Manually Operated Ground Throws for About $1.

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A little bit more for the deluxe model.

I believe in keeping true to the prototype as far as possible. Where the prototype uses switch motors and centrally controlled turnouts I use them and where they use ground throws I do also. Therefore, I needed several inexpensive ground throws for my railroad, the Short Line subdivision of the Cincinnati Division of the Louisville & Nashville RR running between Osborne Yard in Louisville and DeCoursey yard in Covington.

I chose to make my own ground throws for several reasons 1) they are less expensive than commercial products 2) many commercial products were oversized and out of scale 3) when I started making my own, no commercial product had auxiliary electrical contacts and last 4) some track switches were hard to reach due to distance from the bench-work edge or obstructed by trees, telephone lines or other scenic features.

It is a simple design using music wire to hold the points in place with a spring action, over center mechanism. I modified this design (several times) over the last 25+ years, on my last three model railroads and those of several friends.

These ground throws can be built with minimal expense, simple materials and a few basic skills. Later we will discuss how to add powered frogs, provide feed back signals when the switch is thrown, how to dress things up a bit and how to deal with difficult installations due to cramped spaces and obstructions.

- **Materials needed**
- Brass tube 3/32” OD
- Music wire 0.055”
- K&S Engineering brand at your local hobby
- shop is one source for items above.
- Solder (silver solder is stronger and best for this)
- 1-inch oak or other hard wood
- Dowel rod 5/16 or 3/8 inch for actuator rod
- Dowel rod 1 inch for knobs
- Screws #8 x 1 round head wood screws
- Dry wall screws 1 inch

  Your local hardware and lumber or big box store Lowe’s or Home Depot

- **Tools Needed**
- ¼ or 3/8 drill and various twist bits, ½” spade bit
- Electrician pliers
- Diagonal cutters
- Screwdrivers
- Butane torch
- 140 W soldering gun

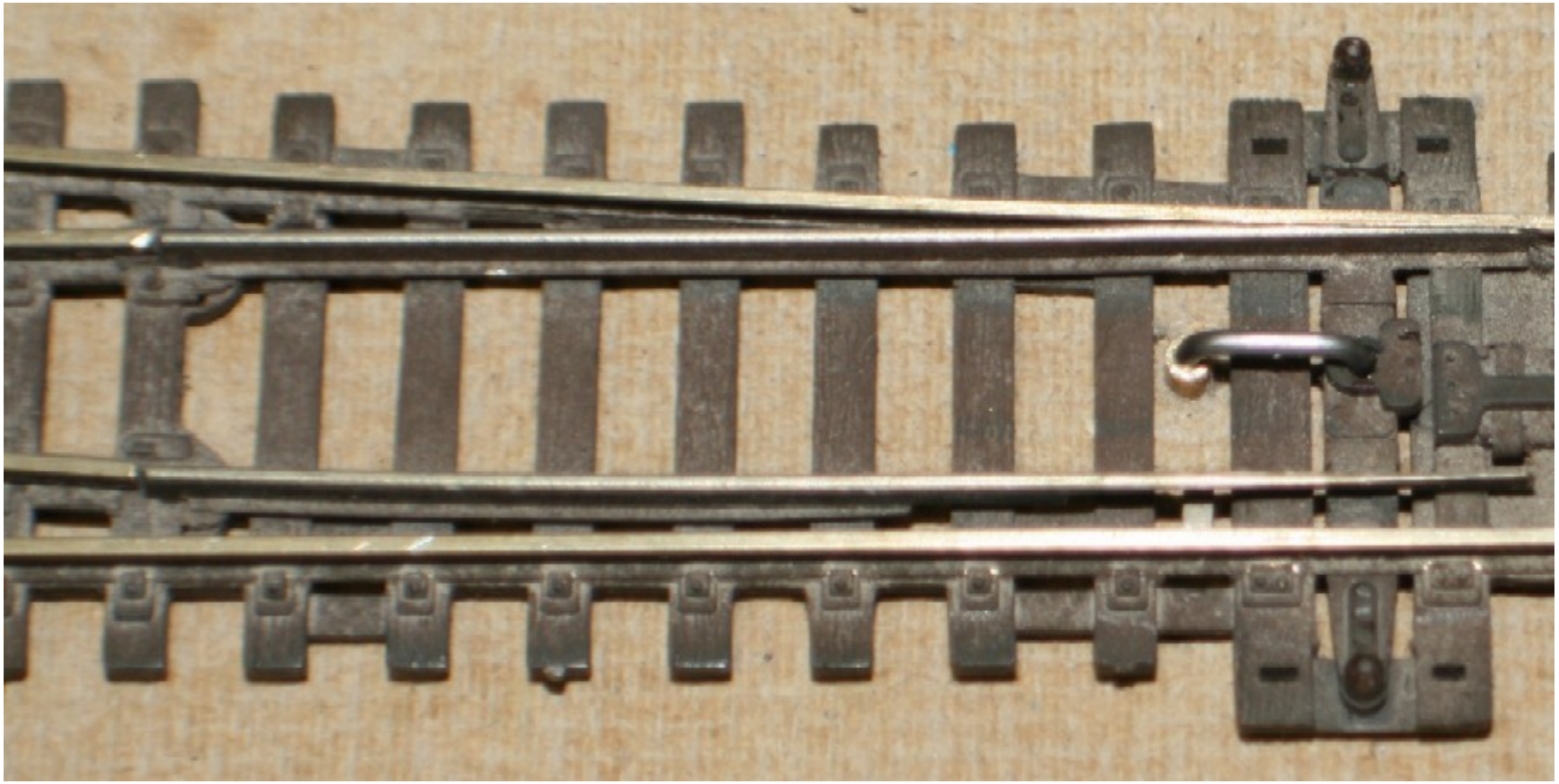
- **Optional materials**
- Micro-switches CRE-00073

