MARCH TECH TIP

Common Repairs for the ZW Transformer Part 1

By Jim Weatherford

The most popular transformer built by Lionel, by far, is the 275 watt ZW. It provides a combination of power, flexibility, whistle control, multiple train operation, direction control, and (this is very important) the user has an inherent understanding of how to control the trains. The ZW is ambidextrous, it can control either a right or left handed train. A used ZW usually reveals the favored hand of the previous owner by the relative wear of the "A" or "D" carbon roller. Righties use the "A" handle and lefties use the "D" handle. Another trivial tidbit: lefties usually run their trains clockwise while righties run theirs counterclockwise. That's why you'll find most right marker lights bent or broken on steam locomotives since the engine will derail and tumble over on the right side when traveling counterclockwise at the speed of sound. Some digressions are interesting, aren't they?

Back to the subject at hand; the celebrated ZW Multi-Control Transformer. First built in 1948, the VW/ZW gained immediate acceptance in the model train world because of the dual whistle and reversing controls and the ability to operate four different trains independently by one transformer. It's difficult to determine exactly when production of the ZW ceased, the 1966/67 catalogue still offered them but they were probably supplied from warehouse inventory. Sales were reaching an all time low during the late 1960's, just prior to the purchase of Lionel by General Mills. It's doubtful the ZW's were still in production. By the way, the VW has all the same functions of the ZW but is only rated at 150 watts.

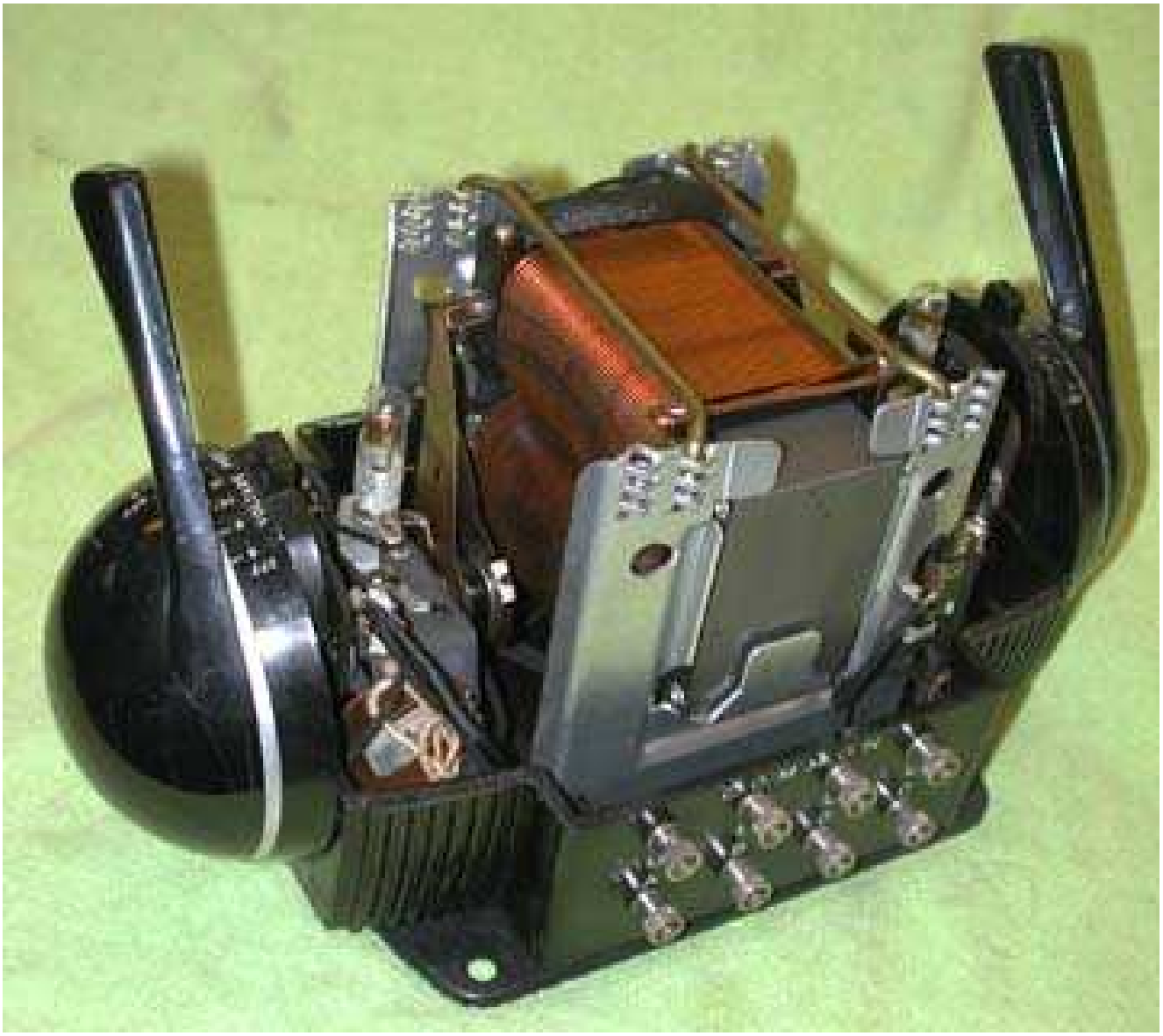
The four most common maintenance problems with this transformer are bad power cords, worn out carbon rollers, loose binding posts, and defective whistle rectifiers. We will address each of these problems over the next three issues of the Mainline.

