3-Phase Motor Demo

R Hoadley
www.coolmagnetman.com
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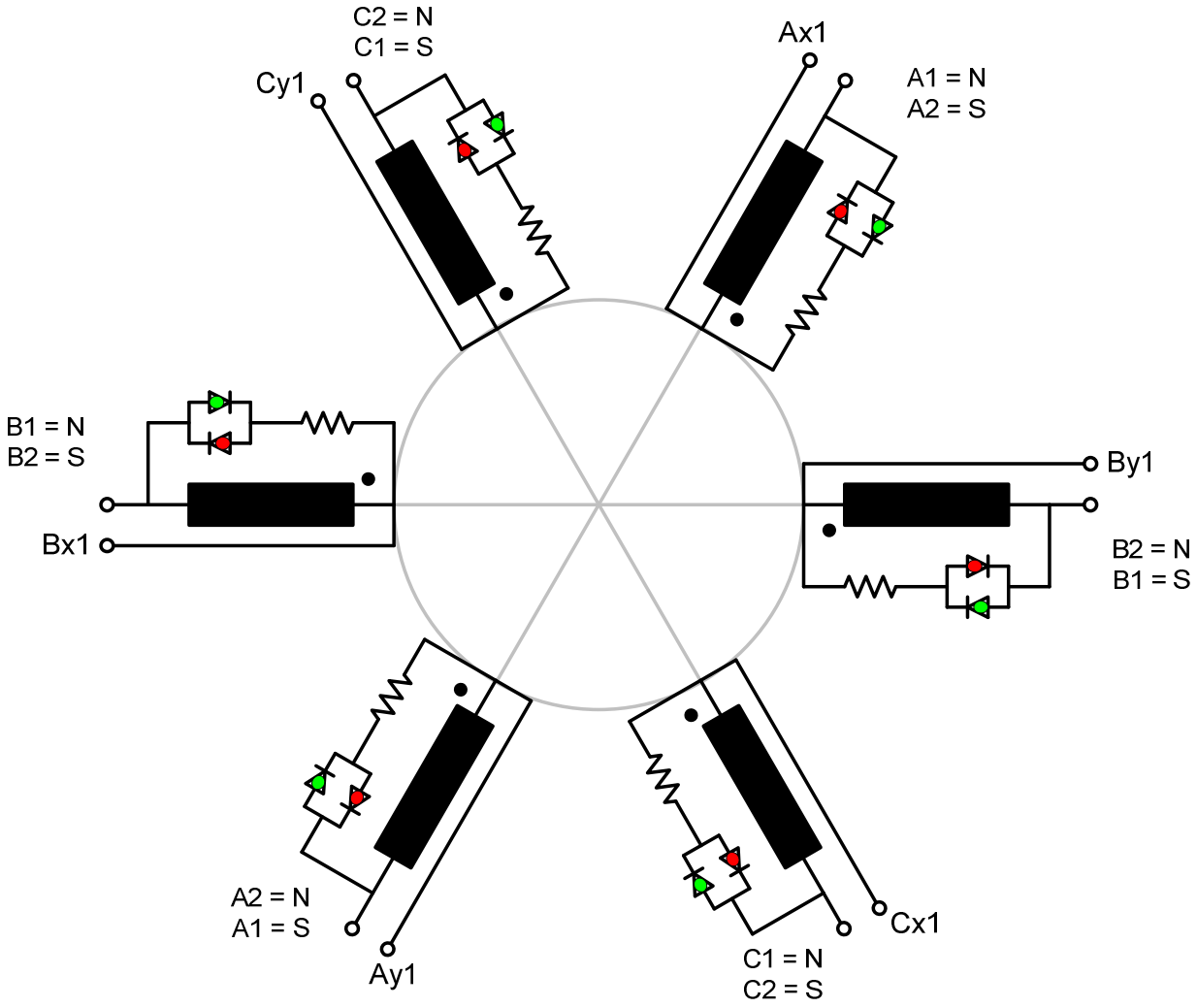
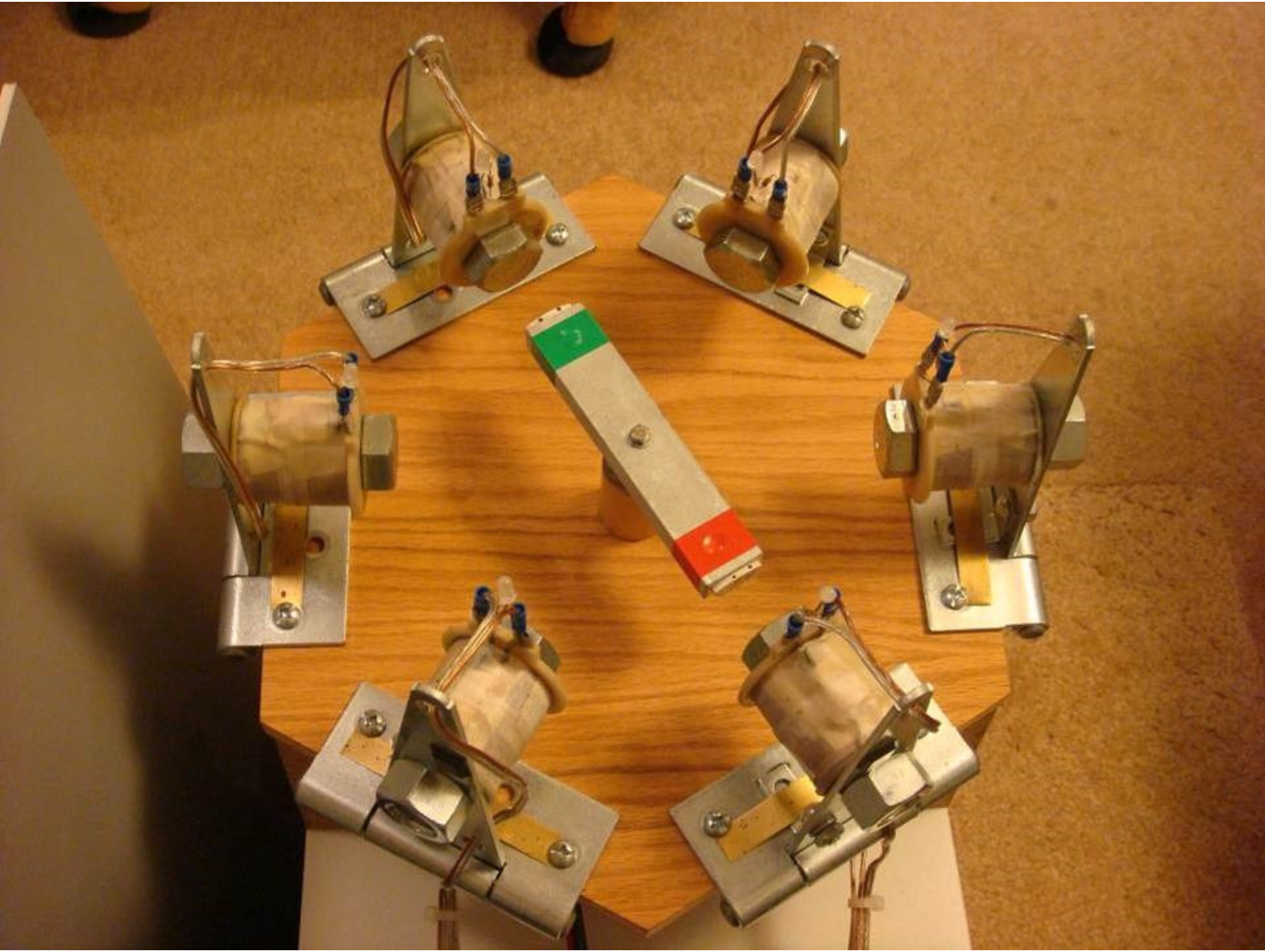
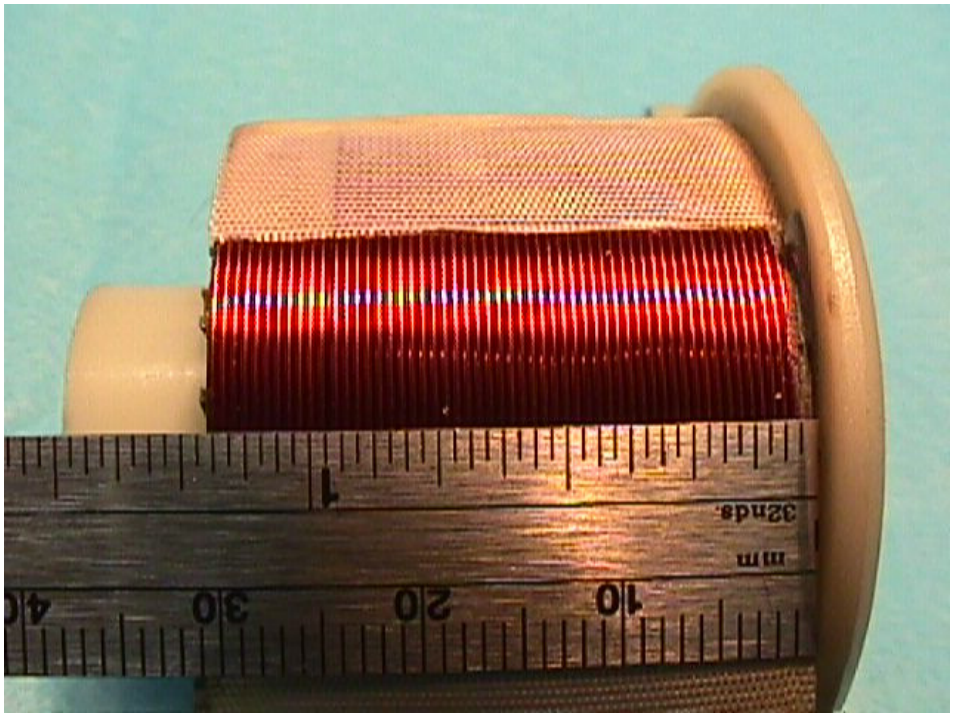
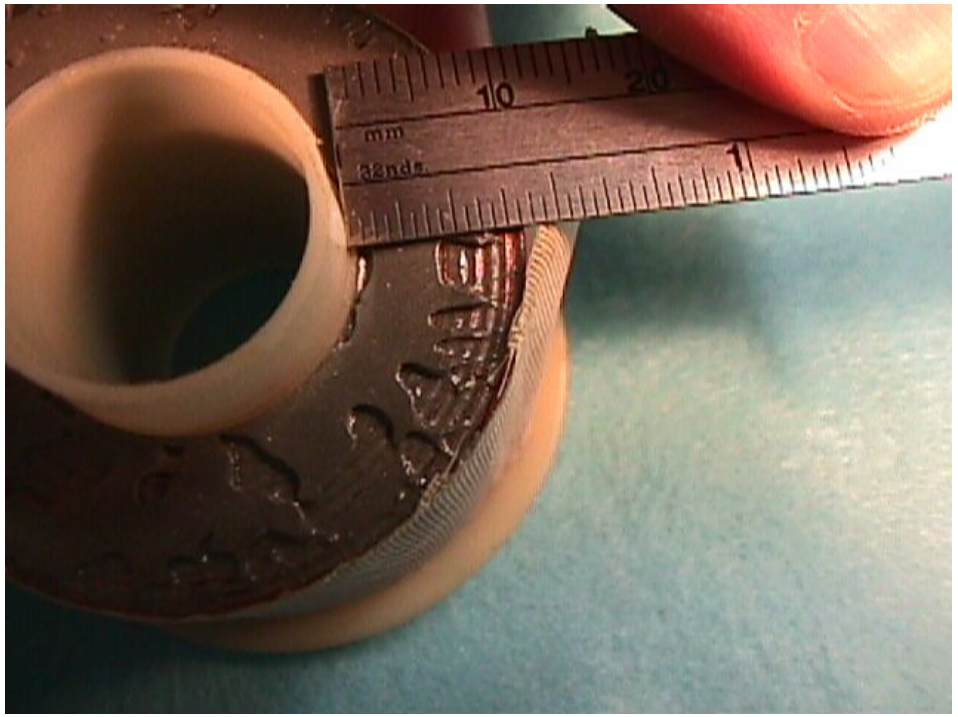
Basic Layout





