

# ULTRA-TINY LIGHTS

*with fiber optics*

BY WAGNER CIONGOLI

## ***Material from toys and lampshades solves a tough lighting problem ...***

### **RAILROAD MODELING IS A FASCINATING HOBBY.**

It does not provide us with financial gains, but with pleasure, relaxation and new friends. Those who like modeling railroads often face limitations in attempting to reproduce certain real characteristics. Lighting locomotives, freight cars and structures can be very difficult. The smaller the modeling scale, the tougher the job.



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With the advent of light-emitting diodes (LEDs), and now microLEDs, the hobby has experienced a major breakthrough in lighting. The drastic reduction in the size of the light sources gives modelers greater opportunities for realism.

LEDs are available in the market in sizes ranging from 2.5 mm to 16.8 mm, but those which interest us are the smallest, now at 2.5 mm. These tiny lights haven't completely solved the problem. Some lamps that are very small in the real world, when reduced to the working scale, need to have diameters of tenths of a millimeter. This is most evident to modelers who work with N or Z scale.

Our project involves an HO GE 5200 electric model locomotive by Frateschi. The major challenge is representing the two red rear signal lights. These lights, in HO scale, should be between 3 and 4 tenths of a millimeter. The lamps are positioned half a centimeter below the windows of the engineer's cabins and light up in red to indicate the rear of the locomotive.

*Photos on the following pages ...*

1. (Lead photo) Optical fiber can be found in some decorative items and toys, like these fibers, that can be purchased in stores or on the internet.



2. So far, lighting descriptions by other modelers have usually referred only to the lights that illuminate the front of the locomotive. Modelers use white or yellow microLEDs for these but have ignored these small rear red lamps, for understandable reasons. The technique presented here uses optic fibers and considerably expands the arsenal of tactics for modelers, as it dramatically reduces the size of the light source.

