DIY COIL CHRONO BUILD INSTRUCTIONS

By Veni Vidi Vici

PURPOSE

Last month, I made a post on the DIY Equipment forum on www.archerytalk.com in which I gave instructions for inexpensively building a chronograph for measuring arrow speeds, and how to use free software to read the results. Many people took interest in this project, and like other projects on the DIY forum, the input from other members helped the project to evolve into a much more user-friendly tool.

Of particular note, ***helsyeah*** decided to work on his own software for using a DIY Coil Chronograph. He is planning to make this software available, along with instructions and source code, to the members on the archerytalk.com forums.

Because this project is so simple to build, almost everyone who has built one so far has come up with their own method using the materials available to them. In order to assist others who would like to build a coil chronograph, I decided to describe another version using inexpensive materials that are readily available. I do not claim that this is the *best* or *cheapest* method, but it does work well and provides a standard construction technique.

MATERIALS LIST

The following materials are readily available and inexpensive. You may make substitutions as you see fit, depending on availability, your skill level, or your desire to scrounge.

Picture	QTY	Item	Location	Cost
	2	6-inch Snap Coupling for Corrugated Drain Pipe	Local Plumbing Contractor Supplier	$4.55 ea $9.10 total
	2	Wooden Yardstick	Home Depot	$0.61 ea $1.22 total
	1	Magnet wire kit (use the 30 ga spool for this project, 200 ft)	Radio Shack	$7.39
	1	1/8" Stereo Plug (T-R-S connector, screw terminals)	Radio Shack	$4.19
	6 feet	CAT 5 cable (a 2 strand cable such as stereo wire would also work)	Home Depot	$0.26 per foot $1.56 total
	1 (Optional)	Package of #10-24 x 1/2" long machine screws and nuts, 8 pairs per package	Home Depot	$0.98 per pkg

The total cost, not including the optional package of screws, is $23.46. If you care to make substitutions, please feel free, but refer to the Safety Notes at the end of the assembly instructions. Alternate construction examples are provided at the end of this document.

