Building a Vertical Solenoid Actuated Lane Change System
By Dan McNarry
www.ac2car.com

Overview

The Vertical Solenoid LC is a simple means to solve the problem of getting slot cars to change lanes. This can be for access to passing lanes or pit lanes. The idea behind the VSLC is to provide a robust yet compact device to achieve the above goals. It is comprised of a solenoid, a vertically oriented blade and a guide for the blade as well as a bracket to support the solenoid in the desired location. The description in this article describes my particular adaptation of this system as used in a 2 lane 2 car AC set up. It is designed to be used in a curved portion of track. It will not provide reliable results in a straight section.

The solenoid should be of the push type. It can be either tubular or open frame. The typical solenoid used should also be of the 12 Volt variety. We'll get in to stroke length and power later on. The vertical blade can be made out of many different materials but in the interest of simplicity we'll stick with brass. It can be easily cut, filed and soldered as required. It is also inexpensive and readily available at most hobby stores. The guide for the blade can be made out of hardwood or some form of plastic, nylon or Teflon. I used hardwood for my VSLC as I had some ready at hand. The bracket that mounts the solenoid to the guide block can be made of any easily workable metal such as brass, mild steel or aluminum. In the case of my VSLC I used aluminum as it is what I had lying around. Once again this is only what I used, I am sure that wood could be used as well.

When power is applied to the solenoid its armature is pushed out an opening in one end of its body. The blade is attached to this armature and upon activation is thrust up in to the slot. By doing so it blocks the normal path of the car and diverts it in to a slot that leads to the desired optional lane.

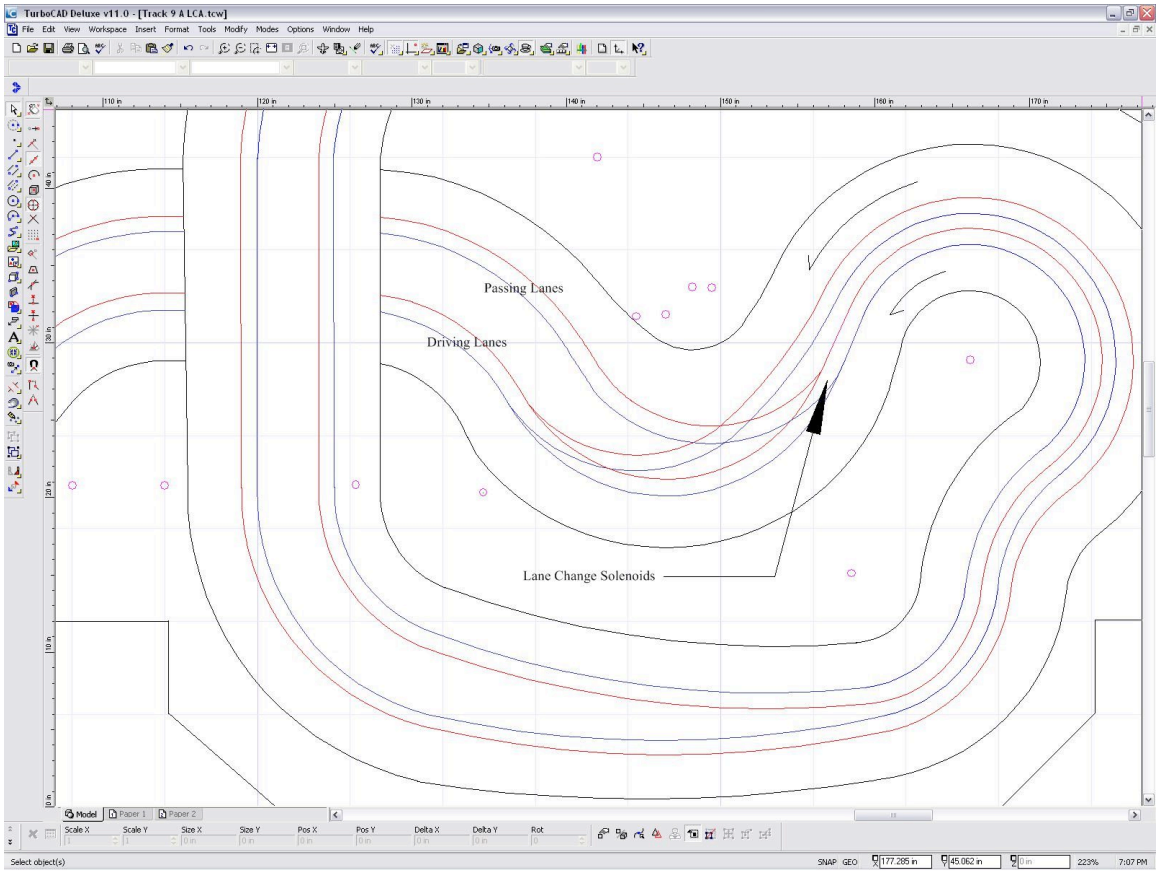


Fig. 1

Figure 1 shows where the solenoids are located on my track. In this drawing the red lines indicate lane 1 and the blue lines are lane 2. When 2 cars are close together the trailing driver can activate the solenoid just as his car approaches the LCA. He will then be diverted to the passing lane for one lap. As you can see, when he comes back around to the LCA again, he will be fed back in to his original driving lane just downstream of the solenoids. Because the two driving lanes are only one inch apart, there will be as many as three other cars to pass in this way. The lanes all funnel together prior to the LCA in order to prevent cars from side swiping each other in the LCA.