Each Electromagnet





Each Electromagnet

- The electromagnets I had were:
  - About ¾” diameter core
  - About 1-3/16” long
  - About 54 turns per layer
  - About 12 layers (3/8” depth)
  - Total of about 648 turns (calculated)
  - Wire gauge of about # 20 AWG
  - Length of about 112 ft for each coil
  - Resistance of about 1.2 Ohms

Each Electromagnet

- To make your own, use:
  - Wire gauge of about # 20 AWG
  - Length of about 112 ft for each coil
  - Resistance of about 1.2 Ohms
- With a 5Vdc power supply, it will need to supply three coils at the same time = 3*5/1.2 = 12.5Adc

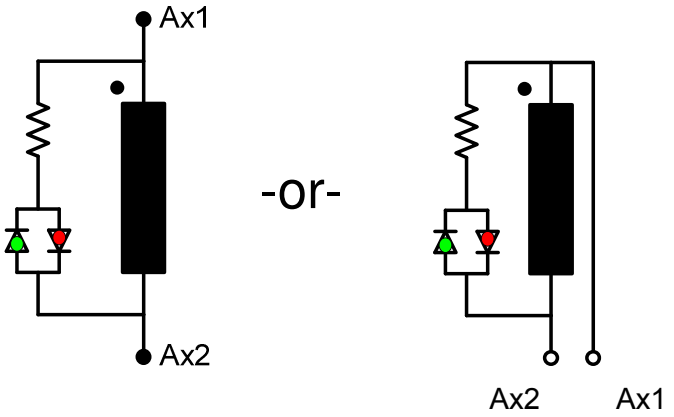
To make the electromagnets

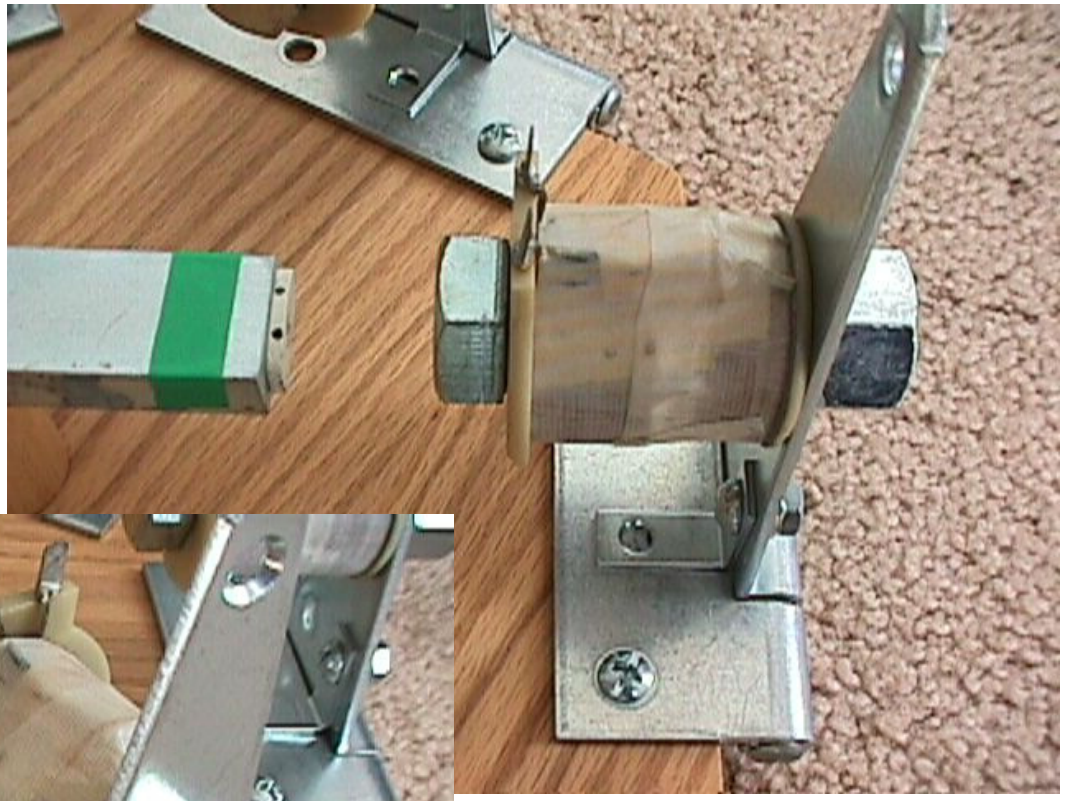
- I would use ½" diameter steel bolts, about 3" long
- Get two nylon "fender" washers (about 1.5" diameter), drill out the middle hole to ½" and slip one onto the bolt, right up against the bolt head. On one, drill two small (1/32" diameter) holes about ½" apart near the circumference.
- Then, put the other nylon "fender" washer onto the bolt about 1.5" from the first washer. Put a nut on to hold the second washer from falling off. These washers will act as the two walls for the wiring that will be wound onto the bolt and will help hold the wire coil in place.
- Put electrical tape, just one layer, around the bolt, between the two nylon washers. This will insulate the bolt from the wire that will be wound onto it.
- Leave about 6" of wire hanging out, thread it through one of the 1/32" holes, and start winding it onto the taped section of the bolt. Wind each one go in the same direction. To be consistent, start at the bolt head end, wind to the other end, then wind on a second layer going back to the head end, etc.
- When done, leave another 6" of wire at the end, thread it through the other 1/32" hole, and put a layer of electrical tape over the whole coil to hold it all in place.
- That should work well.

Mounting the Electromagnets

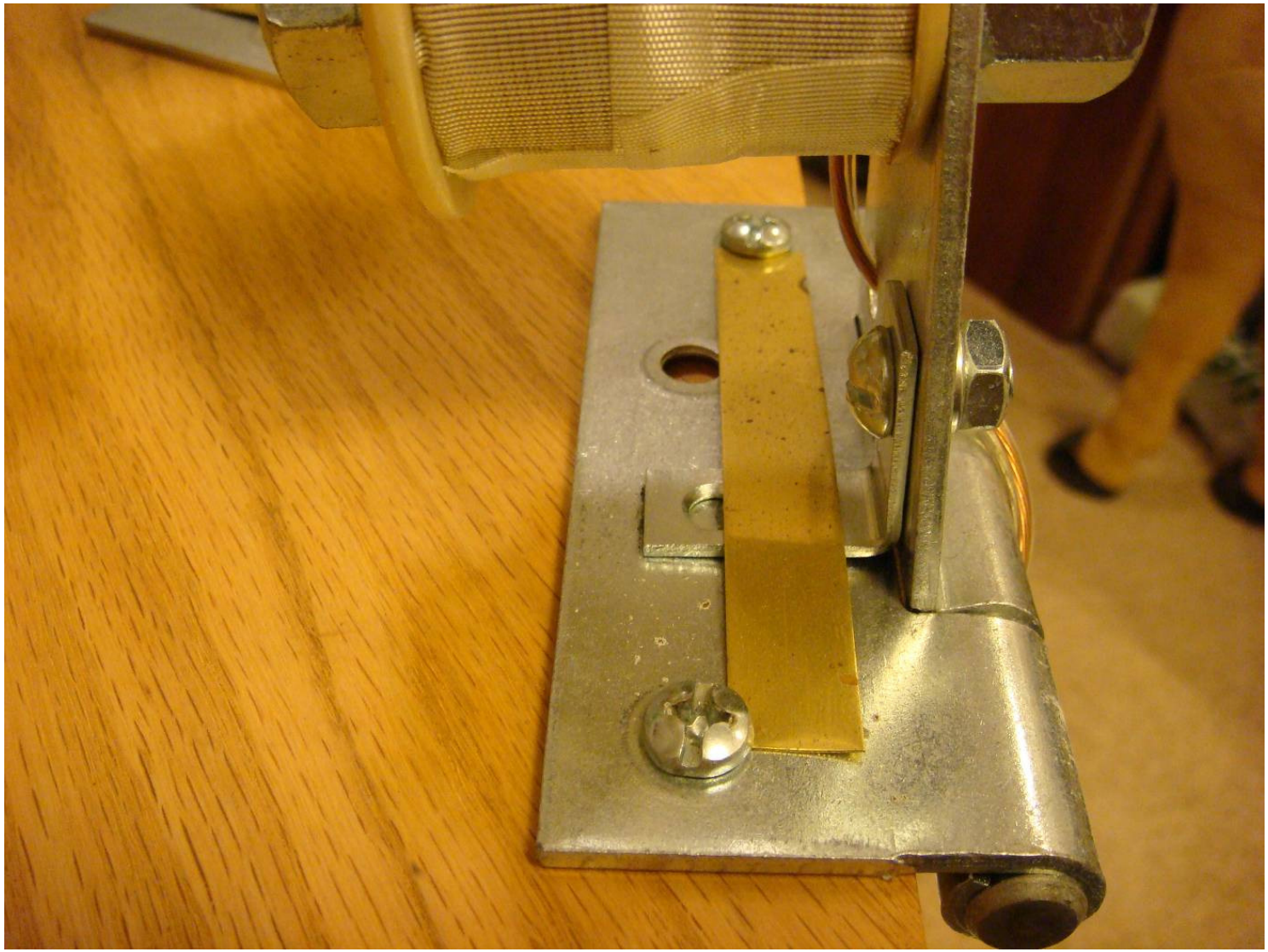
- Then mount each electromagnet onto a hinge (I had to drill out a hole in the hinge to accept the threaded end of the bolt).
- Mount each hinge onto a platform.
  - I made my platform a hexagon. Not necessary, but was nice.
- Yours will look a little different from mine, but should work just as well.

