

# Building the B&CC: The Motive Power Fleet

How to (not) scratch build a fleet of engines

Ryan Moats, MMR

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# Blackhawk and Central City

- Set in 1870
- Small (< 70 sq. ft.)
- Freelance, based on prototypical track construction standards (the CCRR and the Gilpin Tramway)
- Scratch build as much as possible (track, cars, motive power, structures, and throw mechanisms, so far)
- Cover the eight miles of CCRR track built along the north fork of Clear Creek from Forks Creek to Central City
- Operations focusing on early rail issues.

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# Starting Specifications

## 19 ton P-B o-6-oT

| Spec            | Value           |
|-----------------|-----------------|
| Cylinders       | 12" x 16"       |
| Driver diameter | 33"             |
| Wheel Base      | 8' 1"           |
| Length          | 20'             |
| (Power)         | 25 mm NWSL Flea |

## 14.5 ton P-B o-4-oT

| Spec            | Value           |
|-----------------|-----------------|
| Cylinders       | 10" x 16"       |
| Driver diameter | 33"             |
| Wheel Base      | 5' 3"           |
| Length          | 17' 2"          |
| (Power)         | 20 mm NWSL Flea |

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# The first challenge!

How to build 33" drivers?

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# Try #1: Modify NWSL 33" wheel set

## Approach

- Drill out axle hole
- Machine boss overlays from brass for to hold crankpin
- Attach overlay to axle/wheel set
  - Solder to axle
  - CA

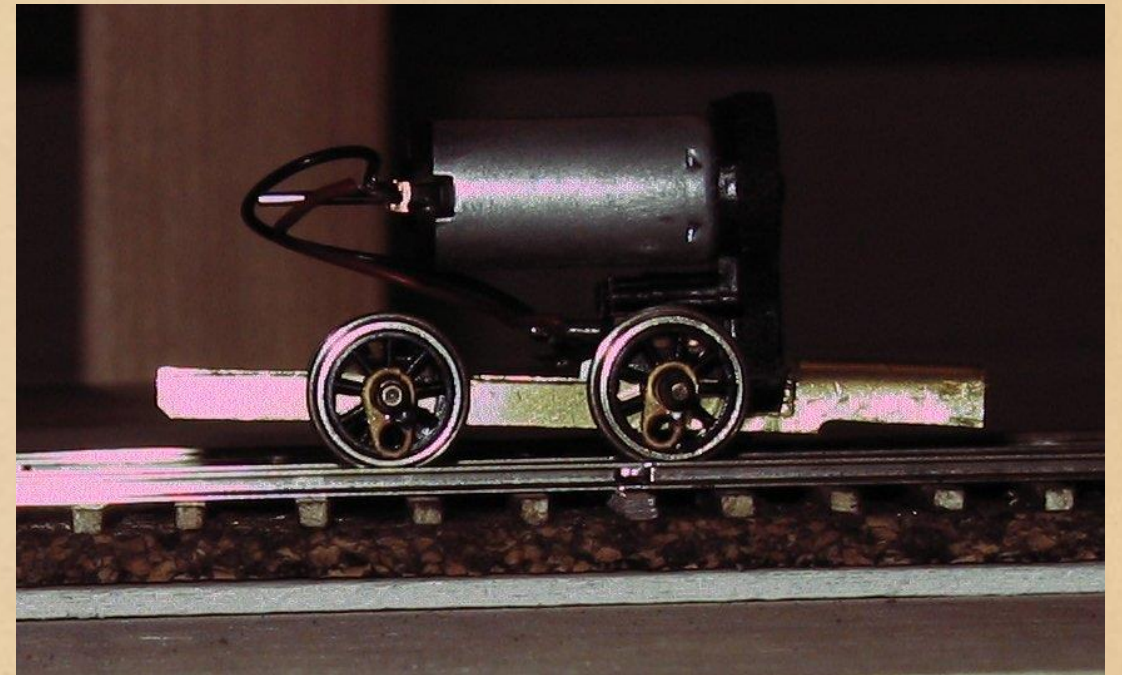


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# Try #1: Modify NWSL 33" wheel set

## Failure Modes

- NWSL wheel centers are cast from acetal
- Boss overlays won't stay on
  - Soldering melted the Acetal before creating a good bond to the axle
  - CA to Acetal? Enough said



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# Try #2: Start with PSC C-16 Driver Centers

## Approach

- Pop out NWSL wheel set center and retain tire.
- Drill out center of C-16 Driver Center
- Machine Driver Center on lathe to fit 33" NWSL
- Mount and drill out crankpin hole.

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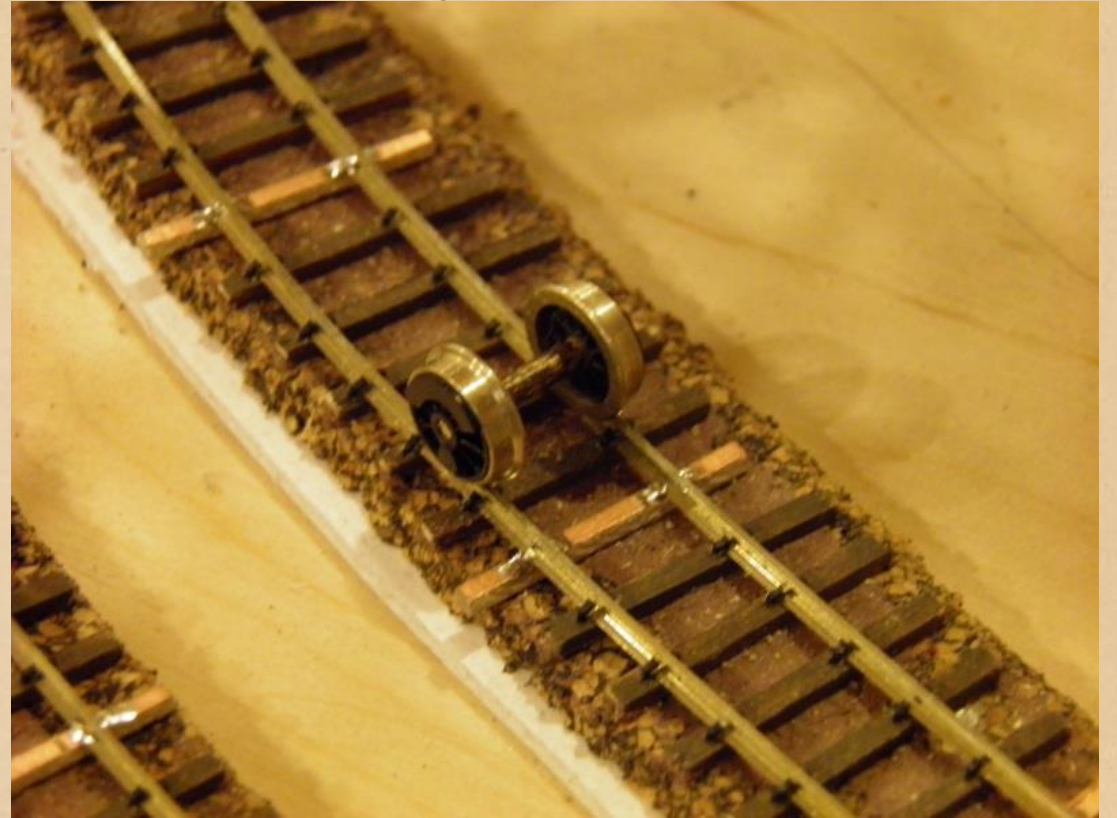
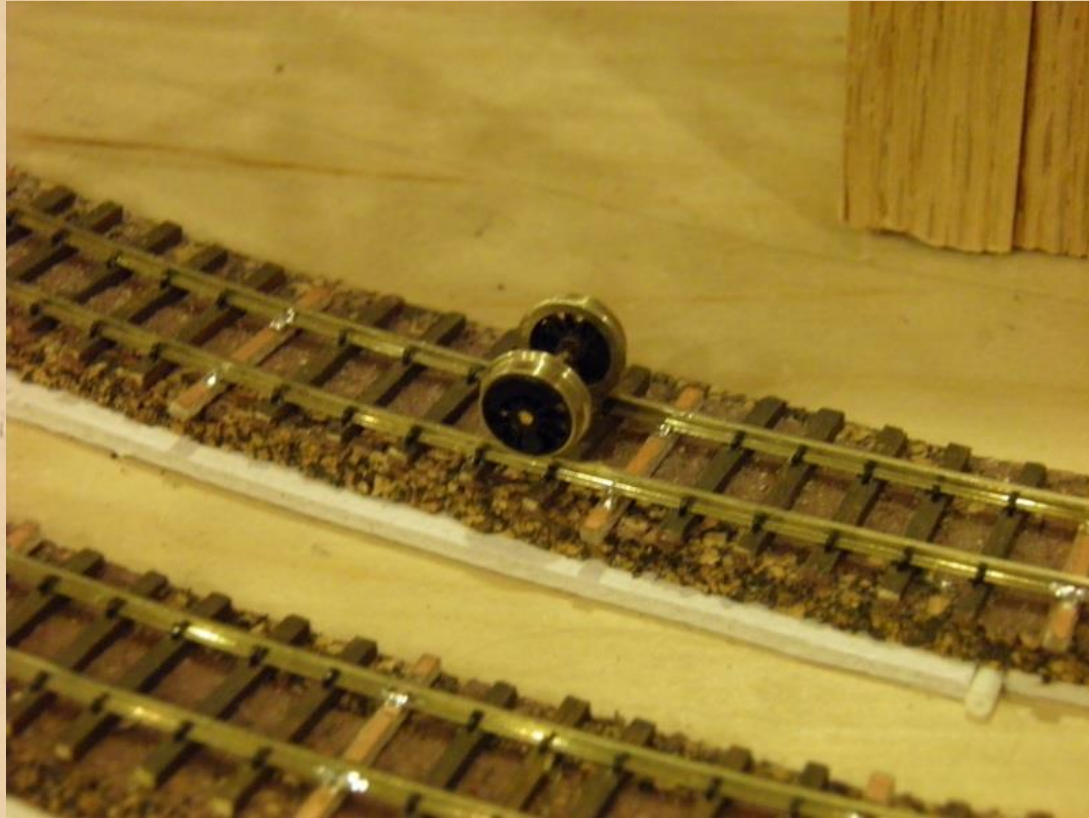
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## Challenges

- PSC C-16 centers only come in acetal if ordered in bulk
  - I needed 30, I got 100
  - And a good thing, too!
- How you drill out the center and crankpin (hand drill versus drill press)
- The NWSL tire has a two step inner profile

# Drivers



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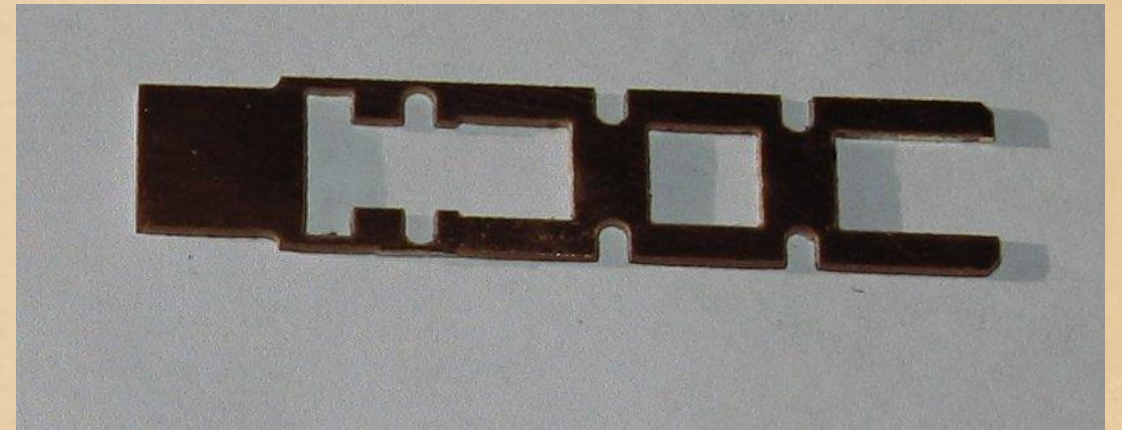
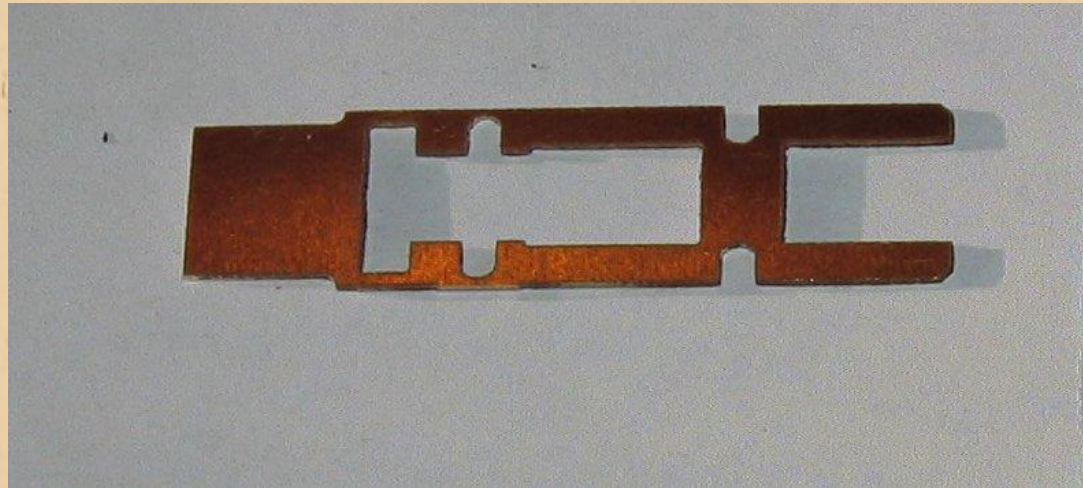
# The second challenge!

How to build the frames?

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# Design #1: Folding Brass Etched Frames

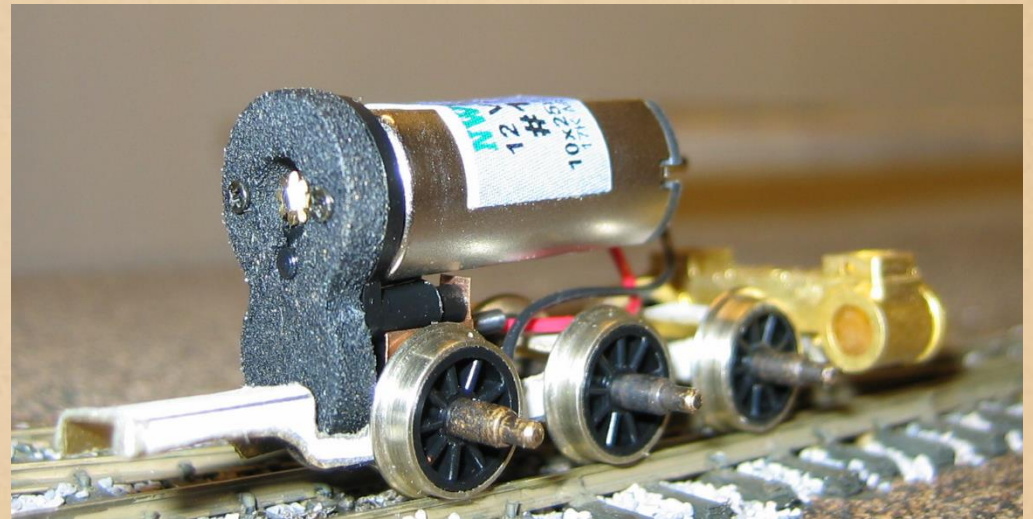
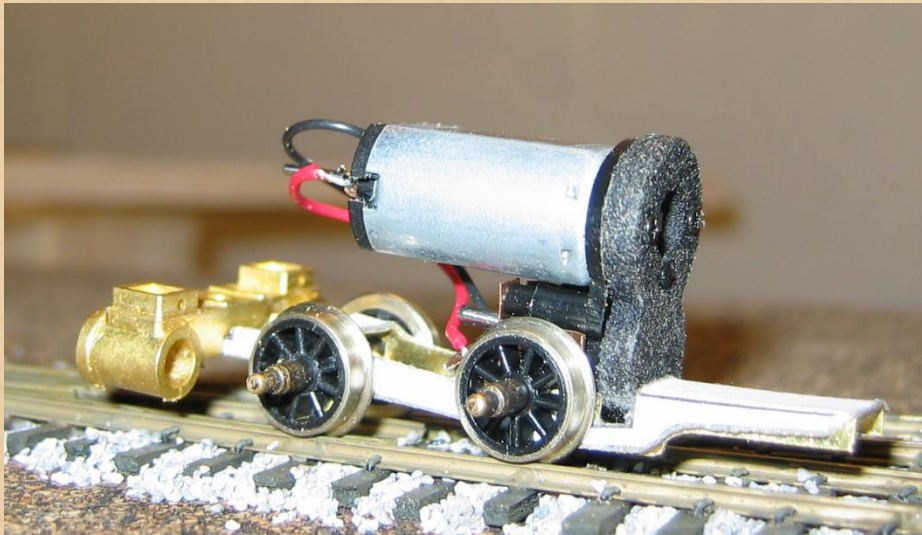
Idea



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# Try 1: Reality

## Problems

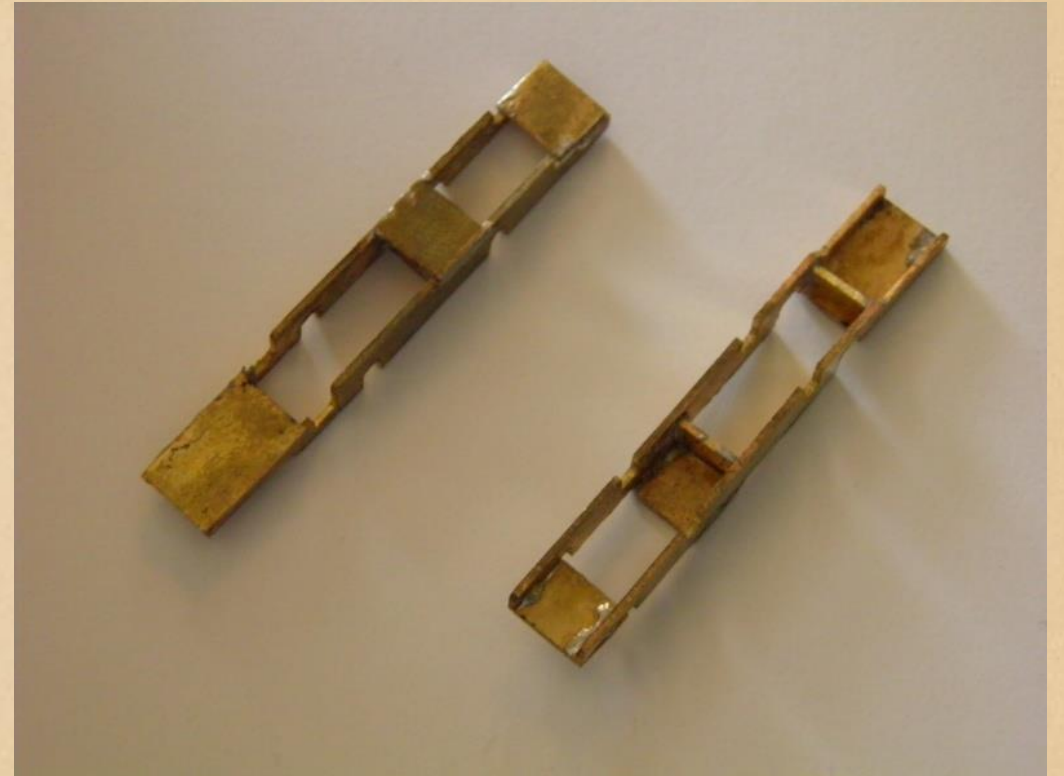


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# Design #2: Soldered Brass Frame

## Idea

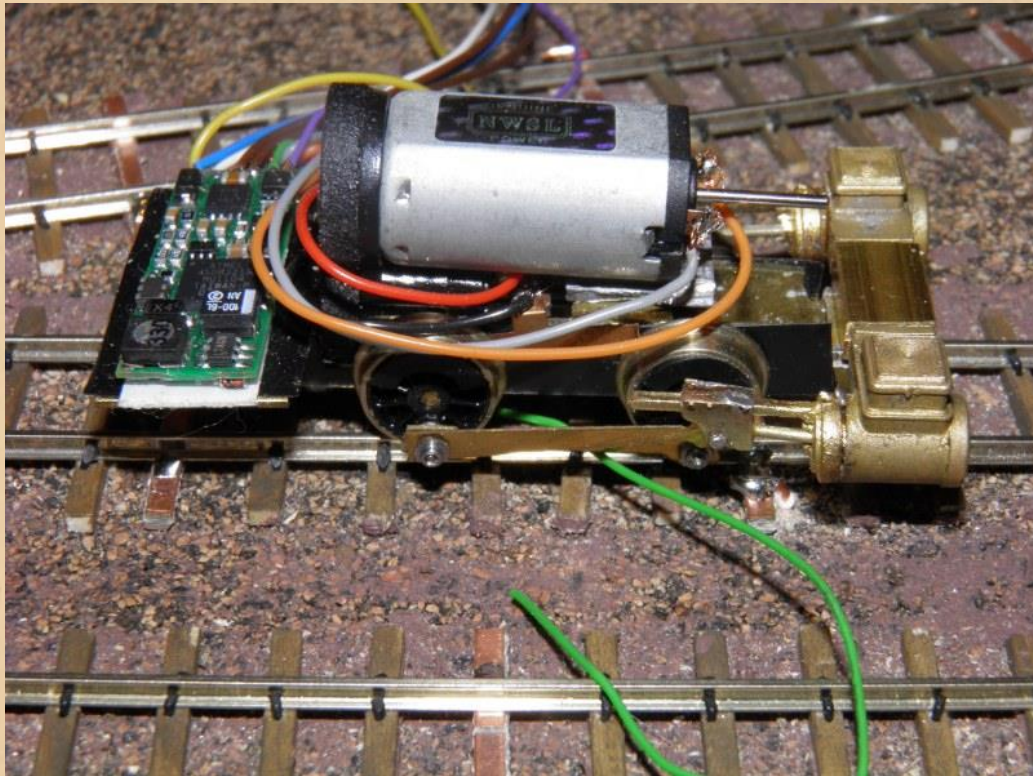
- “Old School”
- Brass sides with brass spacer
- (o-4-oT frame shown)