The link below should give a good indication of what a typical tubular solenoid spec sheet looks like. The intermittent 12 Volt solenoid would work well for most applications. This is only a recommendation, nothing else.
http://www.guardian-electric.com/html/tp6x12_dc_push_tubulars.htm

Building a VSLC

Build a test track! I can't stress this point enough. There are many things to be learned from a test track that incorporates your newly built VSLC. The most important being that

if you have not built a routed track before this will be an excellent introduction to the process. You will learn how to layout and route slots. You will also learn how to lay copper tape and run power to your lanes. The lane change mechanism is just the icing on the cake.

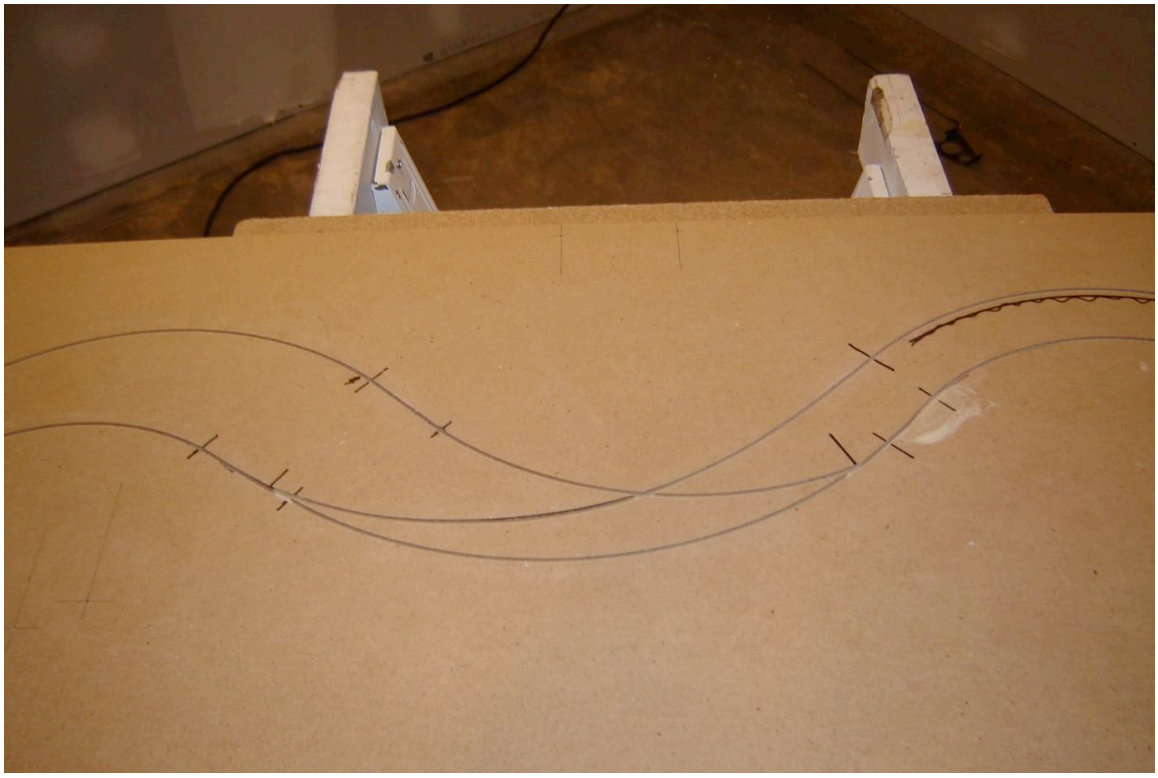


Fig. 2

Figure 2 shows a routed lane change area built to mimic my full size track. This is only a one lane test track and was built to test the VSLC idea. I had never routed a track before so it was good practice. Notice the requisite mistake just before the LCA! I made another one on the other side of the track.

