**Atlantic Shore Line**
**Locomotive 100**
Curatorial Report no. 3
17 January – 5 February 2007
*by Donald G. Curry, Interim Shop Manager*
Seashore Trolley Museum

Despite spells of bitterly cold weather, we have been able to work in relative comfort, even in the 'bus' box. Either by having a propane burner going or leaving the door open into the '100' box, we have been able to carry on. In fact, over this past weekend, there were six of us working on 100: **Randy Bogucki, Corey Connors-Reynolds, Chuck Griffith, Dean Look, Bill Pollman** and myself.

**The Trucks** – If you had walked into the north end of the box you would have found the area rather empty. The major parts of the truck were taken to A.C. Electric's plant in Auburn, ME for sand blasting. They came back 1 February (two weeks later), beautifully blasted and primed in Rust Oleum red oxide. The work took 21.5 hours at $60/hr. plus $117 for two gallons of primer[1] for a total of $1,407. While the majority of the parts came from truck no. 1 we did send a few from no. 2 so the rest of the job should be less expensive.[2] Although this seems expensive, it really moves things ahead and we can concentrate on things that can't be done by contractors. In fact, we're considering another load up there consisting of smaller but time-consuming parts.

<u>All things being 'equalizers'</u> – While the equalizer frames were being sand blasted, the castings which separated them (There are two per side per truck; the castings separating the frames by about 4 in.), required a lot of work. Most of the bolts[3] which went through them had rusted badly, many becoming 'rusto-welded'[4] so solidly that they could not be driven out.

Our milling machine 'staff' (**Chuck Griffith** and **Dean Look)** had to burn the ends off and either drill or mill the bolts out using the Bridgeport vertical mill. This is quite hard on the drills and cutters because the rust is very abrasive and heating the bolts can create hard spots.

Five of the eight equalizer coil spring 'cups' were badly cracked, with over half the outside rim missing. In the bottom of these cast iron 'cups' are two one-inch diameter holes which were supposed to let water drain out. For whatever reason, YUCo added shimming under the springs, the first of which was a ⅜ in. thick red oak disc. On top of that they placed several steel discs. The oak has a very corrosive effect on steel which helped rust the discs but, more seriously, it sealed the drain holes as it swelled, thus allowing the water to pocket and, over the last XX years, formed an oak/rust sandwich over 1 in. thick. The process of rusting absorbs water and oxygen from the air, causing the metal to expand greatly, thus cracking the rims of the cups.

The former steel had turned to a very hard brittle substance resembling a very hard coal. Removing all this corrosion/wood mixture took over one day's time using a cold chisel and Chuck's Zip gun. **Eric Gilman** and **Norman Down** sand blasted them to prepare them for the next step.

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[2] The second truck is left together as a pattern.
[3] ¾ x 7 in. square-head
[4] A term originated by Fred Talbot, a Seashore member of many years ago who did restoration work at Warehouse Point.

Equalizer spring cups before and after removing rust build-up.
Note oak disc under the rust.

On the five cups with the broken sides, **Dean** milled off the remains of the 'sides' and turned a recess around the circumference of the round base. Using a scrap piece of 8 in. well casing, which he found in our scrap, he cut five bands about 2 in. long. These he slipped over the recess, effectively 'clamping' them in place prior to welding because their diameter was just about ½ in. less than the diameter of the cup. This left a gap of about an inch which Dean filled with a small piece of steel. He welded them with nickel rod.

Restoring the spring seat cups.

1. Dean checking the size of the groove for the new ring
2. Dean welding the ring in place
3. The finished weld still glowing
4. Chuck drilling out a rusted-in bolt

We have not inspected the condition of the coil springs thoroughly yet to see if they have been ruined by the rust. Also we are not quite sure what we will do to prevent this condition from occurring again. This will be partially determined by the amount of shimming we need to put under the springs. Possibly for our purposes, none will be necessary?

There was one drawback, if you can call it that, to the sandblasting. A C did such a thorough job that removing the rust and 'crud' that had built up on the surfaces of the piece and revealed the true extent of how badly they were corroded. We are examining each piece to determine the extent the pits will have to be filled. Some are being totally replaced, others patched, some filled by MIG[5] welding, and some left as they are.