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# Try #2: Reality

## Problems

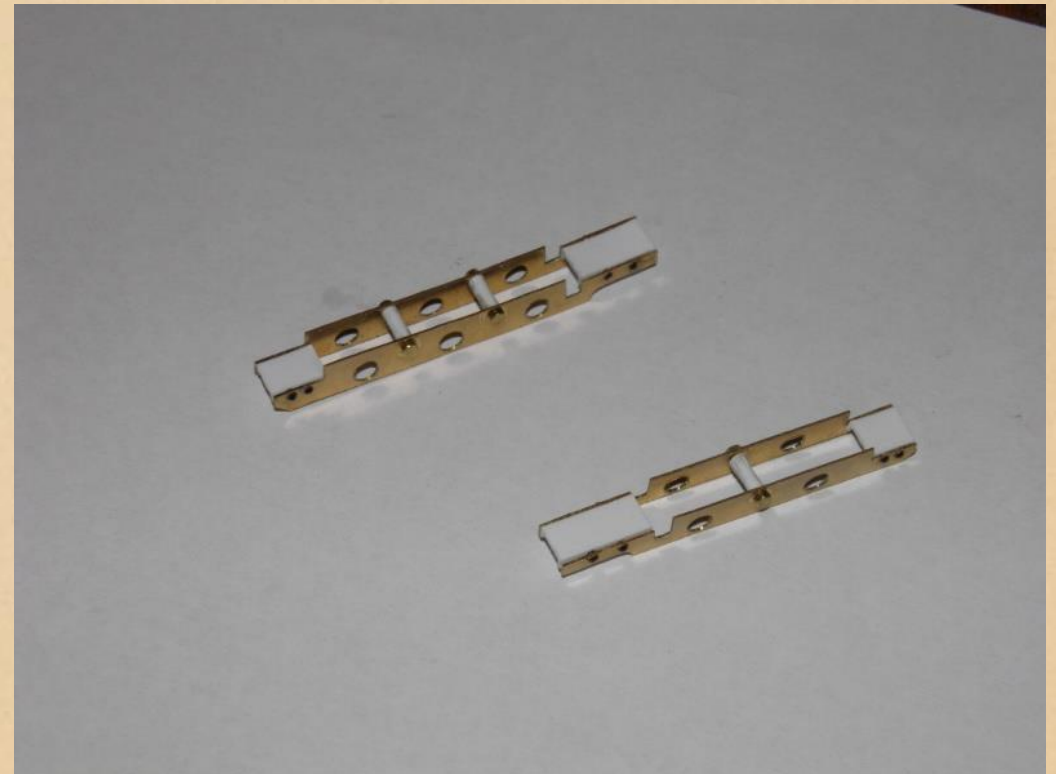


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# Try #3: Hybrid Plastic/Brass Frame

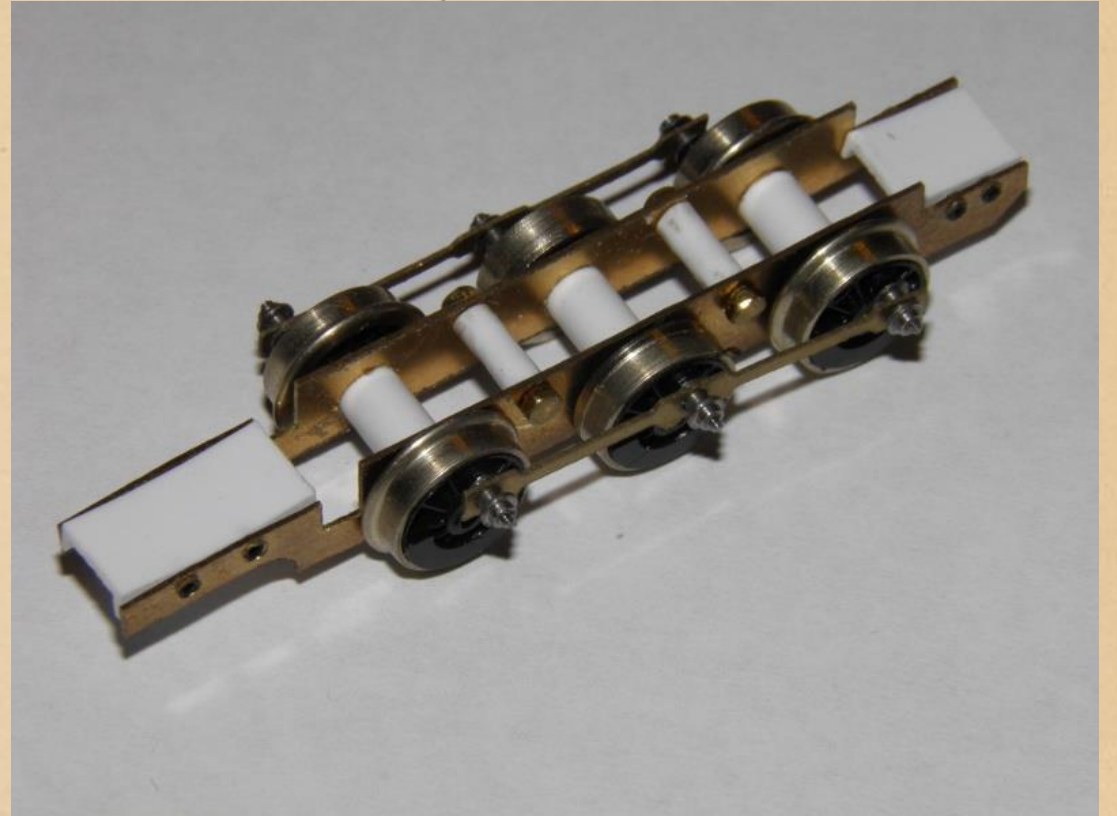
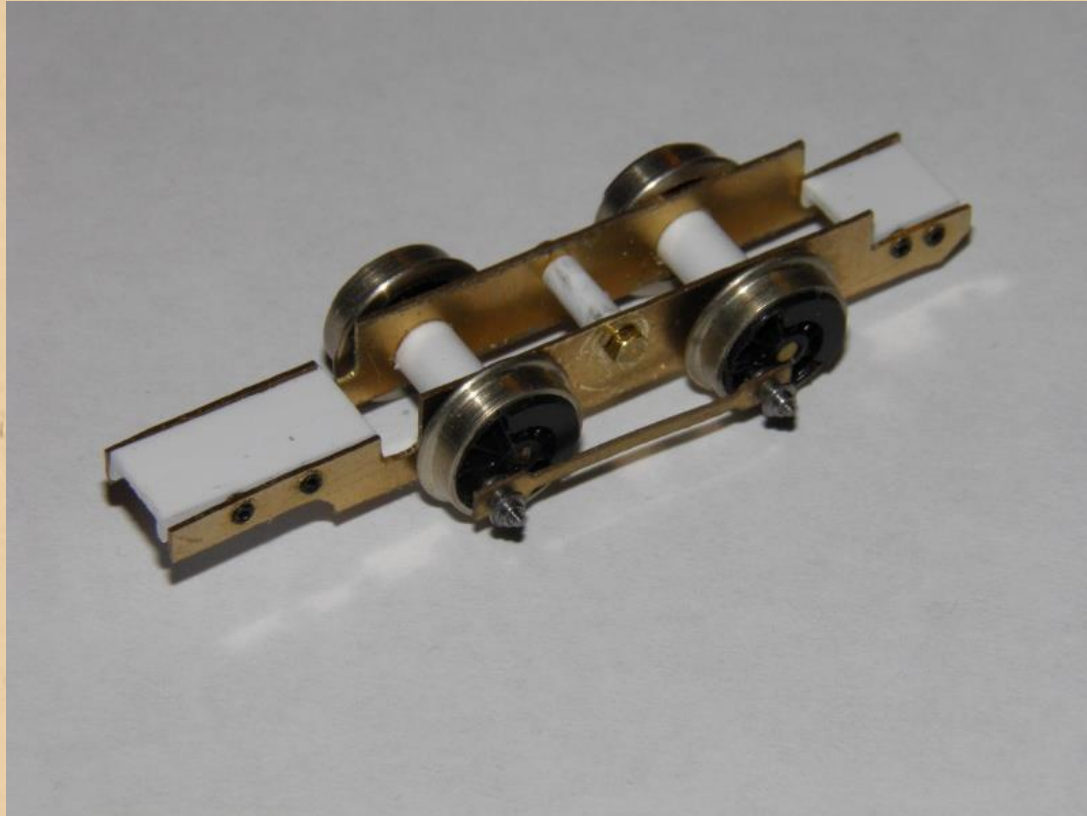
## Idea

- Plastic spacers to maintain electrical isolation
- Frame sides brass
  - Can be used for electrical pickup
- All assembly mechanical
  - “Easily” disassembled/reassembled



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# Fit Drivers and Side Rods



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# Fitting Gear Box, Adding Pickups and Motors

Why mechanical assembly/disassembly is nice!