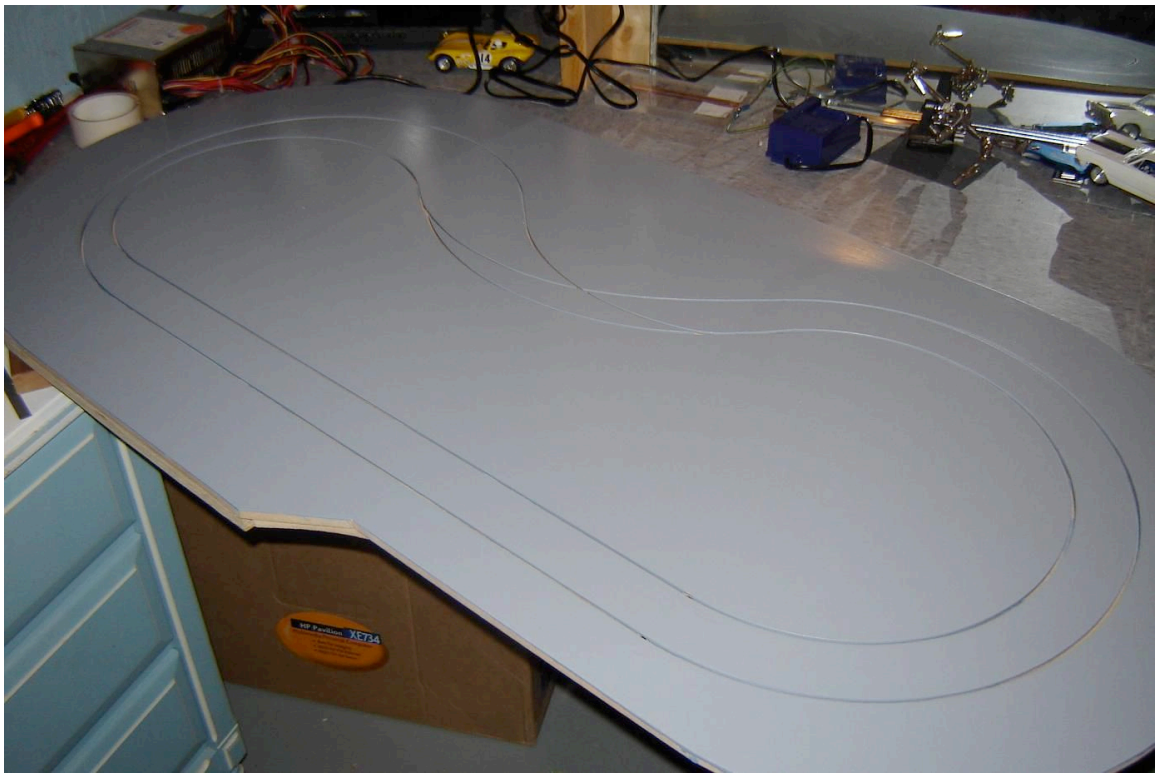


Fig. 3

Figure 3 shows the test track before the copper tape was laid. I only had a 2 x 4' piece of MDF so I had to graft on an extension at one end and part way down one side to provide some sliding room. The next step is to cut a slot in the track for the blade. This has to be positioned very accurately. You want the blade to be positioned so that it feeds the car in to the passing/pit lane smoothly. If the blade is not aligned right you can have at least one of three big problems. The first and hardest to correct would occur if the leading edge of the blade protruded in to the slot. The result would be that the car would stop dead and quite possible breaks the flags mount. A similarly disastrous scenario would be if the blade did not overlap the "island" created by the diverging slots. Once again the car would hit this protrusion and come to rather abrupt halt, not good! If the blade is angled too steeply the lane change will not be very smooth. The blade angle on my test track was a little bit too steep but worked okay. I flattened the angle out on my full size track. You can compare this in the various photos.

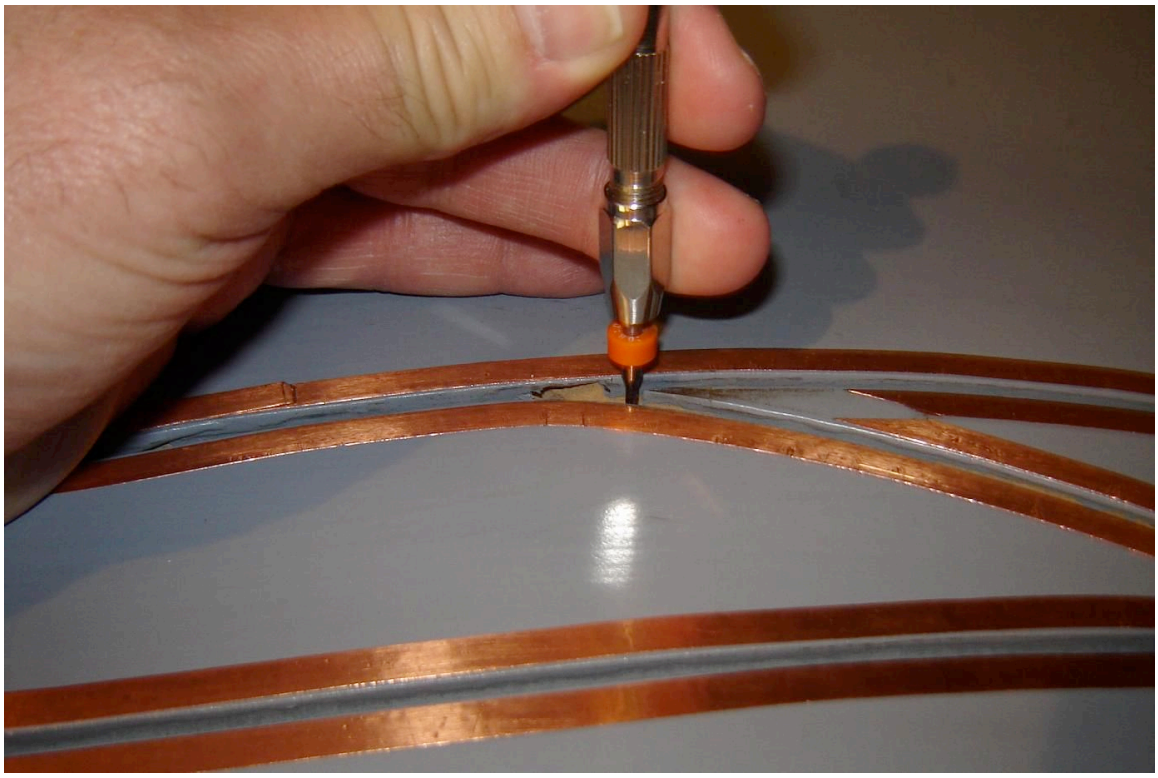


Fig. 4

Figure four shows how to layout one end of the blade slot. Make sure and err on the side of caution. Don't try and get it dead centre on the island! It needs to be slightly offset to the passing/pit slot side of the island. Drill a small hole at each end of the slot. If the blade will be angled so that the leading edge is actually under the track you won't be able to drill the leading hole at the extreme end of the slot but rather part way along. That's okay, see figure 5.

Fig. 5

I am taking these photos after the fact as I didn't document the building of the test track very well. At this point you would line your blade up with the island end of the slot by placing the blade over the hole. Leave a very slight gap toward the island side. Just enough to prevent the blade from being tight. Line the other end of the blade up so that it covers the other hole you just drilled. Mark around the blade with a pencil and then cut the slot out. I drilled a series of holes and the carved out the remaining material with an Xacto knife. See figure 6.