Need 6 Identical Electromagnets





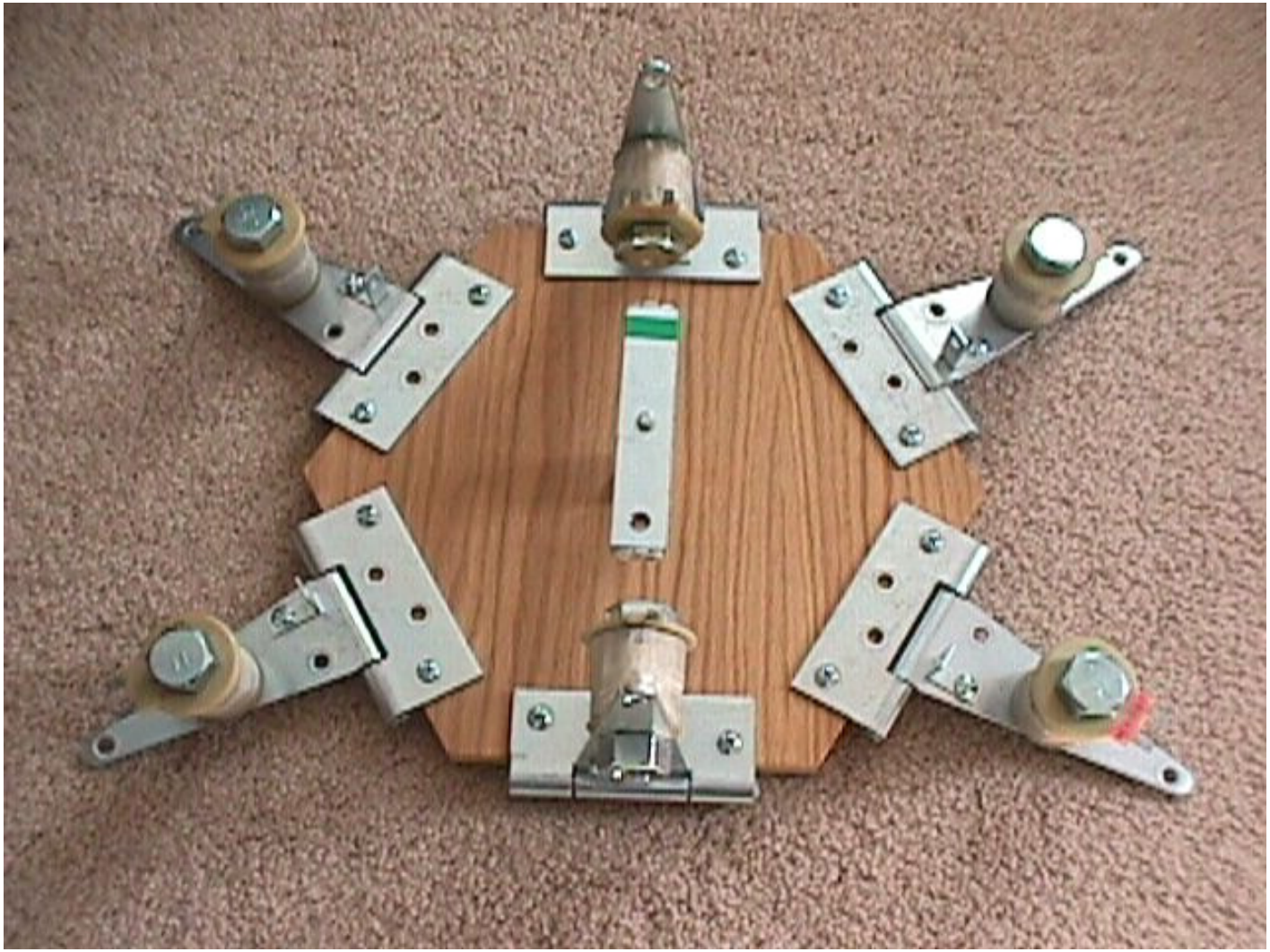
I used brass strip and small L bracket to hold hinges upright



Why Hinges?

- I used hinges so I could drop the B and C phase electromagnets away to simulate a single phase motor which has no inherent direction of rotation
- Or drop just the C phase electromagnets away to simulate a shaded-pole single phase motor that will always turn in the same direction.

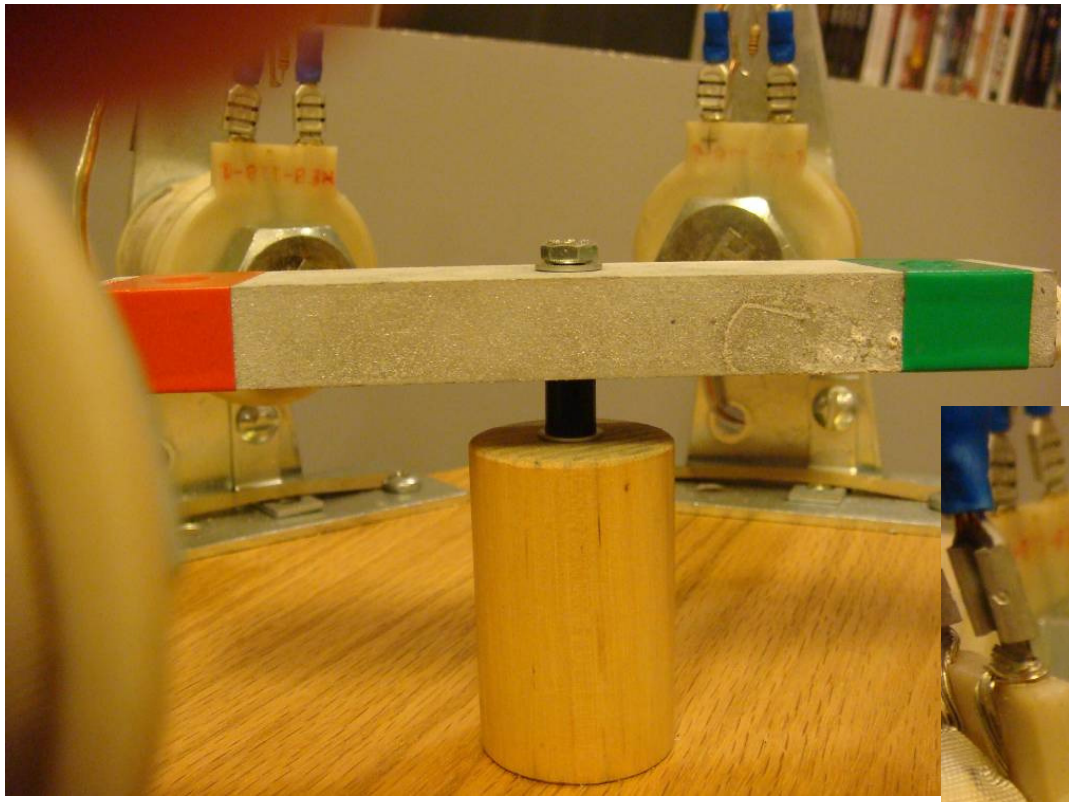
Single Phase Motor

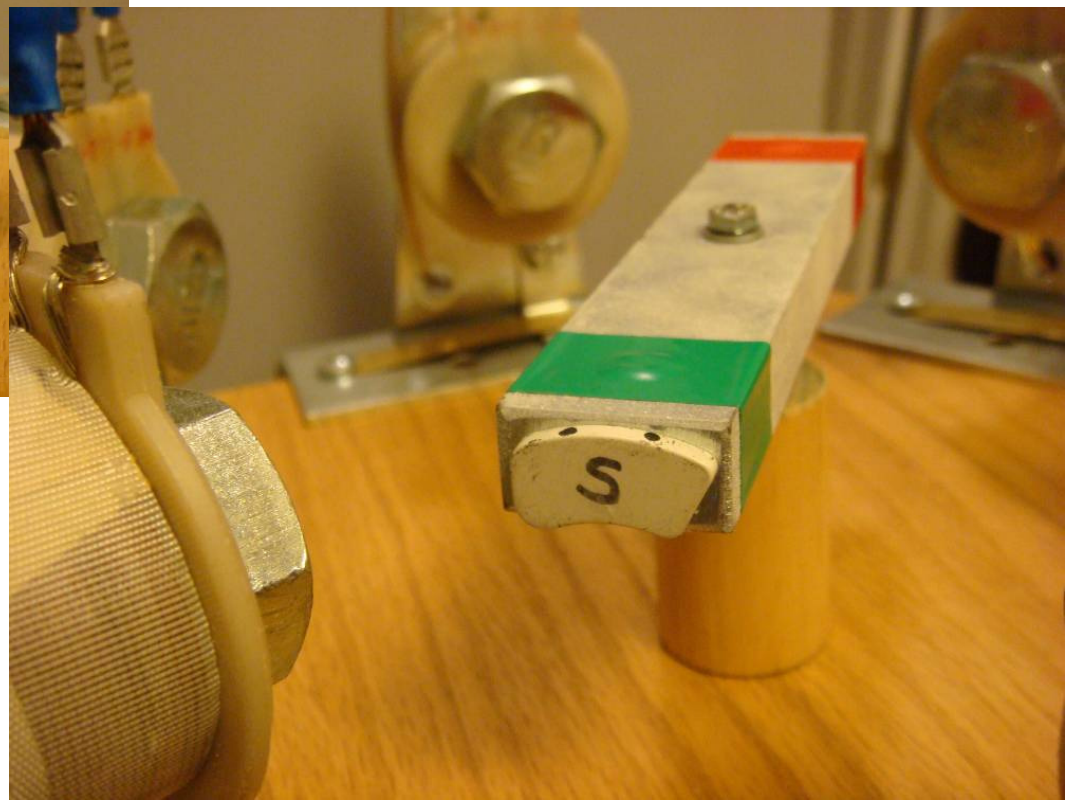


Make the Rotor

- The rotor was made from a bar of steel, with a small NdFeB magnet stuck on each end. I used Red tape for North poles, Green tape for South poles.
- The bearing was just a simple bolt, flat washer, bar, black nylon washer/spacer, flat washer. The bolt was press-fit into a dowel rod that was fastened to the center of the platform.