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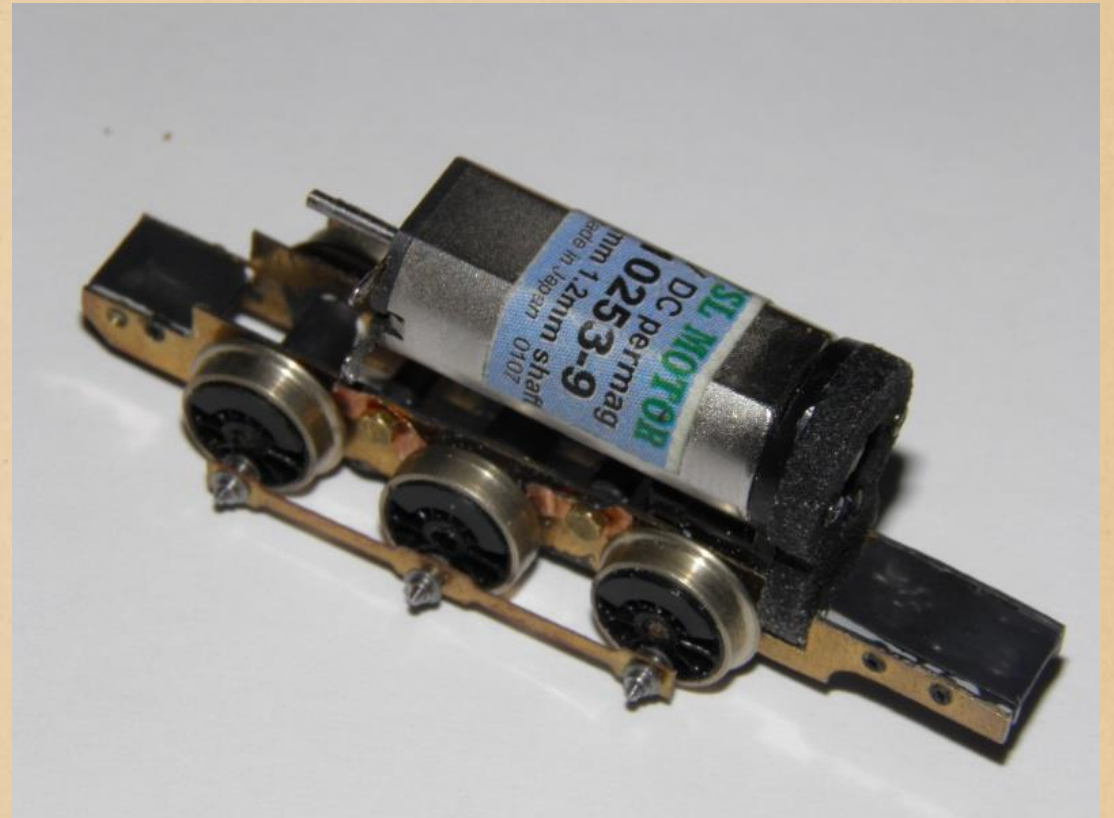
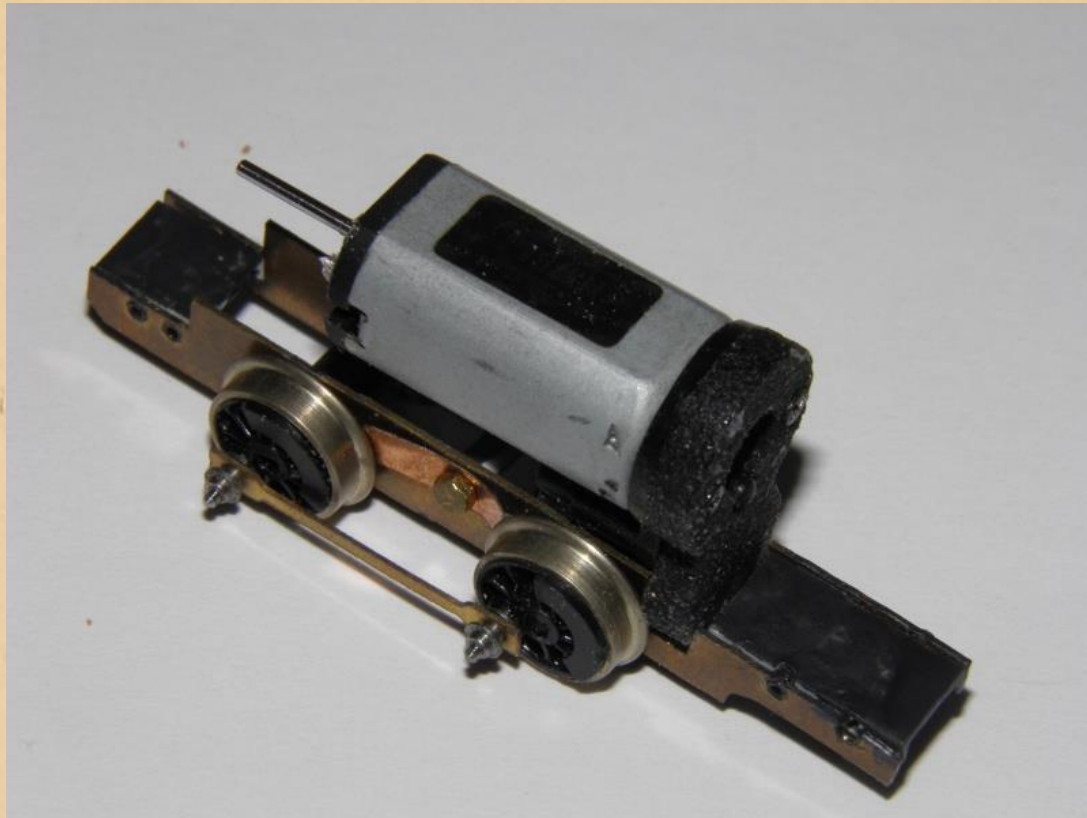


# Add Gear Box and Pickups



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Add motor and begin testing



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# Adding the Cylinder Blocks, Crossheads and Main Rods

Those crankpins need \*HOW\* much clearance?

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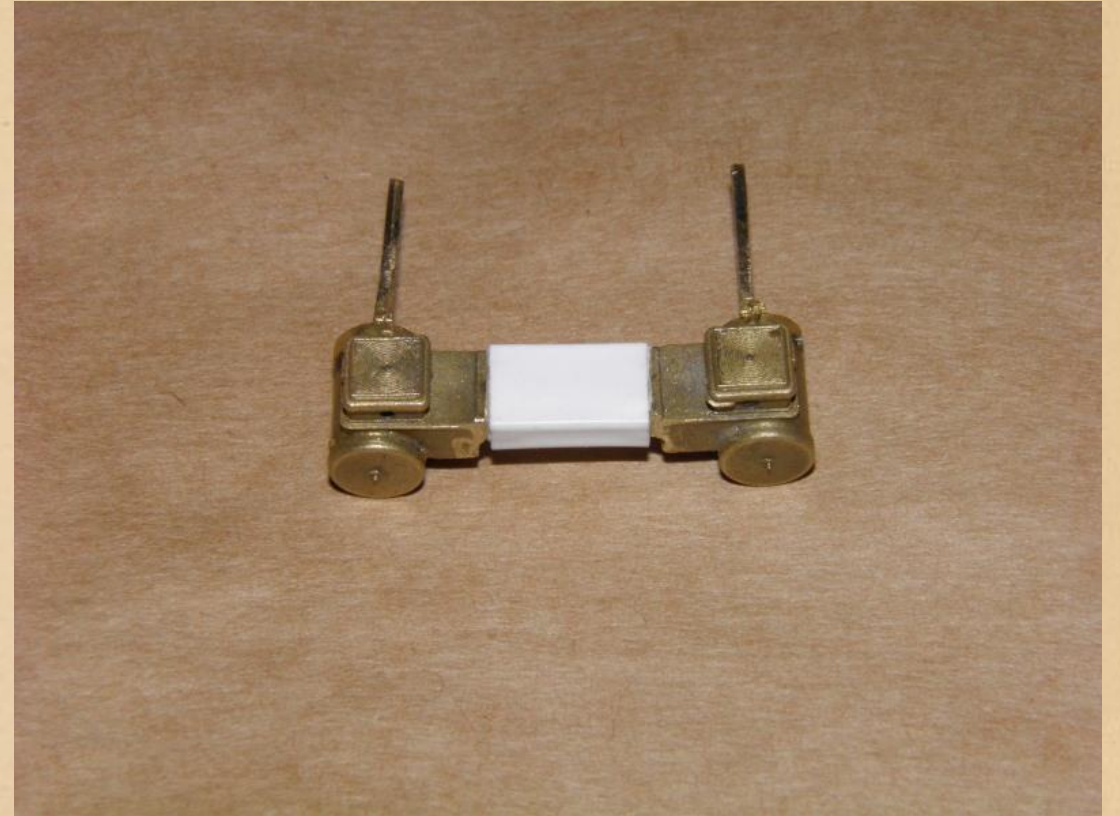
# Cylinder/Crosshead Fit

- From Precision Scale
  - Cylinders #31184
  - Crossheads #31201
- Clean cylinder components with micro files and solder
- Clean guide to fit crosshead
- **Problem: need additional mm clearance for crankpins**



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# Cylinder Block Dis/Re-assembly



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# Crosshead/Main Rod Subassembly (2)