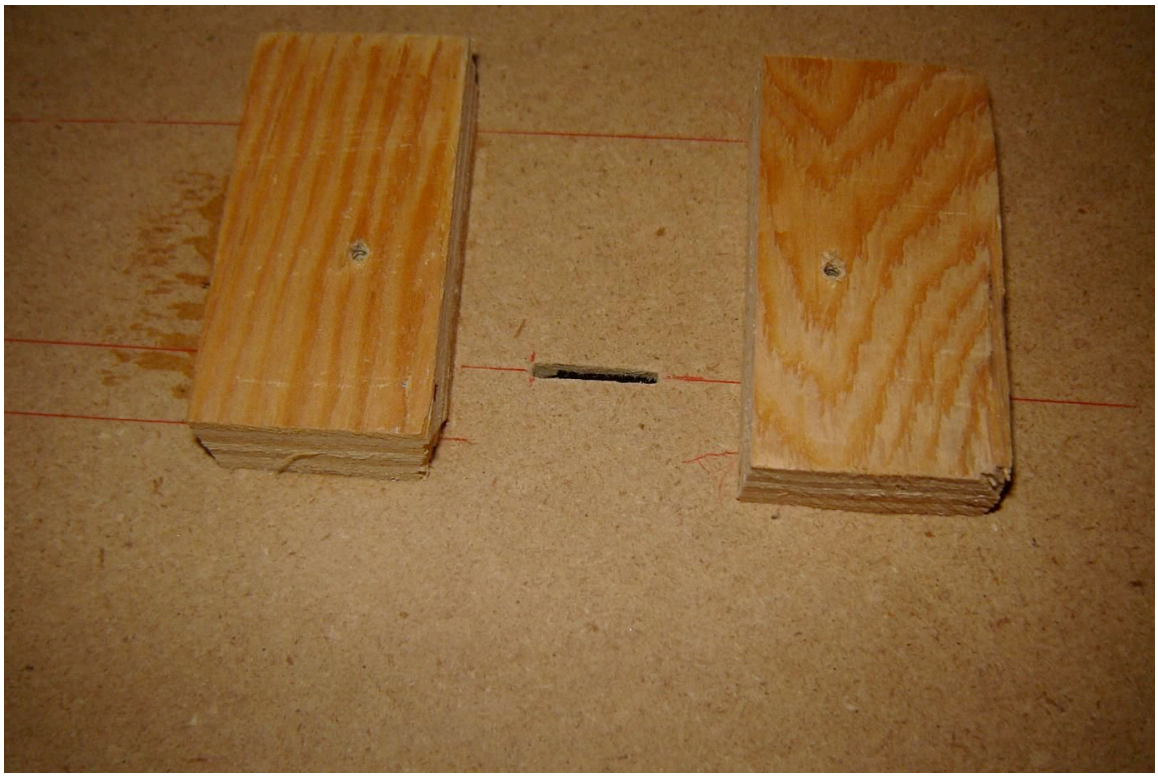


Fig. 6

Figure 7 shows the blade on the test track deployed. Notice how it slightly overlaps the passing/pit island.