  Available from Micro Mart or
- E-Switch MS0850501F045S1A or Omron SS-3GLP

  Both available through Mouser Electronics
- Switch stand targets
- Wooden drawer pull knobs to dress things up a bit

Follow along with the photos as we build the Mark IIX turnout control. The basic subassemblies are a base, a linkage, a spring and an actuator rod.

Example of Completed Manual Throw



Many people bring music wire above the ties to connect to the throw bar. I find this objectionable. 0.047” music wire is over 4 inches in HO scale 0.055” is 4-3/4”. Way out of scale to be on top of the track. I designed a way to bring the actuator wire from underneath to minimize its appearance. See the instructions for building the base.

Base

The first step is to make the actuator base. I use 1 inch oak boards as the base, however thinner material down to ½ will work. Oak tends to resist deformation and wear over time compared to pine or other soft wood. I cut them on a table saw. However, a router can be used to make the 1/8-inch step and if you are skilled and careful you could use a circular saw or hand saw to cut them.

(SAFETY IS YOUR FIRST CONSIDERATION! You need all of your fingers for future modeling projects.)

1) Cut blocks that are about ¾ x 1-1/2 x 2 inches, with a 1/8 x 3/8 step as shown.

2) Drill two mounting holes to accept drywall screws and counter sink.

3) Drill a hole 5/64 inch (just one size under the clearance for the brass tube). Keep it as perpendicular as possible (a drill press is a big help here). This is a press fit.

