Memo for Record,

SUBJECT: Rolling Stock Wheel Arcing at Switch

I purchased a used Lionel 6-85174 Southern #1372 O Scale LEGACY Steam USRA Pacific late November 2019. Yesterday I started the engine in Legacy mode and ran it in forward direction around my 14x10 foot Gargraves track / Ross switches oval a couple of times. Then I turned off all track power and added 10 drops of smoke oil to the whistle steam fill port and another 10 drops of smoke oil to the main boiler smoke stack fill hole. Restarted the engine and made another couple of runs around the oval in forward direction checking closely for engine smoke performance. Then slowed the engine to a crawl going forward, stopped it, and put it in reverse at a crawl. Within seconds of beginning the reverse crawl, something popped the 5amp quick-blow fuse that I have between my transformer and the track the engine was operating on. The engine stopped immediately. Aaahhh sh**.

I shut everything down, replaced the blown 5-amp fuse, and powered up the track again. The engine headlight came on upon power up and there was also the normal Railsounds sounds of a standing engine. However, the engine was unresponsive to any Legacy command. Opted to try re-programming so went through the normal reprogramming procedure without gaining any engine response. After repeated PGM/RUN switching back and forth, I did finally get the engine to briefly respond to Legacy control, but the engine only went about one foot down the track then stopped and the headlight dimmed and fluttered, then totally unresponsive to Legacy control. Then opted to check out Bluetooth and Conventional operation and both performed as expected without any issues. Got horn/whistle in both modes as well as dialogue.

I let the engine sit for an hour with power shut off to the track then powered the track up to 18 volts and again, there was no response from the engine. I then went through multiple PGM/RUN reprogramming cycles without success again. So, the engine was totally unresponsive to Legacy Control. I tried my Legacy Base and handheld controller with several other Legacy engines that I have and all responded correctly. So the nonresponse to PGM/RUN setting was solely with the Lionel Legacy USRA Pacific Locomotive ... apparently brought on by the short circuit that blew my track 5-amp fuse.

This morning I removed all rolling stock and powered up the track hoping that a good night's sleep had cured my Legacy steam engine of whatever ailed it the day before. Low and behold, upon track power up, the engine immediately started in Legacy mode when I selected its programmed engine number on my Legacy hand held controller and then pushed the 'Start' button on the controller. All Legacy functions were working as I ran the engine/tender around my 14x10 foot oval several times. Then (fingers crossed) I repeated yesterday's crawl in reverse at the same location on my track oval ... no problems. Went back and forth forward/reverse at that location a number of times with no issues. The engine clearly was not causing a short internally or on the track itself.

Believing that the engine was not the blown fuse culprit, I opted to explore the cause of yesterday's track short as perhaps due to one of the rolling stock. Several rolling stock cars were on two back-to-back Ross switches at the time of the blown fuse while in reverse. So removed the engine/tender from the track. Then I put all of the rolling stock cars back on the track at that track location just as they were aligned yesterday. I slowly manually backed the string of five boxcars + caboose through the two Ross switches and immediately blew a fuse. Got out my multi-meter and checked voltage across the various parts of both Ross switches ... no problems noted. So I installed another good fuse and repeated the six-car backing up while closely examining the undersides of the cars as they passed over the switches looking for a spark. Didn't see a spark but did blow another fuse. So it was clear that one of the cars was causing the short circuit, but which one. I uncoupled all of the cars and moved them one at a time across the two switches. No sparking until I got to the fourth boxcar from the end and as soon as its wheel truck passed over the first Ross switch, the fuse blew again. So, I had found the bad actor, but why did it cause a short circuit. With all track power shut down, I closely examined the wheels of that car as they passed over the Ross switch and could see that the inner wheel wall contacted the powered center switch rail stub while also still making rolling contact with the outer rail ... cause of my repeated short circuits. So why did that particular box car make wheel contact across the outer rail-to-powered rail? Turns out to be a couple of things. One, the boxcar is a Menards car and when I subsequently measured the inside wheel gauge it was 1-3/16 inches while all of my non-Menards rolling stock are a hair less than 1-1/4 inches. Two, the Menards wheel truck has more side-to-side play than my non-Menards rolling stock wheel trucks. Third, it appears that the Ross switch in the photo had a smaller gap between the powered center rail stub and the adjacent outer rail. I had bought it in January this year so it had little run time yet and this was the first time I had run anything across it in reverse. Upon comparing its gap with other Ross switches on my layout, I judged it was a bit tighter than the rest. A somewhat smaller gap on the switch rails coupled with the narrower wheel gauge of the Menards truck and more side-to-side slop of the Menards wheel truck coupled with reverse direction movement through the switch were the perfect storm for the short circuit.

My solution for now was to use my needle nose plyers to nudge the tip of the powered center rail stub away from the switch outer rail to accommodate the rather loose riding Menards rolling stock ... I have eight Menards cars all with 1-3/16 wheel gauge separation and the wheels appear to be permanently mounted on their axles so spreading them apart another 1/16 inch is not doable. Anyway, nudging the Ross center rail stub away from the outer rail was quick and easy with no negative consequences.

So, five fuses and 24 hours later, my original problem has been identified and corrected plus, the engine came back online without issue after a good nights sleep.