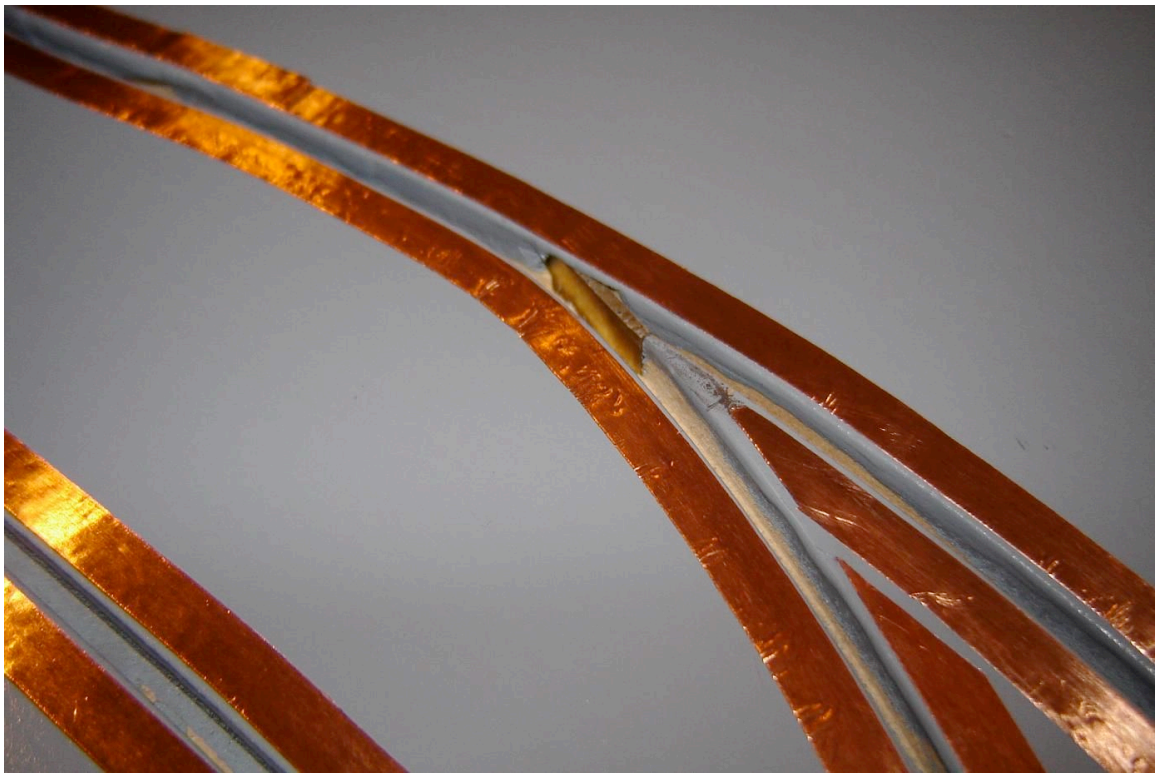


Fig. 7

It's time to start on the solenoid now. I used tubular style solenoids because they were readily available and I liked the included mounting bracket. You can mount your solenoids singly or in pairs. I don't see any reason why you couldn't line more up if required. The armature on the solenoid will in most cases be much longer than required. The effective stroke of the solenoid/flag assembly should be just a tad longer than the depth of your slot. This will ensure that deep flags don't hit it as they go by. A solenoid with a stroke of somewhere between .5 and .75" should work just fine. You won't need this much stroke but you will be shortening the armature to get the stroke right where you want it. The push type solenoid starts with the armature oriented toward the open end. When current is applied it sucks the armature in and pushes the pin end out the other end. The armature is one piece with the main body being thickest and the pin end being the thinnest. This pin end is where you will attach your blade. I soldered a piece of 1/16 inch I.D. brass tubing in to a slot cut in to one end of the blade. The pin end of the armature fits snuggly in to this cup. This allows the VSLC to be disassembled easily.

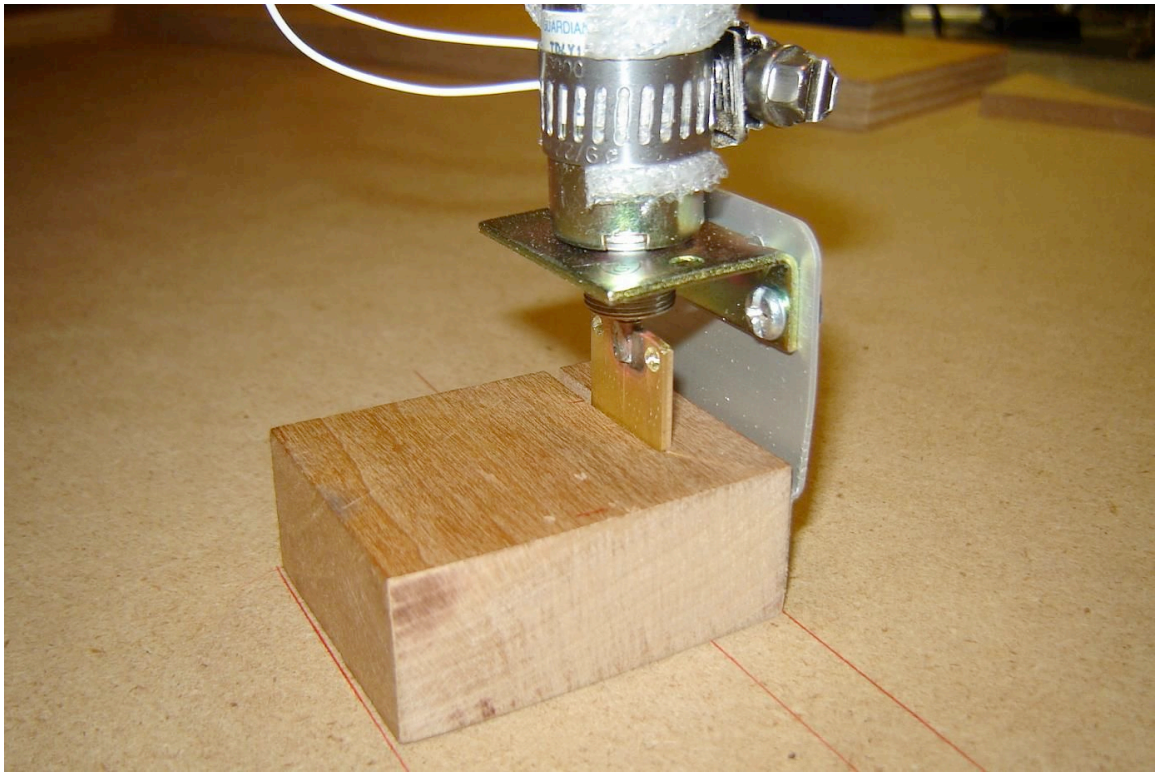


Fig. 8

Figure 8 shows the single solenoid from the test track. The piece of foam wrap is attached to keep the armature from falling out when the device is turned over. Next we have to transfer the slot (s) from the track to the hardwood block that guides the blade (s). I am going to switch to the full size track now because we will be working with multiple solenoids. This is quite a bit trickier than mounting a single solenoid. The first step is to transfer the blade slots to the hardwood block. I did this by soaking the slot area with a

really wet black marker and quickly pressing a piece of paper over the area to make a transfer. See figure 9.