Pitting around the bolt holes for the spring seats on the equalizer bars

Condition of the rest of the truck – In the last report, we noted the condition of the steel in truck. First, virtually every casting is in good condition or easily brought to it. However this cannot be said for many of the remaining components: (Comments in this type face)

- Truck bolsters (1) seem to be in excellent condition with little corrosion. Center bearings look like new and there is virtually no wear anywhere. However there was rust under the wear plates (which are actually an inverted 'U' bolted to the top and under the center bearing. All bolts were badly corroded including the four which run through the spacer castings under the center bearing. So these were removed prior to sand blasting. At the 'Vee' on each end of the bolster, where the upper and lower plates join, there is rusting but this is so hard that it is virtually impossible to remove. Fortunately it does not seem to be enough to create a problem. (On the body bolsters, this area had so much rust that it split the top and bottom members. The truck bolster is still solid and in excellent condition with the sand blasting revealing no pits.)

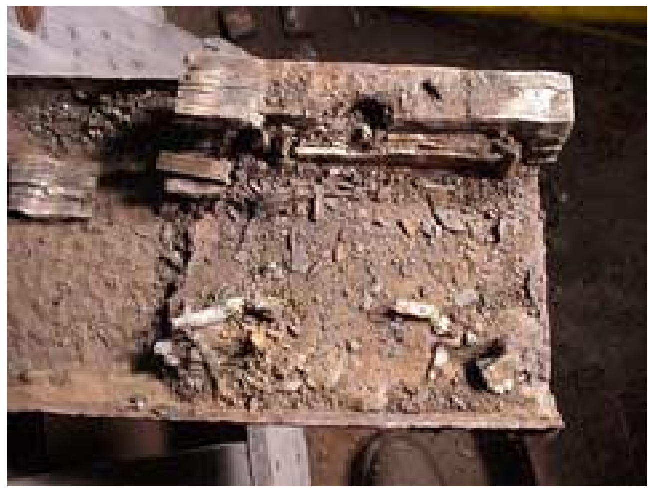
- Double - Elliptic (bolster) springs (two sets) – (Note, they are not 'elliptical' as stated in the last Report.[6]) Under each side end of the bolster are actually four springs making a double 'full elliptic' set. One spring arches up at the center and the other downward; with the ends of each pair connected to form a 'football' shaped loop through which 'binding' bolts holds both pairs together. On our first inspection of the trucks, what little we could see of the springs was not encouraging and that was confirmed when the bolsters were removed. The springs on the no. 1 truck virtually disintegrated into a pile of barely recognizable scrap iron when they were removed. Corrosion had eaten away at the lower leaves and forced them apart, breaking the binding clamps. Those on the no. 2 truck have been released but not removed as yet, but possibly are marginally better.

[5] Multiple Inert Gas
[6] This came from the writer's remembering the term from Gilbert and Sullivan's *Mikado* where the Lord High Executioner sings about the fate of his victims being forced to use "elliptical billiard balls".

We removed one of the springs from the second truck and found it to be in much better condition. One of the parameters Beall Mfg. asked for was the 'loaded' height and under what load. With the help of **Randy** and **Bill** we put the spring on the hydraulic press. Randy had noted at the end of each spring, a smooth area where the leaf had rubbed on the one below it as the spring depressed. By exerting the pressure necessary to get to the end of that area, we were able to get a rough idea of the loaded height of the spring. It took about 5,000 lbs. (2 ½ tons).

We just received the quote from Beall Mfg. to make new springs: $2,915 each!!! In talking with **Jeff Sisson** we discovered that is not an unreasonable price.

- Spring seats (2) – short heavy casting (channel-shaped) on which the binding strap of each spring rests. From what we have seen, they seem to be in good shape. Beneath that is a short block of oak about 2 in. thick, and 8 in. square. Apparently this is some sort of shim, possibly added as the spring flattens with age. We aren't sure if it was always there.

Spring plank (the channel), spring seat, spacer blocks and lower casting for swing link pin.
Rusted area after removing block. Stubs of lag screws showing.

