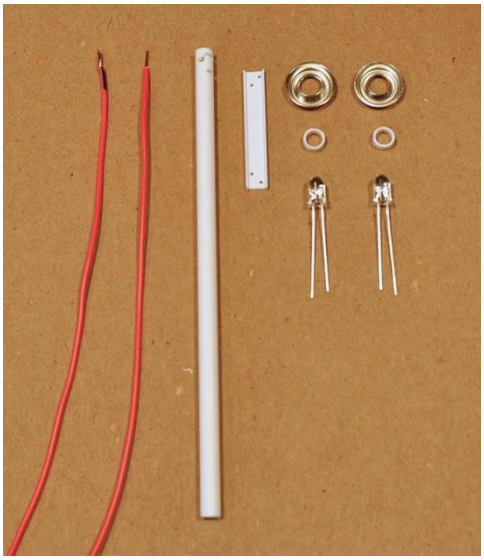
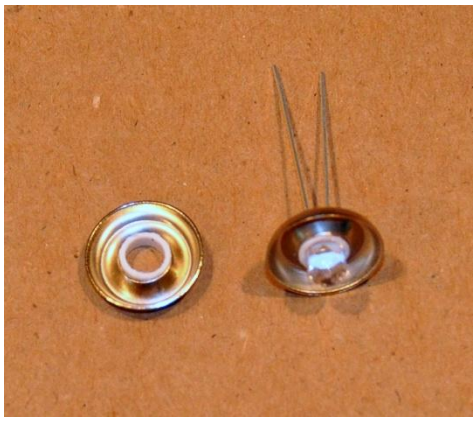
LEDs for Track Lighting

Since most circle track races are run at night I thought that it would be great to light my HO track with LEDs and run with the room lights dimmed. I built the type of stadium lights commonly seen on oval tracks in the '60s.
I used 7/32nd inch (5.5mm) diameter styrene tubing for the posts and 1.4th inch (6.3mm) channel 1 1/2 inch (37mm) long for the crossbeams. The reflectors are #10 finish washers.

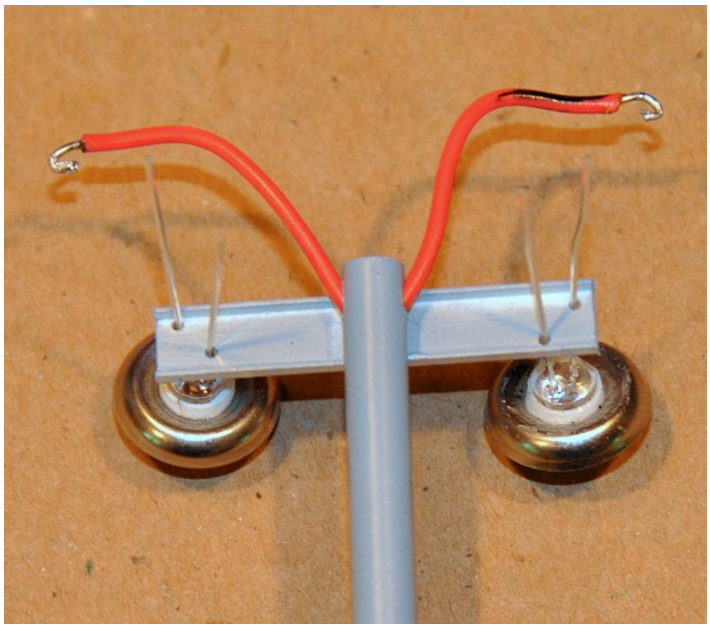


I cut 1/8th inch lengths of 1/4th inch diameter tubing and pressed those into the finish washers. The 5mm 8000mcd white 45 degree viewing angle LEDs that I used are a perfect press fit inside the 1/4th inch diameter tubing. I did glue the tubing to the reflectors.

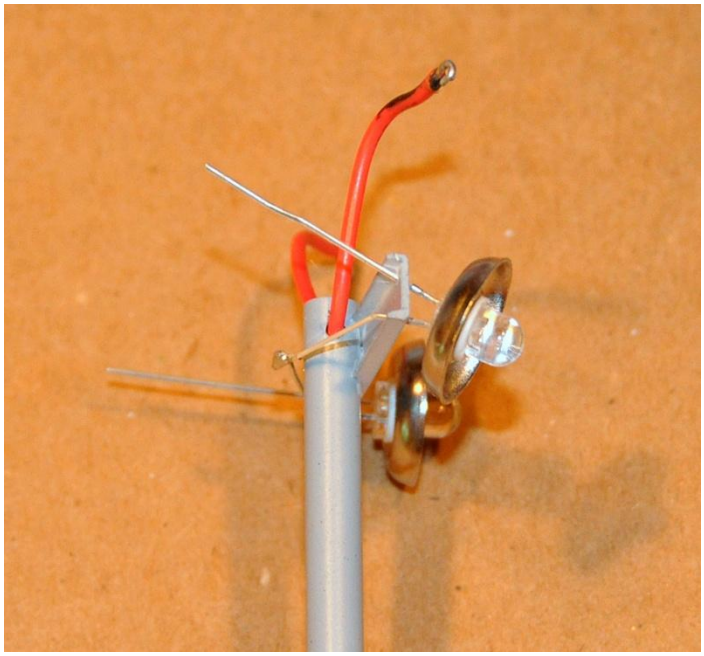


I drilled a 5/64th hole right through the pole 1/4 inch from the end and also cut notches for the crossbeam. I drilled two # 62 holes through the crossbeam for each LED, then glued the crossbeam to the pole and painted them with gray primer.

