

# My Balsa & Glass Workshop

## 3D Printed Steam Turbine Puzzle Box

26 September 2025

I wanted to make a Christmas present for my oldest son Kent using my new 3D printer. I found a very interesting, nicely designed, great looking, and very complex to solve Steam Turbine Puzzle Box, designed by Ralph Hanson of **flarPuzzles**, which you can build using the STL files that are for sale on Etsy (<https://www.etsy.com/shop/flarPuzzles>). With the purchase you can download the 44 STL files and a detailed instruction manual.

The Steam Turbine Puzzle Box, which measures 150mm on each side, consists of 59 3D printed parts for one version and 68 parts for an Alternative Version. There is no difference in the solution, it's only cosmetics. In addition to the 3D printed parts some other hardware will be needed, and they are all listed in the instruction manual. The locked **prize compartment** is 52x80x80mm. 3D printing all the parts will require approximately 1.2 kg total of filament, and lots of time!

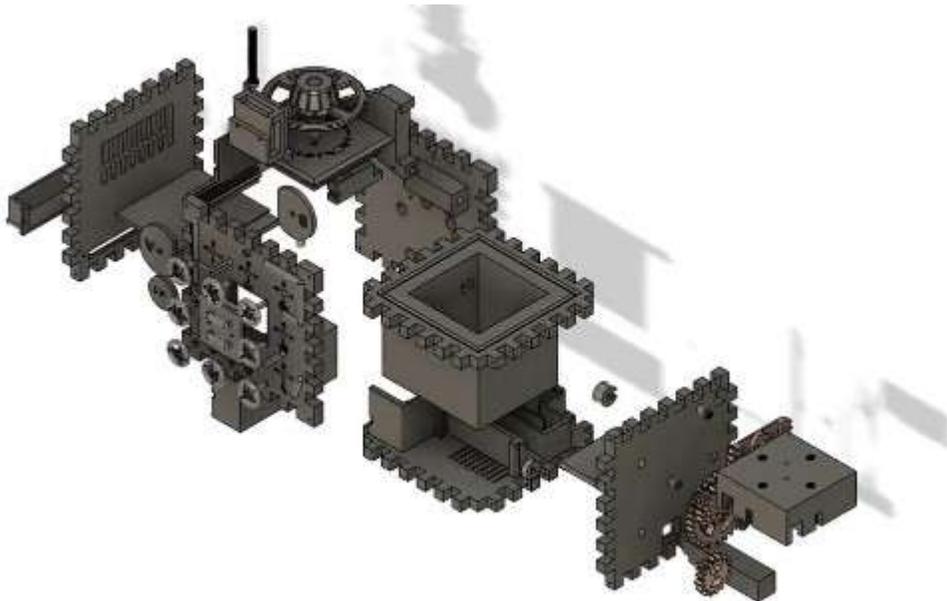


Figure 1 - Exploded View of the Steam Turbine Puzzle Box

Image Source: <https://www.etsy.com/shop/flarPuzzles>

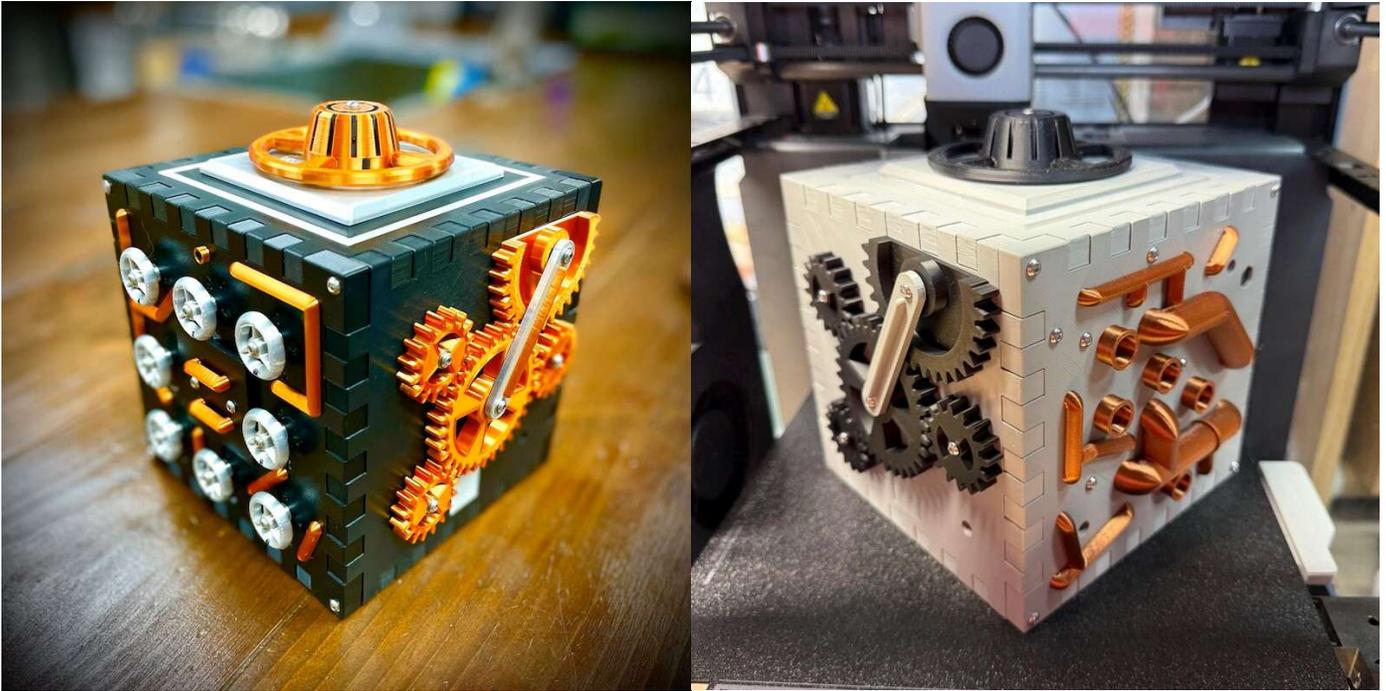


Figure 2 - Some Nice Examples of the Steam Turbine Puzzle Box

Images Source: <https://www.etsy.com/shop/FlarPuzzles>

Also provided by the designer are the following videos:

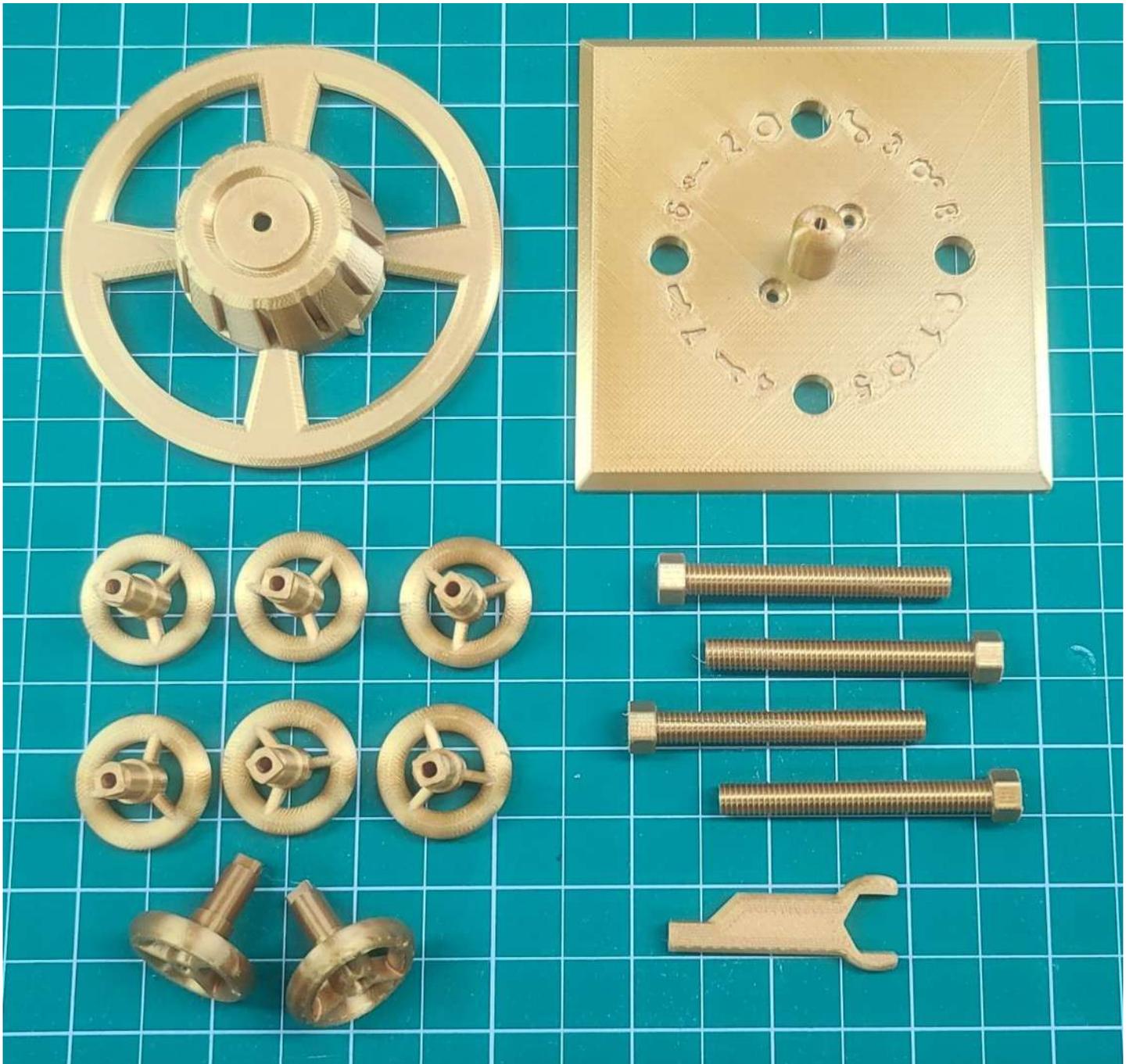
The Steam Turbine - Assembly instructions: <https://www.youtube.com/watch?v=gPLOP75x8r8>

