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Spring Repair Project

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Introduction

Along the way some of the leaves in the front left leaf spring of the Vancouver Electric Vehicle Associations (VEVA's) 1913 Model 38 Detroit Electric had broken. This resulted in a visible lean to the left.

This document describes the project to repair that spring.

The Broken Spring

The front left spring was originally thought to have two of the seven leaves broken. One of the breaks can be seen in the figure. A quick measurement found that the front left side of the car was 9/16" lower on the left than the right, and a little less than that at the rear.

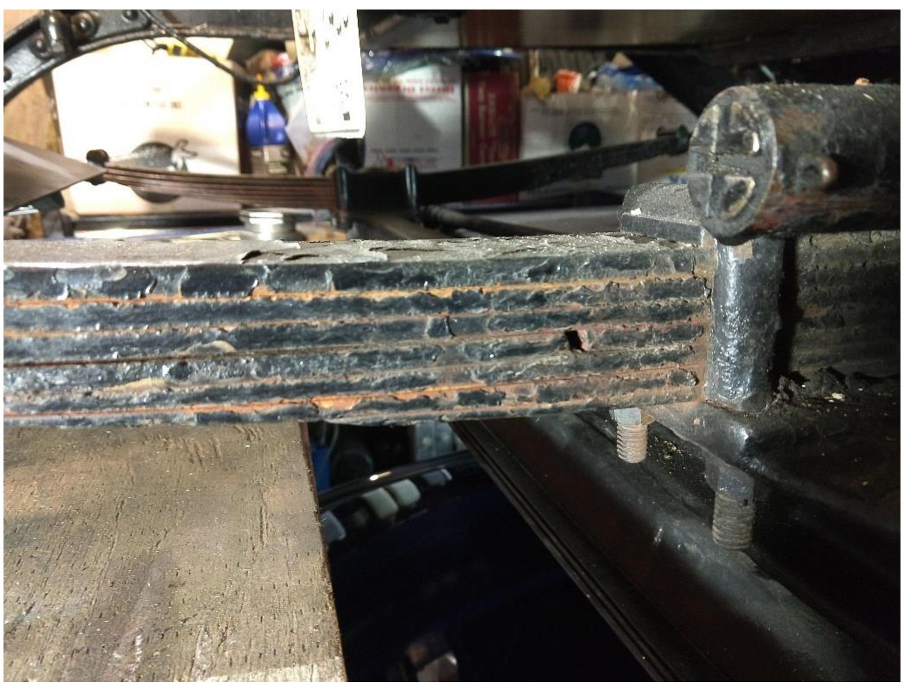

Figure 1: Broken Leaf, Front left Spring

A Temporary Fix and Weighing the Car

As part of the repair, VEVA wanted to determine if the weight from side to side was even so that the spring repair shop could be informed if special adjustments were needed.

Therefore, after inserting a piece of wood in the front spring the correct size to make the front of the car level, the four corners of the car were weighed.

The weights were taken with two bathroom scales and a piece of wood to spread the weight between them. The maximum capacity of 440 lb. for each of the scales was just enough.

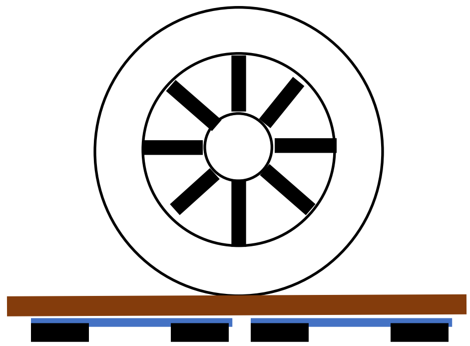

Figure 2: Weighing a Detroit With Bathroom Scales

Figure 3: Front Left Wheel on the Scales

Table 1: Wheel Weights

Weights		
Front Left: 601.2 lb.	Front Right: 513.9 lb.	Front: 1115.1
Rear Left: 783.8 lb.	Rear Right: 837.8 lb.	Rear: 1621.6
Left: 1385.0	Right: 1351.7	Total: 2736.7 lb.

As the weights show, even though the side-to-side weights were within 33 lb., the front left and rear right weights were significantly higher – indicating a twist in the frame.

It was assumed that the twist in the frame would abate over time, and therefore VEVA concluded there was no need to have the springs specially curved for each side.

