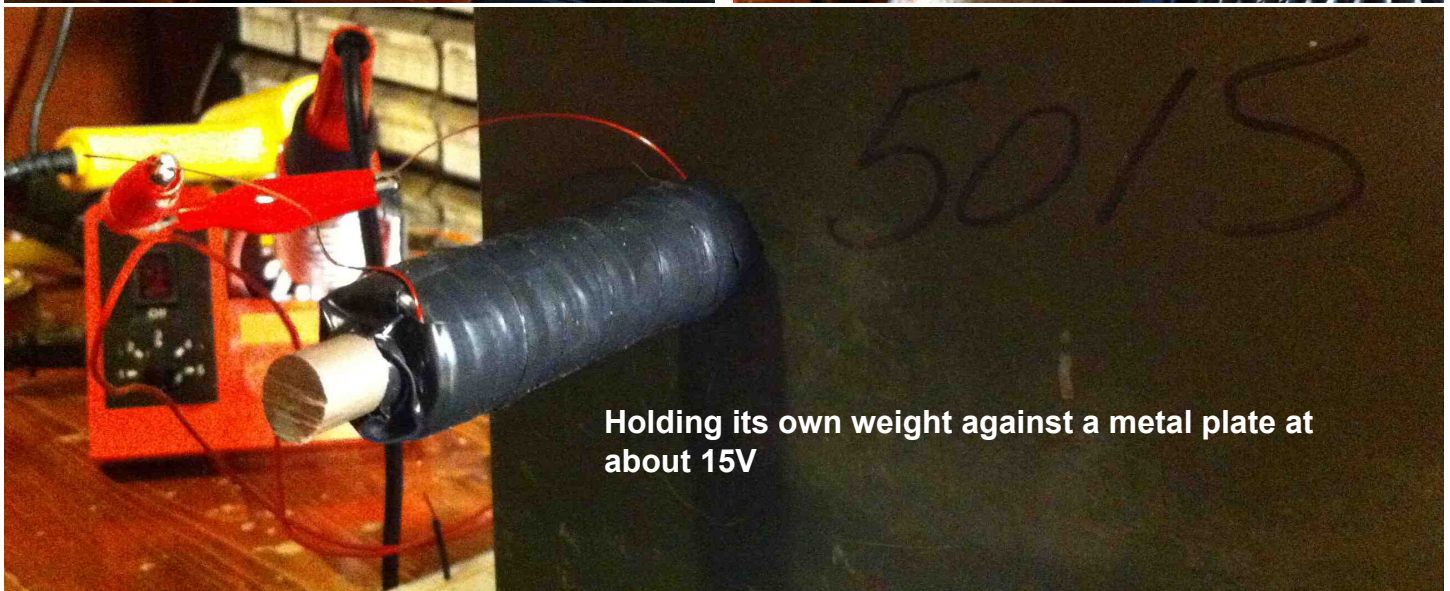
**10.** To test out your magnet, first make sure you have sanded off the insulation on both sides of the wire. Use some clip leads or some wire to attach the + and - of a 9v battery to the two leads of magnet wire. It doesn't matter which side goes to + or - at this point. (Changing that will switch the north and south polarity of the magnet).

You should be able to pick up a few paper clips or bottle caps with just the 9v.



For more power, use more electricity. Try hooking it up to a DC power supply. The increase in available amps will increase the power of the magnet dramatically. But it will also increase the heat it generates. Sometimes it can be hot to the touch so be careful.

Here are some examples:



A lantern battery would also work much more efficiently than the 9v. If you're comfortable you can also try a moderately powerful DC wall wart, but don't play around with plugging stuff into the wall unless you are more experienced. **Remember: Batteries can't hurt you, but wall power can!**

## INTRODUCTORY INFORMATION ON USING AN ELECTROMAGNET FOR TELEVISION HACKING

Though this will all be covered in the next tutorial, here is an explanation on where all this is going in regards to video hacking.

If you have ever stuck a magnet on a CRT, you know how it alters the colors and images on the screen. Doing this internally makes for some very interesting and dramatic imagery.

The electromagnet needs to be between 4 and 8 Ohms because this is around the same resistance of an audio speaker (or impedance when you're talking about an alternating current signal like audio). If you amplify an audio signal, such as a sine wave, and replace the speaker with the magnet, you have a magnet that is rapidly switching polarity. This is useful over a stationary magnet because you can make an image wobble over time rather than just a still distortion. If none of this makes sense, don't worry, it doesn't have to in order to make it work. Here are some example results of the process:

