

# Track Cleaning Car

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# Problem Definition: N scale Track Cleaner

## Primary Functionality:

- Cleans the track
- Must be easier than current solution.
- Pushes a pad with cleaning solvent

## Secondary Functionality:

- If autonomously moved by a train, could take little to no effort at all to clean the entire layout.
- Could be replenished with tank of solvent
- Could look like a real train car

## Thoughts:

- While a physical tool would be easier to make, a cleaning-car is a preferable solution due to the ease of use.
- What would be the best protective coating be if I make a 3D printed solvent tank?
- Could likely use old trucks from busted train cars for the cleaner.

# Research of existing solutions

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# Track pad with handle

## Functionality

Allows easy way to slide pads with cleaning solution along track

## Pros

- Cheapest solution, easier to use and clean when done.

## Cons

- Tricky to clean inside tunnels, would have to add cleaning solution often

## Takeaways

- This design is effective, but not very versatile.



# Track cleaning tanker-car

## Functionality

- A tanker in scale with the track can be filled with cleaning solution and pulled by a locomotive while it slowly drips into the cleaning pad below.

## Pros

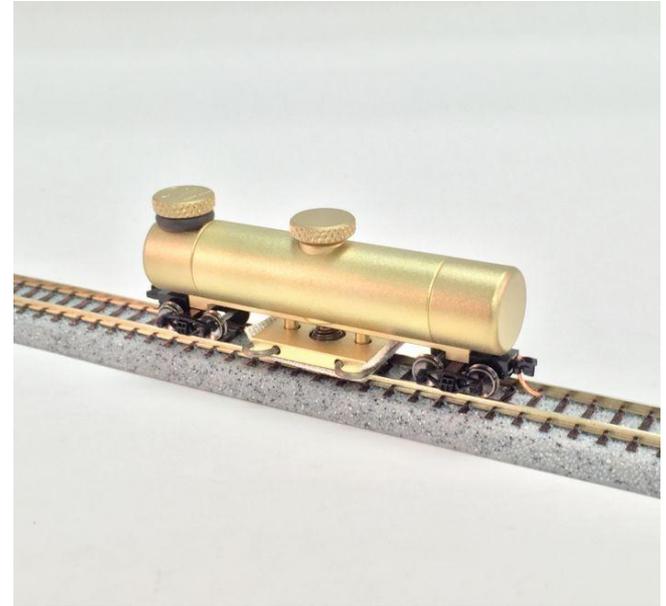
- Easiest way to clean track
- Highly versatile, can go on any part of the track a train can.

## Cons

- Premade ones are stupid expensive, going for \$100 in some cases.
- Would be hard to make even with a 3D printer.
- Needs wheels, which can't be 3d printed at such a small scale.

## Takeaways

- It's possible to do, though it would be a lot more difficult to create a working example.



# Attachable Trackpad

## Functionality

- Clips onto axle or undercarriage of rolling stock and drags along track

## Pros

- Really easy to make and use
- Low profile, less ugly then other solutions

## Cons

- Requires high accuracy 3D print
- Not as effective as other solutions, needs heavy rolling stock.

## Takeaways

- Easiest solution, though it's also not as effective.



# Takeaway Summary

- Can't find a product that solves my issue and isn't expensive
- It would be easiest to make an attachable pad or a pad with a handle, but it wouldn't be as versatile.
- My best option would be to make a tanker-car that can be filled with a cleaner like rubbing alcohol and run in a consist with a normal locomotive. The biggest plus to this design is that it won't have to be replenished with cleaner mid-clean, like would have to be done with alternatives. Additionally, this design has the most opportunities for prototyping.

# Constraints and Key Features

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# Primary Functionality

- Cleans track to the point that it is totally usable, and trains run on it with no connection issues. (an exception to this being if the train itself has conductivity issues.)
- Must be relatively easy to use and run.
- holds cleaning fluid and transfers it to a cleaning pad.
- Can't get caught on switch points (where 1 track splits into 2.)
- Can be pushed/pulled by a locomotive

# Constraints

Size: equivalent to the size of a average box car

Weight: moderately heavy, or about as much as a locomotive weights or more.  
(more weight = better abrasive effect on the track.)

Durability: can hold isopropyl alcohol or equivalent. (this chemical isn't acidic so a plastic tank isn't an issue, biggest concern is making it waterproof.)