Easily the most common problem is the cracked and brittle power cord. The insulation was made out of rubber and, with age, dries out and deteriorates to the point where bare wires are exposed. Naturally this is a severe safely concern and resolution of the problem is not for everyone. If your ZW

has been in the basement or attic for the past 40 years and you want to set up the family train, you should check the power cord to ensure it's pliable and safe to plug into a wall outlet. Inspect the cord especially near the case for cracks or brittleness. Bend the cord double to make sure the insulation is flexible and doesn't split. Check the power plug to see if it's still part of the original molded cord. If the cord is suspect, do ***NOT*** attempt to apply power. Replace the power cord before going any further.

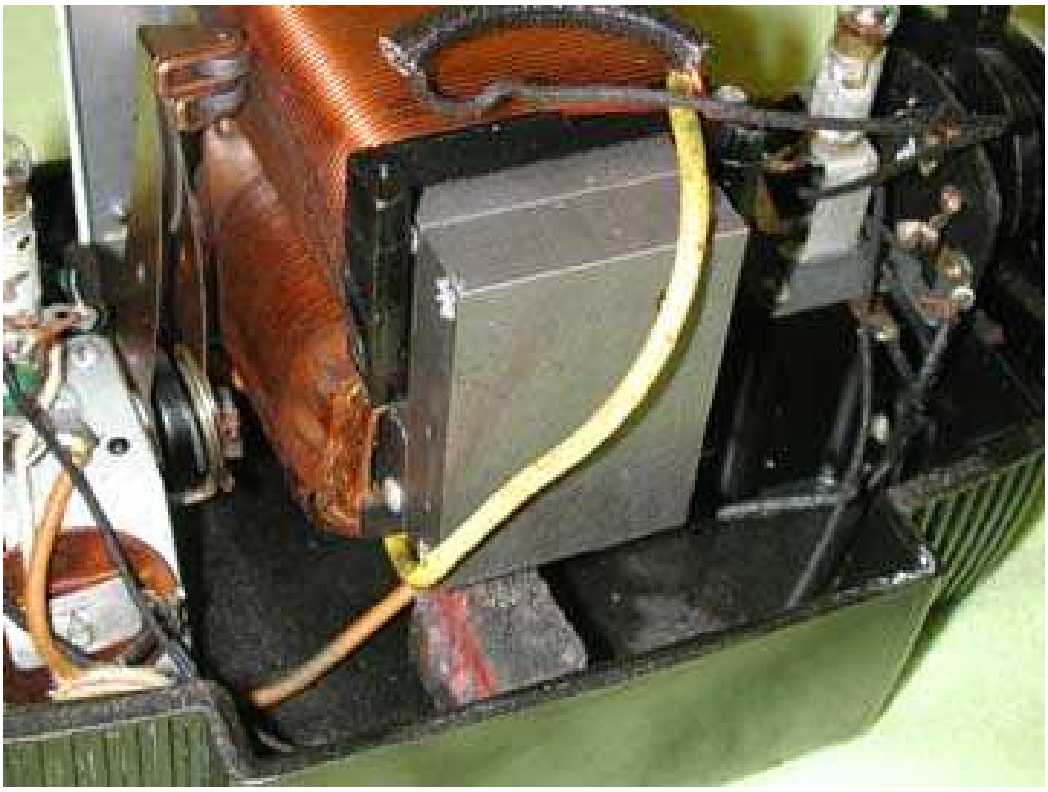
Warning!! **If you are unfamiliar or uncomfortable working around 120 volt AC electrical components, take the transformer to a qualified Lionel service repairman. Do not attempt to make this repair yourself.**