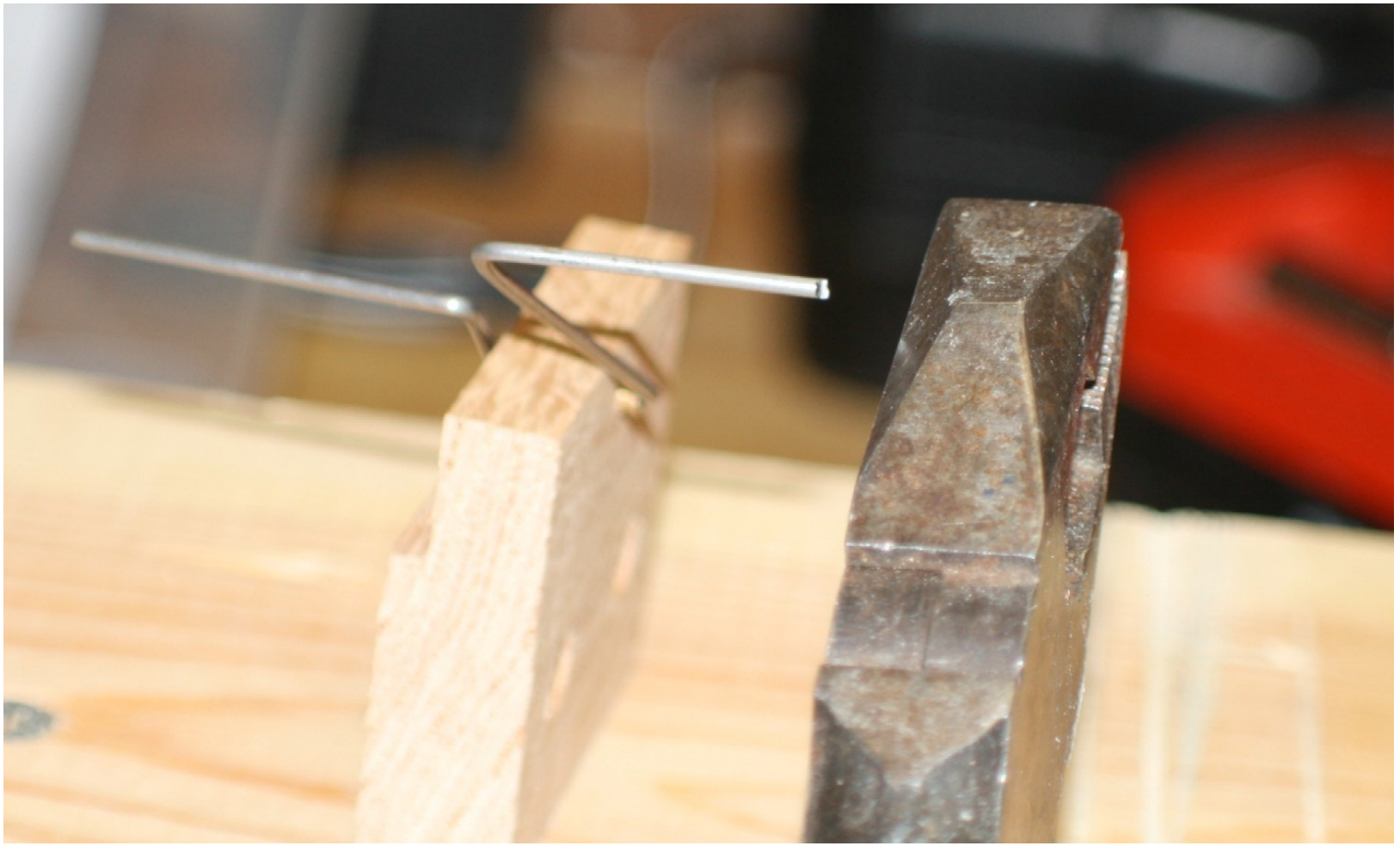
7) Now press the tube in the hole. I used my vise; you can also use a small C-Clamp or a small claw hammer to drive the bushing in. Try and keep it perpendicular to the base. When assembled, ream the bushing with #54 bit to clear any obstructions.

Reaming Bushing of Actuator base

Linkage

1) Bend the linkage wire as shown in the photo fig 2 above. Keep these lengths short. I come out only about ½ inch from the brass tube then up to whatever length is needed to reach the throw bar through the sub roadbed. The other side that connects to the spring is also kept short (about 1/2:”) then bent down to connect to the #7 spring and cut off at 1 inch. The length is not critical. Just remember a shorter linkage with be stiff and will snap in place. A long linkage will be soft and spongy. However, a shorter linkage will be more difficult to make and adjust. By experimentation you will find what feels right for you. Typical lengths for me are ½” in the horizontal plane and 1” in the vertical (as mounted). Note the base in fig 2 is on its side.

Base with linkage wire



2) Next mount the base and linkage under the bench work. You will need an oversized hole in the sub roadbed under the turnout throw bar the same as you would to mount a Tortoise brand switch machine. I make mine ½ inch. You can also make a slot between the head block ties with a 1/8” bit by drilling a line of holes. Insert the linkage wire up through the sub-roadbed through the throw bar. Position the base so that you are centered on the centerline of the track. Test that you have equal throw to each side and that there is free unobstructed movement with no binding. Note that the track does not need to be parallel with the bench-work edge. Only the lower linkage needs to be parallel to the front edge of the bench-work. So these two wires in the linkage may not be parallel in that case. Now all that is visible is the point of the actuator wire in the throw bar.