Improved version will not test containment of cleaner, but rather the most effective design and dimensions to clean the track. (Ex. should it be short or long, high CoM or low, ect.)

Key Feature 1:

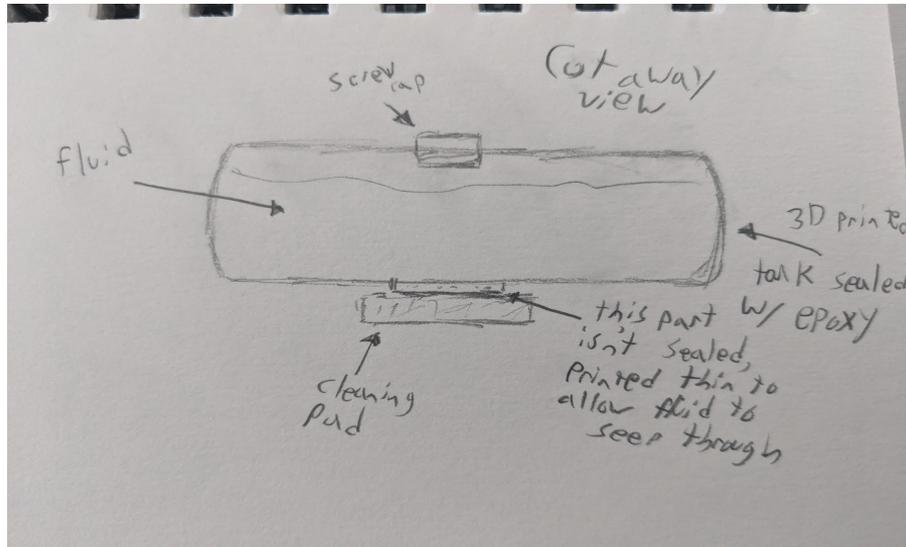
## Helping Power

- The cleaning car itself doesn't run on its own, instead a locomotive that preferably has more tractive effort than others and is the most reliable is used to either push or pull the car along the track.
- Pushing from behind sounds like a better idea, as if it were pulled the locomotive in the front would be running on the still uncleaned track ahead before the cleaner gets a chance to clean it.
- Needs to use more recent Knuckle couplers instead of older rapido style as all of my locomotives currently only use the Knuckle type coupler. This will allow the locomotive to keep the car with it instead of it rolling away if it goes downhill, ect.

Key Feature 2:

## Fluid Control

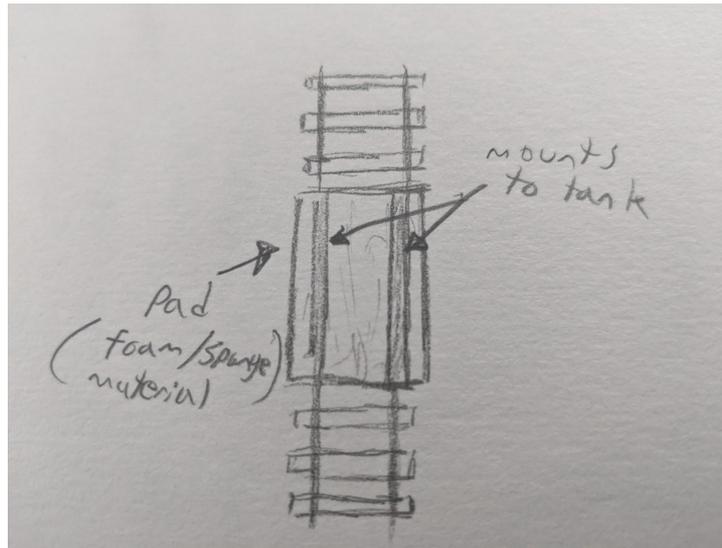
- Tank mounted on wheelbase holds cleaning fluid, can be filled from the top with screw-cap.
- Fluid is directed through passageway not sealed with epoxy, as this area of 3d print will have small air gaps making it slowly seep into the cleaning pad.