STEP 1: Make sure the old cord is not plugged into a wall outlet. Remove the case top (four Phillips head screws) and also remove the bottom mounting plate by unscrewing the four hex-head screws. Set the plate aside.



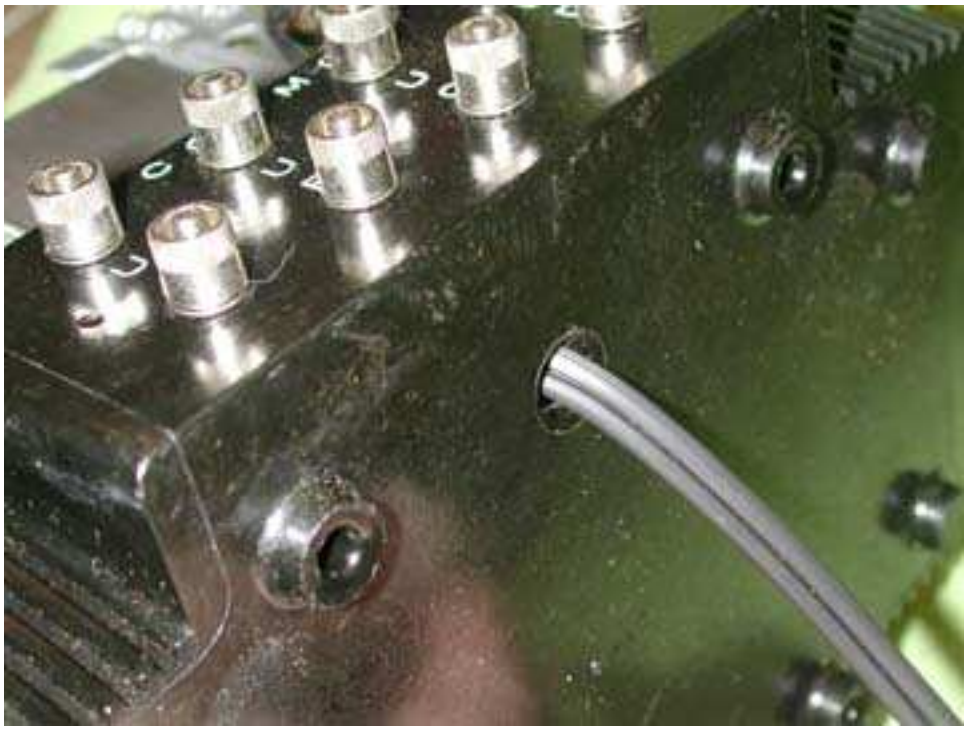
STEP 2: Cut the old power cord off where it enters the bottom case. Set the transformer on its bottom and warm up your soldering iron.