Rotor



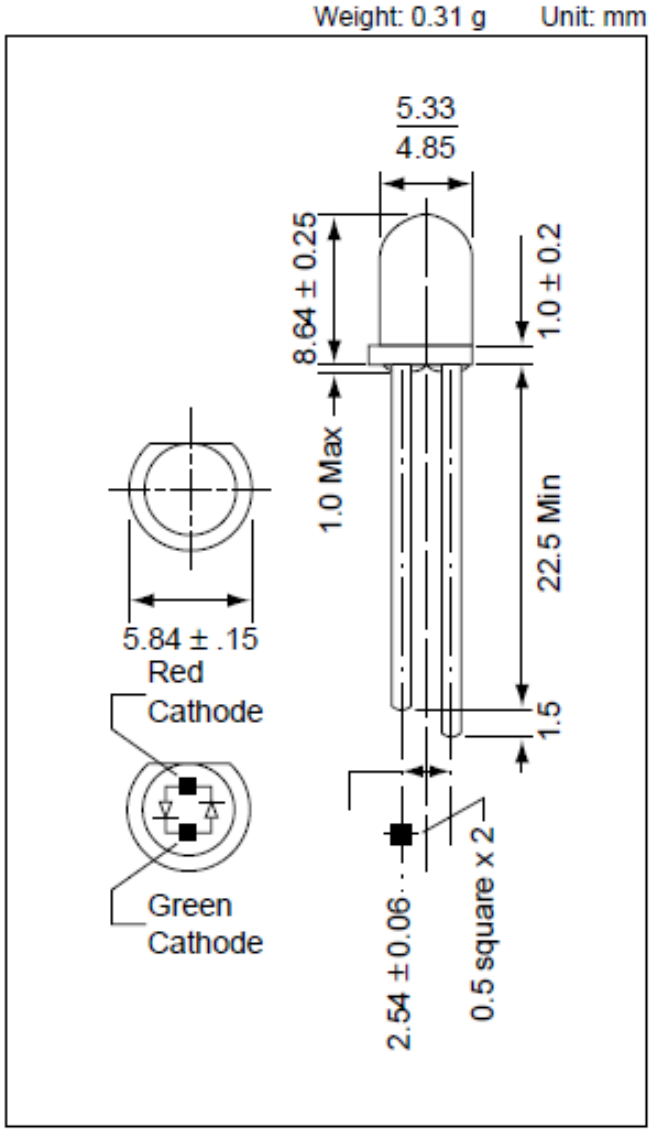


Rotor Close-up

Making the Polarity Indicator

- The polarity indicator uses a dual color LED (has both a red and green led inside – one will turn on when current is in one direction, the other will turn on when the current is reversed).
- Since I was using a 5V supply for the electromagnets, I used a 100 Ω resistor in series with the LED. Was only 1/8 watt. Make them all the same way. One lead of the LED is longer than the other, attach the resistor to that lead to be consistent.
- Attach one assembly to each pair of coil leads.

Dual Color LED



AND2451RGL

Dual Color

5.0mm Round Bi-Color, Bi-Polar Lamp

Features

- Dual color indicator: Red/Green
- Two leads
- Low drive current
- Wide viewing angle: 120°

Optical Characteristics (T = 25°C)

Part Number	Source	Color		Lens Desc.	Luminous Intensity @ 10 mA (mcd)	
		Emitting	Lens		Min.	Typ.
AND2451RGL	GaAsP/GaP	Red	White	Diffused	0.7	1.2
	GaP	Green	White	Diffused	0.8	2.7

Available from Radio Shack

$1.69

5mm Red/Green LED

Model: 276-012 | Catalog #: 276-012

Use with electronic devices. Typical MCD is 6.3. This 5mm Red/Green LED has a typical wavelength of ...

Product Rating

★★★★★ (4 Ratings)

