Shay - Electrical System II - Headlamp

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Headlights: The Shays of the early 1900s had oil lantern type headlamps.   Based on photos and comments in Philip Brogan's book Shay Logging Locomotives At Cass, West Virginia, 1900-60, the switch from oil to electric headlamps occurred at Cass around 1920. The oil lamps on the first couple Cass Shays had large square cases. The majority of the oil headlamps had 16" round cases similar to the later electric headlamps.   The round oil lamp had a squat chimney on the top whereas the electric lamp had a smooth top. Some of the oil lamps had number boards on the sides as did some of the later electric lamps.   Castings for a Pyle type lamp with side number boards are available from Railroad Warehouse and they also offer an assembled Sunbeam type lamp that is a close match for the round case electric headlamps used at Cass. This assembled lamp is equipped with a 12 volt Halogen bulb that is a mismatch for my 6 volt system.   The choice is to model the electric or the oil lamp. If the electric lamp is modeled, then one would want to have a steam powered generator. Castings for a non operating Pyle generator are available from LS Manufacturing.

Recall that limited power is available via a set of D cells under the tender so I decided to try LEDs. A couple of the large LED flashlights were purchased from Harbor Freight to get the LEDs, lens and reflector. The item description from the Harbor Freight website is shown below.

13" LED FLASHLIGHT

Super-efficient light emitting diode technology makes your batteries last 10-20x longer than with incandescent bulbs.

- 15 LEDs for brilliant clear illumination
- Lightweight aluminum body
- Water-resistant O ring seal
- Rubber no-slip grip

Batteries: three "D" cells; Bulb type: 15 LEDs; Construction: aluminum with rubber grip; Overall dimensions: 2-1/4'' diameter x 12-3/4''L; Shipping Weight: 1.4 lbs; Disclaimer: Uses three D cells, sold separately

ITEM 3652-1VGA

$24.99

$19.99

Disassembling the Flashlight: The first step was to unscrew the lens piece. The 15 LED unit was then exposed.

The LED unit was then pried out of the end of the body. At this point it was determined that the LEDs are wired in parallel on the little printed circuit. Two wires go from the printed circuit to the switch area.

The flashlight body was sawed in half just behind the switch to access the wires at the switch. Note the resistor; it's 2.7 ohms. The resister serves to limit the current to the LEDs.

At last, the LED panel and wires with series resistor were separated from the flashlight.

The LEDs with series resistor were connected to a variable power supply set to 4.5 volts. The current at 4.5 volts was about 400 milliamperes (0.4 amperes). The voltage was then reduced to 3.6 volts and the current decreased to about about 200 milliamperes (0.2 amperes). The brightness was still good at 3.6 volts.

(Note: the LEDs are polarized; current flows in only one direction. If no light, try reversing the leads.)
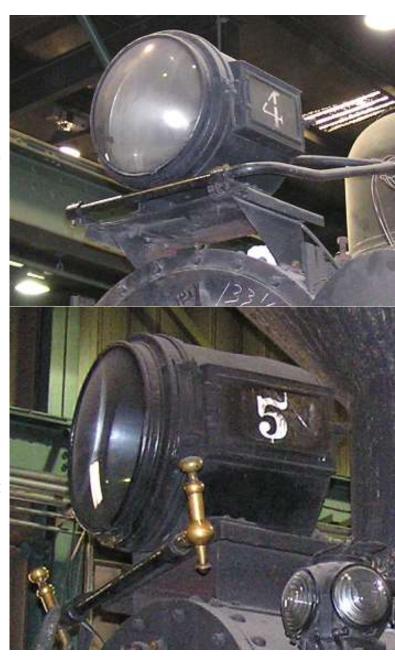
The equivalent resistance of the resistor plus diodes at 4.5 volts input is (4.5 volts divided by 0.4 amperes) about 11 ohms. Similarly, the equivalent resistance at 3.6 volts input is about 18 ohms.

The technical specification for the Eveready E95 energizer alkaline D cell was downloaded from www.eveready.com. The constant resistance curves were then used to find a typical service life at a 1.2 volts cutoff (3.6 volts for 3 cells) of ~80 hours for a 11 ohm load and ~ 150 hours for 18 ohms. A 100 hour service life is probably a good estimate. If this estimate proves to be accurate then rechargeable batteries aren't worth the effort

Cass Headlamps: Cass was visited in March, 2004 to checkout a few details of the boiler top such as handrail stanchions, generators and headlamps.   Turns out the each headlight is a little different.   One of the craftsman at the Cass shops said that the headlamp cases collect moisture and rust through so most have been refurbished. He said they roll replacement cases.

This first photo shows the lamp on Cass 4.

This and the next photo are of the Cass 5 headlamp. Note that this lamp sets a little further back than the lamp on Cass 4.   All the lamps are ~ 16" diameter and ~ 16" front to back ---- scaling to 2" length and 2" diameter.

The back view of the Cass 5 head lamp showing the electrical connection. The number board protrusion is ~ 10" high.   This also shows good detail of the mounting arrangement.

The Cass 6 headlamp has slanted number boards.

This is the lamp from Cass 11 --- no number boards.

Case: All the lamp variations use a ~2" diameter by ~2" long case so the case was fabricated first.   The OD of the lens end of the flashlight was ~2.2".   A 2.25" OD exhaust pipe extension was secured from Auto Works . A piece was sawed off and the ends squared in the lathe and length adjusted to 2" The burr on the inside was carefully removed. The smaller diameter of the lens piece was chucked and the larger part carefully turned down so that it was a loose sliding fit in the tube (allowance for paint). A short shoulder was left on the end of the lens piece. The smaller diameter part was then sawed off the lens piece.

This shows the lens piece inserted in the case. It's a nice fit. A screw through the bottom of the case into the lens piece will be used to secure the lens piece.

The back was rough cut from 1/8" steel and then turned on a mandrel to the correct OD. The back will be soldered in place later.

At this point I was undecided as to whether to make the number boards or to make the headlamps like the Cass 11 lamp with no

number boards.   The number boards looked like a pain to make and I was in a hurry.   I also knew that If I made them without the number boards I'd regret it later. So, put the project aside and worked on the lawn for a day.   Nothing like lawn work to provide motivation to work on the shay!   The lamp will be finished in Part III

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