I threaded the 12 inch lead wires through the holes in the pole and pushed enough wire through to have about 6 inches showing past the bottom end of the pole. One of the wires is marked to indicate negative. I then stripped 1/4th of an inch of insulation from the end of each wire. I pushed the leads of the LEDs through the crossbeams, but not quite all the way so I could adjust the aim later. I tinned the ends of the wires and bent them with a needle-nose pliers to form hooks. Note that the negative lead of a LED is the shorter one.



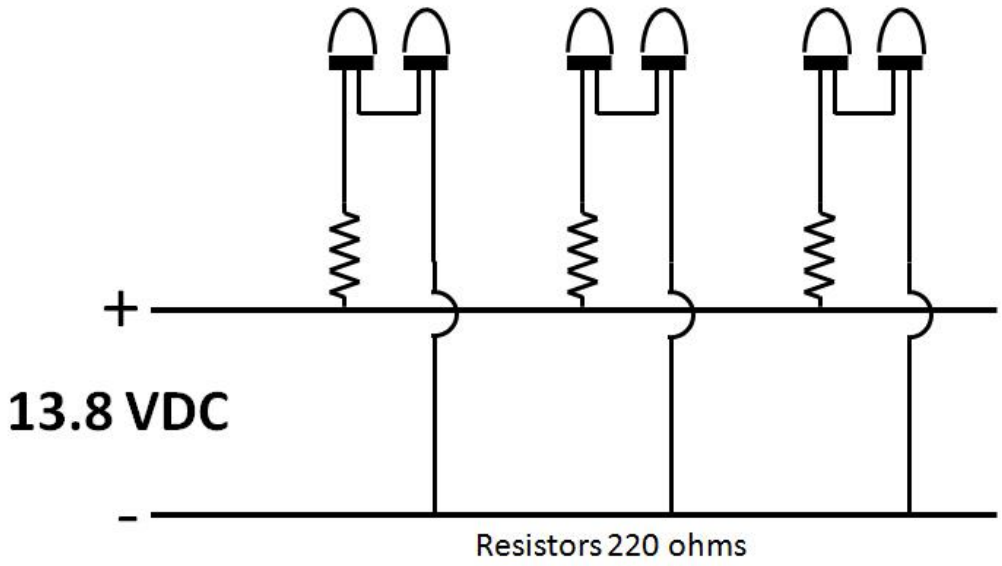
The plus of one LED was connected to the minus of the other so that they are in series.



The lead wires are connected with the negative wire going to the negative LED lead. The poles are 5 1/2 inches long with 5 inches showing above the table top, 27 feet in

1:64 scale. The cost is about $3 per unit. Twenty-two of these units are enough to light the entire 4X16 foot four lane oval track. The LEDs were purchased from Superbright LEDs.

Each LED operates on 3.5 volts, the two LEDs on each unit are wired in series so each unit runs on seven volts. I have a variable power supply so I just set that to seven volts. With a fixed power supply there would have to be a dropping resistor in series with each unit.



The LEDs that I used draw 30 milliamps each (0.03 amp). A 1.5 amp power supply is enough to run all of the lights. I stapled two loops of 14 GA bare copper wire to the underside of my table and connected the units in parallel.
I used LEDs with a fairly wide 45 degree viewing angle so I would not have to use too many lights. In order to power LEDs you need to know their operating voltage and current draw plus you need to know the supply voltage. If the supply voltage will be greater than the operating voltage dropping resistors must be used. There are online calculators like this one: http://led.linear1.org/1led.wiz available.
You should be aware that the nameplate voltage on a power supply may not be correct. I once purchased a 12 volt regulated power supply that actually puts out 13.8 volts. It is best to measure the voltage before you continue with the calculations. The necessary calculations are really quite simple. First you must determine the voltage drop that is needed, just subtract the operating voltage (sometimes called typical voltage) from the supply voltage, in the case of the LEDs in the schematic 13.8-7=6.8 volts. To select the right resistor to get that voltage drop you need to know the current draw of the LED. The LEDs that I used take 30 milliamps (mA) each, When they are wired in series the same current must go through both of them. To find the resistance divide the voltage drop by the current in amps, 6.8/0.03=226.6 ohms. 220 is close enough. Resistors have a watt rating, multiply the current in amps by the voltage drop across the , 6.8X.03=0.204 watts, use a 1/4 watt resistor.
There is also a way to avoid using any resistors. If two units are wired in series they will run at 14 volts, so at 13.8 volts they will not need any resistors. The drawback to that arrangement is that if one LED fails all four of them will go out.