Solving The STEAM TURBINE Puzzle Box!!: <https://www.youtube.com/watch?v=ISDnTe4pUz0> and <https://www.bing.com/videos/riverview/relatedvideo?q=Solving%20The%20Steam%20Machine%20Puzzle%20Box%20video&mid=862FE666BCA521D4C84A862FE666BCA521D4C84A&ajaxhist=0>

### 3D Printing the Steam Turbine Puzzle Box

Once I had all the STL files and instruction manual, the first thing I did was to establish which parts would be printed with the various types/colors of filaments I planned to use. After looking through the many fine examples of the Steam Puzzle Box posted on the web, I decided to use four filaments for this project. For the eight S1 Knobs, S1 Fork, four large Bolts, S2 Knob, and the S2 Top, I will print using GIANTARM Gold Silk PLA Filament. For all the Alternative Side 6 S6 Big and Small steam pipes, and five S6 Pipe Ends, I will print using GIANTARM Copper Silk PLA Filament. This filament will also be used to print the steam pipes on Side 1 and S1 Drawer Lid, which I will discuss later. For all the Side 4 Spur Gears, I will print using GIANTARM Silver Silk PLA Filament. And for all the puzzle box sides, internal boxes/drawers, and other internal mechanical parts I will use Polymaker PLA PRO Metallic Chrome Filament.