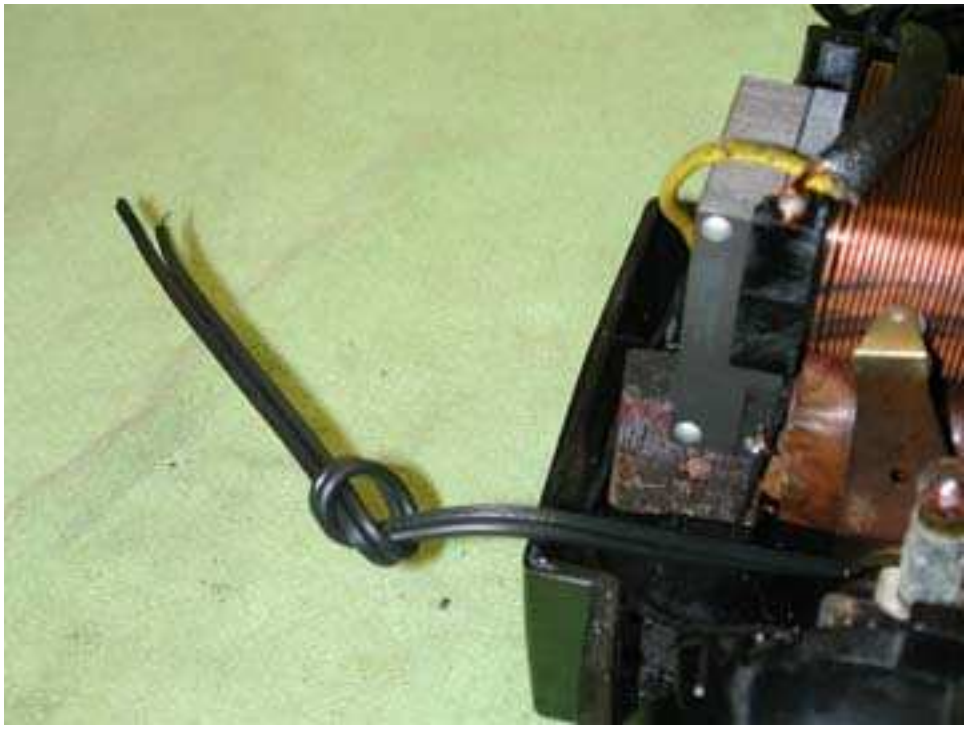
STEP 3: Use wire cutters and cut off the cord about an inch from the terminal so each wire is separate. Remove the rest of the old cord from the bottom of the case. Remove the two coil support straps and the rear core support bracket. Prop up the core with a small block of wood about 2 inches. (This exposes the power cord terminals so you can get to them easily.)



STEP 4: Heat up the top terminal with the soldering iron and use needle-nosed pliers to gently pull the wire free of the eyelet when the solder joint is fluid. Do the same with the bottom terminal taking care not to pull or bend the small, solid conductor primary core wires. The new power cord should be two-conductor and the same size as the old one.

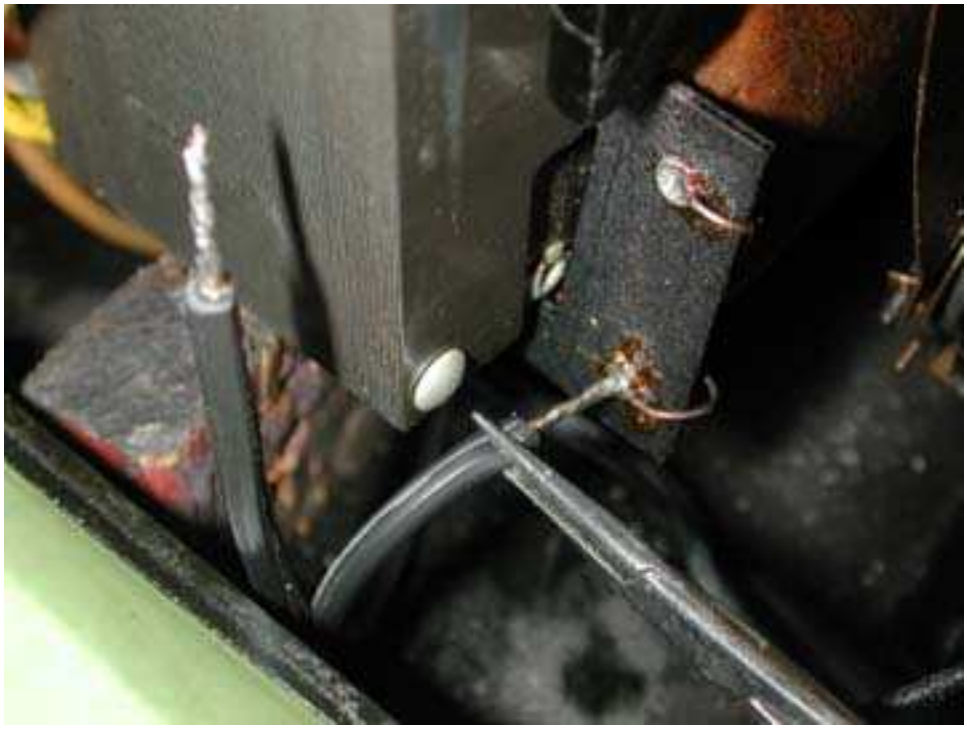
STEP 5: Feed the new cord end without the plug through the hole in the bottom of the case from the outside. Pull enough through so you can tie a knot in the cord about six inches (approximately) from the end to prevent stress on the terminals in case someone pulls on the cord from the outside.