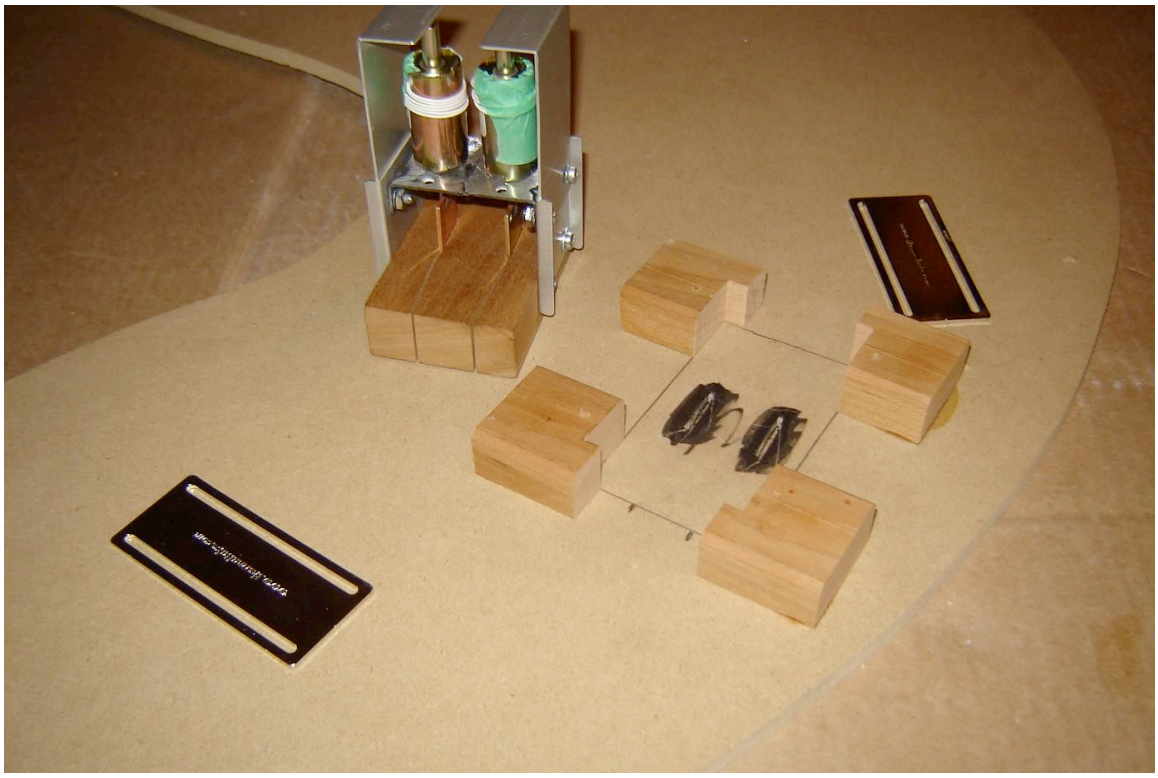


Fig. 9

Cut the slots out of the piece of paper as accurately as possible. Lay this over your hardwood block and use the marker to fill in the slot. I recommend that if you don't have a band saw find a buddy who has for the next step. As you can see in figure 9 I ran my band saw in to the blade area and cut away the far half of the slot cutting all of the marked area away very carefully. I then brought the piece back out and turned it around. I brought the piece back in to the blade from the back side. This allowed me to finish up the near end of the slot. You want to use a really thin blade for this so that the end of the slot that has the access cut in it can still have a square shoulder to act as a blade guide. If the slot is too wide the blade will not get any support. If your available band saw blade is of a thicker variety then I would recommend going to a thicker material for your VSLC blade, probably twice that of the band saw blade. Your blades should slide easily in the slots you have cut but not be sloppy.

To mount the solenoids you can see that I have welded the two supplied solenoid brackets together. I used some scraps of aluminum to mount the combined solenoid bracket to the hardwood. At this stage I still haven't fine tuned the length of the armatures. Before we get to that let's look at how we are going to attach all of this to the track. Once I had the blade moving freely I put the mounting block over the slots in the track and dropped the blades through. I made sure that the blades would go up and down easily in the slots and then clamped the assembly in place. Check again for freedom of

movement. Once satisfied I glued four blocks in place as shown in figure 9. The locating blocks should be slightly thinner than the mounting block so that it can be clamped down. The blocks should fit snuggly to the mounting block but not be so tight that you can't get the block out. Be careful not to glue the mounting block in! This would make fine tuning the solenoids a real pain.