TOOLS

Wire cutters/strippers

Soldering iron/solder

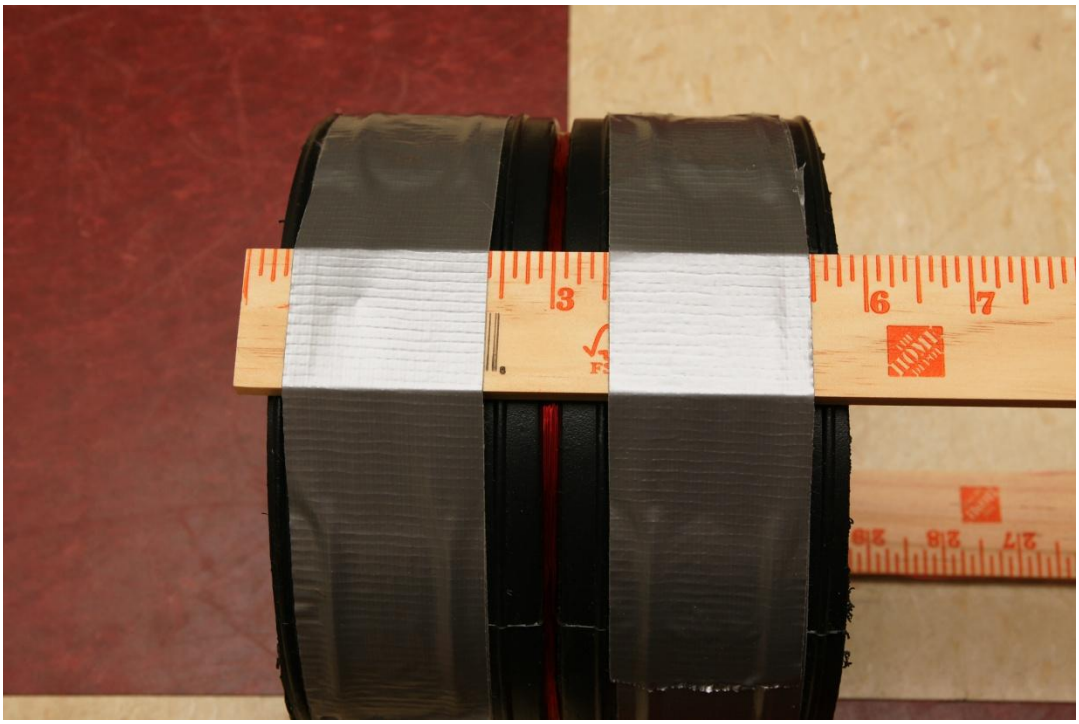
Electrical tape

Duct tape

Assembly Instructions

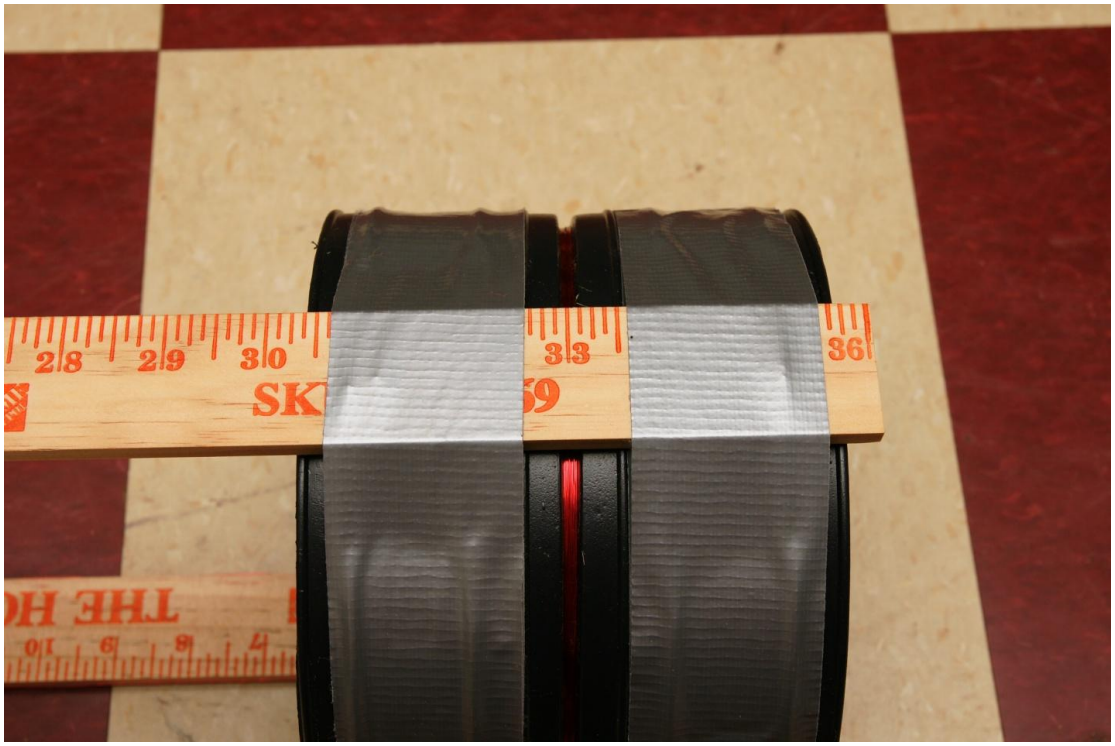
1. Wind 50 turns of 30 ga magnet wire in the groove on one of the 6-inch snap couplings.

2. Tape (or screw) the first snap coupling to one of the yardsticks so that the center of the coil is even with the 3" mark.



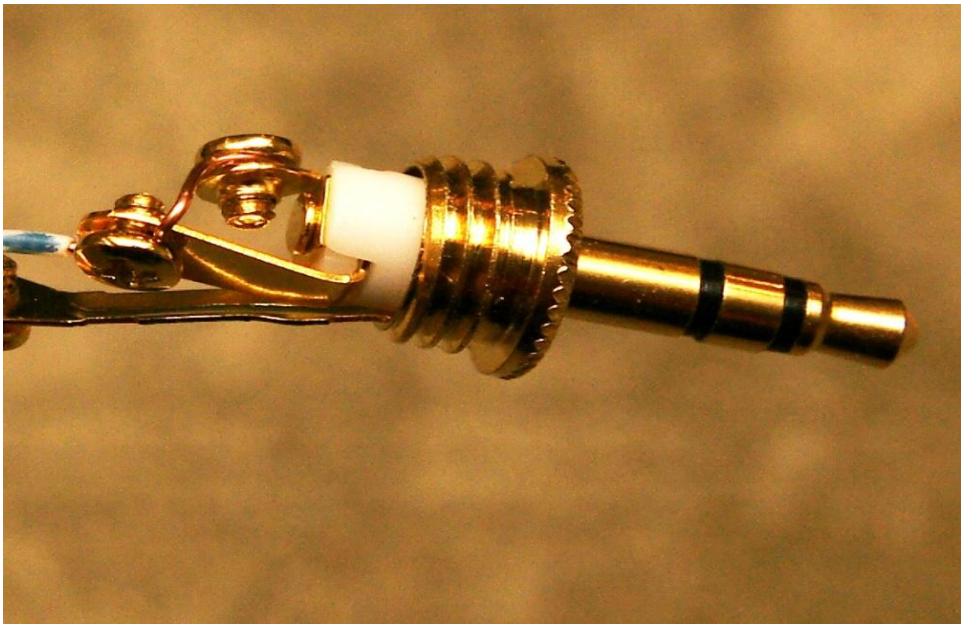
3. Skipping approximately 30" - 34" of wire, wind 50 turns around the groove in the second snap coupling. It is best to wind the wire in the same direction as you wound the first coil (CW or CCW).

4. Tape (or screw) the second snap coupling to the yardstick so that the center of the coil is even with the 33" mark. This will set the distance between your coils at 30".

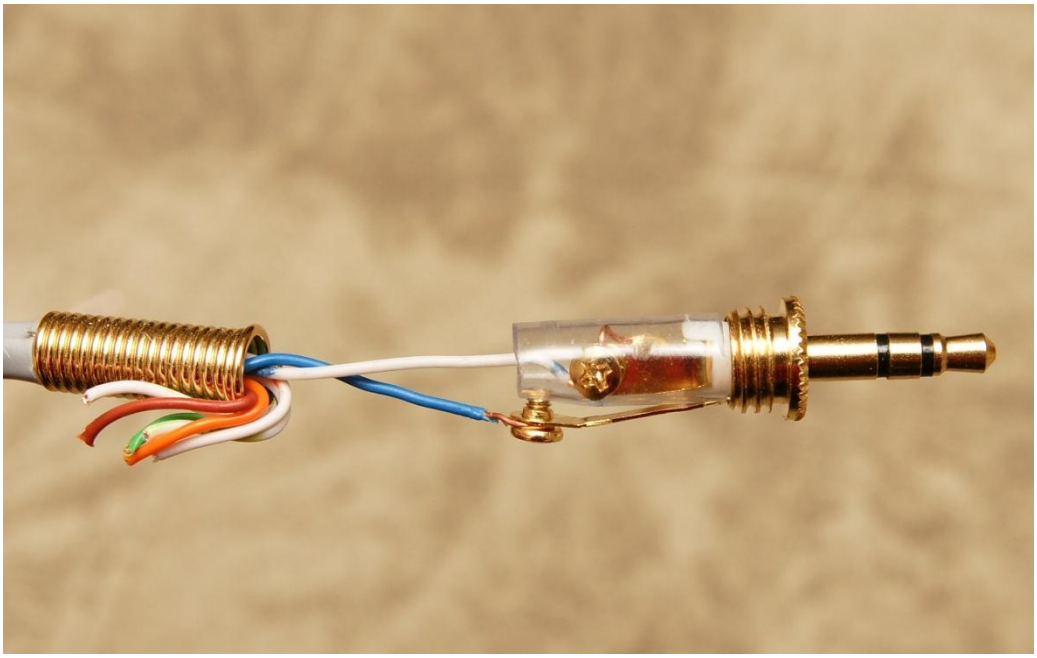


5. Run the wire back along the edge of the yardstick. Run the 30" - 34" wire connecting the coils along the other edge of the yardstick. Tape in place periodically with electrical tape.

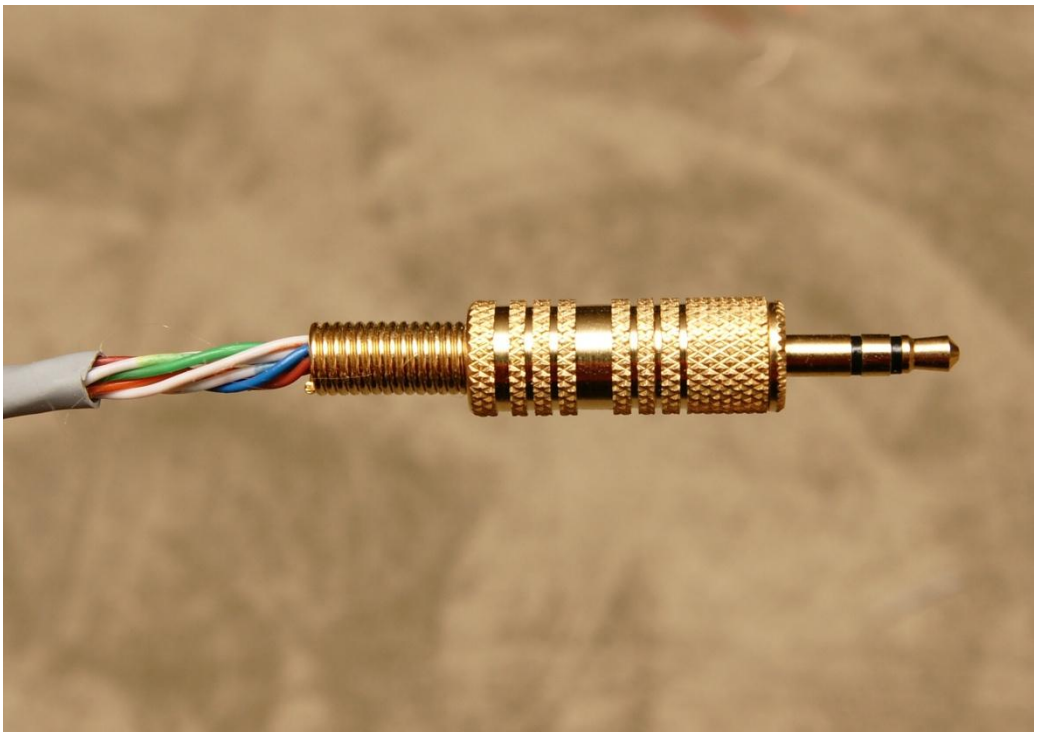
6. Slide the barrel body of the connector over the cable. Strip the outer jacket off one end of the CAT 5 cable for a length of 2" - 3". Slide the spring from the connector over the stripped wires with the flared end towards the ends of the wires. Identify one twisted pair of wires (blue and white pair is pictured). Strip the ends of these two wires. Slide the clear plastic insulation tube over one of these wires. Attach the wire that is inside the clear insulation to **BOTH** the short and the medium screw terminals. Ensure that the other wire is on the outside of the clear insulation, then attach it to the long screw terminal.