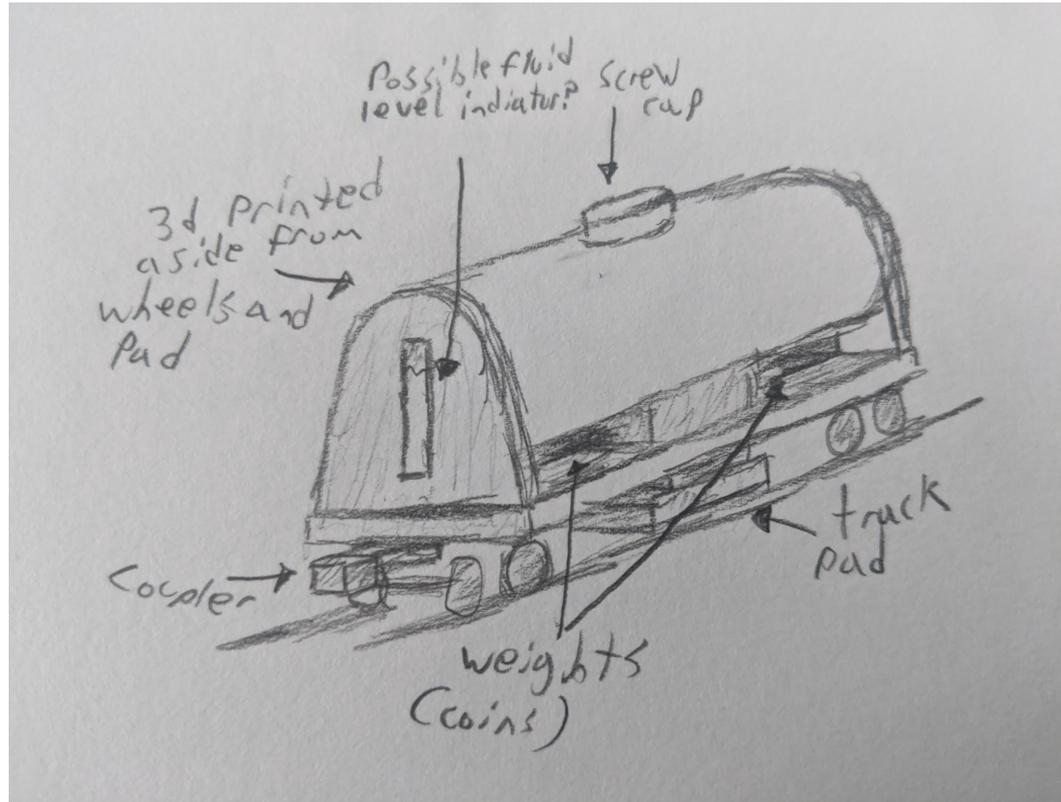
Key Feature 3:

## Cleaning Pad

- The cleaning pad absorbs fluid that seeps from the tank, helping it in removing oils or grime, along with it additionally dragging along the track with weight to add an abrasive factor.



# Full Prototype



# Prototyping

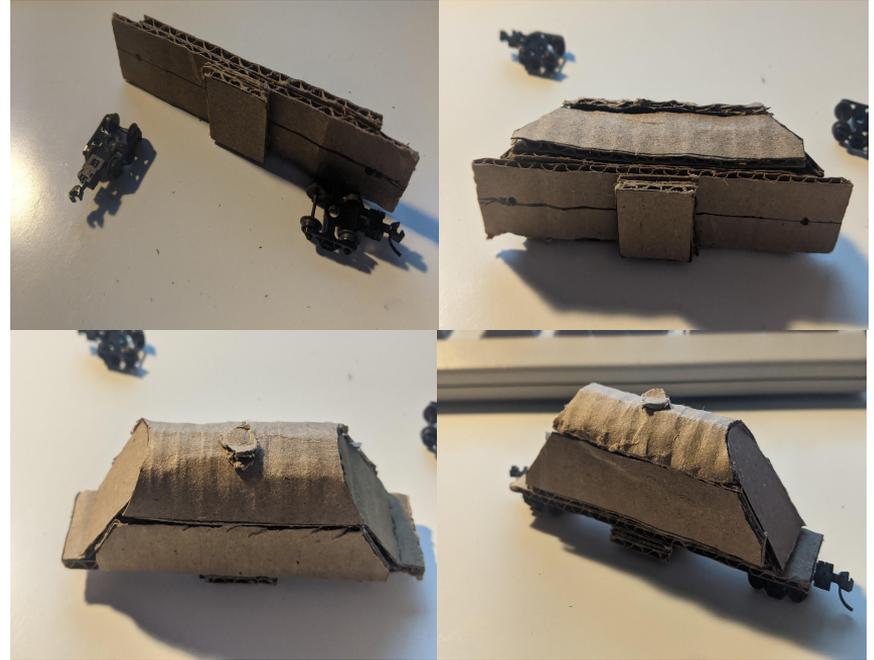
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# Phase 1 Prototype Build

I learned it'll be pretty tricky to build a complete cleaning car entirely by hand, so I'm thankful I have a 3D printer.