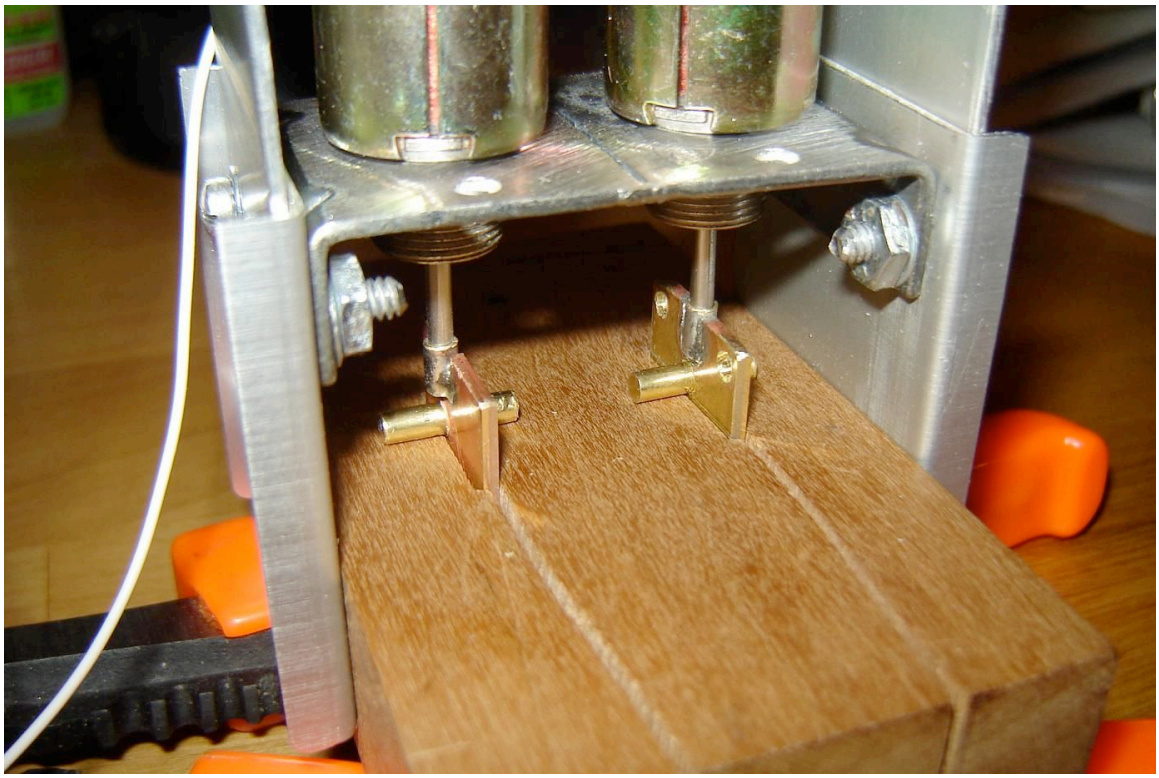


Fig. 10

Figure 10 shows the solenoid brackets tack welded together. At this stage I have got the armature lengths right and the stops in the blades. The stops prevent the armatures from bottoming out in the solenoid housing. They also set the final depth of the blade protrusion in the slots. You can also see that the blades are thicker than the band saw access cuts. Figure 11 shows the finished assembly mounted to the track. I should say almost finished as the stop pins are not in place yet as shown above. The hold-down clamps are pieces of metal I had lying around. My wife would disagree but it pays to be a pack rat. The pieces of aluminum that come up over the top of the solenoids are to prevent the armatures from falling out when the track section is turned over.