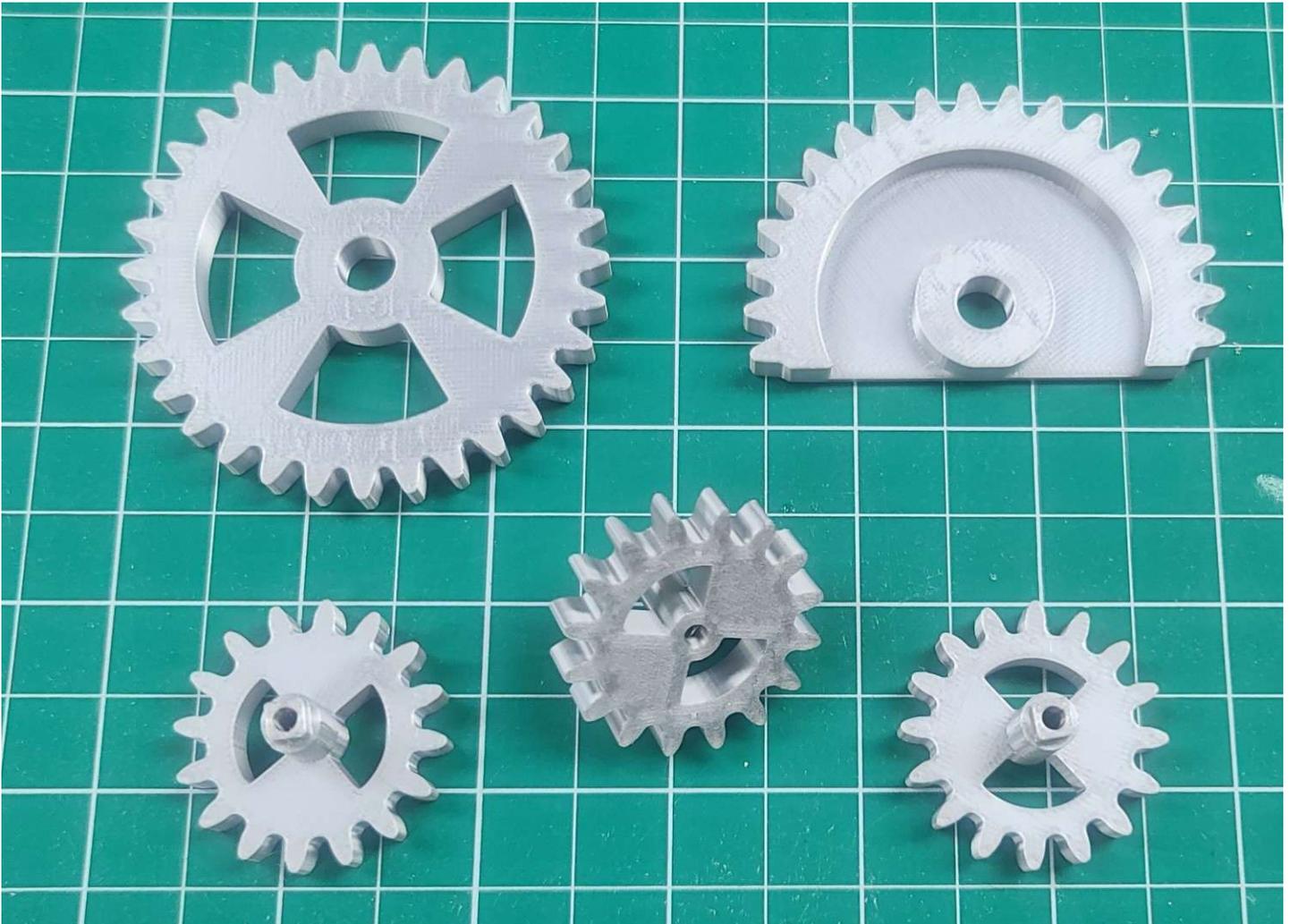
Following the instruction manual printing instructions sheet, I setup the profiles I would need in Creality Print for the 0.1mm & 0.2mm layer heights, number of top and bottom layers, and Infill percentages required for the various puzzle box parts. I then set off to print all the GIANTARM Gold Silk PLA parts in 3D. Figure 3 below shows the results of my efforts. Using a 0.1mm print layer height with Silk PLA resulted in some nice parts.



*Figure 3 - Steam Turbine Puzzle Box Gold Silk PLA Parts*

With the Gold Silk PLA parts printed, I next moved on to 3D print the Silver Silk PLA parts which include all the Side 4 Spur Gears. Just for reference, the total print time for the five Silver Silk PLA

parts was 2h 39m. This is due not only to a print layer height of 0.1mm, but also the lower print speed (I used 50 mm/s) required when using Silk PLA filaments. (Slow down the printing speed to as low as 20 mm/s if you want the best surface finish.). Figure 4 below shows the results of this effort.



