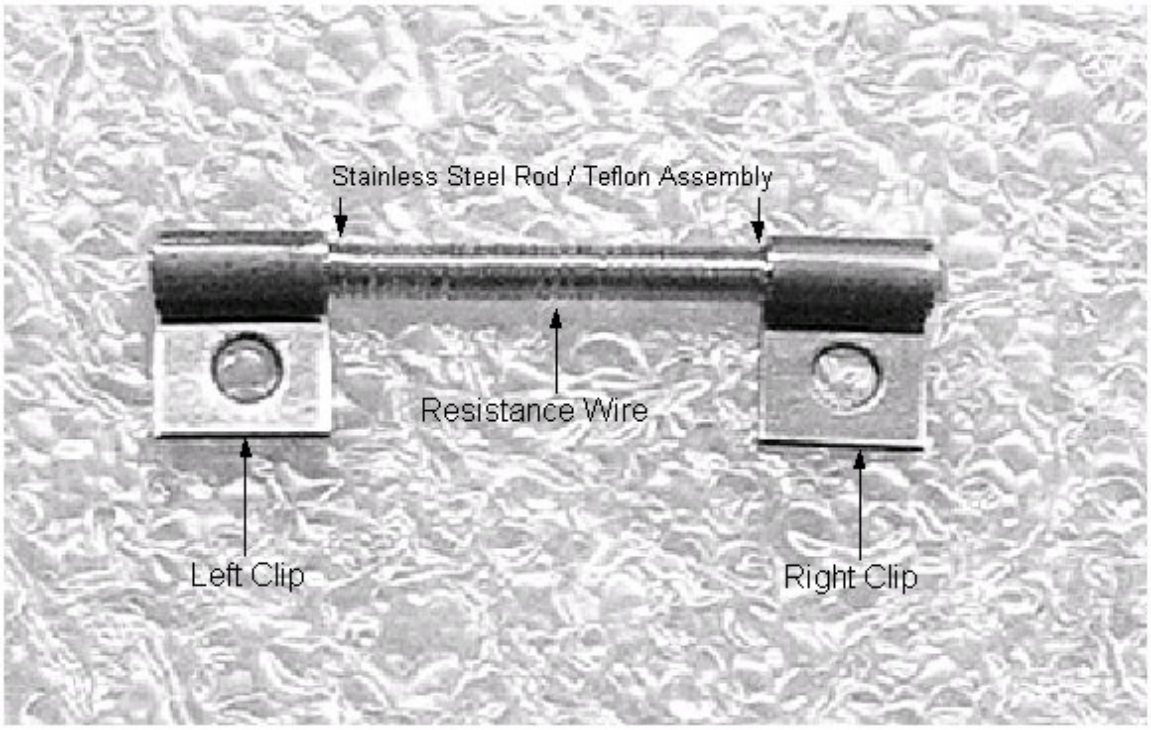
Johnny Astro II Coil Notes – Issue 1, 2/26/2005

This document is intended to provide supplemental information regarding winding the coils used as a speed controllers for the Johnny Astro II project. I used to wind some of my own coils many years ago as a kid when I built crystal radio kits. Those coils were different in that the winding was done around a hollow tube and enamel coated wire was used, which in turn was sanded to form an active region for a wiper to move across. The coils we are making for the Johnny Astro II project are different and consist of the following parts (refer to Johnny Astro II project drawings sheet 3.0); a stainless steel rod at the core of a piece of Teflon spaghetti tubing, around which is wrapped bare uncoated resistance wire that is secured at each end by two copper mounting clips. A picture of a completed coil is shown below along with all parts identified:



Tips Before Getting Started / Tools required

If you have never wound a coil before there is no reason to fear – anyone can do it! If you are a hobbyist who prefers to do everything yourself, you already realize the importance of knowing things in advance, getting the right tools and using an established procedure. For winding the Johnny Astro II coils, the following tools are needed:

- a set of tweezers
- a set of needle nose pliers
- a tape measure
- wire stripper/cutter
- a metal crimper (or jeweler's pliers with a dimple)
- a clothes pin

- a bench top vise
- a digital multimeter capable of measuring resistance
- an original Johnny Astro coil or a mechanical template of one
- measurement calipers

Set up your work area and organize your tools properly so you will achieve desirable results. Be sure to always work in a well-lighted environment so you can see everything. It is also helpful if your vise is either mounted to your work surface, or heavy enough so that it won't move as you wind your coils. Situate your tools so you can reach everything you'll need while you are winding. Use common sense when you set things up – if a tool is a single use item in the process (like the measuring tape) – get that tool out of the way after it isn't needed anymore. Keep the other items (like the tweezers and the clothes pin) nearby so you reach them and use them without impacting the winding operation.

Remember to strive for winding coils that are tightly wound. It is important to achieve minimal spacing between windings and make coils that do not have any adjacent windings touching. Note that the final impedance of the coil is impacted if any adjacent windings touch each other, while it may be a lofty goal to expect that no two adjacent windings touch each other – keeping this at a minimum will allow you to produce coils with acceptable impedance. Also note that the stainless steel rod is conductive, and the impedance of the resulting coils can be adversely impacted should the coil touch the rod at any point. While it should be the goal to wind tight coils, do not wind them too tight! The spaghetti Teflon tubing has some give to it, and winding too tightly will cause the tubing to actually push off the stainless steel rod at the opposite end when you are winding, keep an eye out for this and adjust your tension accordingly – having some depression on the spaghetti tubing is OK, you will learn what the happy medium here is through practice.

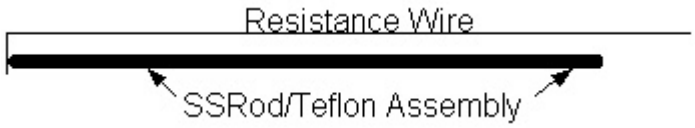
Coil Winding Procedure

This section will provide the procedure for coil winding. While this procedure has been proven to work, it can likely be improved upon. As always, the hobbyist is encouraged to adapt and make any improvements as desired. Here goes on the procedure:

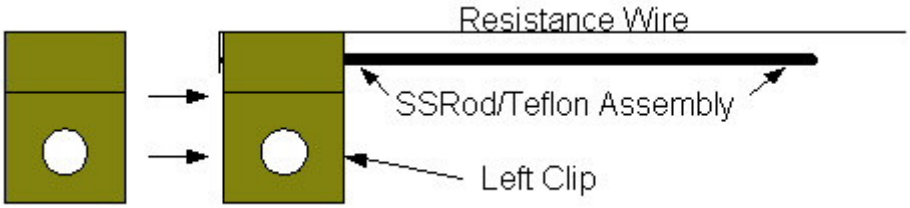
1.Cut desired amount of resistance wire. As stated on the Johnny Astro II official drawings, 23.5" of the resistance wire should produce an impedance of 16 ohms, which is the coil target resistance. Since the plan is to secure the wire under each of the two copper clips of the coil – this length must be taken into account as well. Theoretically, assuming the resistance wire is made perfectly to specifications, the length required should be equal to the 23.5" + the length through two copper clips (about .75"). So the first thing to do is measure out a 24.25" length of resistance wire. Now use the Digital Multimeter and measure the coil resistance at that length and you should slightly exceed 16 ohms. Measure out enough resistance wire such that the meter reads at least 16.3 ohms. Cut the wire to this length, whatever the length is.

2.Fine tune resistance wire length. Now take the resistance wire cut in step 1 and stretch it out on your work surface. The objective is to wind a coil that goes through a copper clip on each end. Therefore, the resistance wire will in effect be shorted out at each end by a length that is equivalent to the surface length of the clips. So either physically put clips at each end or take this into account as you measure the resistance. Move either the clip at one end, or the meter probe at one end and find the point on the wire that will produce exactly 16 ohms with clips contacting the resistance wire at each end. Cut the resistance wire at this point.