I liked how the overall design turned out, we'll see how well it fits through tunnels

Next time the tank will be inverted, so gravity will force a higher amount of alcohol to the cleaning pad.



# Phase 1 Prototype Test

## *What is the purpose of the prototype*

- To test the size constraints of my final design, and to decide more on the aesthetics.

## *How did you test your prototype (User Testing, Simulated Test, and/or Visual Evaluation)*

- Ran it through some completed tunnels on the layout to check if it would fit
- Checked looks in comparison to other locomotives

## *Results*

- Seems like my chosen size constraints will work, and it seems like won't look too out of place with other cars and locomotives.



# Phase 1 Prototype Evaluation

***What aspects of your design and/or build do you like?***

- Shape and Size
- Simple yet effective design

***What aspects of your design and/or build do you not like?***

- Tank shape

***How are you going to improve your design?***

- Tank will be flipped to better allow for more efficient flow to cleaning pad.



Rough Draft

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# Rough Draft Build

## *Something I learned was*

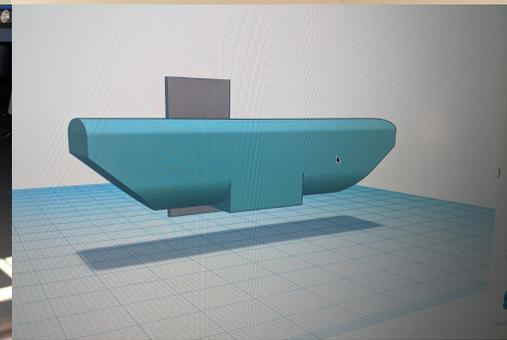
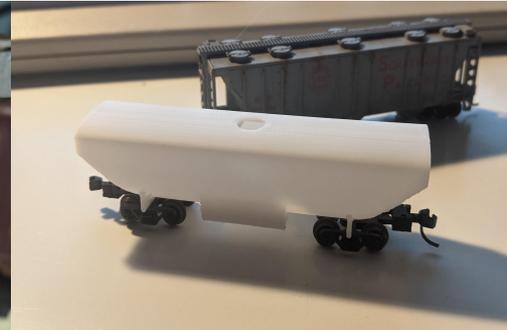
- Some design aspects don't favor 3D printing very well.

## *Something I like was*

- Overall tank design
- Size and dimensions fit perfectly with rolling stock

## *Something I will not do again*

- Bottom of tank had shallow taper going to the hole, will exclude that in the final design as it had issues printing.
- May use pop on cap instead of screw on, as again it'll be easier to print and easier to use.



# Rough Draft Test

*The key features my Rough Draft addressed were*

- Dimensions
- Tank flow

*To test my Rough Draft I did a (User Testing, Simulated Test, and/or Visual Evaluation)*

- Visual evaluation and simulated test.

## **Results**

- Tank design will be certainly used in final
- Flow test of the tank couldn't be performed, as bigger hole formed from failed print.
- Tested different materials to be mounted to the tank outlet, and decided on microfiber cloth.
- It absorbs cleaner reasonably well, and has the most friction against the track without catching on everything like foam does.



# Rough Draft Evaluation

*What aspects of your design and/or build do you like?*

- Tank shape/design
- Ease of use with the rest of rolling stock

*What aspects of your design and/or build do you not like?*

- Weight (far too light to properly drag along track)
- Failed parts of the 3d print

*How are you going to improve your design?*

- Remove hindrances on 3d model that negatively affect print
- Add an area to weigh the car down with coins
- Add platform with places to pin in wheels on either end
- General aesthetics (can't paint it as cleaner would melt off acrylics or enamels, so will use a different color plastic)