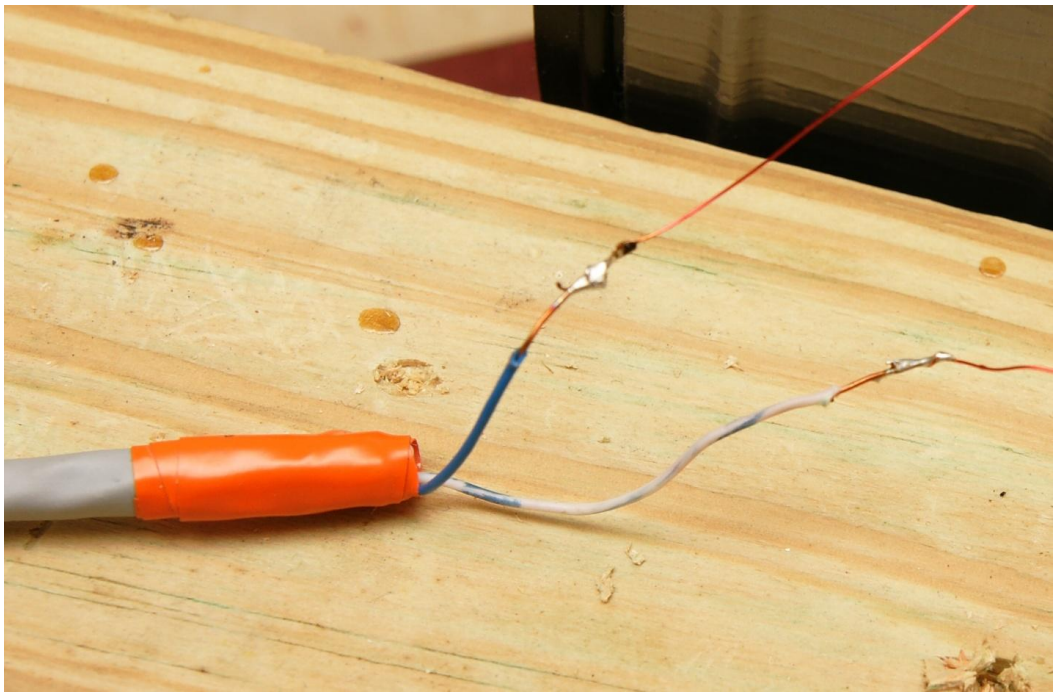
7. Slide the plastic sleeve up over the white body and the two shorter screw terminals. Push it all the way up so it prevents the long terminal blade from possibly contacting the other terminals.