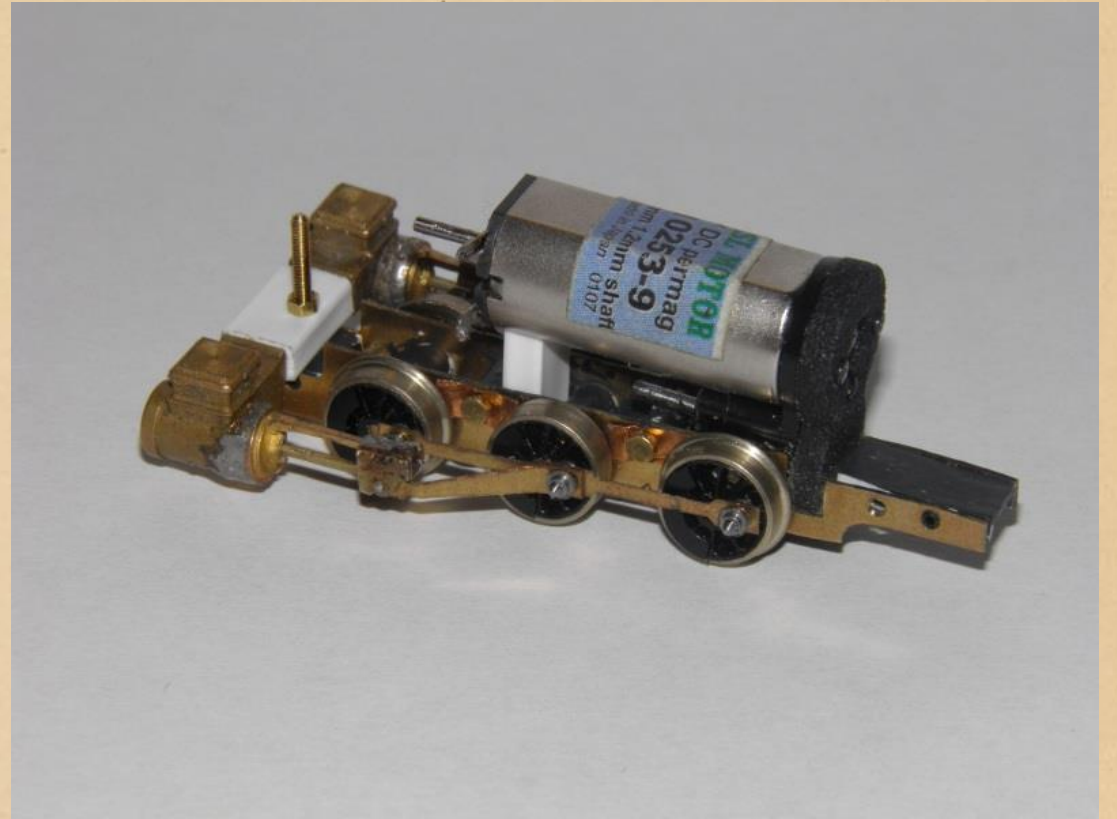
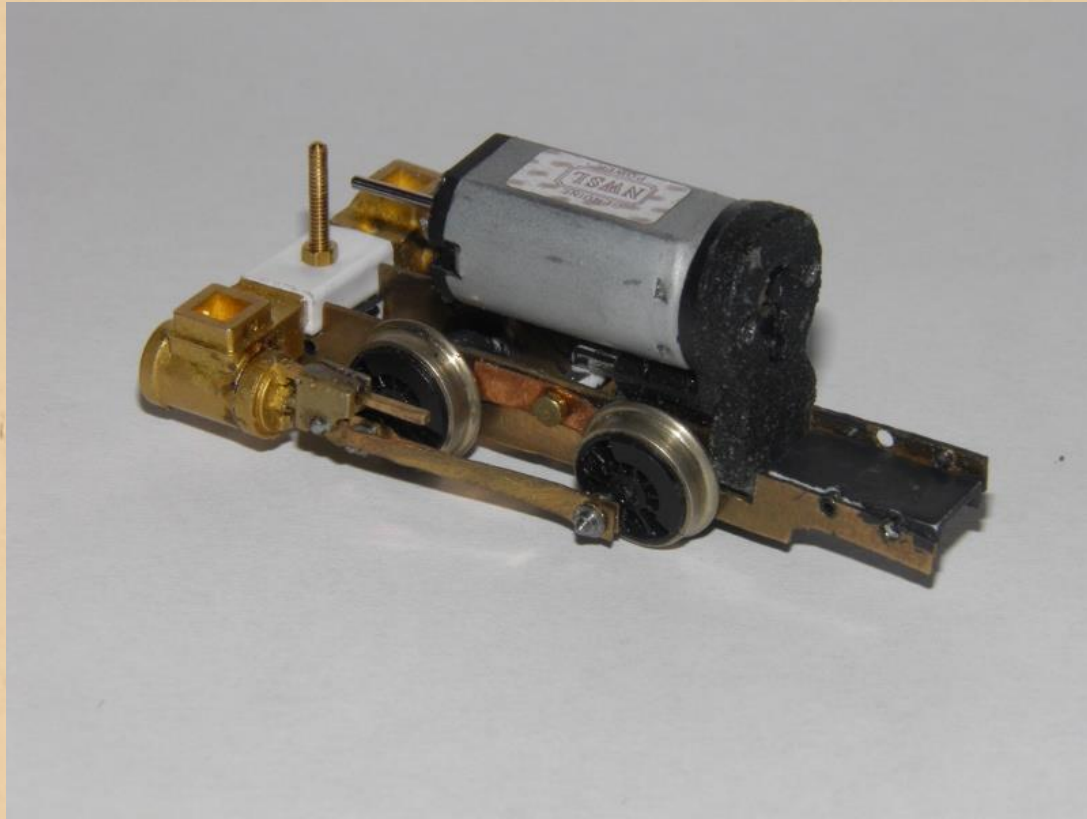
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# Adding more moving parts

*And finding more binding points...*

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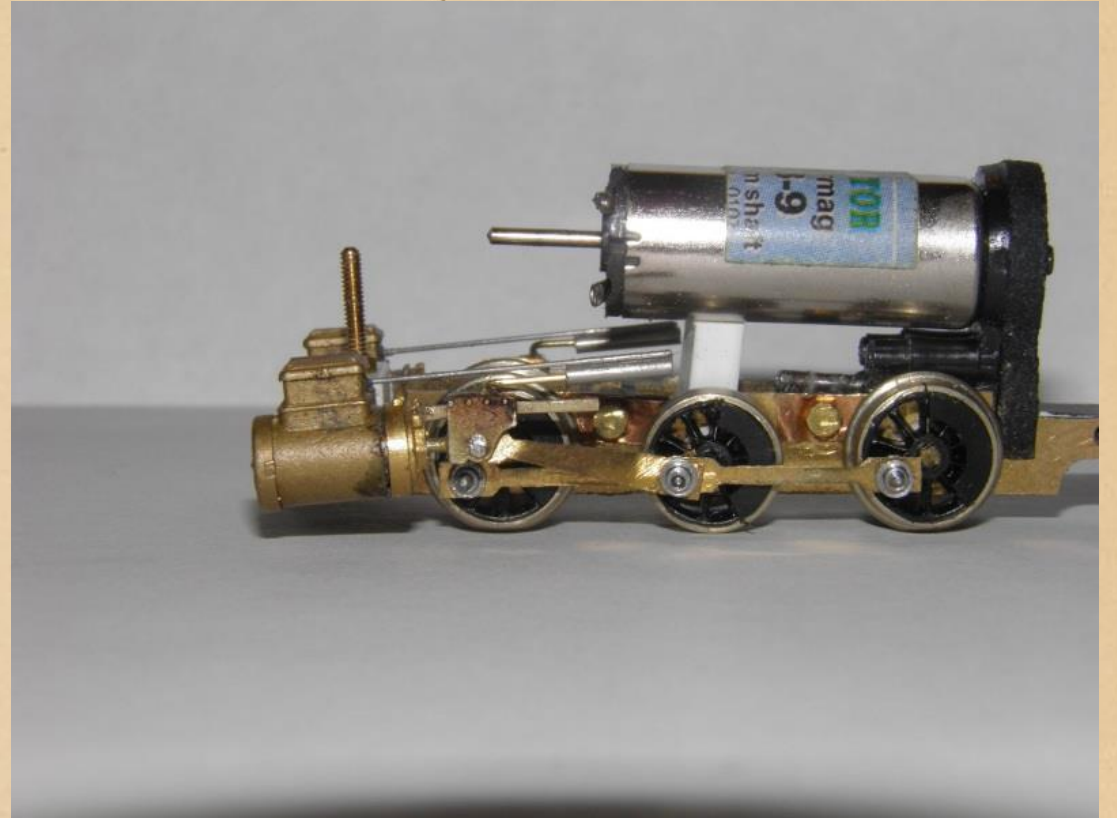
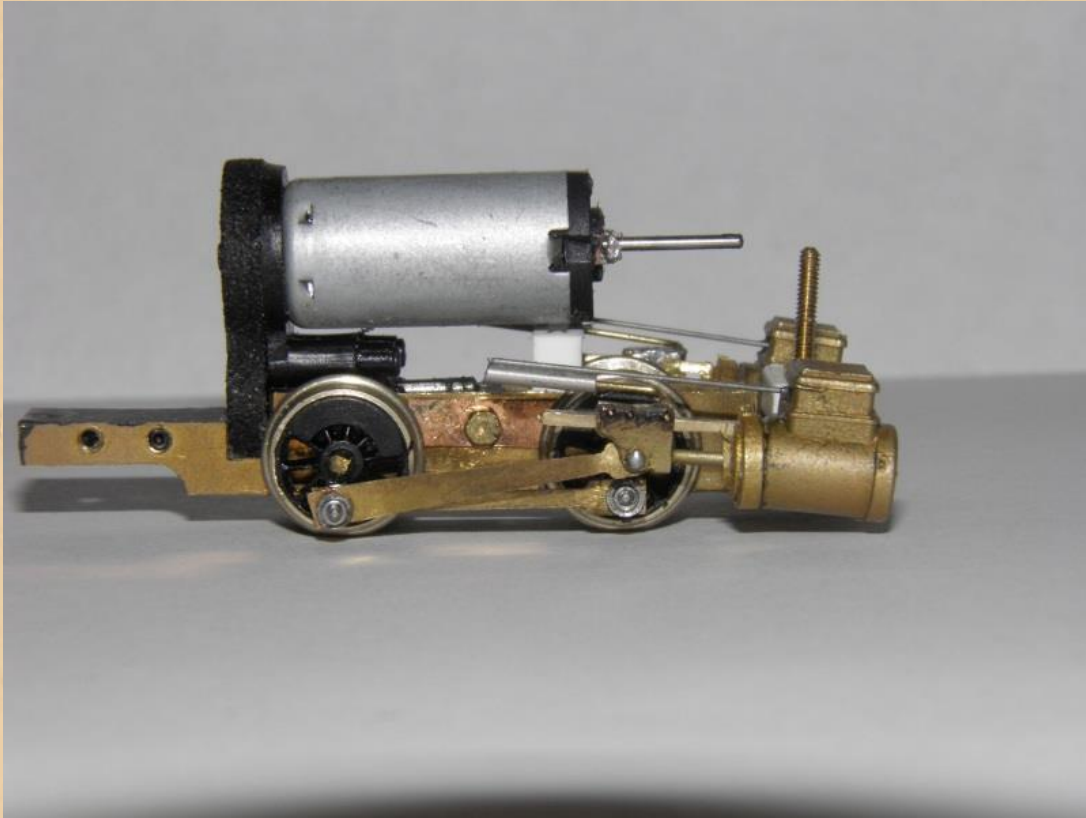
# Add cylinder block and main rods