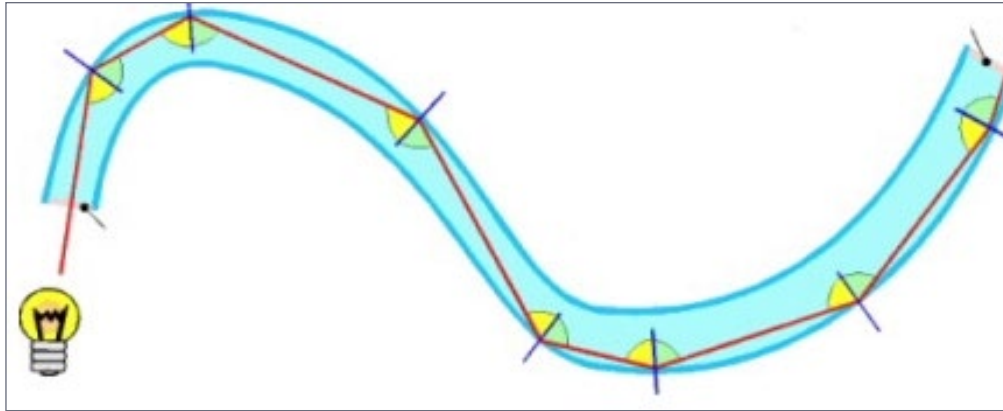


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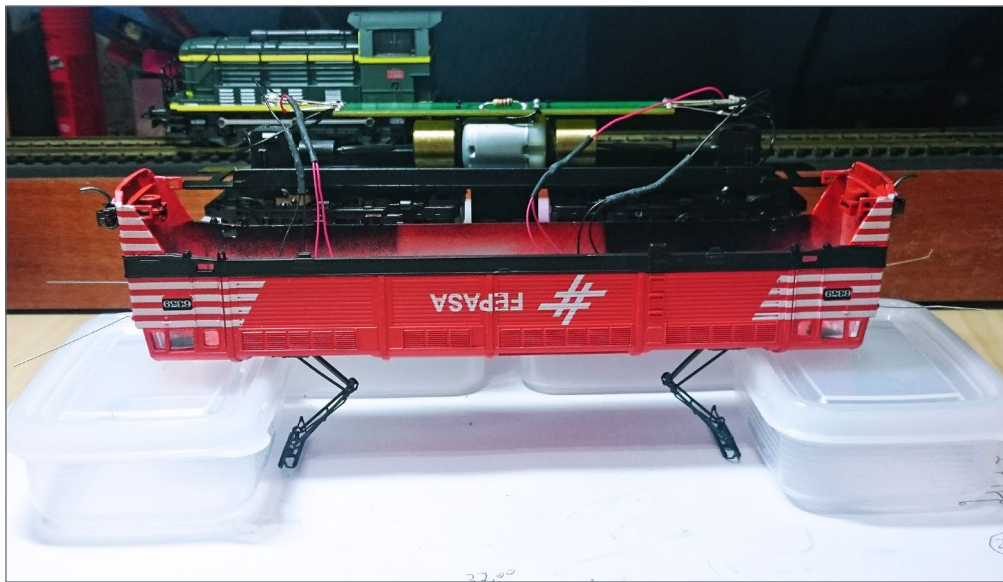


3. In 1870, the English physicist John Tyndall demonstrated the principle of guiding of light by means of a simple experiment. Using a leaky container with water, a bucket and a light source, Tyndall observed that the beam was illuminated through the hole in the container.

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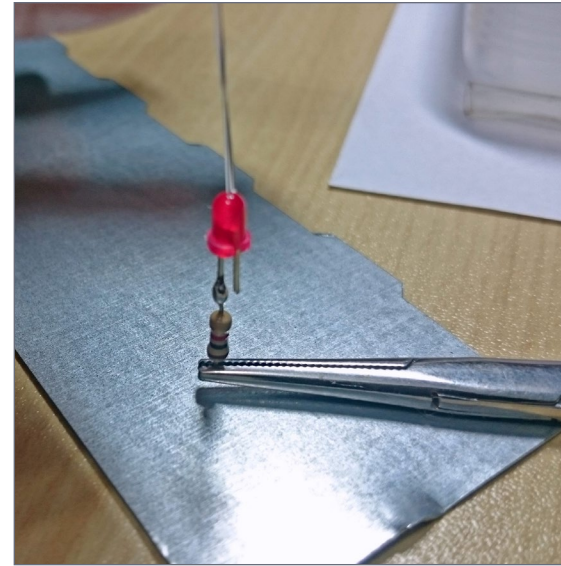


4. The optical fiber is glass or plastic polymer. Optical fibers have a transparent core surrounded by cladding with a lower refraction index. Light is contained in the core by the phenomenon of total internal reflection.