- Spring planks (1) – a shallow channel (8 x 2 ¼ x 65 in.) running across the truck, supported on each end by the swing links. There is a hole in the middle for the kingpin[7]. As noted in the last report, the pins were too short to extend down that far. Normally they would extend far enough to have a 'keeper' put through them to keep the truck from falling off in a major derailment.[8] The channel faces up so, when the bolster and elliptic springs were taken out, it revealed a sorry sight. The channel, like so many other areas we are now getting used to finding, was full of rust flakes and dirt, all of which held moisture, accelerating corrosion. On the no. 1 truck the plank (channel) is bowed upward about 2 inches in the center and the 'legs' of the channel are badly corroded away. At some time it appears as though the channel was reinforced by the addition heavy plates, (1 in. x 7 ½ x 24 in) one on each side, laid on the channel. It was difficult to determine if they were welded in place or what appeared to be a weld was rust build-up. If they were not welded in place, they would provide no reinforcement. Anyway, on the no. 1 truck, it wasn't enough because of the bend. Also, why didn't it go all the way across from one end to the other? Further, what caused the bend because operational stresses would all be downward? The

[7] At least there is one in the no. 1 truck. Details in the no. 2 truck in this area are concealed under a thick layer of dirt and rust.
[8] You may recall that the presence a kingpin of the proper length with a keeper would have prevented Connco open car 838's embarrassing 'de-truck-ment' this past summer.

plank on the other end is straight but we have not yet examined it to give a good assessment of its condition. Very likely it will require replacement.

We now have new two pieces of C[9] 8 x 13.75# at a cost of $52 ea. These appear to be exactly the same cross-section as the original.

There is some discussion about adding the 1 in. plates that were added to the channel by YUCo. We don't feel that they were effective because they weren't placed where they would do the most good, so will be omitting them.

In cross-section, the ends of the spring plank are sort of a sandwich with the channel in the middle. Under the spring plank is the cast iron saddle under which the swing link pin passes. This supports the weight of the bolster on which the entire weight of the locomotive rests. On top of this is an oak block which is probably an added spacer that can be adjusted as the springs sag or things wear. Pointing vertically up through this block, through the channel and into another oak block are four lag screws, which hold things together. (A somewhat precarious looking arrangement but it seemed to work. On top of the upper block is a 'brick' of cast iron with two pin-like projections, about 1 in. in diameter, which stick down into the upper block, thus holding it in place. This 'brick' is where the elliptic spring rests. (Got that?) With the exception of the 'saddles and bricks', everything else will be new.

- <u>Transoms</u> (1 pair) – are the heavy beams which tie the truck together, side-to-side, in the middle. They consist of two channels facing each other, separated by the area for the bolster, 10 in. x 3 ½ in. x 79 in. with a ⅝ in. thick web. All four channels are badly corroded and on the no. 1 truck again, they are also bent. We have not yet found a modern-day equivalent for these channels should we decide to replace them. On the inside of each channel (the base) are two wear plates 4 x 13 ¾ in. about ¼ in. thick, fastened to the channel with flat-head rivets. Against these a heavy channel on the bolster rubs as the springs allow the bolster to work up and down. All of the plates have accumulated a large amount of rust build-up behind them which has caused at least one to break away and disappear. Normally these would be made of an abrasion-resistant steel but we have not checked this yet. (Incidentally during the disassembly they found a journal packing iron, badly rusted jammed within the transom, an artifact of the Y.U.CO. We wonder if they're still missing it?)

  This has been an area of considerable thought regarding the most accurate and least expensive way to replace them. First we checked with our steel supplier and he was not able to find this section. He suggested fabricating one with two 3 ½ in. strips for the flanges and one 8 ¾ in. x 5/8 in plate for the base. This would require two welds per transom (There are 4 channels) at a cost of $300 or we could do it. **Dean** then suggested that we take two 5 x 3 ½ in. x 5/8 in. angles and weld them with the two 5 in. sides together, making a channel of the right dimensions. This was available but would have required our purchasing extra steel as well as or welding it or Mill Steel doing it for $200. The total cost of each of these options was about $1,100.