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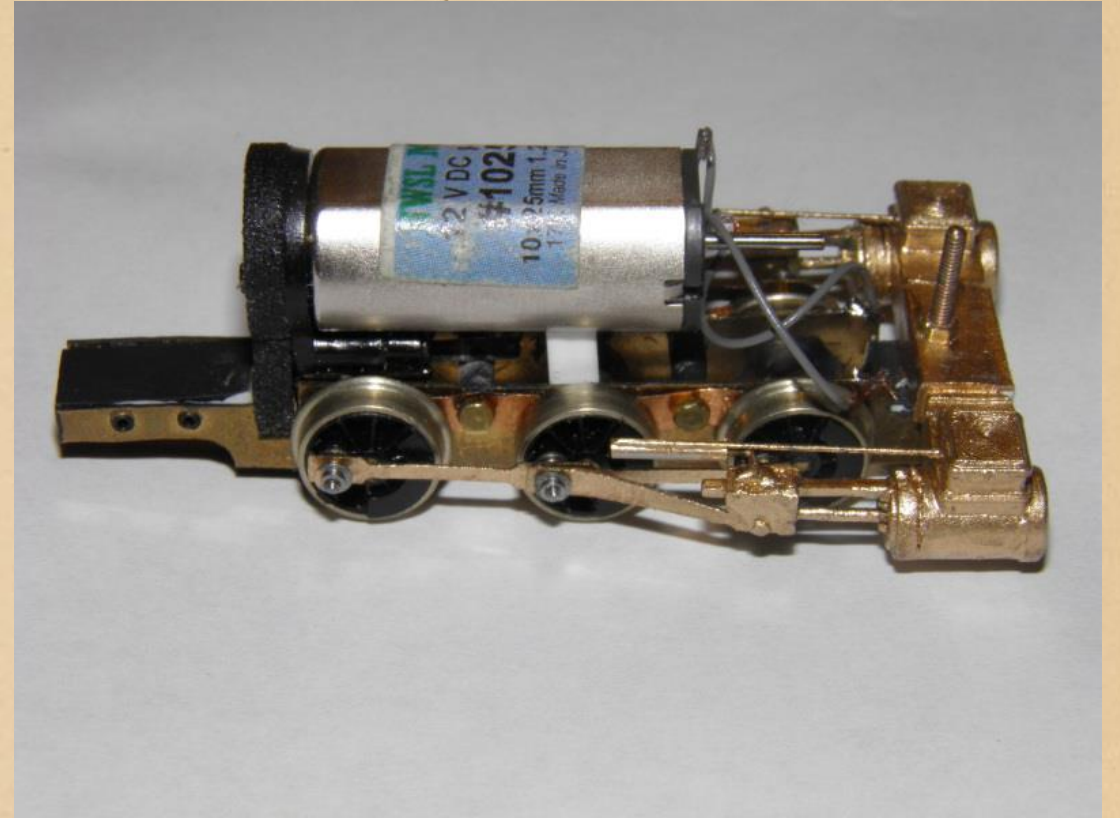
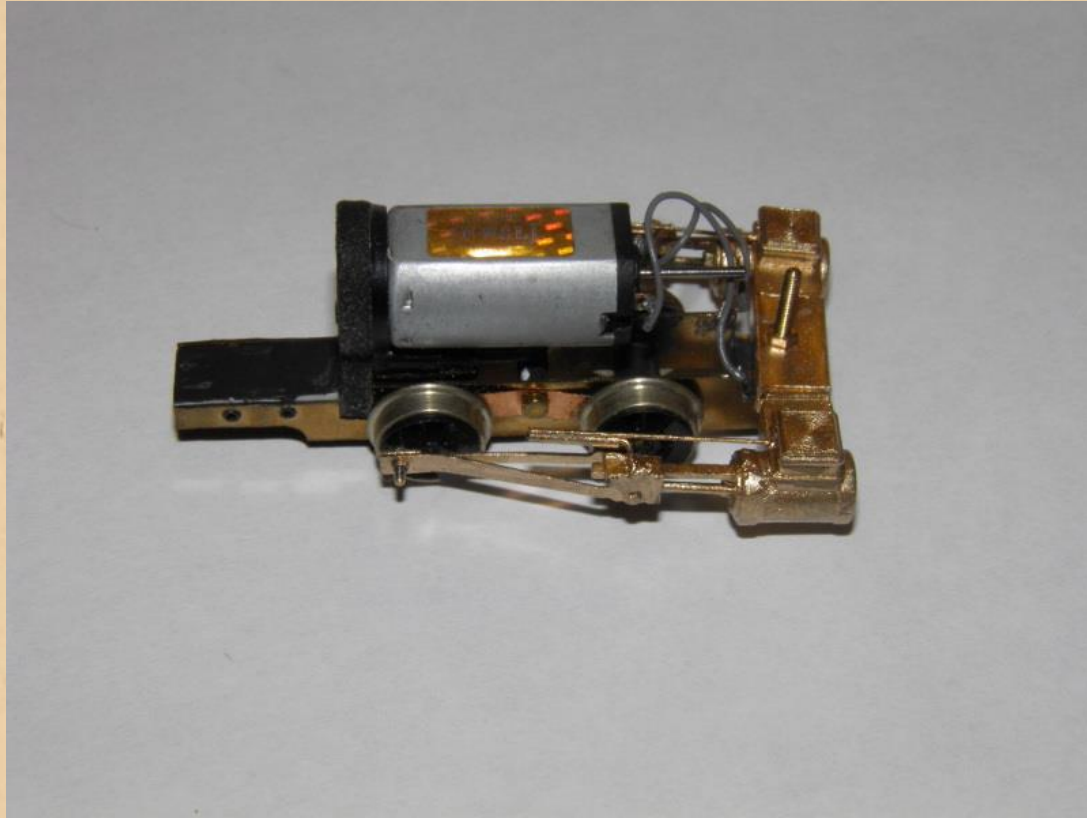


# Adding Running Gear



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# Paint things up



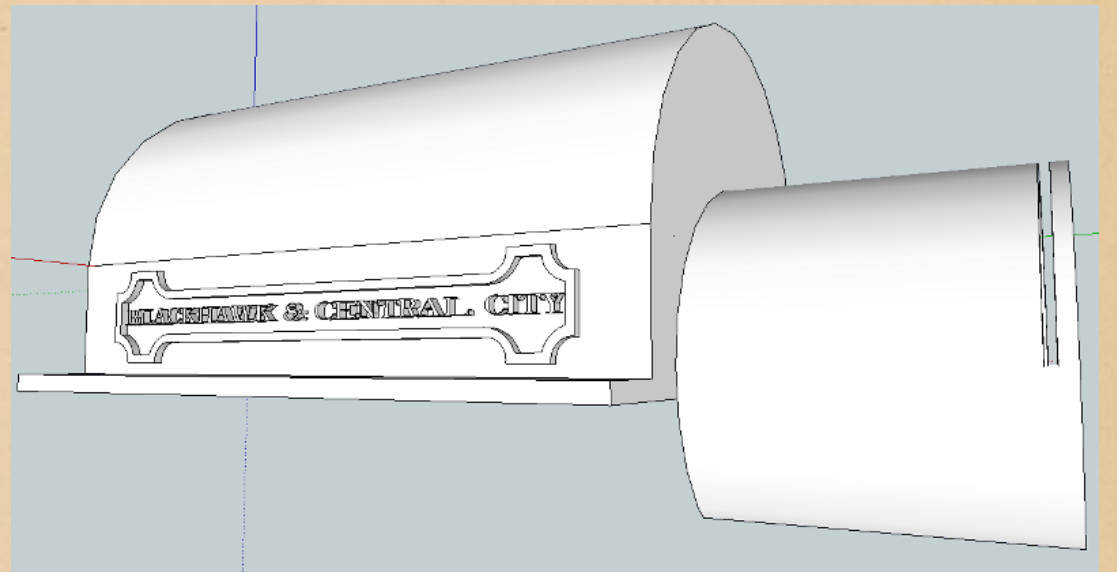
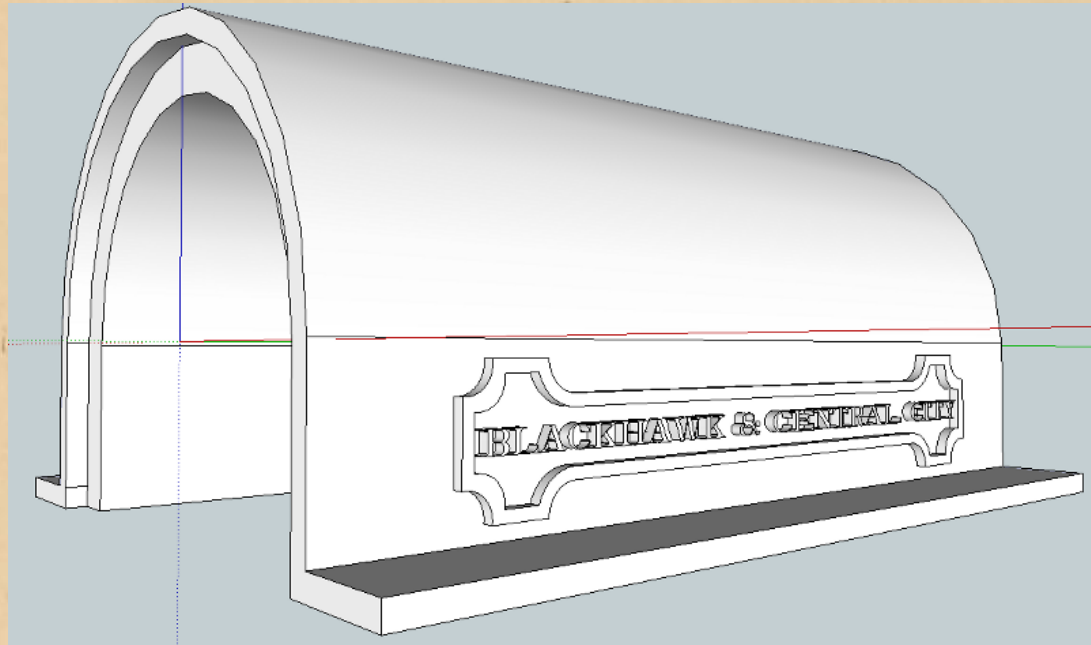
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# The Saddle Tanks

What would I do without 3-D printing?

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# The 3-D designs



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Hmm, maybe some repaint with primer?