# Final Iteration

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# Iteration 1 - *Wheels*

## *I chose to focus on this area because*

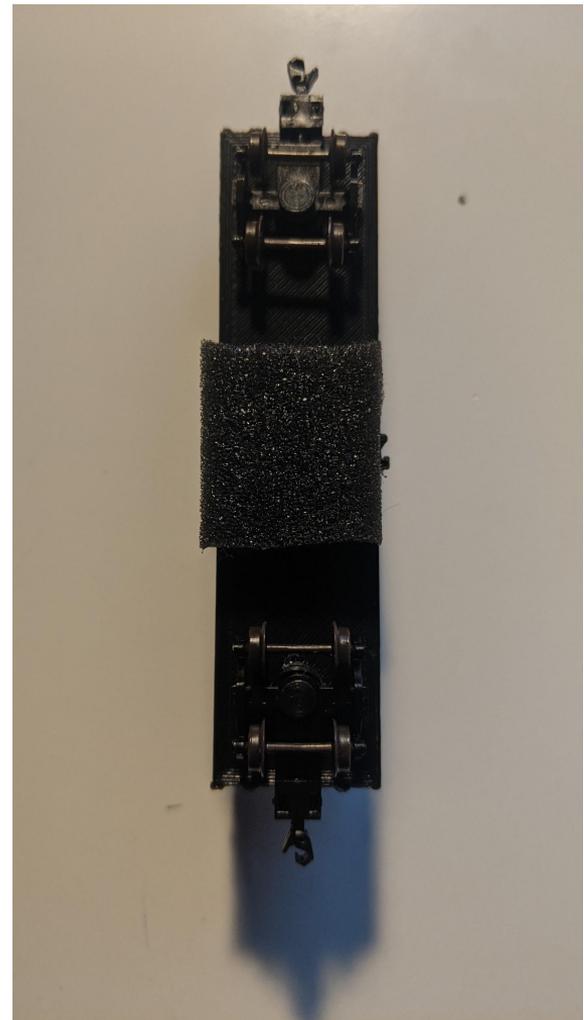
- My first printed draft did not have a way to connect to trucks

## *My approach*

- Took measurements from other model cars to create a spacer and pin

## *The results*

- Tried a final design a couple times, as Mark 2's spacer design was too small to print reliably. mark 3's was enlarged and made a separate glued piece to make printing easier.



# Iteration 2 - *cleaning pad and outlet*

## ***I chose to focus on this area because***

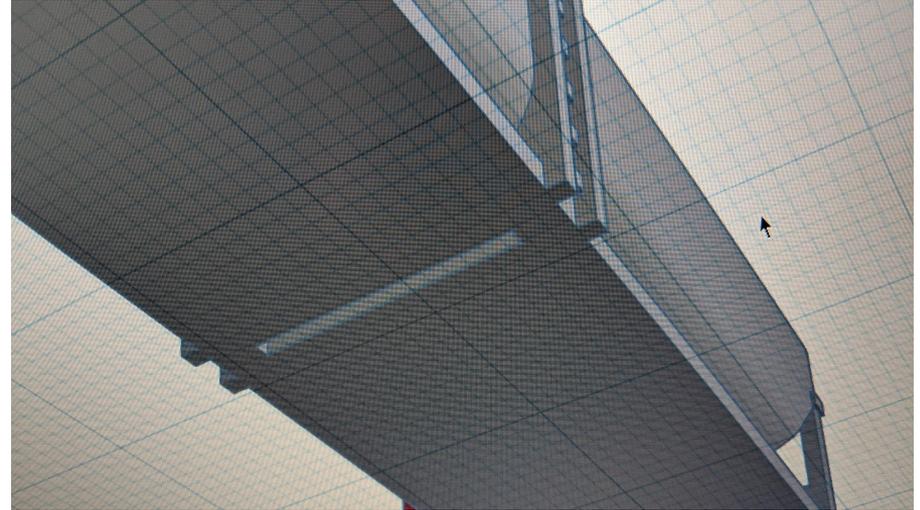
- First draft had no cleaning pad, and Mark 1 and 2's outlet for fluid suffered from surface tension.

## ***My approach***

- Created a more open slit along the bottom, and after bouncing between a couple designs I decided to go the easier, simpler route by using foam packaging. Microfiber is grippier, but foam can crush instead of pushing against the track, bringing the wheels off the ground.

## ***The results***

- The hole works, though a little too well now.
- the foam is simple but effective.