  Meanwhile, **Randy** had gotten on the internet and saw a C10 x 30[10] Channel. He checked with Novel[11] Iron Works in Portsmouth, NH and found that they could easily obtain this section. It is

[9] C=Channel
[10] 10 in. high x 30 lbs./ft. or 192 lbs. for each 79-in. channel.
[11] Pronounced as in 'novel' (a fiction book) from a Mr. Novelowski, the founder. Anybody who has traveled north on the New Hampshire Turnpike has noted their bridge crane with "Novel Iron Works" spotlighted.

slightly different in that it is 11/16 in. thick *vs.* 5/8 (10/16) x 3 in. *vs.* 3 ½ in. flanges. Dean and I checked the truck and the original pieces, now removed, and found this slight change would still fit in very well. However, today Randy and I looked at it and decided we should weld a short section of ½ in. material about 6-8 in. long at the ends of the flange because there is a 1 5/16 in. hole in that location to widen the flange, which would be too close to the edge of a 3-in. flange. Novel will furnish the steel with all the holes punched for $790—a bargain at this price. We drew up a sketch and sent it with the purchase order, to Novel. Randy will bring the finished pieces back to Maine in his pickup truck. I talked with Novel's Andy Cole who said they will then turn our sketch into a CAD drawing from which they will work.

- Swing links
  - Pins (4) – These are (once) round rods which allow the bolsters to sway slightly from side to side as the car moves.[12] They are 1 ¾ x 18 in., apparently mild steel with a pin in each end to keep them in place. All the upper ones have large flat spots worn in them and the lower one that I have seen is badly corroded. Should be replaced. We now have a 20-ft. bar which cost $73.20 from which these can be cut. All they require is cutting to length and drilling a hole through each at each end for cotter pins. Each pin uses $5.49 worth of steel and the remainder can be used as stock.
  - Swing link pin bearings (4) – These castings are bolted to the top legs of the transom and have a hole through them through which the pin is placed. They have worn to an oval shape. Randy thinks they would be hard to build up. On these trucks they have not been bushed.
  - Swing links (4 pairs) – These are 'dog-bone' shaped links about 24 in. long with the pins through each end forming a "U" which is closed to an "O" when the upper pin is inserted. The one set of two I observed seems to be ok. These have not been blasted and we need to check the holes through which the above pins pass.
- Equalizer bars (2 pairs) – These are all in good shape with a small amount of corrosion built up at the ends where they seat on top of the journal boxes. When they were returned from sandblasting we found they were badly pitted. We are debating just how much filling should be done but certainly will do the areas around the holes.
- Equalizer springs (4 sets) – These coil springs come in pairs—an outer with heavier wire and an inner of lighter wire. One is inside the other. There is some corrosion on the bottoms, especially the smaller inner ones. To be examined. Outer spring: 1 in. wire, 7 in. O.D., 7 turns. Inner spring: ⅝ in. wire, 4 ⅞ in. O.D. Both springs are 11 ¾ in. high. Still require close inspection. Some have been sand blasted but, because of the time this takes, we are sending them up to AC.
- Equalizer spring caps (4 upper and 4 lower)
  - Upper – held to the truck frame with a ¾ in. square-headed bolt. All in good shape. Within each is a steel disc about 6 ¾ in. diameter x ¼ in thick which must be some sort of 'pad' against the cap. There is a still-shiny spot worn in the top center of each where the mounting bolt rubbed. (All of these are in excellent condition with no visible cracks.)
  - Lower – Many of these have cracked due to the rust build-up within them. Beneath the spring is a wood disc of unknown thickness and possibly a steel disc. We have not 'dissected' nor evaluated them yet. Uncertain if the broken-off parts can be replaced by brazing in some sort of replacement or a new casting has to be made. See above
- Truck frame- (1) This large rectangle (79 x 120 in.) is of 1 ¼ or 1 ½ x 4 in. steel. Appears to be in good shape. It has a very rough surface but we feel this was from the original forging[13]. It has a slight

[12] Ted Santarelli used to was eloquent about swing-links but I have never figured out just what their virtues are. Can anybody tell us?

[13] One of the things that has gone through our minds is what must the machinery have looked like that wrapped this long and stiff bar into the rectangle it now is as well as welding it together and whether it started with one piece or several. The weld(s) were the forged type whereby, they steel was heated to just the right degree of redness (temperature) and pounded on with a heavy trip hammer.

bend in one side. We are discussing whether to straighten with some heat and force or see what happens when the rest of the truck is attached to it. We did not notice the bend until the truck was apart. In addition to priming, this was also given a coat of Super Jet Black *Awlgrip.*

- Arch bar (2) – Flat steel bar in good shape. ⅝ x 4 in. 108 in. end-to-end, 13 in. 'deep'. This too also has an 'historic' bend which we may cut out and replace the steel. Randy has filled the major defects with weld and ground them smooth.
- Brake levers **–** One of the reasons 100 had not been used with brakes is because at least two of the brake levers had broken. We will be cutting them from ¾ x 3 ½ in. flat bar. ($92.25 for two lengths.)