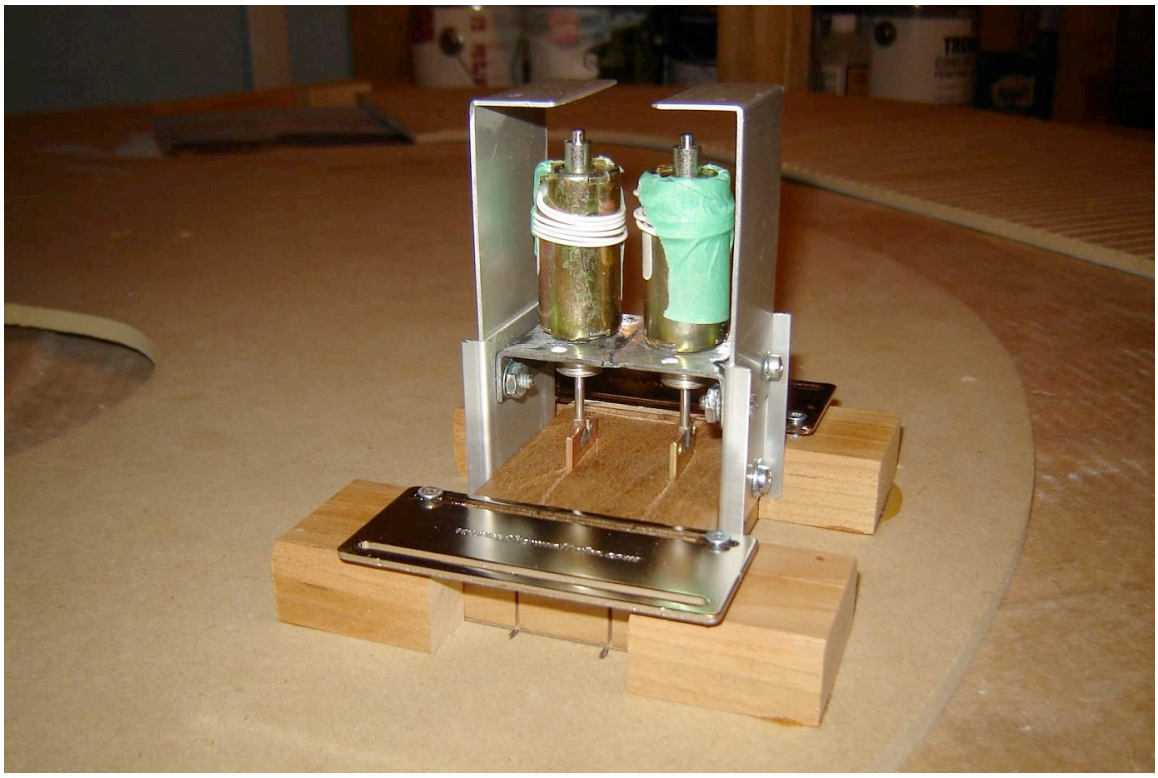


Fig. 11

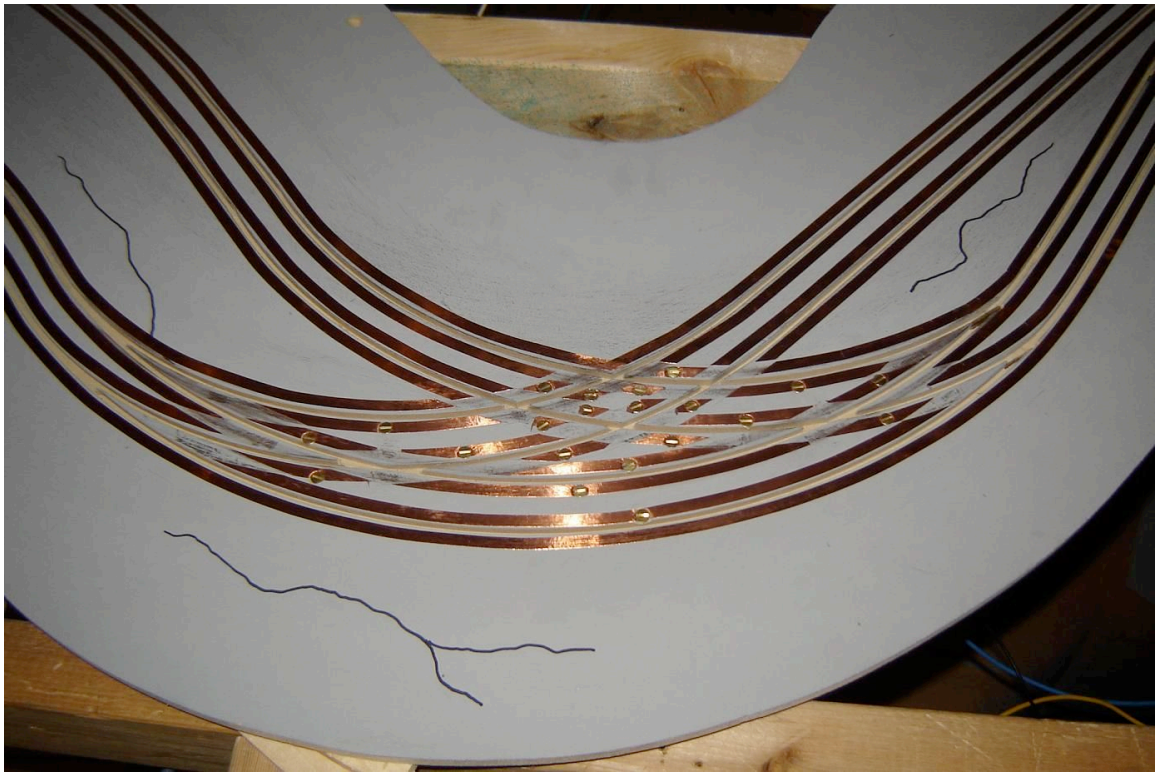
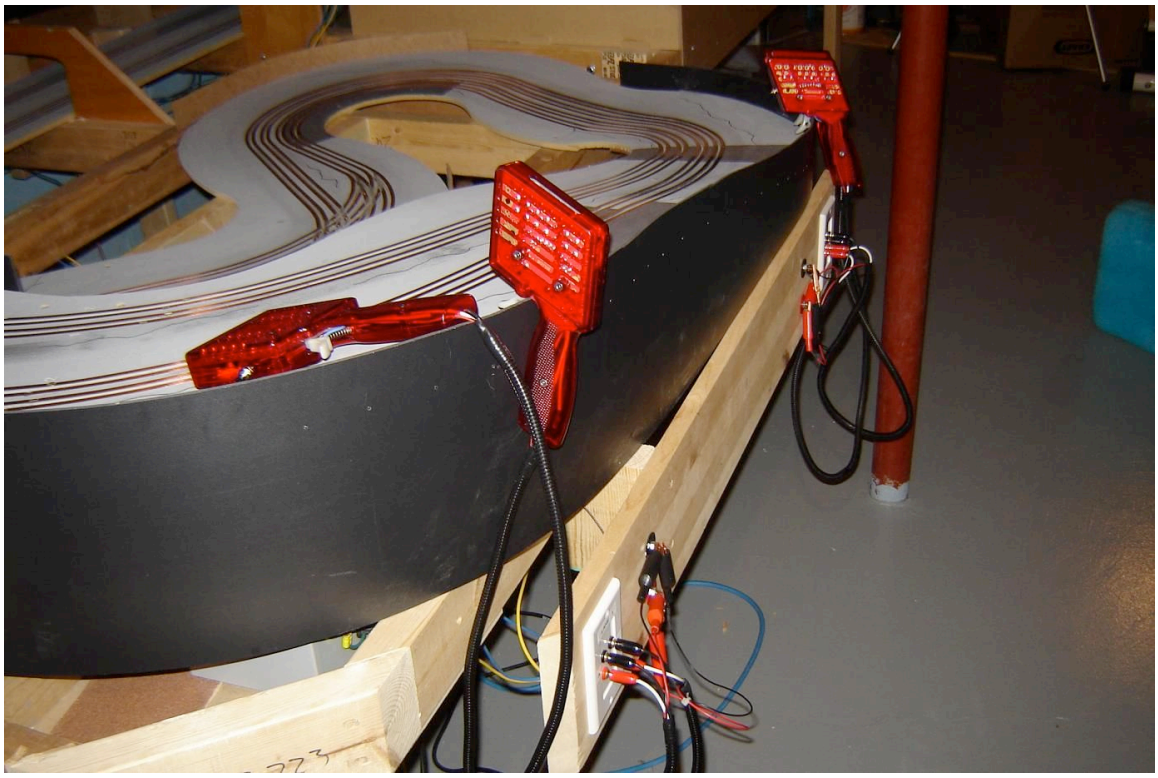


Fig. 12

Figure 12 shows the lane 1 solenoid deployed. I used buttons mounted on my Professor Motor controllers to activate the solenoids. For power I am using a computer power supply as my track power is 18 Volts AC and the solenoids are 12 Volts DC. Figure 13 shows the PM controllers and the alligator clips that I put on them to clip to the LC hook ups. I changed the controllers to banana jacks and used the alligator clips this freed up. Both controllers for lane 1 connect to the same LC hook up. The two controllers in the back ground are for lane 2 and both connect to the lane 2 solenoid.



That about sums it up. This simple manual may provide more questions than answers but I think that between us we can find a way to fill in the gaps. In closing I would like to say that I am very happy with this system. It should last a long time and has provided lots of fun racing to date.