3) After I cut the music wire flush with the throw bar and paint the throw bar it will nearly disappear. See fig 8 on the last page.

Spring made in jig

Spring

I built a jig to bend the music wire to make the spring shaped like the number 7. This makes for consistency from turnout to turnout. I start with 0.055-inch music wire and a 3/32-inch brass tube. The tube ID is just a little larger than the music wire but with a tight fit.

1) Cut a brass tube to 1-inch length for a bushing for each turnout.
2) Heat ¾ inch of the end of the music wire with a plumbers torch (you can buy at the local hardware store if you don't have one) until it is red hot, and then with pliers wrap the music wire around the 8d finish nail in the jig. Keep the heat on the end only as you will take the temper out of the spring if you heat more than the end of the wire.

3) Remove the coil of wire from the finish nail and reheat the coil. Then use your pliers to twist it tightly around the brass tube inserted into a hole in your jig work surface. BE SAFE AND HANDLE WITH CARE THIS IS HOT AND WILL BURN YOU MORE THAN COFFEE AT McDonalds Drive Thru.
4) Now clean all of these parts with a wire brush and add soldering flux paste between the coil and the brass bushing.
5) Heat with a 140-watt solder gun and solder the music wire to the bushing using acid cord solder. Keep the bushing perpendicular to the spring wire.
6) Clean the flux and acid off the parts with an old toothbrush and denatured alcohol, else it will rust.

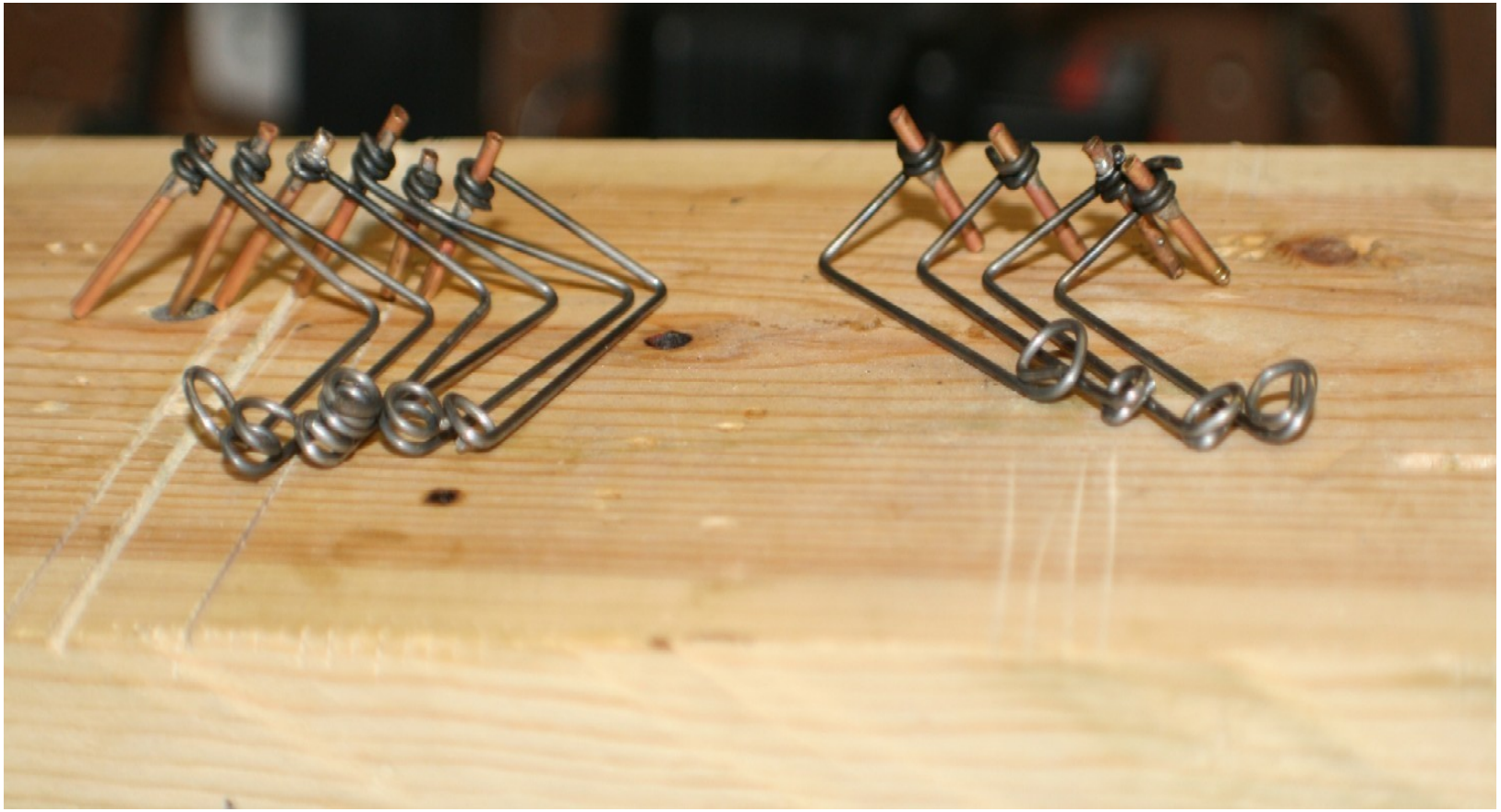
7) Insert the brass bushing and wire in the jig and bend it around the first screw.