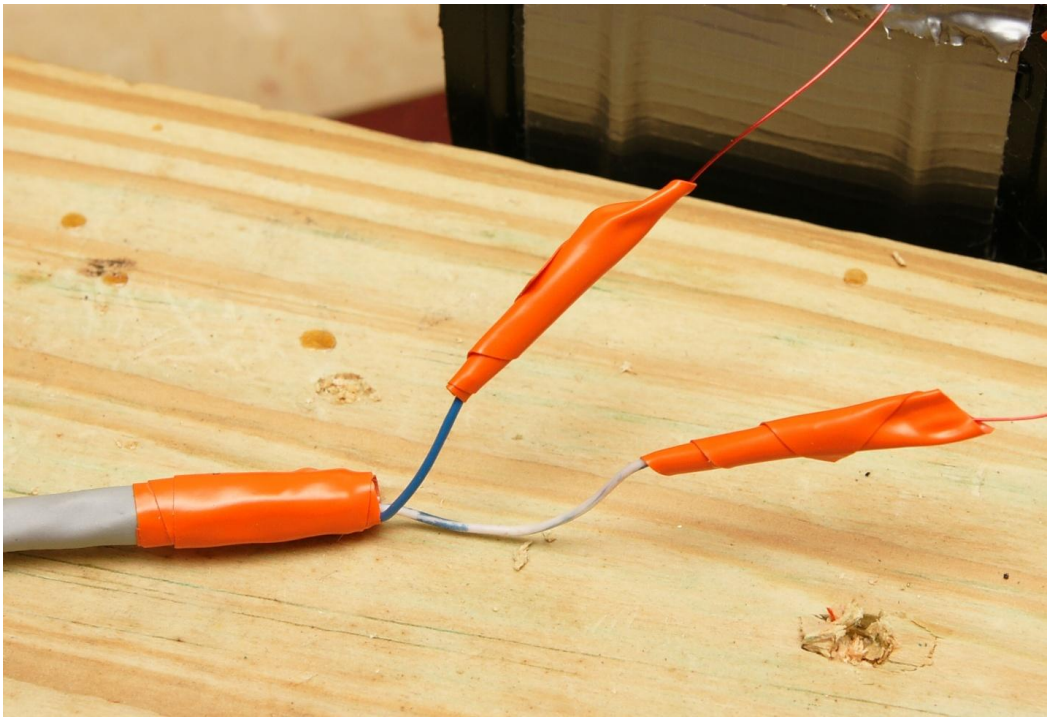


8. Slide the spring and body barrel up, then thread the body barrel onto the connector jack to complete the plug assembly.



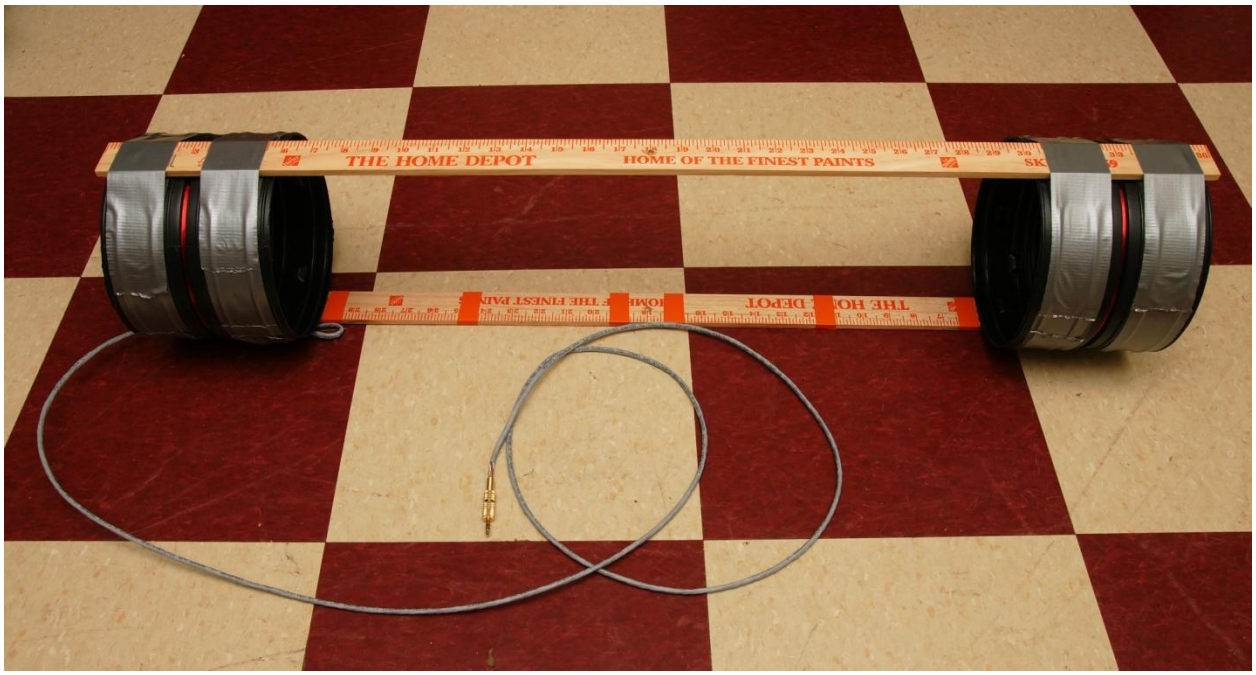
9. Carefully sand the ends of the magnet wire (1/4" - 3/8" long) to remove the insulating varnish. Identify the ends of the same twisted pair (blue and white in these pictures) and strip approximately 1/2" of insulation from each of them. Solder one magnet wire to the blue wire and the other to the white wire. Wrap these connections individually with electrical tape.





10. Use duct tape to attach the CAT 5 cable to the first snap coupler. It is good to tape a loop of the cable down in order to prevent a direct pull from putting tension on the fine magnet wire.

11. Use duct tape (or screws) to attach the other yardstick to the snap couplers, again lining up the 3" mark and the 33" mark with the centers of the coils.



12. A tripod makes a good stand for using the chronograph. Most tripods have a 1/4"-20 screw sticking up that threads into a camera body. You can drill a 1/4" hole at the 18" mark on one of the yardsticks and use a 1/4-20 nut to attach the assembly to the tripod.

USING THE DIY COIL CHRONO

The DIY Coil Chrono will detect the steel field point on an arrow as it passes through the coils. However, the tip should be magnetized for best results.