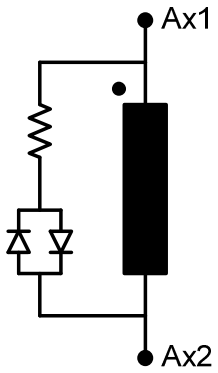
Write a Review

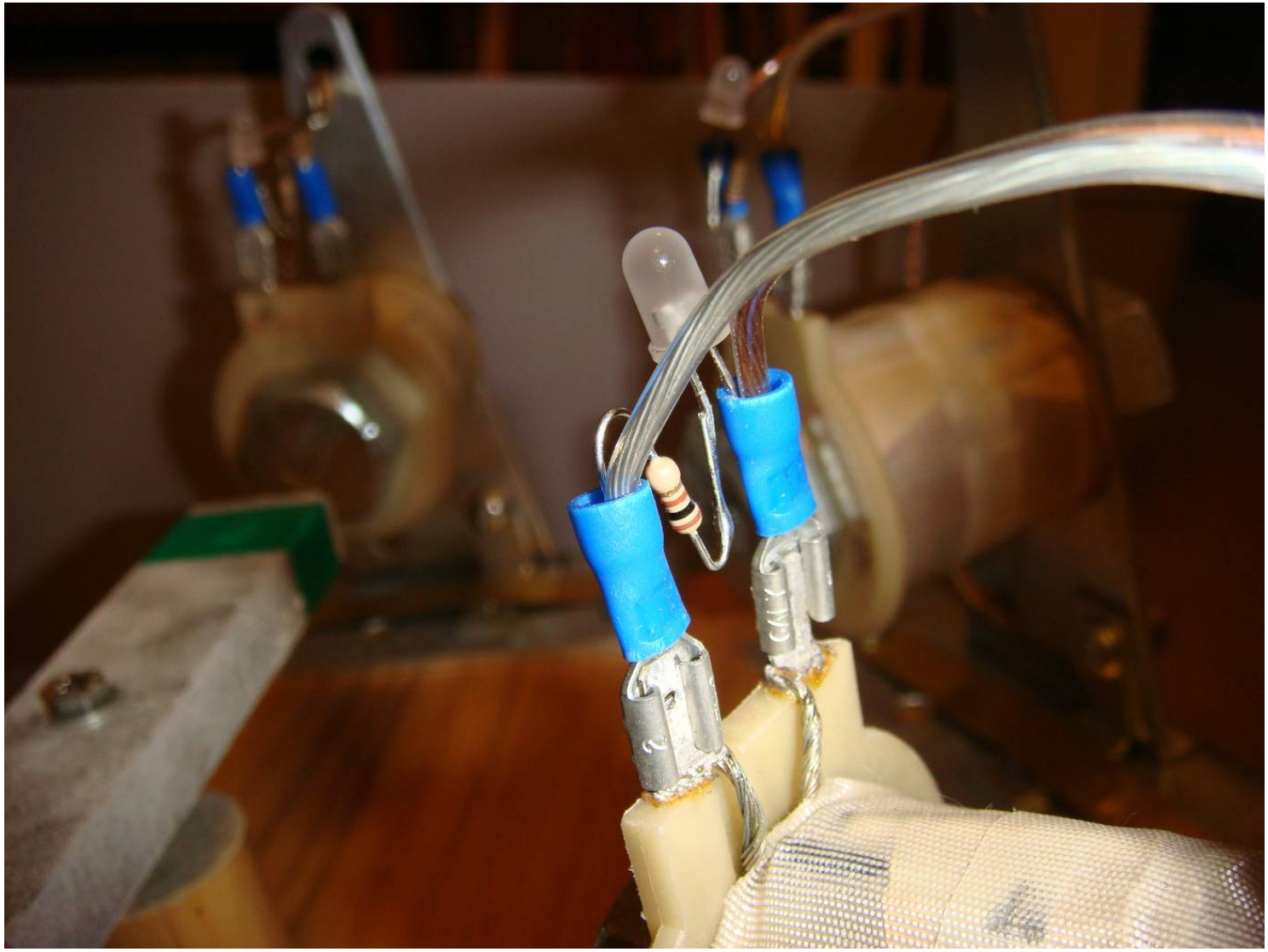
Read 4 Reviews

+ WISH LIST

ADD TO CART

Polarity Indicator

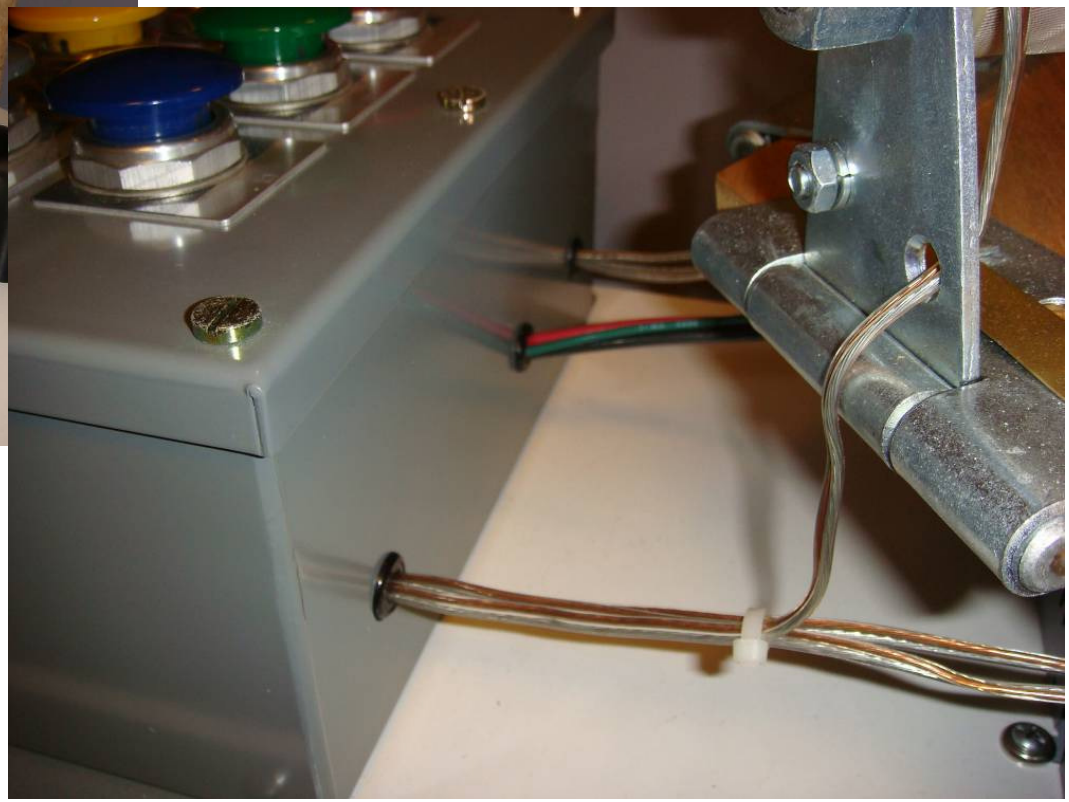




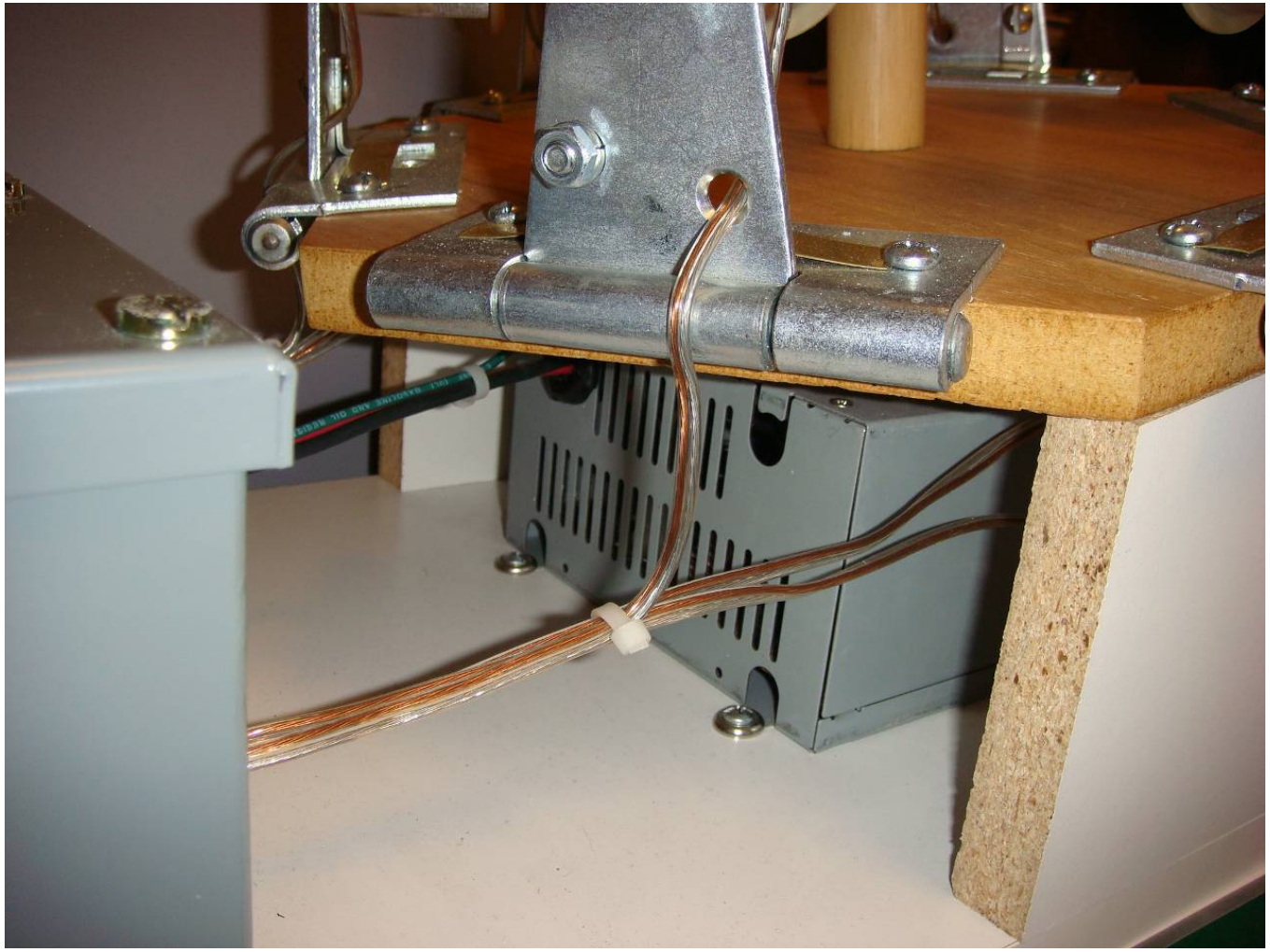
Wire up the unit

- I found a power supply from a tower computer where the 5V still worked. I mounted it under the platform and fed the 5V and common into the switch box.
- Inside the power supply, I connected all of the 5V leads together since I would need to be able to supply about 12.5A when three buttons were pushed.