STEP 6: Separate the ends of the cord for two inches or so and cut one inch off one of the ends. Strip one half inch of insulation off each end, twist the ends tightly, then tin them with solder.

STEP 7: Take the short wire, holding it near the tinned end with long, needle-nosed pliers, heat the lower primary terminal with the soldering iron, and push the end through the back of the eyelet all the way to the insulation. Bend the end down on the inside using the soldering iron and add solder to ensure a solid electrical connection. Solder the other wire to the top terminal eyelet and make sure the cord is pushed to the bottom of the case, out of the way of the contact arm roller assemblies.



STEP 8: Next pull the cord from the outside until the knot is against the hole. Remove the wooden block, install the core support bracket, and ensure the core is centered. Install the bottom mounting plate with the four screws. Make sure the brackets are securely tightened. (If the screw slips in the bracket, bend the aluminum female holders together slightly and then tighten the screws.) Install the core support straps and the case top. Now you're ready to test your handiwork.

APRIL TECH TIP

Common Repairs for the ZW – Part 2
ZW Roller and Binding Post Replacement

By Jim Weatherford

The February Tech Tip addressed how to replace the ZW power cord. This month we will show you how to replace the carbon rollers (four each) and loose or missing binding posts (eight each). Fortunately there are third party replacement parts to rectify both of these common ZW repair problems.

So how do you know if there are bad rollers without removing the case top? Move each variable handle and feel/listen for uneven movement or grinding. Broken rollers or flat spots on the rollers produce these effects.

Since binding posts are all external, it's relatively easy to spot loose, broken, bent, missing, or poorly replaced posts. If there are binding post nuts on the terminals, turn them clockwise until tight and apply pressure to see if the post turns with the nut. This will usually indicate a bad internal connection and the post should be replaced. If there is a machine nut on a binding post that usually means the old post was replaced with a machine bolt. That too should be replaced.

If you can check the transformer with power applied, you should determine if all of the 'U' (common) binding posts are making connection. Sometimes the binding post seems solid but the internal rivet is broken and the common strap is not making connection. With power on and the 'A' handle dialed to 8 volts, attach one end of a jumper wire to the 'A' binding post and touch the other end to each 'U' binding posts momentarily. You should get a small spark at each 'U' post. Of course you can use a multimeter to check voltages if sparks make you uncomfortable.

We're going to assume you have defective carbon rollers and loose binding posts that have to be replaced. Let's get down to business.

REPLACING THE CARBON ROLLERS

First remove the top case of the ZW by unscrewing the four screws visible on the top of the case. Next examine the carbon rollers to determine which ones need to be replaced. Look for worn rollers, rollers with a flat side, no roller at all, or rollers that won't roll.

It's usually the "A" or "D" since they are the most utilized. There are two ways to replace rollers; the easy way and the hard way. The hard way entails removal of the short contact arm assembly for the "A" or "D" rollers and the easy way is to install the new rollers in place. Installing the rollers in place means you have to remove the remains of the old rollers and the rivets.

Move the "B" or "C" roller arm out of the way first. Use needle-nosed pliers to crush the bad roller and cut the rivet in the middle with diagonal cutters. Remove the two rivet halves and clean up the crushed rollers pieces from the bottom of the case. Make sure there are no loose pieces rattling around in the case.

Slip the new roller in the yoke and insert the new rivet from the top through the yoke and the roller. Use pliers to gently flare the open rivet end at the yoke bottom so it can't come out. Make sure the roller turns freely. I use small vise grips adjusted so you can't squeeze the rivet too much.

Make sure the ‘A’ and ‘B’ yoke arms don’t touch as they roll over the secondary coil. Adjust if necessary.