**Body bolsters** – On any car there are two forms of bolsters: the truck bolsters, which have the 'female' version of the center bearing bolted to them, and the body bolsters, which have the 'male' version. The center bearings are fairly large castings which are meant to interlock with each other, thereby keeping the trucks and the body together. Through them pass the kingpins but these don't actually do anything unless there is a significant derailment (as should have been with 838).

As stated above, the truck bolsters, for the most part, are in very good shape, requiring a minimum of overhaul. However the body bolsters are a very different story. Unlike most cars, those on 100 are out from under the shelter of the body so moisture gets into them and is trapped between the bolster steel and the wood sills. Additionally dirt collects on top of them as well as within them, acting like a sponge to retain moisture. On top of that, the electrical ground return wires are bolted to them. The area around this is badly pitted.

The body bolsters are quite simple in construction, consisting of a ¾ x 8 in. metal plate, 103 ½ in. long extending from one side of the car's frame to the other. This is the top plate. The bottom plate is 1 x 8 in. but is spaced down 5 ¾ in. at the center, creating as a truss. Instead of relying entirely on bolts to keep the two plates in line, the outer ends of the upper plates are bent tightly over on themselves, pointing down and inward. The bottom plate ends at the inside of each of these bent-over areas, thereby tightly locking itself.

In the center of the bolster, above the body center bearing, is a large cast iron spacer through which the bolts holding the top to the bottom plate run. At each side bearing is another pair of spacers, the outer one being 1 ½ and the inner one 2 ½ in. because of the angle of the bottom plate. All these spacers are cast iron with a 7/8 bolt running through each of them.

On 4 Feb. we finally took the no. 1 bolster completely apart. As we did this we noticed that the amount of steel remaining about equaled the amount of rust we scraped off. Fortunately the iron castings were not at all subject to rusting and will clean up well. The castings are:

- Side bearings, held to the bolster by two 7/8 in. bolts which also pass through the. .
- Spacers above the side bearings. There is a pair of each at each spacer that are angled on the bottom to match the slope of the bottom member of the bolster.
- Spacer casting in the center with a 2 1/8 in. hole in the center for the kingpin and with four holes (one in each corner)[14] through which ¾ in. bolts pass to anchor the. .
- Center bearing. (Only one of the four bolts remained, the others having rusted away). This casting is in very good condition.

The bolsters are fastened to the car body by ¾ x 14 in. bolts coming down through (added by YUCo) metal plates on top of the sills, through the sills and through the top member of the bolster.

[14] This casting, which is roughly "I"-shaped, has broken at the large hole. Dean looked at it and feels that, since the load on it is in compression, that we shouldn't fool around with trying to weld it. This might make it worse.

Bolster after removal    Build-up of corrosion between upper and lower plates
Note the bent-over upper plate.

We figure that we can make new bolsters with some help from Novel Iron Works. They will make the four bends necessary to form the bottom piece. (It is flat on the ends for 7 in. to match the top plate and flat in the center, but 5 ½ in. lower, for the center bearing.) On 5 February, **Randy** took the bottom plates to them so they can put in the proper bends. I have just gotten off the telephone with Novel's draftsman who is making a CAD drawing for their shop to do the bending. I also said that the original was so badly corroded that it was very difficult to get solid dimensions from it but we figured out what it should be.

We asked Andy Cole if they could bend the top plate back on itself as Laconia Car Works did, but he said they didn't have the equipment to do it. So we will weld a block to the bottom side of the top plate to give the same effect as well as hold the bottom section in line. Novel will also punch the 2 1/8 in. hole for the king pin.

We will then drill the holes in the plates using our Jancy magnetic-based drill pres and *Rotabroach* drills. The Jancy drill is much easier to handle and move that to try to wrestle the big plate around. The *Rotabroaches* are a multi-spur drill that does the job faster and more accurately than a regular twist drill. We are ordering two sizes: 13/16 and 15/16 in. to give clearance for the ¾ and 7/8 in. bolts at a total cost of about $150.

It is important that we get bolsters finished and installed because they are critical items in keeping the long sills straight and properly spaced.