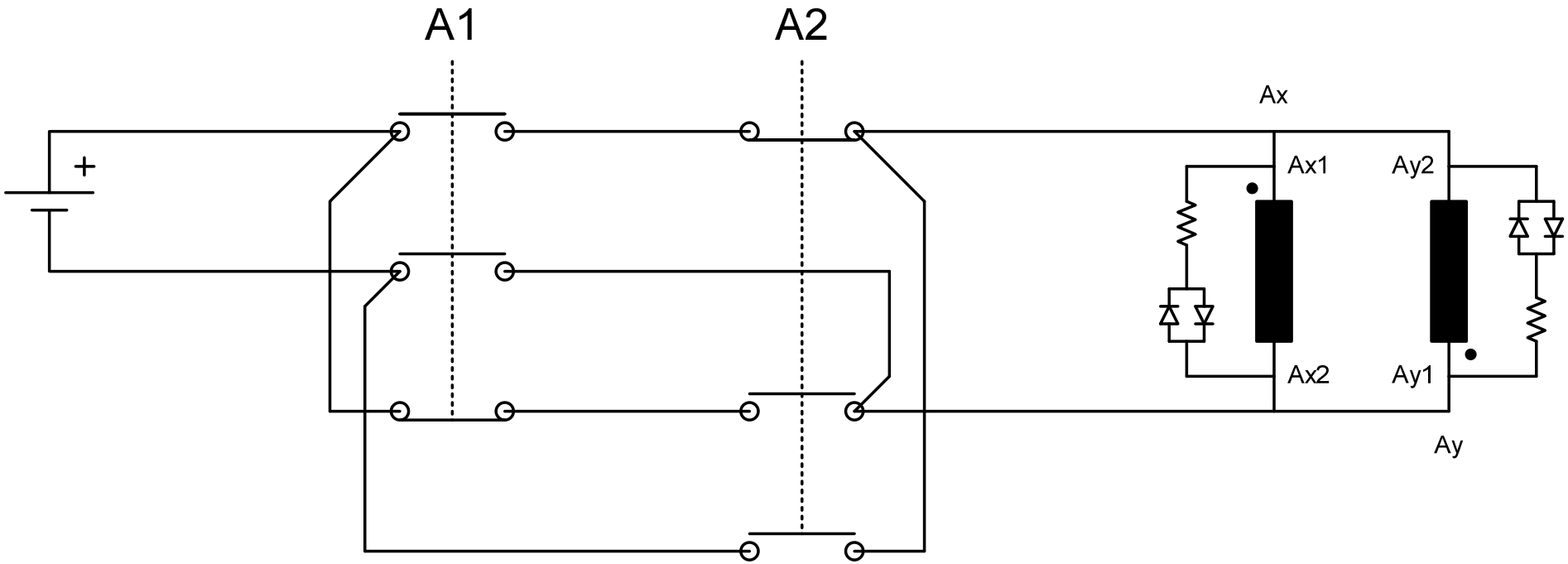
5V Computer Power Supply



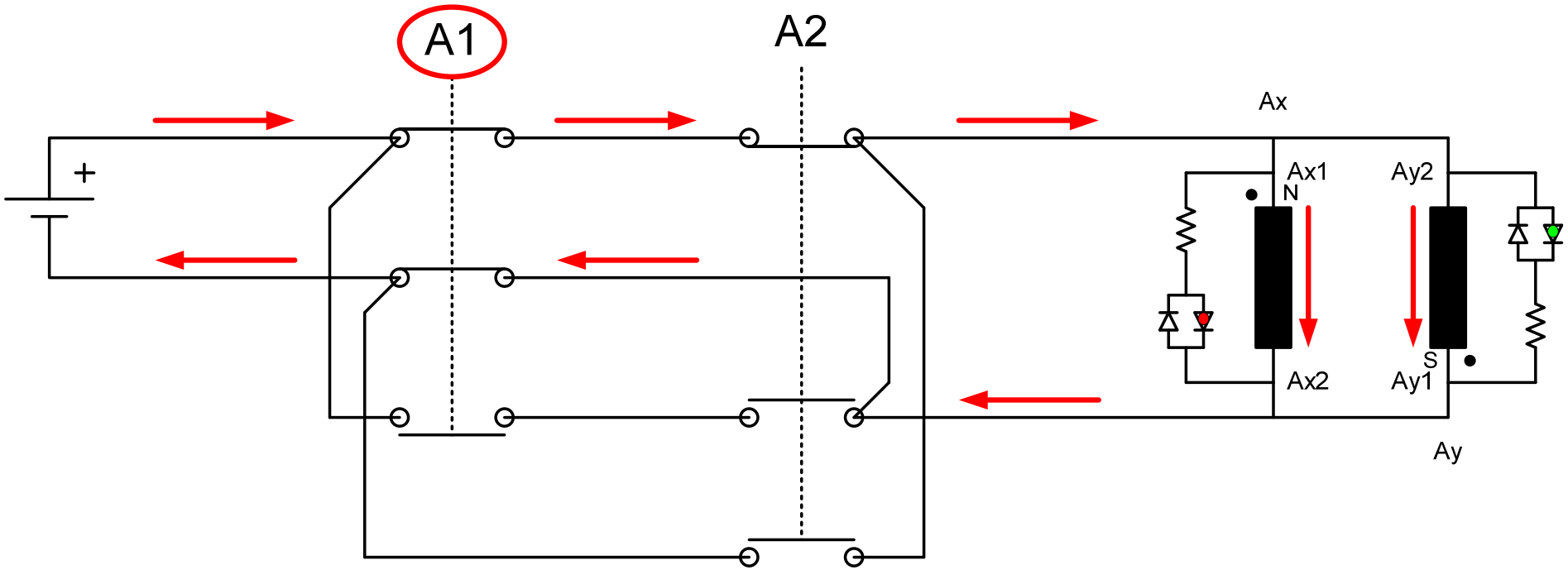
Note slight angle on the platform



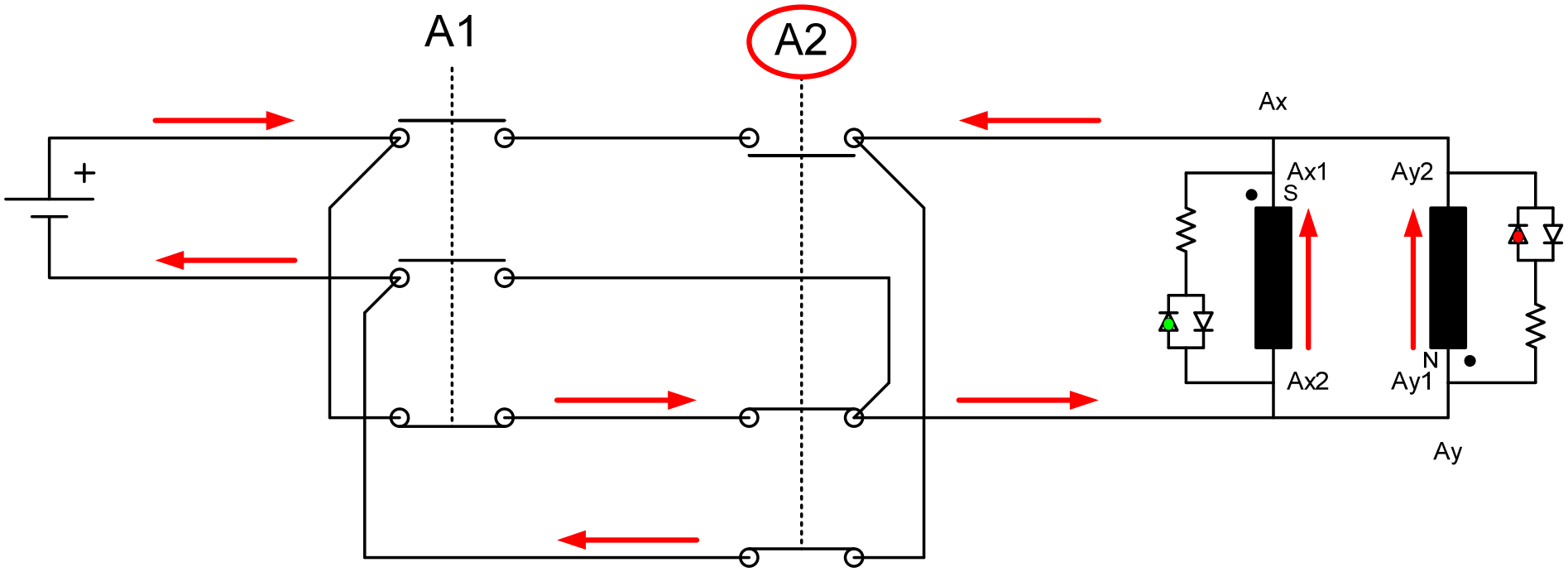
Wiring Concept - No Buttons Pushed



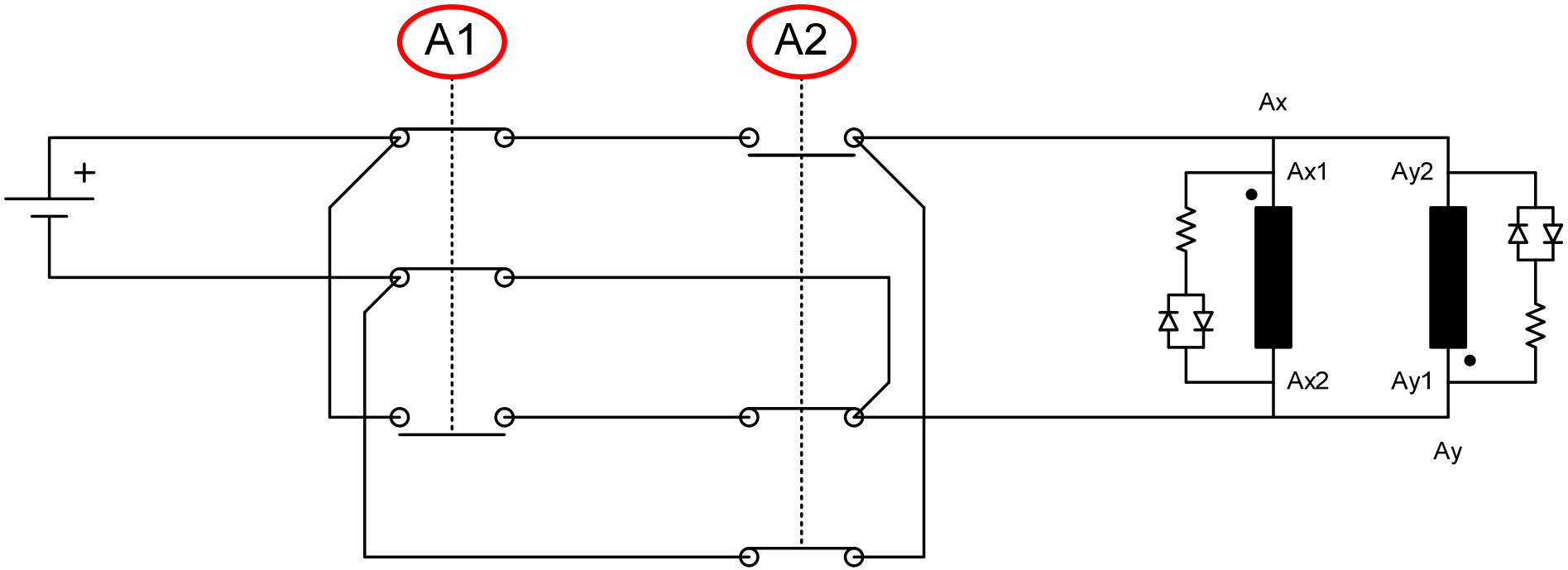
Button A1 Pushed



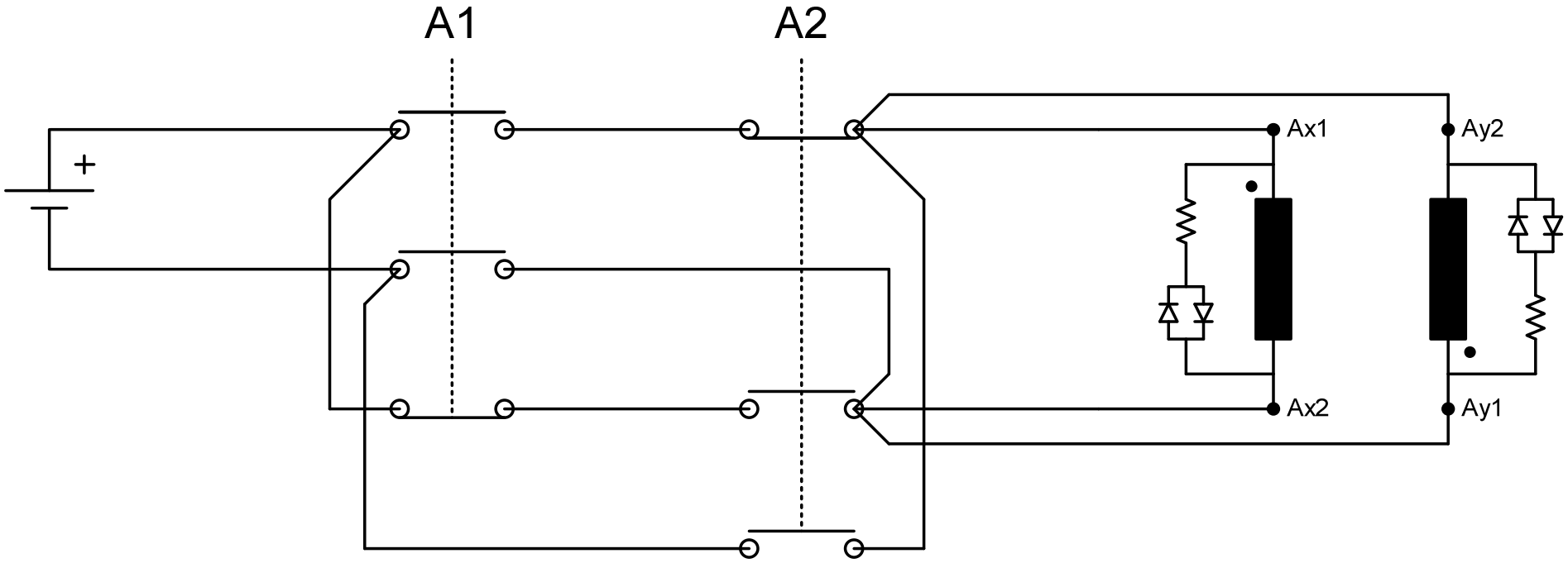
Button A2 Pushed – reverses polarity



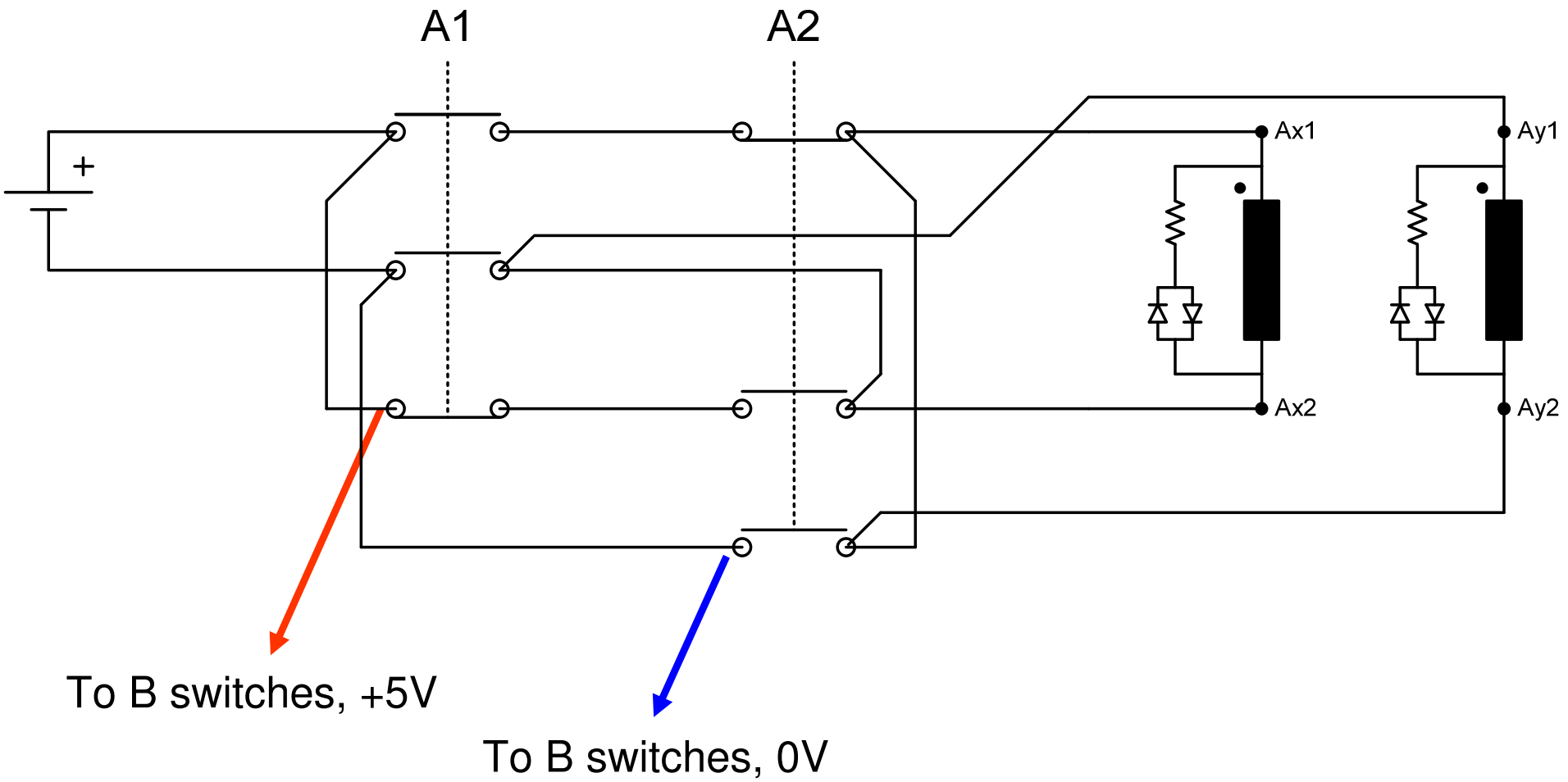
Both A1 and A2 Pushed – no short circuits