REPLACING MISSING OR BROKEN TERMINAL BINDING POSTS

It’s very common for the terminal (binding) posts to become loose, bent, or fall out altogether due to age and misuse. This isn’t terrible, especially since there are bolt-on replacement posts available from you local parts dealer and they’re easy to install.

Once the post is loose, this generally means the wire lug riveted to the back (inside the case) is no longer attached. All the ‘U’ terminals are attached to a common buss bar so even if one of them is gone, use any of the other three if you don’t want to replace the terminal post right away. Posts ‘A’, ‘B’, ‘C’, or ‘D’ however, must be replaced if you want to use the related function. Find the loose wire and remove the old flattened end of the riveted post if it’s still attached. All the wires have

a round lug crimped to the end that will fit over the replacement post.

Remove the old post and insert the new one in the hole. Put the loose wire lug over the threaded stud and screw on the nut until it's tight. Make sure no other bare wires are touching the end. Replacing one of the 'U' posts is easier since it's on the top row and there are no loose wires, just the solid buss bar.

(Note: I usually remove the bottom mounting plate screws that hold the front core aluminum mounting bracket so I can slip the core mounting bracket out of the way (you'll need more room for the bottom posts) when tightening the nuts for the replacement binding posts. Place a small block of wood under the core to hold it in position while working on the posts).

OPERATING TIPS

by Jim Weatherford

Tip #20 - Transformer Smoking? - Have you noticed how your transformer sometimes smokes when you blow the whistle or horn for long periods of time? This will usually happen when you're running a heavy load through the transformer, e.g., dual-motored F3's with lighted passenger cars, and you blow the horn for more than 10 seconds. High current is flowing through the resistor wire and it will get hot and start to burn the cloth covering along with whatever dust has accumulated. The solution is to NOT activate the horn (or whistle) for more than five or six seconds and then let it cool off before doing it again. You shouldn't have this problem with small, single motored locomotives but it's still better to follow the short horn rule.

MAY TECH TIP

Common Repairs for the ZW – Part 3 Whistle Diode & Circuit Breaker Replacement

By Jim Weatherford

The February Tech Tip addressed how to replace the ZW power cord and in April we showed you how to replace the carbon rollers (four each) and loose or missing binding posts (eight each). This Tech Tip will address replacing the whistle rectifier and the power circuit breaker.

REPLACING THE WHISTLE RECTIFIER

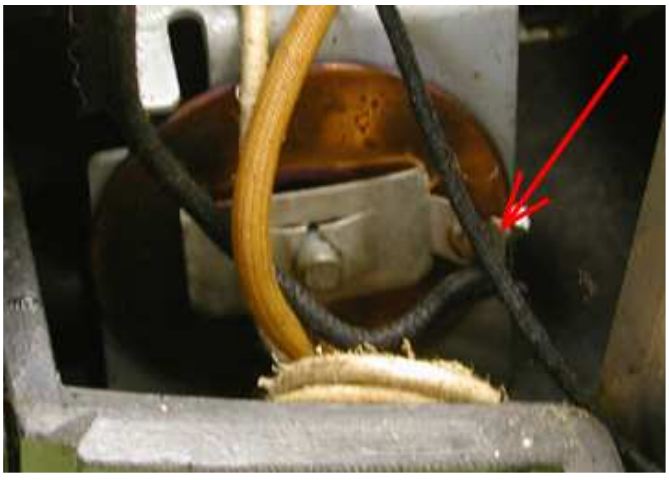
There are two whistle rectifier disks in the ZW transformer; unlike the KW. The copper oxide rectifiers used in all the Postwar Lionel transformers is old technology and is most often no longer performing its diode duties; namely activating the horn or whistle relay in our diesel or steam locomotives.

I don't recommend using an original rectifier disk or even the new replacement disks since they don't produce a direct current pulse with square sides. Further, the old rectifiers usually are not very efficient and output voltage to the track will be affected. Lastly, many of the new solid state sound systems will not work well with the oxide rectifiers.

Consequently, I like to use the modern solid state stud rectifier when replacing the whistle diodes. I use to use 50 volt peak to peak 15 ampere rectifiers and they worked well. Recently, I have started using stud rectifiers, cathode to the case rated at 40 amps; they have less voltage drop and are sturdier. Present prices are around $4.50 each.