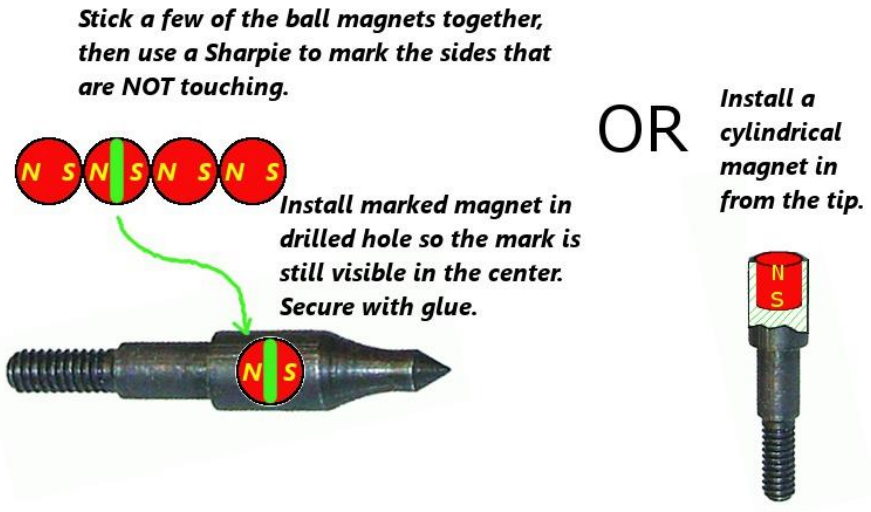
Magnetizing a Field Point

The simplest method involves rubbing a magnet on a field point to make it slightly magnetic. Thirty strokes of the magnet, rubbing in one direction only, should do it. It is a good idea to mark one end of the magnet "NOCK", and always point the "NOCK" mark towards the arrow nock and stroke the magnet towards the tip. If you don't do this, you may accidentally hold the magnet the opposite way the next time you rub the field point which will *demagnetize* the field point.

Installing a Magnet in a Field Point

If you want a stronger signal, you can install a magnet inside a field point. A rare earth cylindrical (disk) magnet (such as McMaster-Carr #58605K75, 1/4" diameter x 1/4" long, available at www.mcmaster.com) is perfect. Drill the field point from the end and insert the magnet. You should either glue the magnet in place, or drill slightly deeper than the magnet is long and peen the end of the hole after installing the magnet. This will ensure that the magnet does not come out. You will also need to add washers or similar material to make sure the final weight of your field point matches your unmodified field point.

A ball magnet can also be used, but you need to determine the direction of the poles first. The magnet poles need to run parallel to the arrow, not across it.



Operation

Plug the coil into your microphone input on your PC or Laptop, then launch helsyeah's Coil Chrono software. Follow his instructions for setting up and operating the software.

When you are shooting, ensure that you are far enough away from the first coil (4' - 6') that the arrow has completely left your bow before the arrow tip enters the first coil.

If you followed these build instructions the coil distance you will enter into the software is 30 inches.

If you already know your arrow's speed based on the readings from a standard chronograph, you can slightly tweak the coil distance you enter in the software until your Coil Chrono result matches the standard chronograph. This sets your "effective coil distance", which may be slightly different than the distance between the centers of your coils. If you need to significantly change your coil distance to make the two values match, something is not working correctly and you need to troubleshoot your setup.