A Special Tool

Special tools are the bane of every home mechanic, and even in the time of the Detroit Electric special tools were created to annoy. In this case, the dome nuts for the shackle bolts required a special tool to loosen them. The pictured tool is homemade on the trusty Craigslist lathe that has helped on so many previous projects. The tool is used with an electric impact gun to loosen and tighten the shackle bolt nuts. After reinstallation, the ends of the shackle bolts are peened to lock the nuts in place, exactly as it was originally.

Figure 4: Homemade Shackle Nut Tool

Figure 5: Domed Shackle Nuts

Spring Repair

The broken spring was taken to a local spring repair shop for repair. Luckily, the Detroit springs are made from relatively common 1.75" spring stock, and replacement leaves could be made easily. It turned out that three of the seven leaves in the front left spring were broken. After making new leaves, the spring repair shop re-curved the original and new leaves for the left side to match the righthand spring. Finally, the springs were assembled with powdered graphite between the leaves for lubrication as prescribed in drawing 32102 – downloaded with thanks to the electricvehiclemuseum.org and Galen Handy.

To lift the rear of the car, a wooden cradle was required to support the frame, while avoiding the rear battery box.

Figure 6: Cradle for Rear Frame

Figure 7: Rear Frame Cradle Supporting Car

Shackle Repair

Coincidentally, or perhaps not so coincidentally, the shackle on the front, left spring was damaged, and had been previously repaired.

The shackles on these cars consists of two shackle links and two shackle bolts. The shackle bolts have a holder for a grease cup. The top shackle bolt had broken off and had been replaced with an ordinary bolt. Thankfully, the grease cup holder for the broken bolt had been left in place, so the repair was much easier.

Figure 8: Spring Shackle Components with Broken Shackle Bolt

To repair the broken shackle bolt, a new bolt shank was made. The inside of the existing grease cup holder had been threaded as part of the previous repair, so the new shank only needed to be threaded to match the grease cup holder.

Figure 9: New Shank to Repair Shackle Bolt

In addition, a grease passage was drilled through the center of the shank, and another hole was drilled to allow the grease to escape and lubricate the bronze bushing through which the bolt passed. After the new shank and original grease cup holder were threaded together, the grease cup holder was welded to the shank from the inside of the grease cup and the bolt was as good as new.

Figure 10: Repaired Shackle Bolt

Unfortunately, at the original dome nut for the broken shackle bolt was lost or discarded at the time of the previous repair, but a wheel lug nut installed backwards on the ½”-20 threads looked very much like the original part.

The original grease cup was also missing, so it was replaced with a threaded brass plug with a standard Zerk grease fitting installed. Coincidentally, the original grease cups were also made by Zerk. Turning the “T” handle on the original grease cup turns a screw that moves a plunger that forces out the grease from inside the hollow cup. The replacement grease cups were also made on the well-used Craigslist lathe – annoyingly, the grease cup’s 3/4”-18 thread does not match a fine 3/4"-16 thread, so replacement grease cups could not be made from a 3/4" bolt.

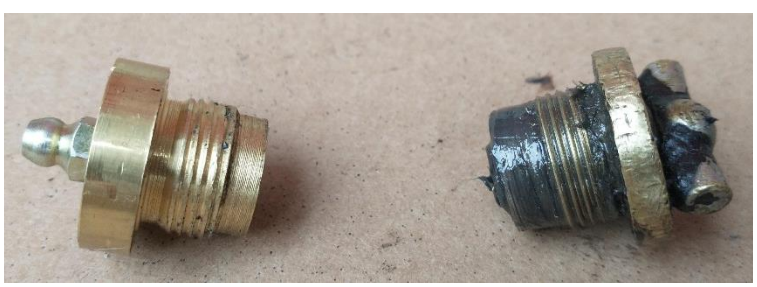

Figure 11: Replacement and Original Grease Cups

Re-Installation

After the springs and shackles had been cleaned and repainted, they were re-installed in the car. At first it was disappointing to measure that the car still leaned a small amount to the left. However, swapping the rear springs from side-to-side resulted in the rear of the car sitting level, and the front left down approximately 1/8". It is anticipated that this inequality will lessen over time as the twist in the frame relaxes.

Figure 12: Repaired Front Spring

Figure 13: Rear Spring