8) Then wrap it 2-1/2 or 3 times around the second screw on the jig.

9) Remove it from the jig and cut off the excess music wire. You may grind the cut end flush if desired, but is not necessary.

That is all there is to making springs. You are through the most difficult part. I make several at a time and set them aside.

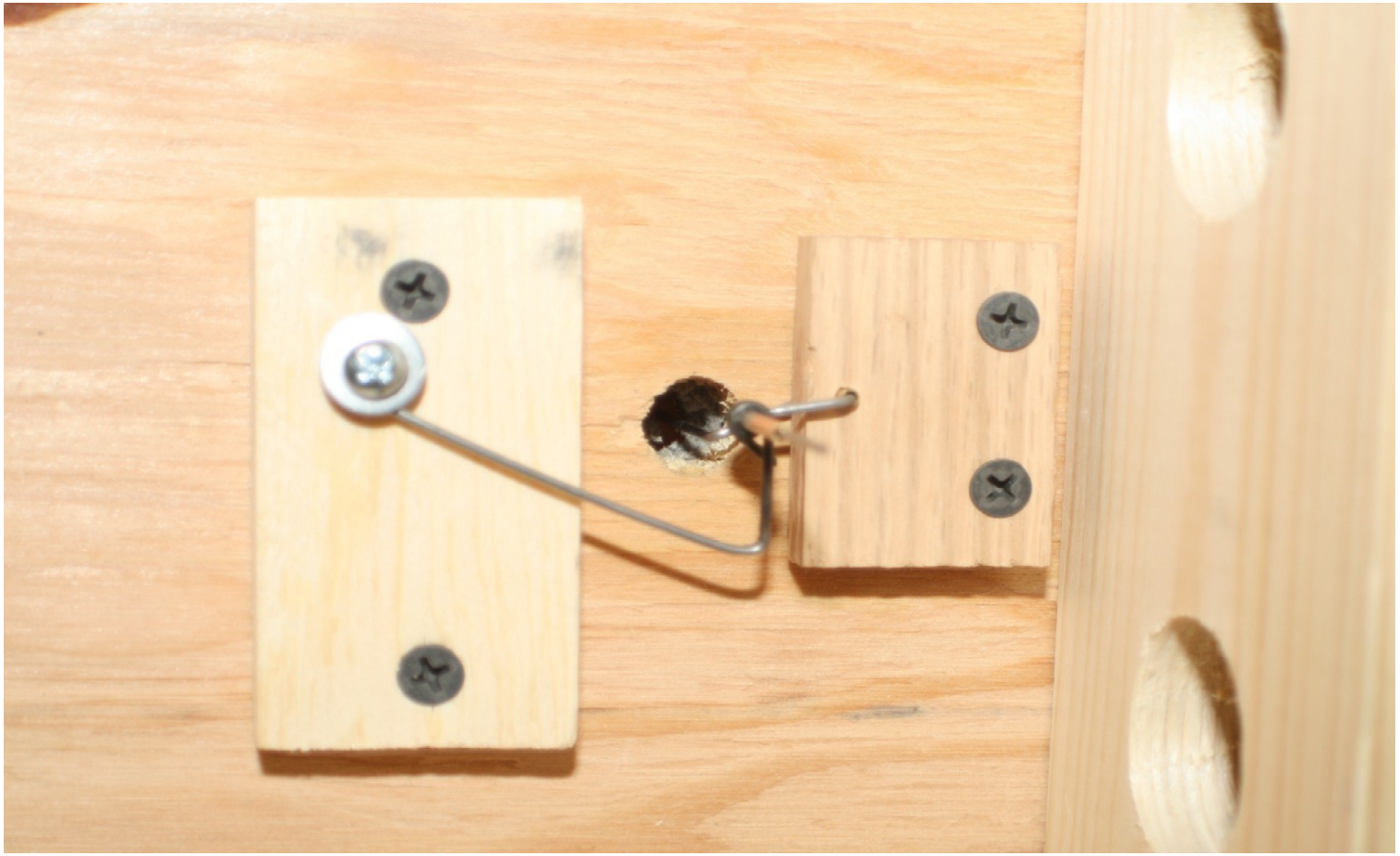
Group of completed springs



Assembly of base, linkage and spring

Now attach the spring to the linkage by inserting the linkage wire through the spring bushing. You are ready to mount the spring using a wood screw. You may have to test a few locations to get the best spring action that is equal in both directions applying equal pressure to the points. Do not use too much spring pressure, as it will be harder on the solder joints at the points. The best way I have found to adjust is to use a pilot drill & bit in place of the pivot screw. I move the points back and forth with my finger, adjusting the position of the drill to get even pressure on the points in both directions and enough pressure to keep the points in place without excessive pressure on the stock rails. Once the best position is found, you can drill the pilot hole, and then drive in the pivot screw. I also use a washer to hold the spring on the screw. However, this is not necessary if you have wound the loop tight around the screw in the jig.

Mounted Spring & Linkage in Base



Actuator Rod

For the control rod use 5/16 or 3/8 inch dowel rod.