**Bolts and washers** – We have gone carefully through our stock of bolts and pulled all the ones that we can use or adapt for 100 or 1160 (which is also having its trucks rebuilt). Where we have lots of them, we will cut longer ones to the correct length and re-thread them. We are finding that square-head bolts are becoming harder to find and purchased those we could. Along with the steel purchase we got 20-ft. ⅝ ¾, ⅞, 1 in. and 1 ⅛ rods from which to thread new ones. We will thread both ends, one longer than the other and screw a nut on the short-threaded one which will then be welded in place. This copies the method used by YUCo where they replaced bolts. Dean will thread them in the lathe. We are working on getting some proper production-type dies because most of STM's are worn so nuts don't thread readily on to them.

**The Cab** – **Norman Down** burned the paint off the sheathing from one side. He found numerous nails broken off inside the wood. Apparently YUCo nailed it on more than once.

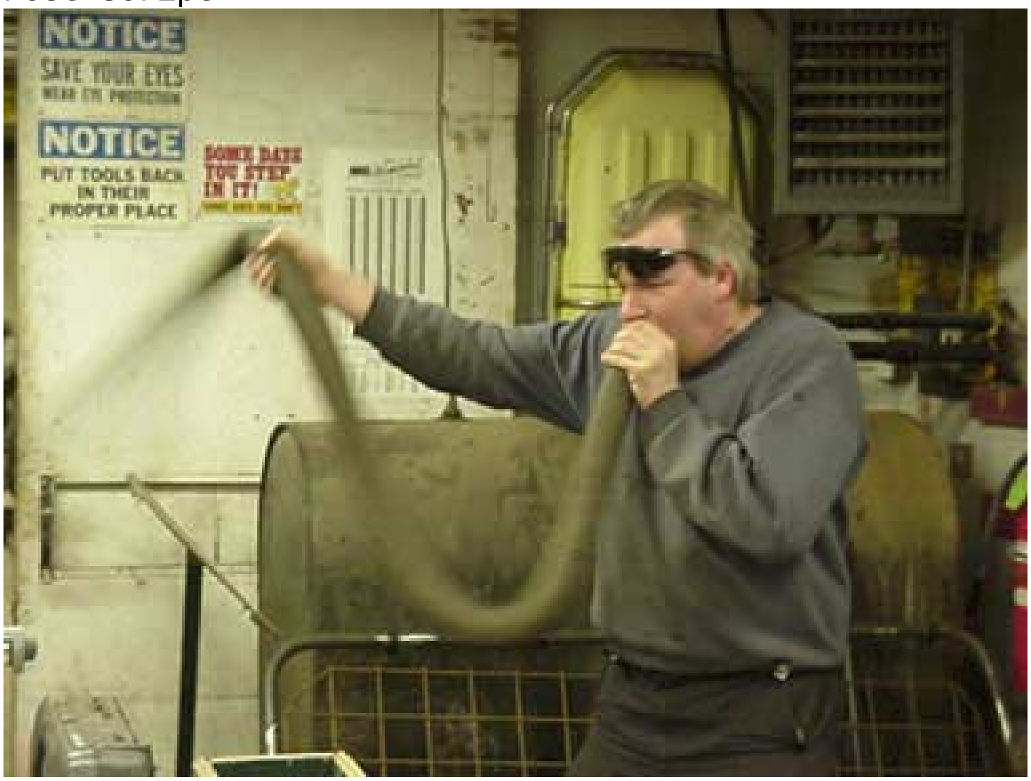
**Funding** – **You can help still.** In the next curatorial report, we will include our estimate of our expenses for materials will be. We have been working on getting quotes as well as trying to think of everything that we could possibly use but there are some major components that have not been estimated as yet, the motor overhaul work being one.

Given the rapidly rising cost of steel and the amount of work necessary to rebuild these trucks, it looks as if we're going to need more financial help so, your contribution to ASL 100 (fund 888) will ensure this work continues uninterrupted.

Phil Morse asked me the other day how it felt to have ample money and not have to stop because funds ran out. I told him it was great. Stopping wastes huge amounts of time and money because you have to re-orient yourself to the project.

Thanks in advance!

Post Script




Bill Pollman celebrating a hard day of truck restoration by playing a solo on his Diggery-Doo (Vacuum Cleaner Hose)