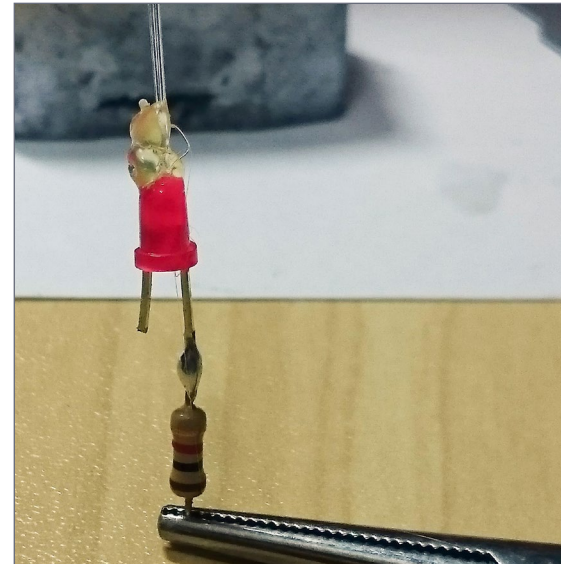


5. Start by disassembling the locomotive or rail car according to the manufacturer's instructions.

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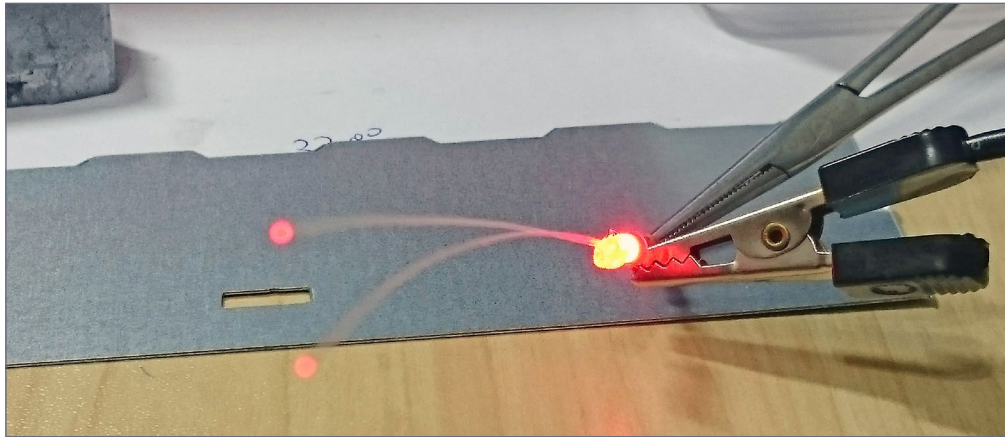


6. This procedure is very important and delicate. The ends of the optical fibers should touch the LED surface to ensure good uptake of light. Before gluing the fibers in place, do a couple of test fittings with a lighted LED to check the ideal position for bonding of fibers.

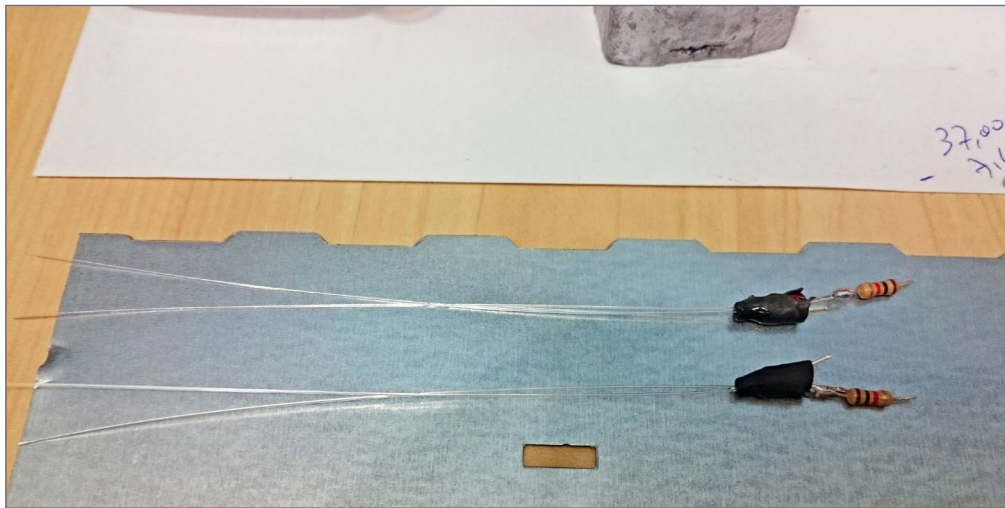


7. We will install two 2.8mm red LEDs, one in each cabin, to serve as the light sources. Solder a resistor to the positive pole of each LED to limit the in-flow voltage. Cut two 100mm (about four inches) pieces of optical fiber and attach them to the LED housings with a drop of hot glue or superglue. Keep the soldering iron away from optical

fiber – heat will make it shrivel up and you will need to start over with a new piece.