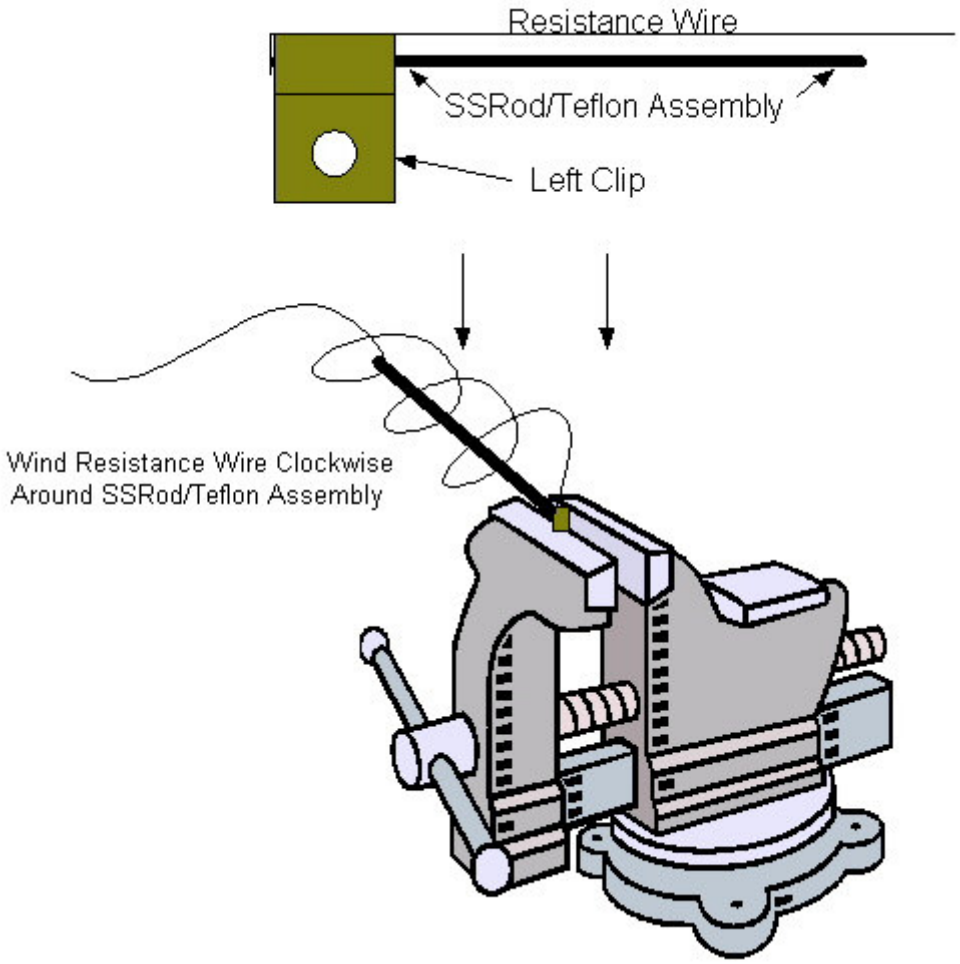
3.Fold one end of the resistance wire on SSrod/teflon assembly. Use the tweezers and bend one end of the wire over at about 1/8". Press this end of the resistance wire onto an end of the SSrod/teflon assembly. Fold the wire over at the end and extend the resistance wire over the remaining length of the ssrod/teflon assembly per the drawing below:



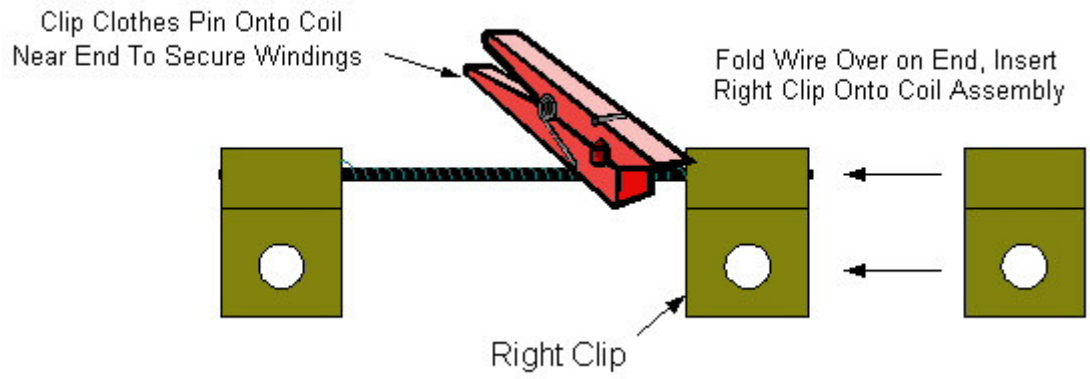
4.Capture one end of the resistance wire on the SSrod/teflon assembly. Use the left clip and slide this clip over the resistance wire and SSrod/teflon assembly. You must support one end of the SSRod/Teflon Assembly with your hand or press that end onto the work surface to keep it from moving as you insert the left clip onto the end. The clip should fit snug on the assembly and render the resistance wire immobile. Push the clip over the wire until the end of the clip lines up with the end of the SSrod/teflon assembly, per the drawing below:



5.Secure the coil assembly in the vise by clamping the vise onto the left clip. Tighten the vise such the overall assembly does not move, but do not over tighten. Be careful not to tighten the vise in a fashion that could damage the clip, as it is advisable to position the clip into the vise such that the hole end of the clip is outside of the vise jaws. After the coil assembly is secured in the vise to your liking, wind the coil in a clockwise direction applying continuous even pressure. Wind 76 turns, or to the point in which there is about ½" of resistance wire remaining. See the figure below:



6.Secure the wound coil near the end with a clothespin or a small jaws style clamp. It is very important at this point to make sure that the coil winding does not come unraveled. Fold the remaining end of the resistance wire over the Ssrod/teflon assembly. Push the right clip over the wire until the end of the clip lines up with the end of the SSrod/teflon assembly, per the drawing below:



7.Make sure that the right clip is co-planar with the left clip. This does not have be perfect, as there will be some "give" or "twist" in the coil assembly that will facilitate mounting into the Johnny Astro control center base. Use the calipers and confirm that the spacing between the clips is per the dimension shown on the Johnny Astro II drawings.

8.Gently tighten both the left clip and right clip onto the coil assembly. Use the needle nose pliers and gently squeeze the tubular sections of both the left clip and right clip to fully secure the clips onto the resistance wire. The coil winding should be as tight as you can get it.

9.Measure the coil resistance. Use the digital multimeter and measure the impedance of the coil between the two clip ends. If everything was done perfectly, the resistance will be 16 ohms, but don't worry if the resistance doesn't equal 16 ohms. The testing on the reproduction Johnny Astro toys has indicated that the toy will work just fine with coils having impedances as low as 14 ohms. Run a set of tweezers across the coil in a fashion to simulate the wiper action, re-measure the coil impedance. Repeat the previous step multiple times.

10.Test the coil out in a Johnny Astro unit. Every one of the coils I have made to date have been fully tested. This is accomplished by simply installing the coil in your existing vintage Johnny Astro or the replication Johnny Astro, depending on your need. Operate the unit and move the throttle back and forth both slowly and a little on the faster side. Note that when using the toy it is not advisable to make abrupt changes in the throttle position, as one would have more of a tendency to lose control of the balloon during sharp changes in propulsion unit speed. Check for any hysteresis when operating the throttle, as this would be a sure sign of a loose coil. Re-inspect the coil windings when done.

Final Notes

A procedure for winding homemade coils for use on the Johnny Astro II project has been presented. It is my hope that this procedure provides some supplemental information that is useful to anyone who wishes to wind homemade speed controller coils. Good luck.

- Bob Lansing