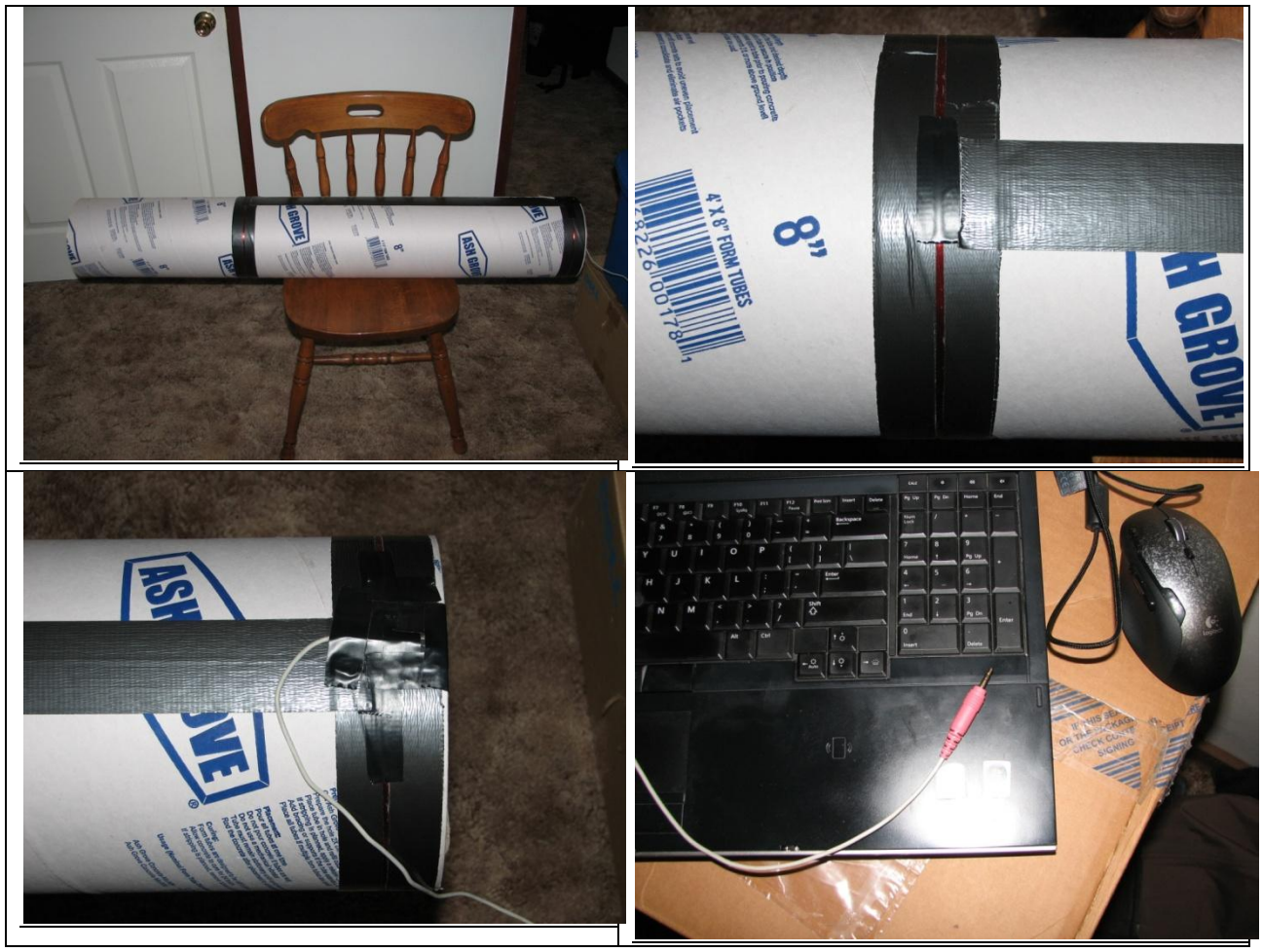
SAFETY NOTES

The inside diameter of the snap couplings is approximately 6 3/4". In order to ensure that your arrow will have a clear path through the chronograph, it is best to have a second person standing behind you to help line you up.

This diameter was chosen to help maximize the sensitivity of the coils while providing a reasonable diameter for shooting through. If you choose to substitute larger materials, the sensitivity may be reduced. However, good results have been obtained using an 8" cardboard concrete form and a 10" outside diameter piece of plastic pipe.

Other Construction Ideas

1. helsyeah's Build



helsyeah's DIY Chrono

Materials List

•800 FT 36 AWG (Guage) Enameled Magnet Wire: $8.75 on EBAY

•4 FT Cardboard Tube 8" Diameter: $7.00 at Home Depot

•Single input Microphone Jack & Cable: $FREE (laying around)

•10-14 FT of Duct Tape

•1000+ grit sandpaper

•Solder & Soldering Iron

Build Process

1. I split a 5' section of duct tape in half length wise and wrapped the two sections 1/8" apart.

2. I then taped one end of my 36 AWG wire in place and wrapped 50 wraps of the wire in the 1/8" gap between the two pieces of tape & taped the loose end in place.