8. The system can be tested by turning the LED on and checking the tiny red lamp that will glow at the tip.

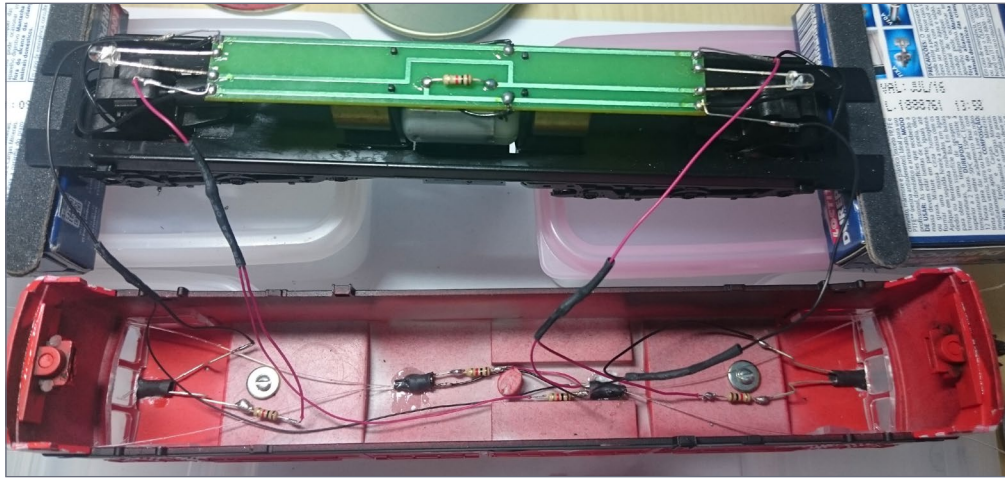


9. The next step is to block the red light that will propagate from the source LED and make the driver's cabin light up red. Use black heat-shrink tubing from electronics suppliers. Choose a size to match the LED and carefully warm it with the soldering iron. It will shrink and wrap around the LED to block the passage of light.