*Figure 4 - Steam Turbine Puzzle Box Silver Silk PLA Parts*

Next I decided to print the Copper Silk PLA parts needed for the Alternate Side 6 of the puzzle box. These are all the various steam pipes that mount to the outside of Side 6. Here again the small print layer height and slow print speed made for some slow going, but very nice parts. The total print time for all nine parts shown in Figure 5 was 5h 8m.



*Figure 5 - Steam Turbine Puzzle Box Copper Silk PLA Parts*

With all that finished, I decided to try my hand at 3D printing the three parts that will require two filament colors. This will be something new for me, so I had to do a little web research on how to accomplish multicolor 3D printing on a part when using a single extruder head printer like my Ender-3 V3.

One of the most common ways to print 3D with multiple colors is to pause the print and to manually swap out the filament with another filament of a different color. Often this is done when the printer increases its Z position to move to a new layer. It is often referred to as the pause at height or pause at layer method. You are not limited to swapping filament colors only once; it is possible to swap filaments many times during a single print to create cool visuals. You can either pause the 3D printer by hand or edit the G-code so that the 3D printer pauses automatically at specific points during the print. It is also possible to have the slicer software automatically insert pause commands when the G-code for the print is generated. This saves quite a bit of time and effort when you want to pause a print several times. Slicers usually do this by running a post-processing script after generating the G-code. This script inserts the pause commands at the relevant locations.

**For the Ender-3 V3 using Creality Print:** Simply insert the word "PAUSE" following the line of code for the ;LAYER: you wish to complete with the OLD color. The printer will pause AFTER that layer finishes and allow you to manually change the filament using "Retract" followed by "Extrude" commands on the touch screen. When the NEW filament is ready to go and you have manually removed the thin strands of filament from the nozzle during the Retract/Extrude routine, hit "HOME" and then "RESUME". The printer will move to its last location and begin printing with the NEW color.

With all this newly gained knowledge, I pressed forward with the S4 Gear Holder part. Printing this part would be started using Polymaker PLA PRO Metallic Chrome filament for the base and then

changed to the GIANTARM Silver Silk PLA filament for the small upper portion. To accomplish this, I needed to insert the "PAUSE" command at the correct layer of the printing process. Using Creality Print 6.2, after slicing the part, in the Preview window I used the small green vertical slide bar just to the right of the part to determine the level height where I wanted to change out the filaments. As you can see in Figure 6, this was at a "Z" height of 3.10mm (which is also layer #30 and 20m 9s into the printing). I then "right clicked" on the top of the slider at that point and selected "Add Pause". The slicer then inserts the orange "PAUSE" box on the screen and the "PAUSE" command into the G-code at that point. That's all it takes, I hope.



Figure 6 - Inserting a "PAUSE" Command using Creality Print

For the S4 Gear Holder I had good results on my first try, as you can see in Figure 7 on the right. I then used the same process for printing two colors on the S1 Drawer Lid, but when the printer resumed printing with the second color, the second color filament did not adhere to the initial color filament printout, and I had to STOP the printing. So, to address this issue I decided to modify the STL file by separating the portions of the part to make two STL files, one for each color of filament I wanted to use. This is similar to the method the model designer used for Alternative Side 6. I then printed each of the separate parts and when finished I super glued them back together for the final S1 Drawer Lid, as you can see in Figure 7 on the left.