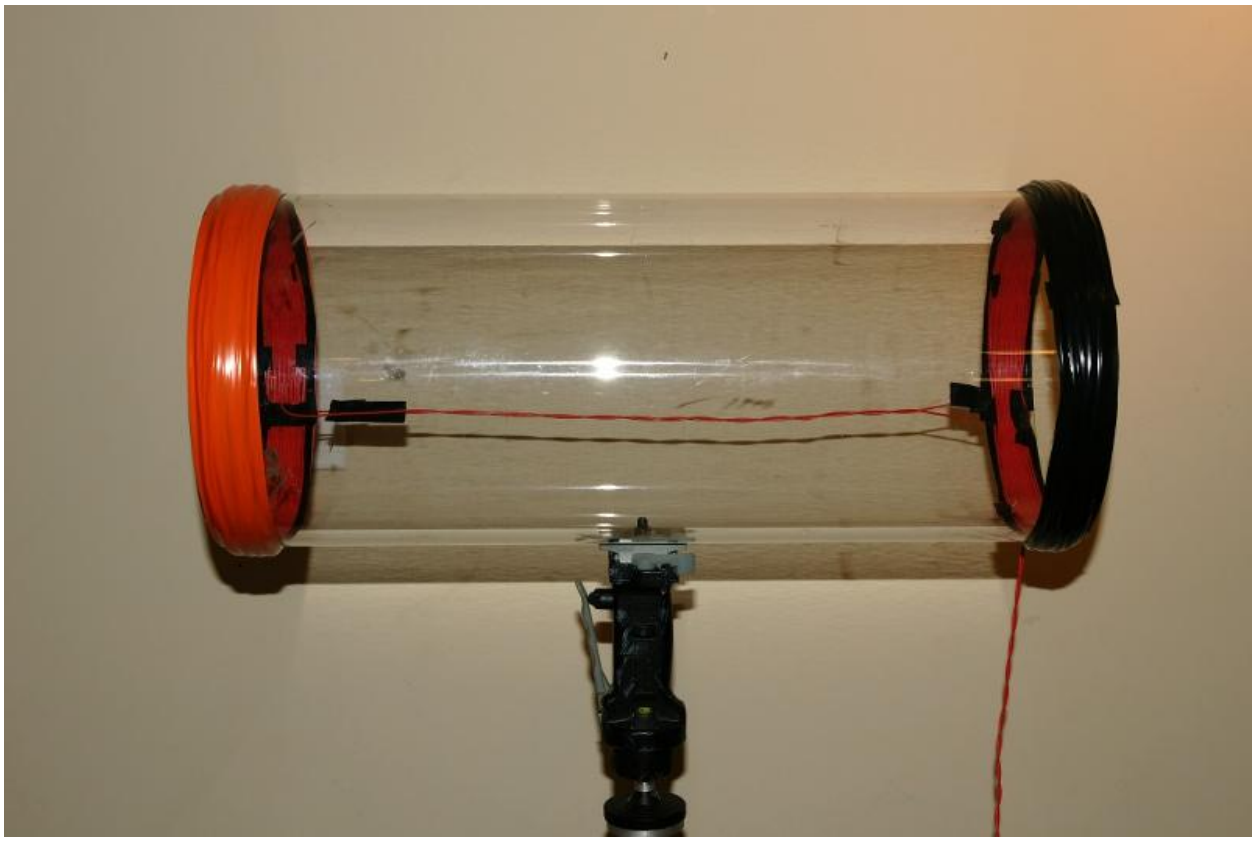
3. I cut another 5' section of duct tape in half and wrapped the two sections 1/8" apart 30" down from the first coil.

4. Then taking the 36 AWG wire I extended it down to the second 1/8" gap, taped it in place and wrapped another 50 turns in the second 1/8" gap.

5. I then extended the wire back to the first coil and taped the last end in place. I also taped over the sections of wire between the two coils to protect it.

6. Taking some 1500 grit sand paper I stripped the enamel off the two ends of wire & soldered them to the microphone cable ends. I taped the microphone wire and other wire ends up to keep them from moving around and breaking easily.

2. Veni Vidi Vici's Other Build



Veni Vidi Vici's Other Build

Materials List

10" diameter x 2 ft long clear pipe (Cost: ??? Something I found and thought might be worth keeping)

300 ft 18 ga insulated wire (Cost: ??? I had it left over from installing my invisible dog fence)

Microphone jack (Cost: $1 at the local Dollar Tree store)

Build Process

1. Wind 50 turns of wire on one end. Went back and forth 5 times making 10 turns each pass.

2. Tape the coil down.

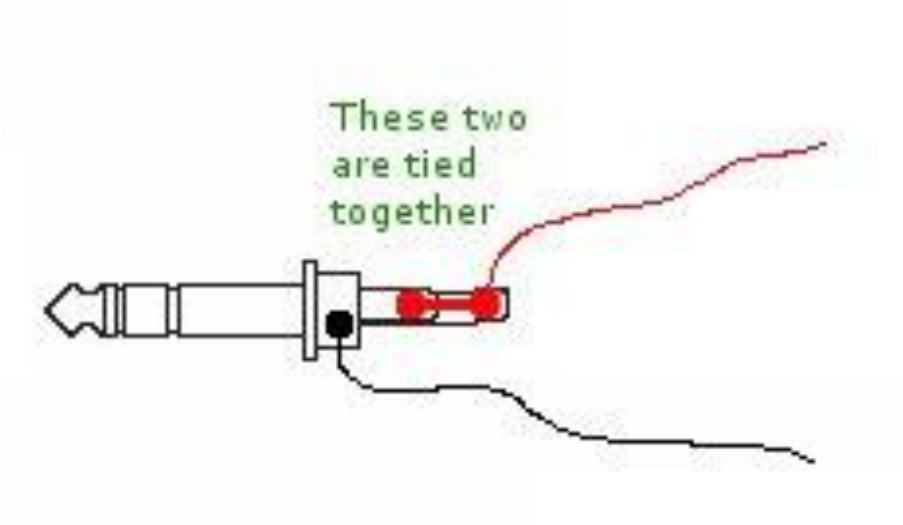
3. Run the wire to the other end and make 50 turns in the same way. Wind the turns in the same direction as the first coil (CW or CCW).

4. Tape the second coil down.

5. Run the wire back along the pipe and tape it down at the first end.

6. Twist the rest of the wire together, leaving about 6 feet of twisted cable.

7. Solder the wires to a microphone jack, as shown below. You can also solder to the microphone jack wires instead of directly to the connector, but you may need an ohm meter to determine which wire corresponds to which portion of the jack.



8. Tape the wires with electrical tape.