# Iteration 3 - *Aesthetics*

## *I chose to focus on this area because*

- I wanted it to better complement the surrounding cars, and look more pleasing to the eye.

## *My approach*

- Designed features like a walkway, false hatches, and scaffolding along the sides.

## *The results*

- Successfully took printing limitations into account, and it turned out great.



# Project Functionalities

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# Primary Functionalities

## *Power is supplied by separate locomotive*

- Car is easily pushed/pulled by all locomotives, and is sufficiently heavy to not be easily derailed.

## *Cleans the track*

- Tested the effectiveness by applying grease to the track, and after running the car over the track a couple times the top of the rails were spotless.

## *Is easier then current solution (paper towels)*

- It is substantially easier, as all I have to do is turn the power on, and let it run around the layout on it's own.

Before:



After:



# Secondary Functionalities

## *Takes little to no effort to clean layout with it*

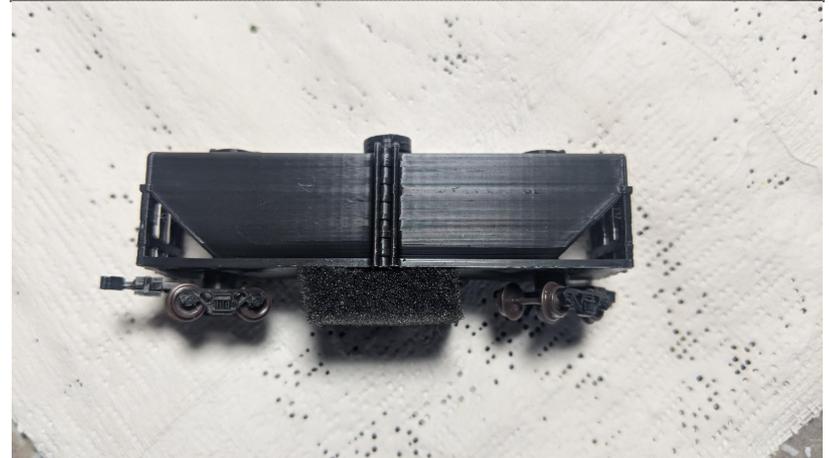
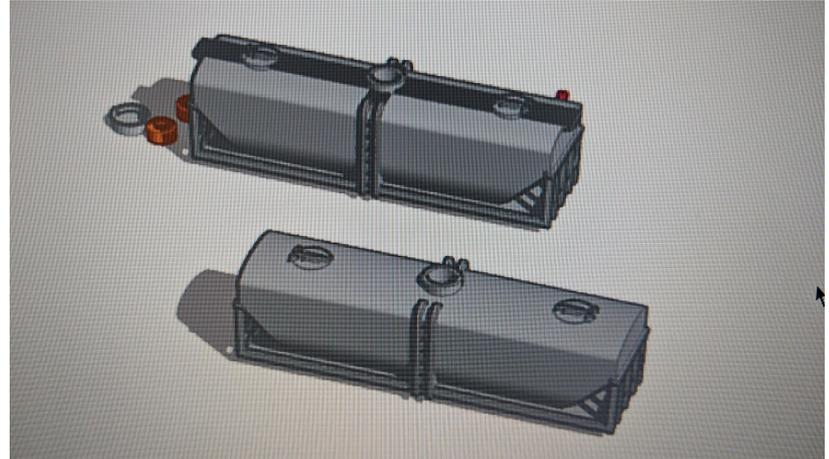
- Almost entirely cleans the track in one pass, so all I need to do is fill it with alcohol before running it.

## *Cleaning pad is replenished with tank*

- Tank, while the weakest part of the design, does successfully transfer fluid from the tank to the pad.

## *Looks like a real train car*

- It isn't a perfect model, but looks far more appealing than a plain tank on wheels. Would've used a more colorful filament, but my current assortment is pretty bland.



# Concluding Thoughts

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# Project Reflection

## *Aspects of my project that I like*

- Final aesthetics
- Effectiveness
- Useful solution to a problem I faced

## *Aspects of my project that were difficult*

- Proper tank flow
- Choosing the best cleaning pad design

## *What I would do differently next time*

- Further explore solutions to tank flow
- Adjustable cleaning pad
- Additional weight
- Additional realistic details