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# Adding Details



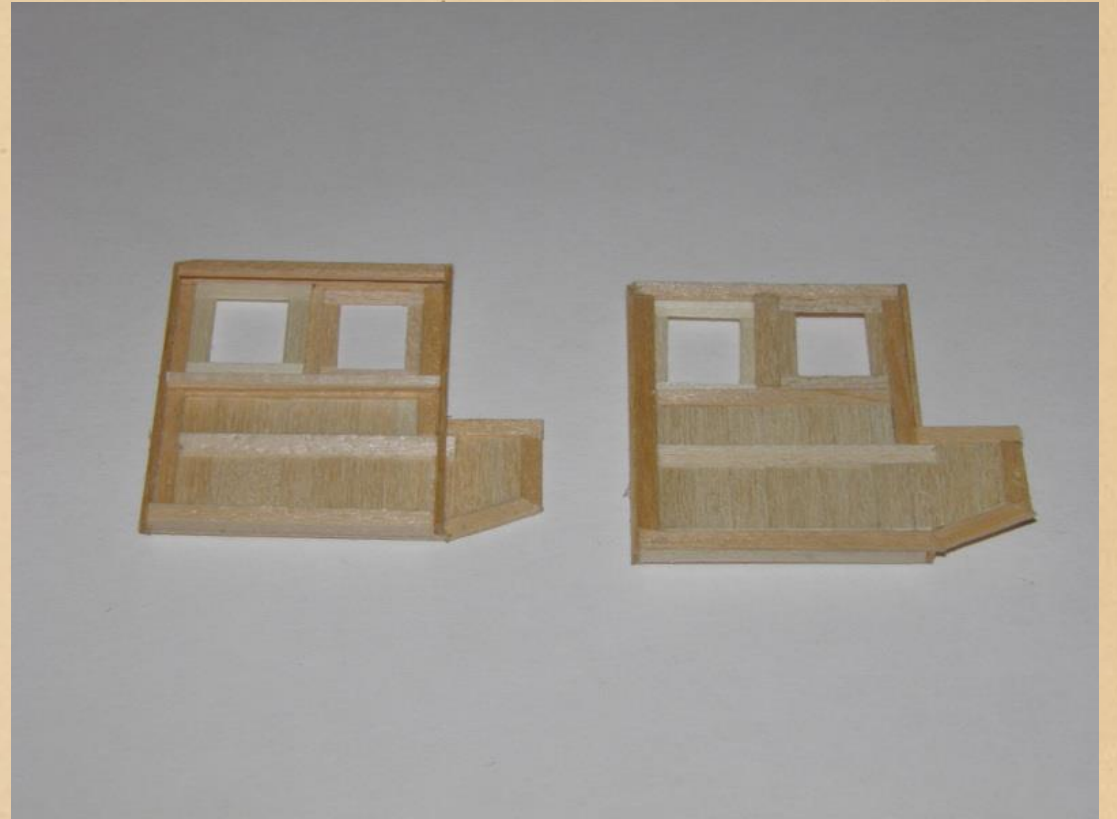
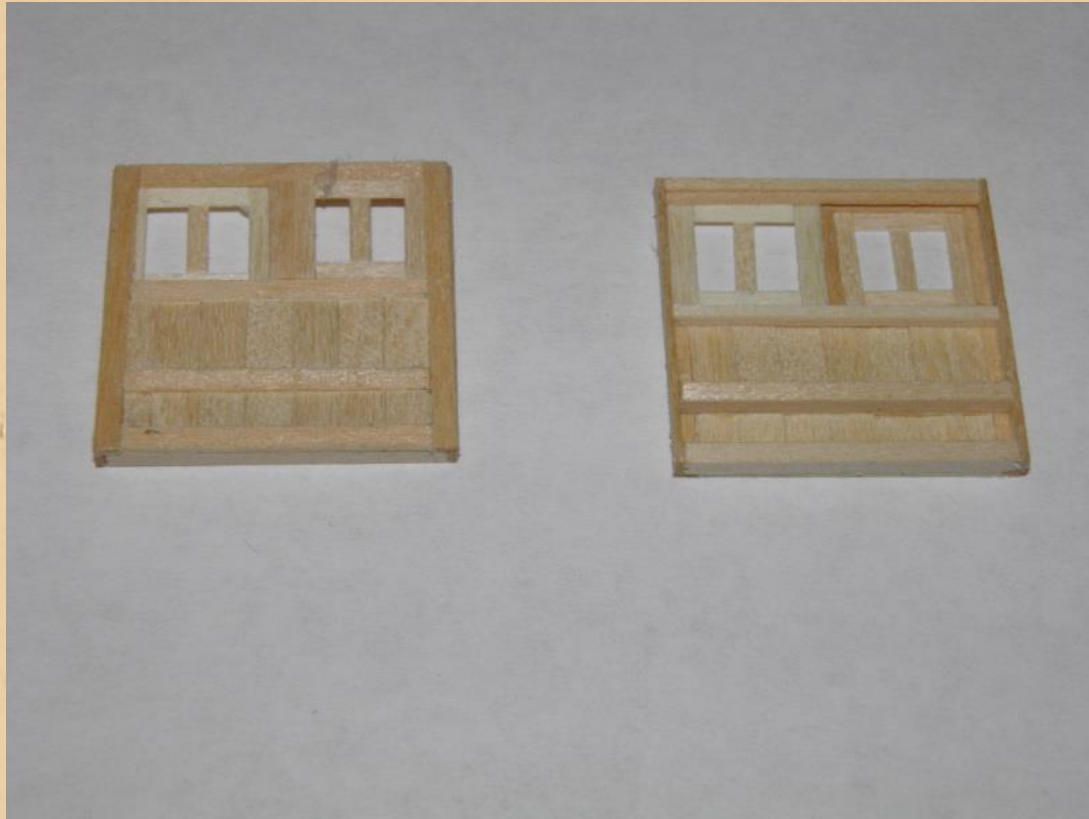
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# Cabs

Of course, they are made of wood – what else would they be?

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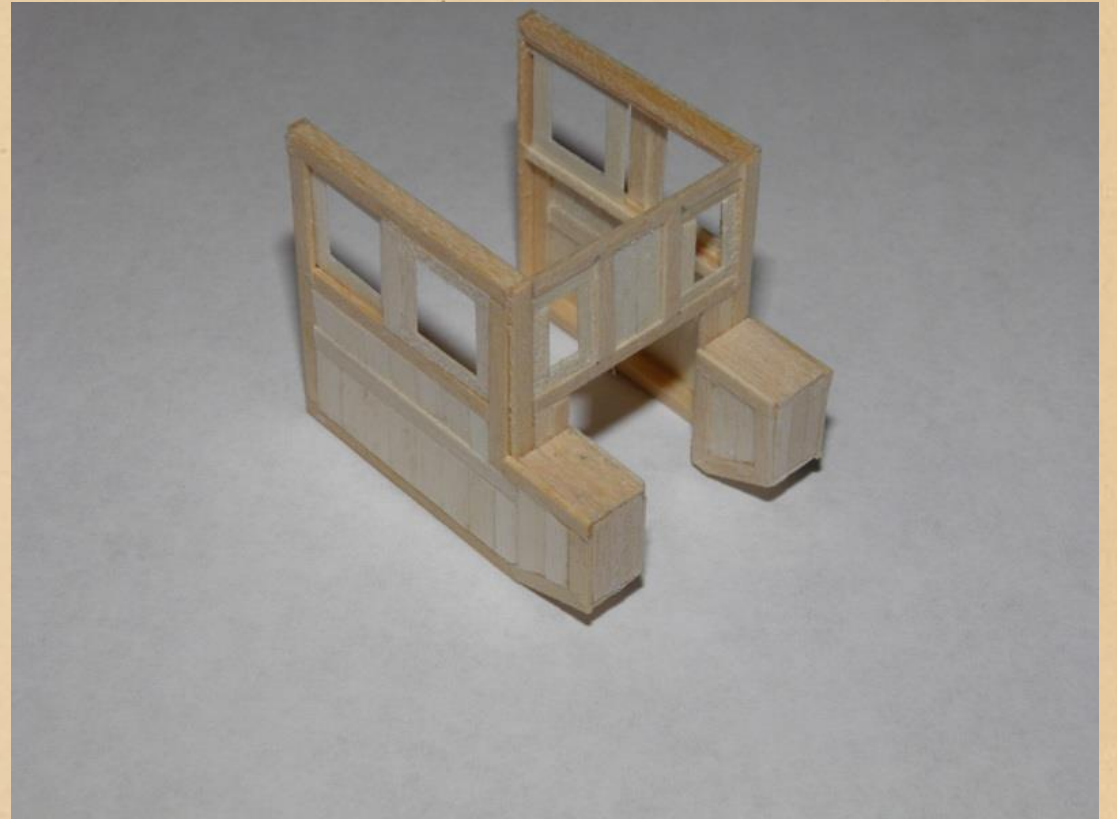
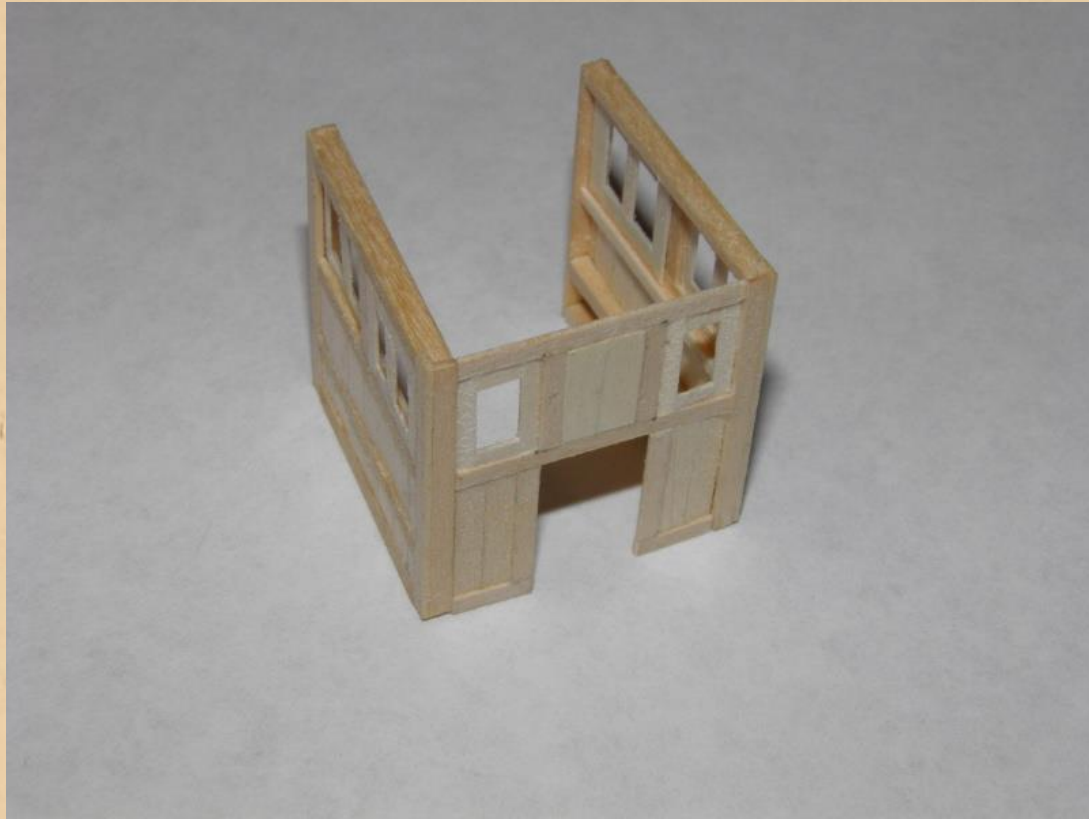
# Cab Sides



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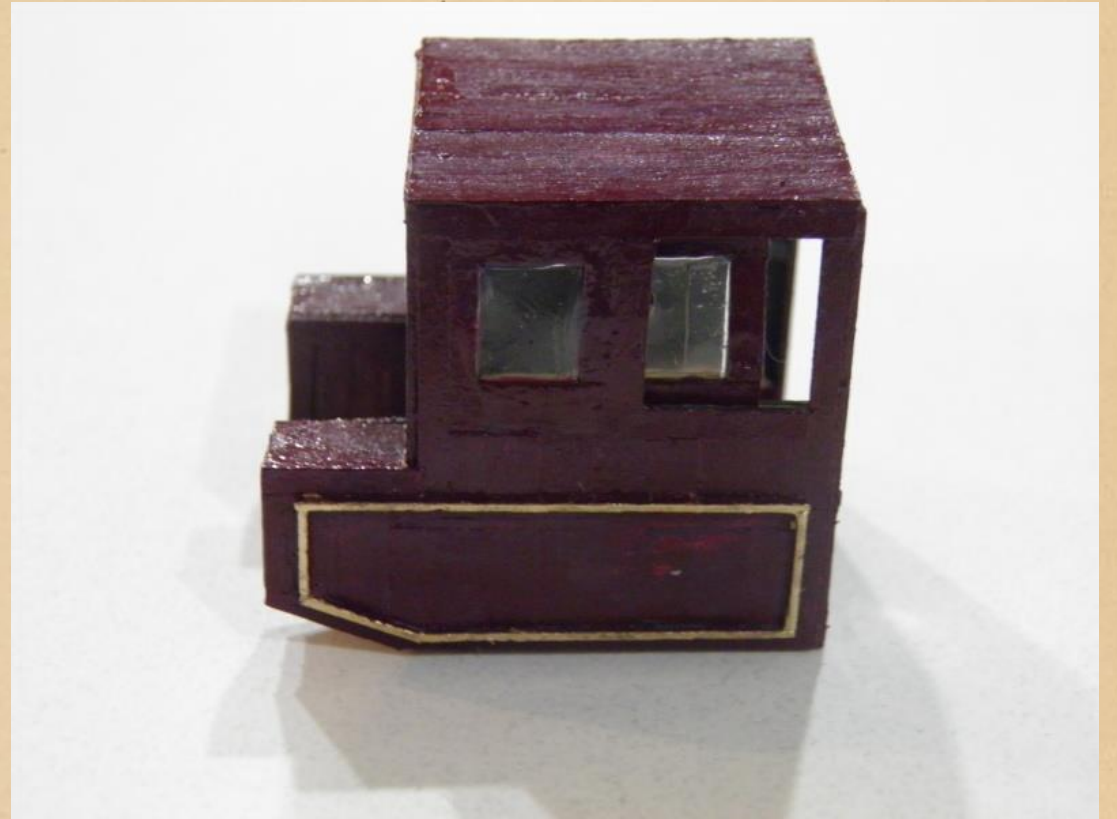


# Cab Front Panels



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That isn't so bad (well, yes it is)



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# The Front Details

Hmm, those cabs will definitely need weight, and a brass pilot? That's a dead short waiting to happen!