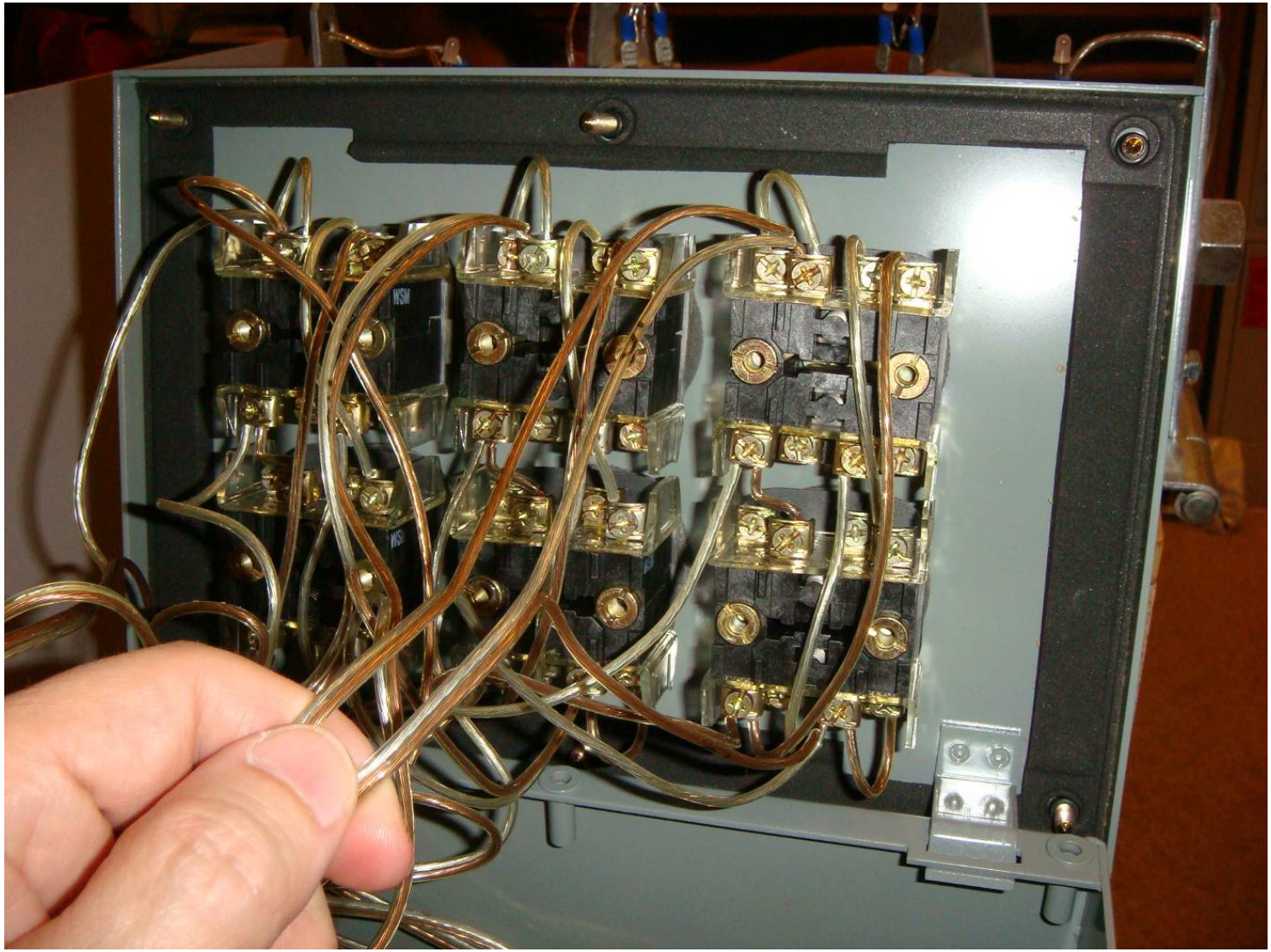
Showing how the switches were wired, since each coil was fed with its own pair of wires.



If you want to limit 2 wires per switch terminal, use this:



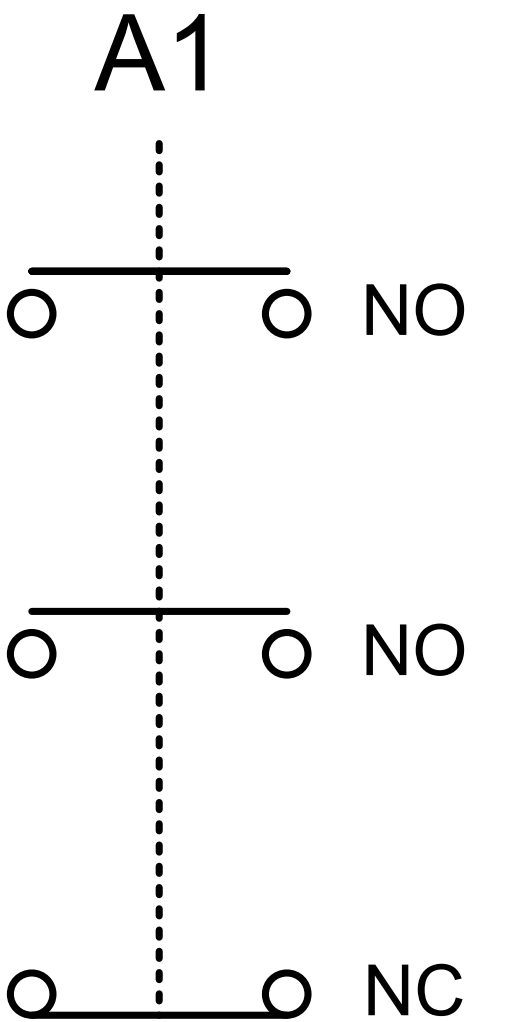
Switch Wiring (I’m holding the two pairs of wires that go to C1 and C2.)



Switches

- Switches were from Allen-Bradley
- Each switch had two NC sets of contacts, and two NO sets of contacts.
- I used the two NO sets and one NC set as you can see in the wiring diagram.

Switch Configuration



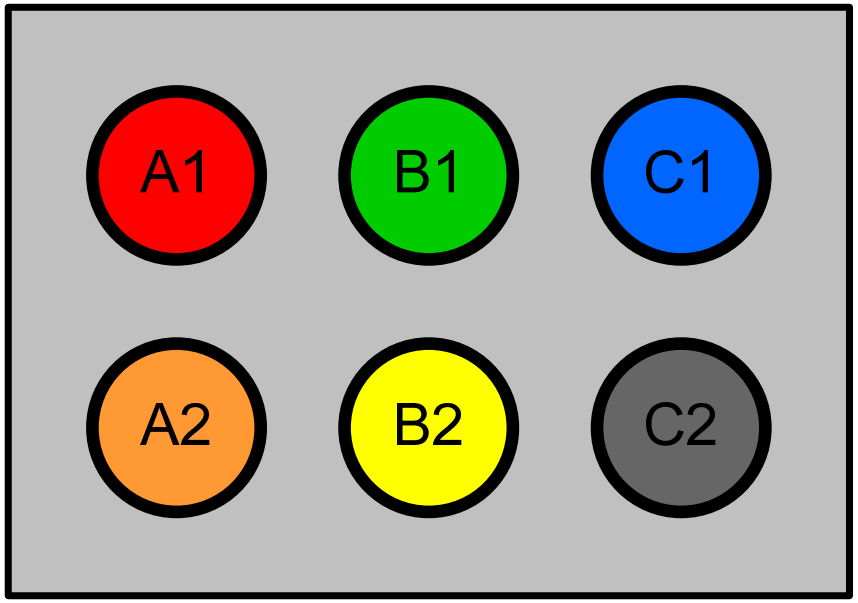
NO (normally open) contact set

NO (normally open) contact set

NC (normally closed) contact set
The other NC set was not used.

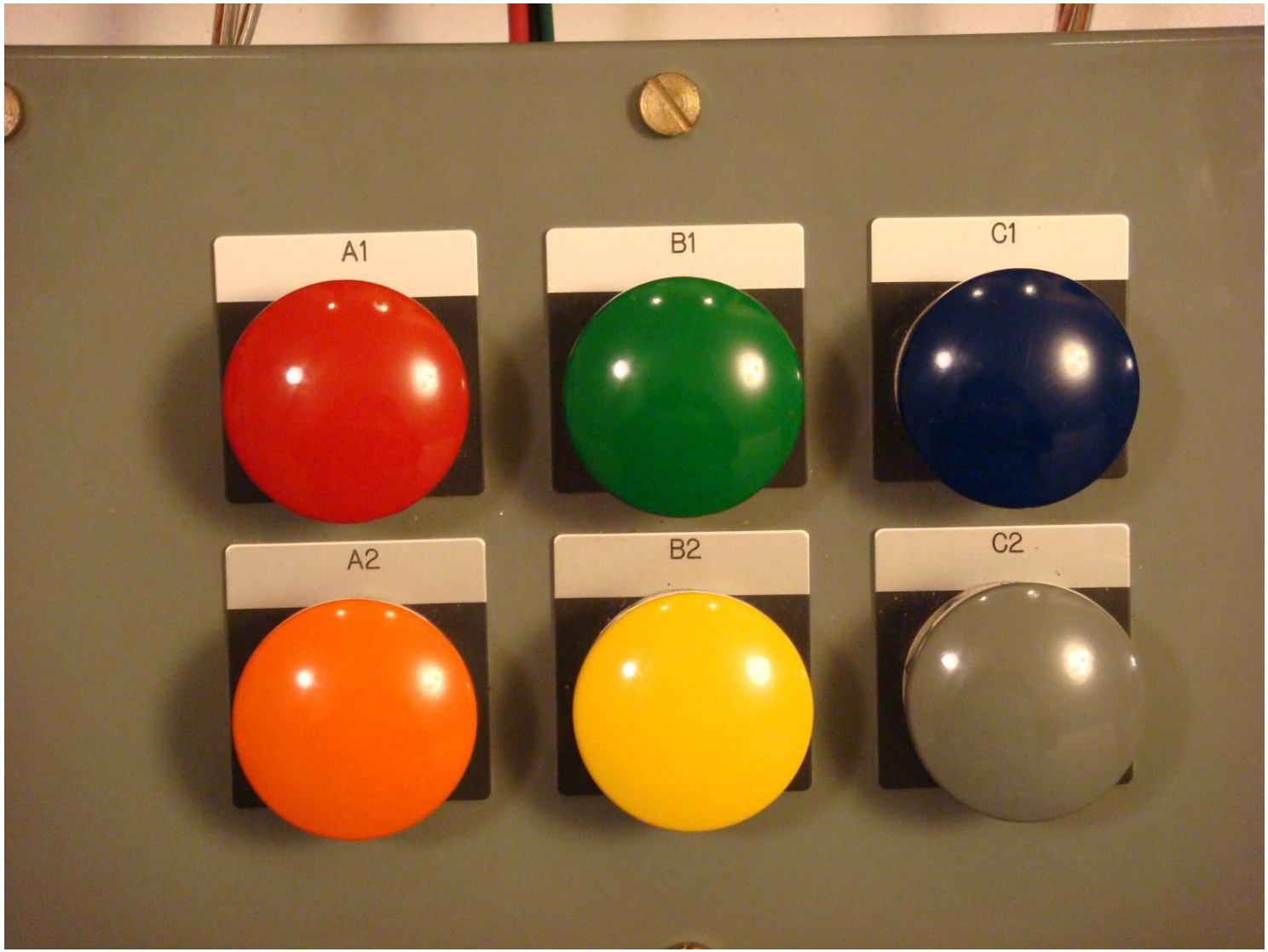
Push-Button Sequence

- To make the rotor follow a North or South Pole all the way around in a CW direction, the sequence I used is as shown.
- Make the colors whatever you like.