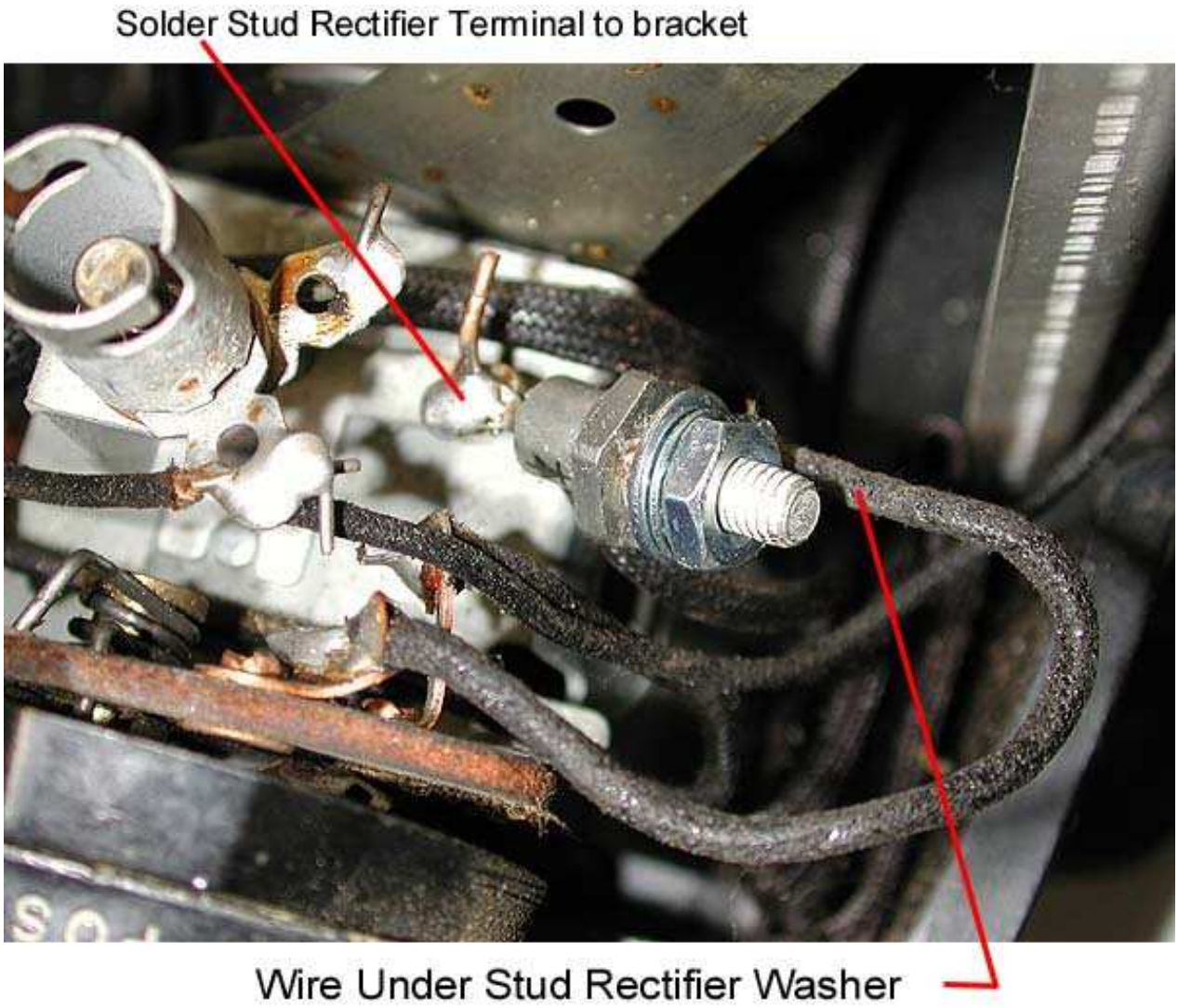
NTE 5980 40 A 50V Cath Case

Now to the easy part. Once you've unsoldered the wire from the speed nut, you can secure the loose end of the wire to the stud



of the rectifier by slipping it under the nut and tightening it. **Note**: Just leave the old copper oxide rectifier in place; it won't interfere with the whistle control circuitry once we install the new stud rectifier.