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# Pilot and Lantern



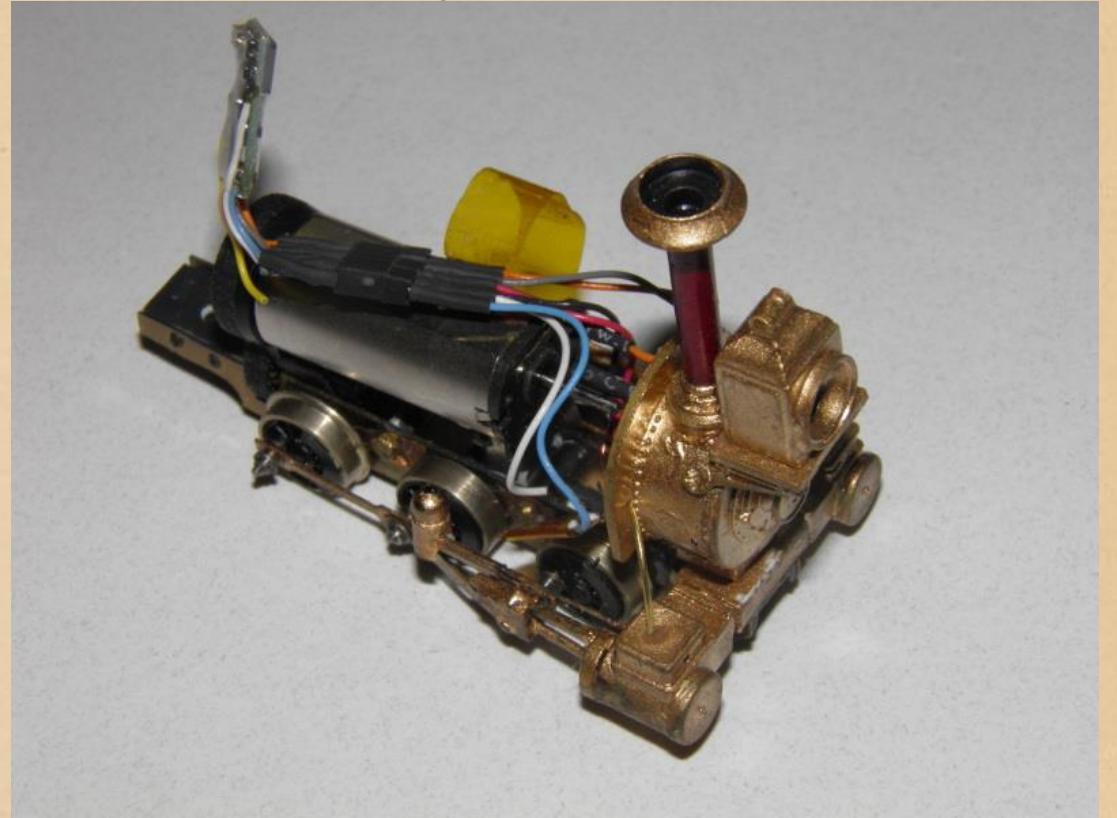
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# Lights, Color, ...



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# Saddles!



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# Wiring and Assembly

Or how to burn up decoders in several easy steps

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# First try: Sound

- CT SL75
- But, I burned through the decoders just looking at them funny  
(these engines weren't supposed to be live smokers)



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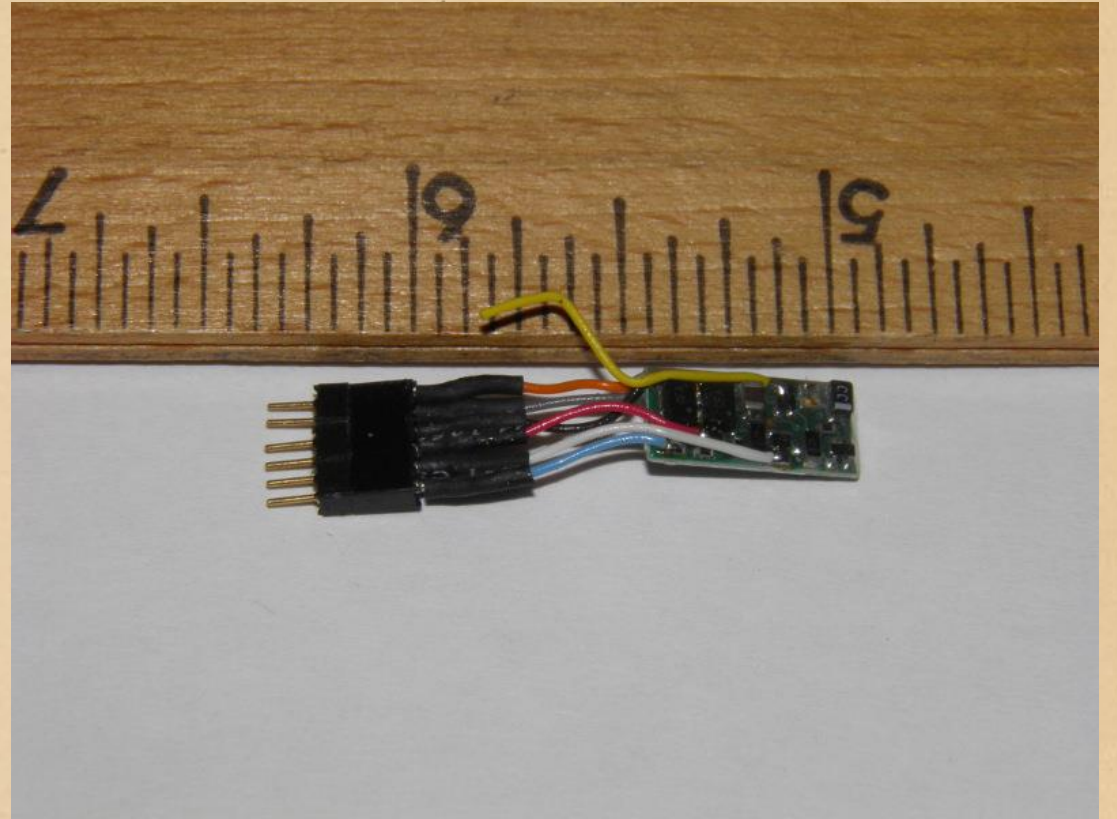
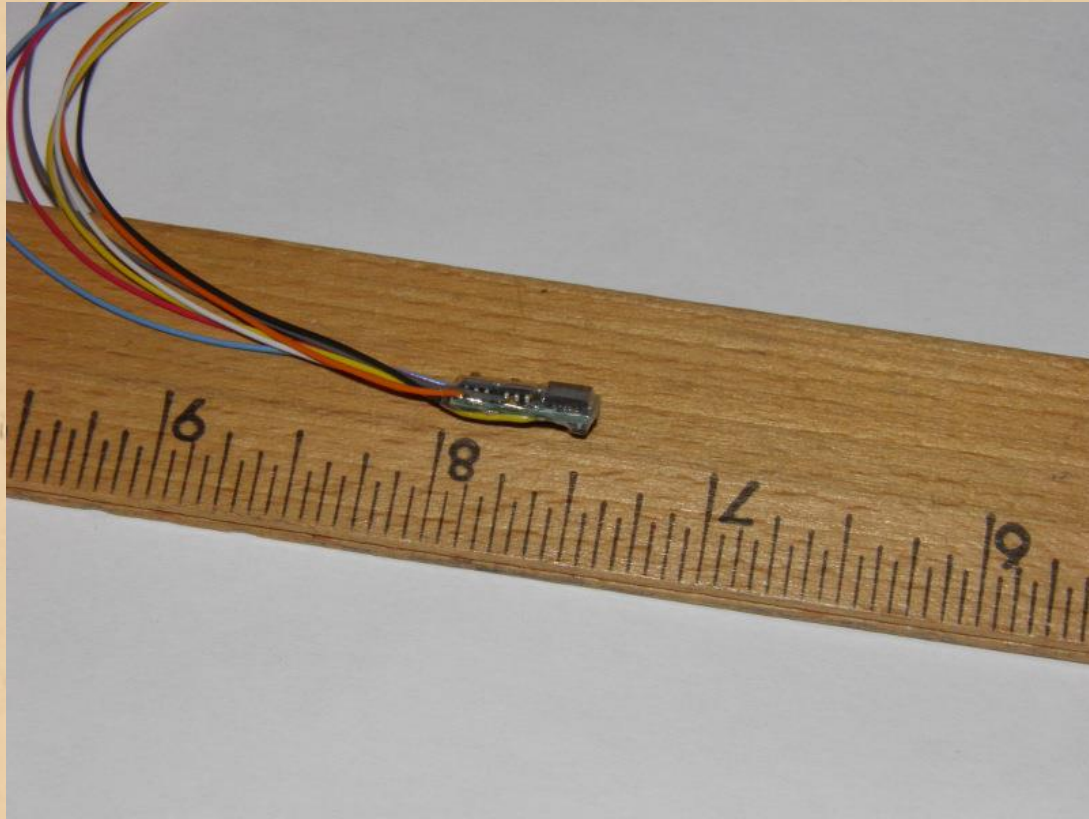
# Second Try: Digitrax

- Still haven't burned one out
- But, too big
  - Exactly how to run the wiring from the decoder under the cab to the motor?



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# Third Try: TCS Z<sub>2</sub>



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# Put it all together

- Will add the 0-4-0T photos once they are back together



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# Yes, it's not quite done 😊

- Transfer of power from rails to frame
  - Phosphor Bronze Wipers
  - Brass Wire
  - Tomar Wiper Shoes
  - PoB (Dead Rail?)
- Re-size the cabs
- Leaf springs
- Corrected brake shoes

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Thanks!

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