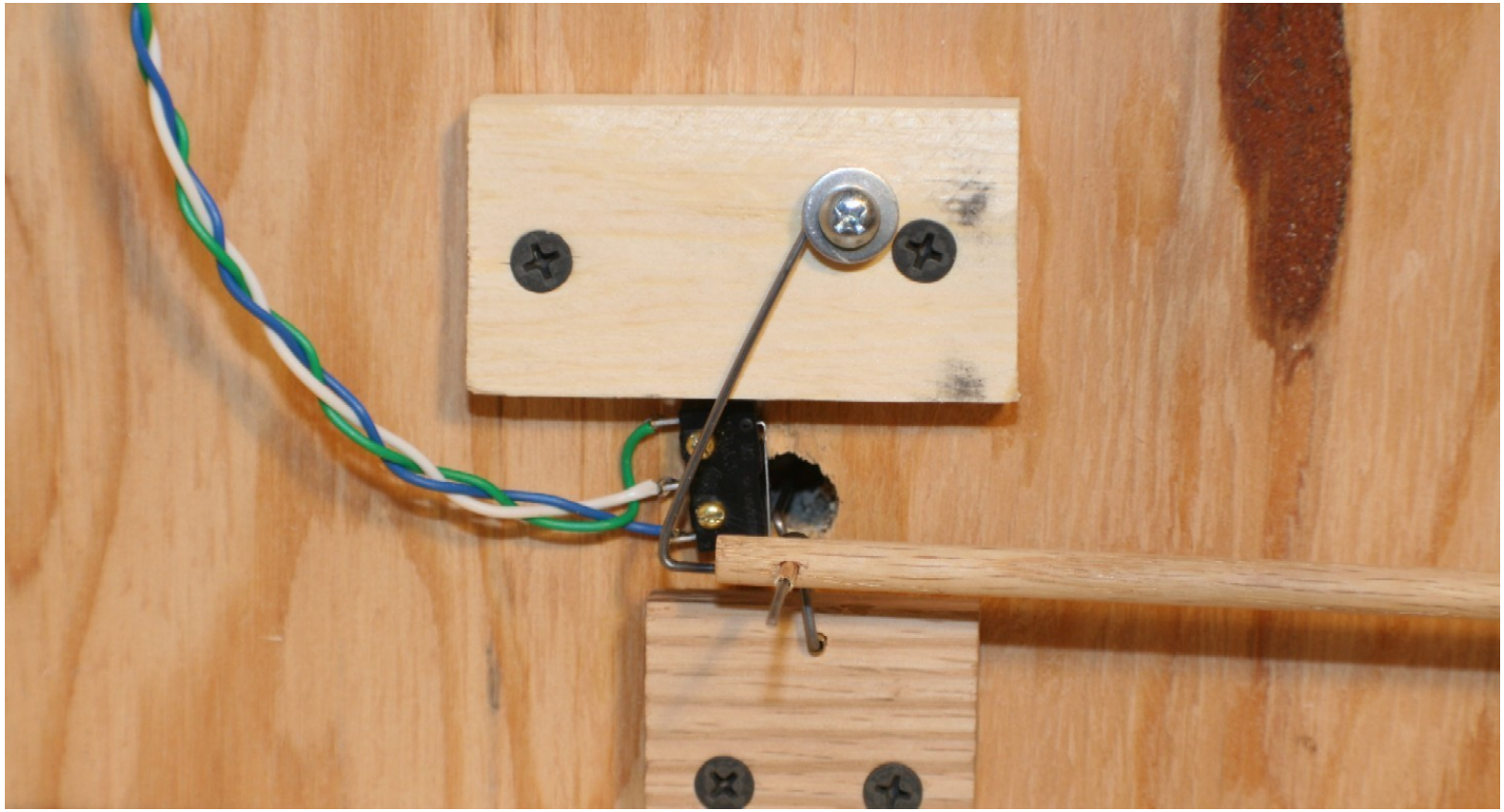
1) Drill a 5/64 hole near the end of the dowel rod. This hole accepts the brass tube bushing on the spring that also contains the linkage.
2) Cut the rod so that it protrudes past the end of the facial board with enough length for movement in as well as out.
3) Make a knob by cutting a larger dowel rod (1 inch) in lengths of ¾ inch and drill a hole in the end to accept the smaller rod. I splurged on this and bought some fancy knobs for 97 cents at the hardware store.
4) Last, insert the dowel rod through the facial board and insert the brass bushing in the hole drilled near the end of the rod.

Actuator control rod & knob ready for installation through facial

Completed Installation

You now have a working manually operated grown throw for minimal cost. I hand lay my track. All frogs are powered for reliability. Also the point rails are very close to the stock rails. To avoid shorts between the points and closure rails through the backside of wheels, the points should be the same polarity as the stock rails. So we need a switch to change the polarity of the frog as the points are thrown as shown below in fig 7. Sometimes I put a second switch on the turnout for feed back for signaling indicating that a train crew has set a switch against the main.

Bottom view of completed installation with switch for powered frog



The final touch is a model ground throw with a moving target that indicates the position. My friend and neighbor Paul Richardson MMR, gave a clinic on how to build scale switch stands last winter. I have hand built some working switch stands from brass (amidst a bit of frustration and difficulty) I have also bought the ones from Rix Products because they are more true to my prototype Louisville & Nashville Railroad. (Interesting that Rick Rideout is also an L&N modeler.) There are many others available. This adds a lot to the appearance and interest to watch the target move and change indications as the points move. The simple manually operated ground throw can be built for about $1 and the deluxe one for about $5 with powered frogs, deluxe control knob and hand made operating switch stands. I hope this gives you some ideas and inspires you to make your own ground throws and improve on these ideas. If you need any help with any aspect of this. Call me at the number below. I will be glad to assist you over the phone, in my shop or on your site of installation.

Top view of completed installation