Then solder the terminal end of the stud rectifier directly to the tab on the direction/whistle control assembly. This has the additional benefit of allowing more air to circulate around the rectifier.



You have electrically reversed the polarity of the diode using this method.

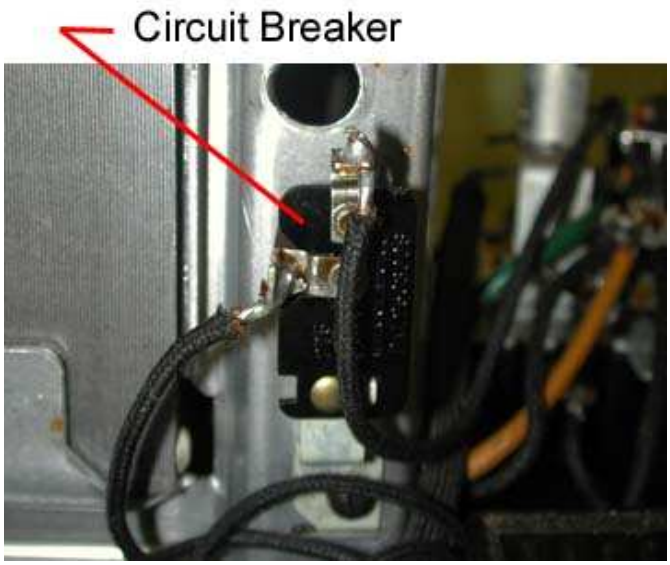
One word of caution regarding the use of modern electronic whistles and sound activation when replacing whistle diodes, always use the same technique so each side is identical. You won't cause problems when switching from one isolated track to another when you activate the whistle or sound effects.

REPLACING THE CIRCUIT BREAKER

The ZW circuit breaker is typically very sturdy and seldom needs replacing. A defective breaker usually does one of the following: it doesn't activate when there's a short on the track and you burn hookup wires; it activates under a load not anywhere near maximum, or the contacts are open and you get no output.

Unplug the power cord and remove the case top. ZW's of the early type have the breaker installed in the case bottom near the left hand controls and the output terminals. It's a plastic piece about 1 1/2 inches on a side held to the case bottom with one 1/2 inch long # 4 screw. The type 'R' ZW has its circuit breaker mounted on the support bracket near the output terminals. It's a metal bracket-like piece about 2 inches by 3/4 inches attached to the coil support bracket with one 1/4 inch long # 6 screw. You can further identify the breaker by noting there are two heavy gauge wires soldered to it; one goes to the "U" terminal bus and the other to the left lamp (red

lens) bracket assembly.



Replacing a bad breaker, fortunately, is very straight forward. If yours is the 'R' type, simply unsolder both wires and remove the mounting screw. Install the new breaker and solder the old wires back on to the terminals.

The older type with the breaker (# Z-22) in the case bottom is also easy. Remove the mounting screw and lift it up with the wires attached. Unsolder the two wires, resolder them to the new breaker and reinstall it back in the same spot.

By the way, the replacement type 'R' circuit breaker that mounts on the core bracket may be difficult to find. You can, however, use the more available older type breaker since the mounting hole is still cast in the case bottom. It may be necessary to replace one of the wires if it's not long enough.

After installation, put the case top back on, plug in the power cord, and test for proper operation by advancing the right hand voltage control about half way and shorting the "A" and "U" together with a screw driver. The circuit breaker should activate in about 3 seconds and the left light (red lens) will illuminate. I haven't oversimplified this repair, it really is this easy.

Something you might experience; the circuit breaker activates but the light doesn't illuminate. You've checked the #51 6 volt bulb and it's ok. What could be the matter?

Most likely, it's the resistor wire that goes from the "U" common terminal to the indicator light bracket. Test if the resistor is bad by replacing the #51 6 volt bulb with a #1445 18 volt bayonet bulb and then install a jumper wire from the "U" terminal to the light bracket. Short the output again to activate the circuit breaker and see if the light illuminates. If it does, the voltage reducing resistor wire is defective. You have the choice of finding a new resistor or just removing the resistor, installing a regular wire in its place, and using an 18 volt bulb. That's what they did on the ZW Type R transformer made in 1952.