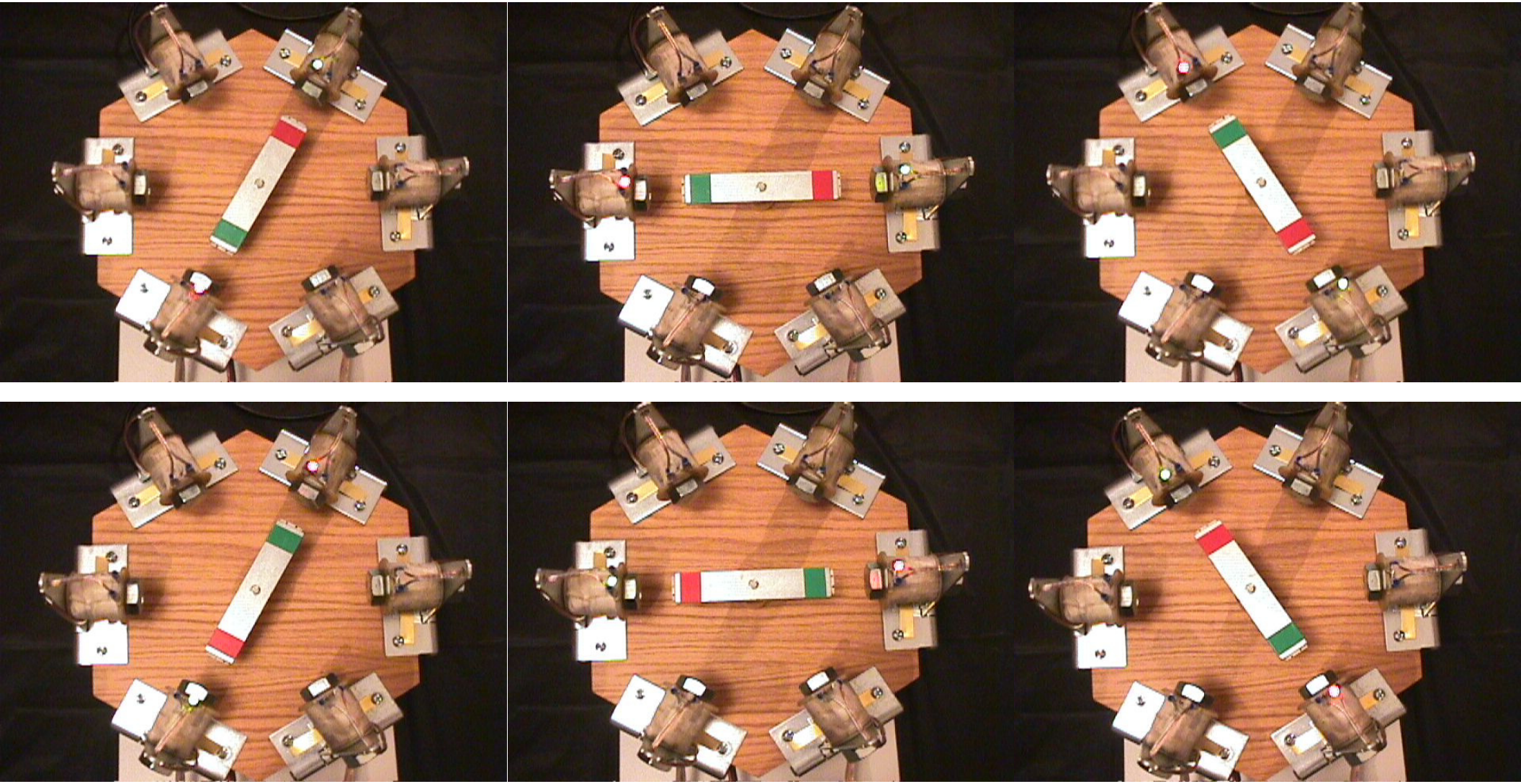


Sequence:
A1 - Red
B2 - Yellow
C1 - Blue
A2 - Orange
B1 - Green
C2 - Gray

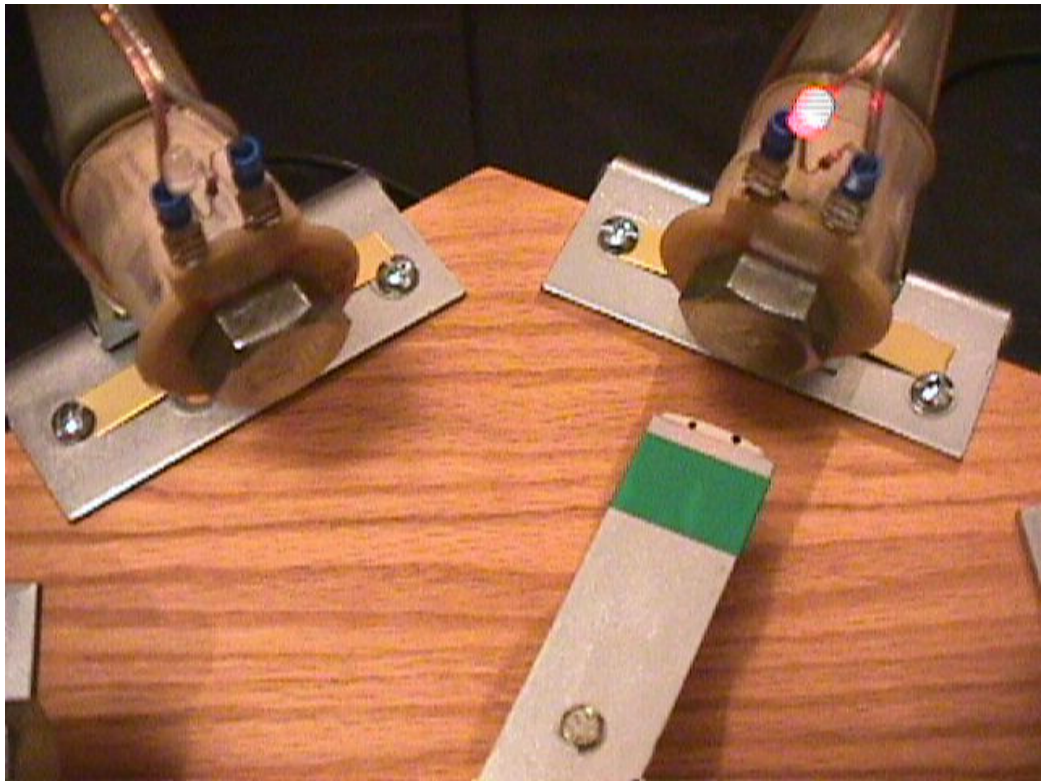
Push-Buttons

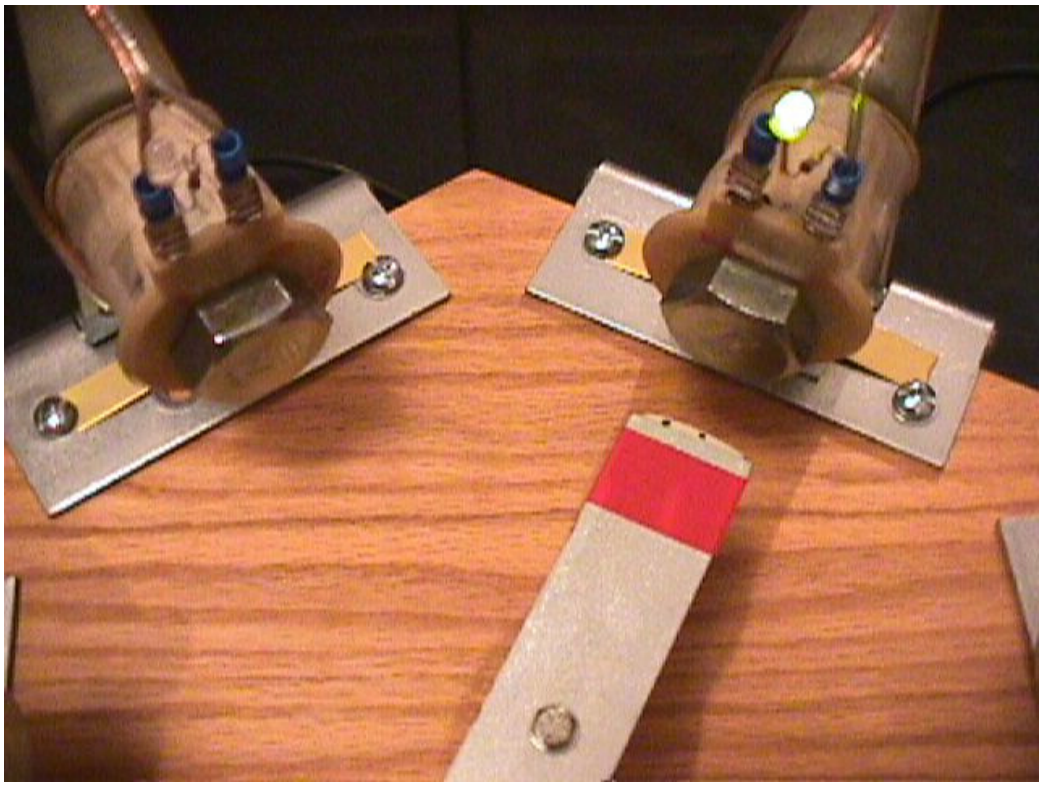


Typical Sequence



Opposite Poles Attract





Questions?

- Contact me at:

  Rick Hoadley

  rhoadley@execpc.com