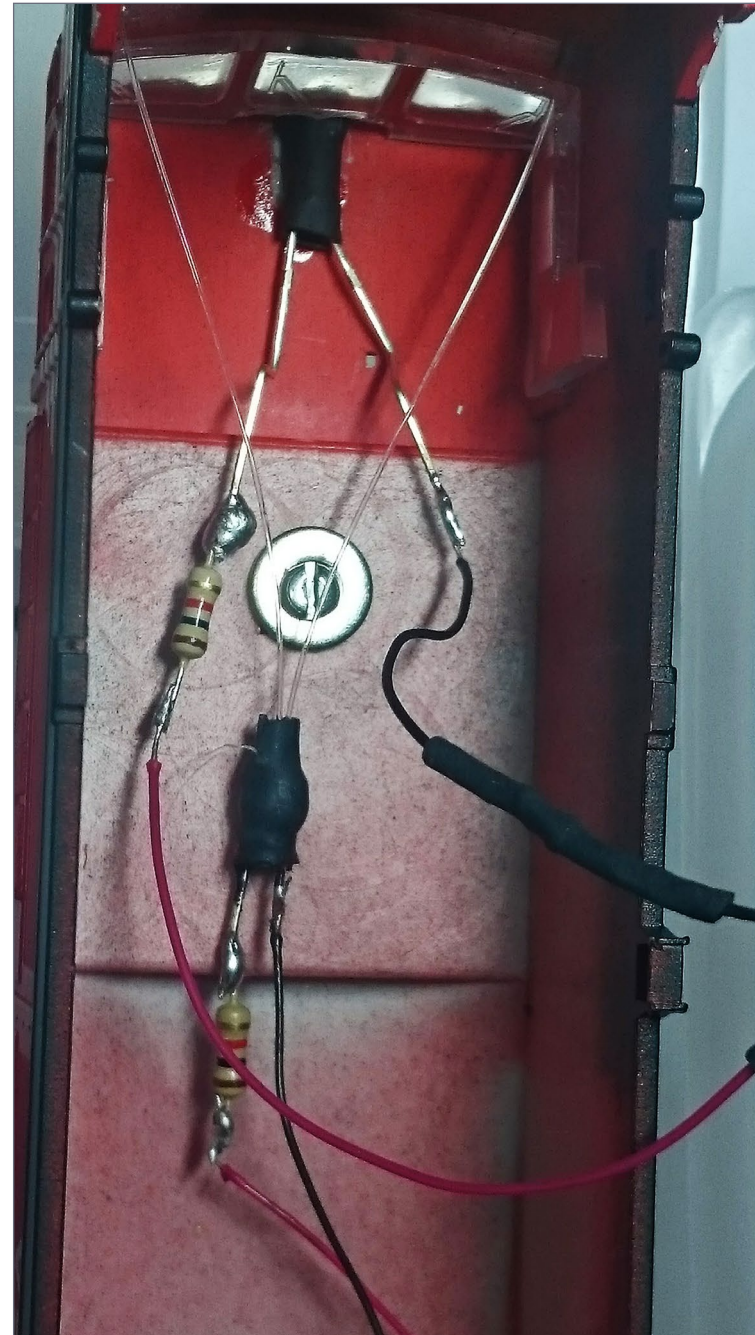


10. To install the optical fiber, we must make a hole in the cab metal weights. Mark the center of the hole location with a very fine pointer. My optical fiber is four-tenths of a millimeter. That converts to .016 inches, requiring a #78 drill. To keep from breaking these tiny bits, hold the part steady in a vise or clamp. Drill slowly and with very light pressure. Let the bit do the cutting. Clean any stray bits of plastic or metal so the optic fiber can slide smoothly into the hole. It may help to chamfer the hole in the inside with a sharp knife tip or a larger drill.

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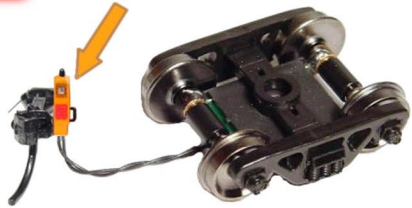
11-12. Finally, glue the optic fiber into the housing with hot glue or clear parts cement.



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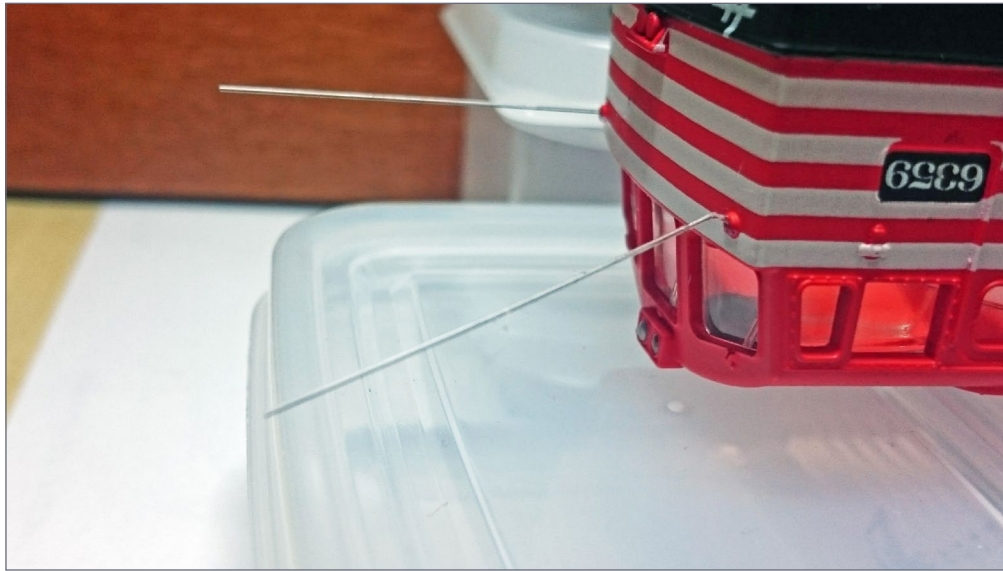
**Does not affect Load!**

↓ Car without Load ↓

↓ Car with Load ↓

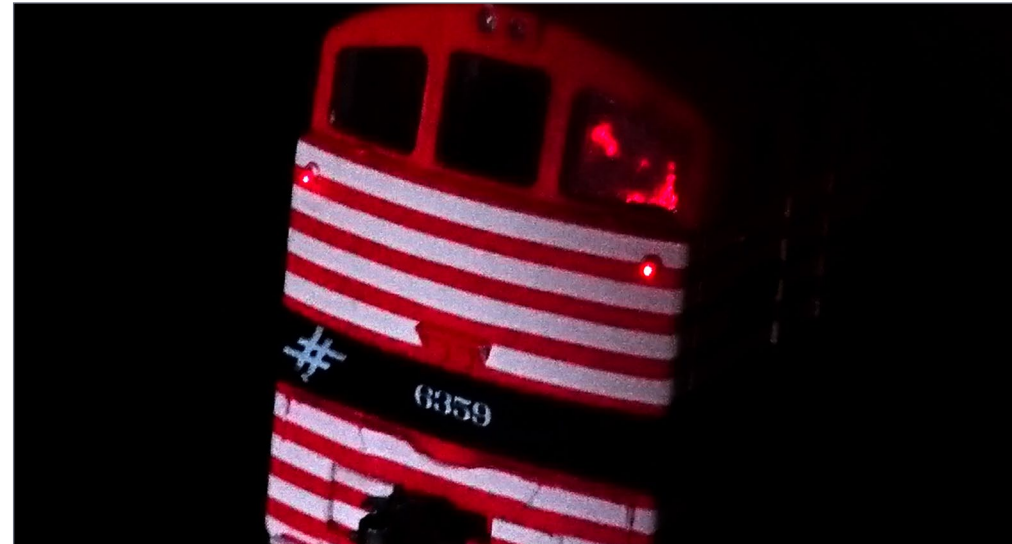


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13-16. Remember that these micro lamps are intended to light up at the rear of the locomotive when it is moving forward. Test the lights for proper operation in both directions. After you verify that everything works, use a nail clipper or flush-

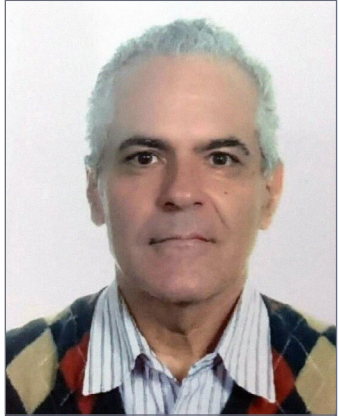
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cutting pliers to trim the optical fiber flush with the outer face of the housing. Then, replace the body on the chassis and it is ready to run! The smallest lamp of the world, in its locomotive in HO scale!

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### WAGNER CIONGOLI



Wagner has liked model trains since he was a child, but it's only been since he became an adult that he's really been very active in the hobby.

He got serious about his model railroad-ing passion in 1994, working in HO. His passion is to model things as faithfully as possible, both the models themselves and the scenery. Wagner also likes to explore new methods and techniques so

he can share them with his fellow modelers.

He models Brazilian prototypes from his native country, Brazil. His latest interest has been improving the lighting of his models, as this article demonstrates.

Wagner is a doctor specializing in cardiovascular surgery. "My woman" (as Wagner calls her in English) participates actively with him in both his professional and hobby activities. Wagner says doing the hobby is a daily activity in his household!



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# HO SCALE CLICK HERE