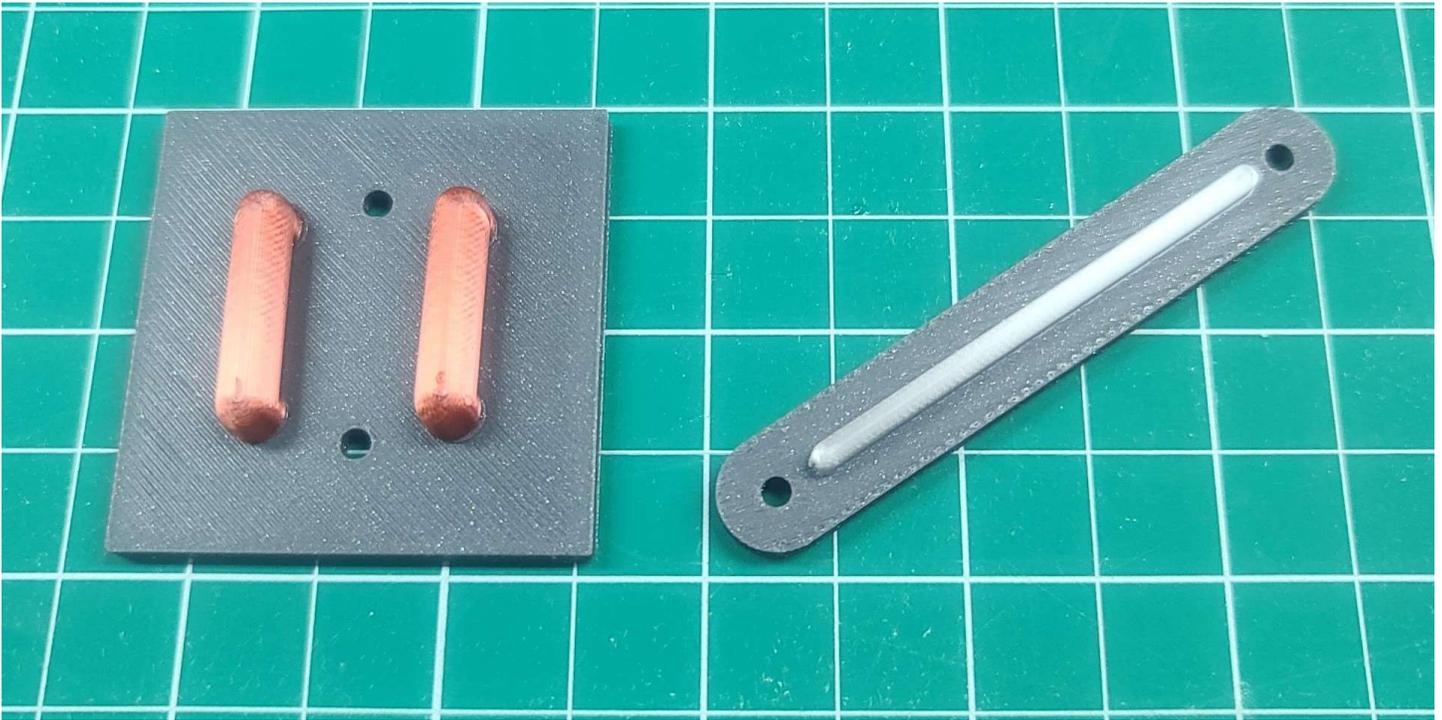


Figure 7 - S4 Gear Holder & S1 Drawer Lid Two Color Printing Results

Now for Side 1, which not only has several small steam pipes on its top (or outside) surface (which I want in a different color from the side color) but many small symbols and numbers, all of which drive a requirement to print using a 0.1mm layer height to obtain the detail needed on the top surface. I setup Side 1 in Creality Print using my 0.1mm PLA-Silk Filament profile and found this would require 129 layers and a **9h 40m** print time. There had to be a better way to print this part, so off to another web search.

I found a great YouTube video @: <https://www.youtube.com/watch?v=jtbcYLDfg14&t=53s> that showed me how to use "Variable Layer Heights" in Creality Print 6. In this video, you learn how adjusting layer heights in different sections of your model can result in smoother surfaces, faster print times, and less filament use, all while maintaining high detail where it matters most. After separating the small steam pipes on Side 1 into a separate STL file to print using Copper Silk PLA, I used the "Variable Layer Heights" approach for the rest of Side 1. This not only would allow me to print the higher detail needed for the small symbols and numbers on the top surface of Side 1 but reduced the part print time to **5h 56m** using layer heights that ranged from 0.218mm for the first 4/5ths of the side thickness and then transitioned to 0.08mm for the final upper layers. I also used the "Variable Layer Heights" for the Side 1 small steam pipes STL file to reduce their print time to 30m 16s. ***The old man learns something new again!***

To finish up all the parts needed to build Side 1, I setup the S1 Knob Disk 45, S1 Knob Disk 90, S1 Knob Small Disk, and S1 Drawer STL files each in a separate 3D print file (.3mf) that would print using my 0.2mm PLA-Silk Filament profile and Polymaker PLA PRO Metallic Chrome Filament. With those finished I now have everything needed, as shown in Figure 8 below, to assemble Side 1.

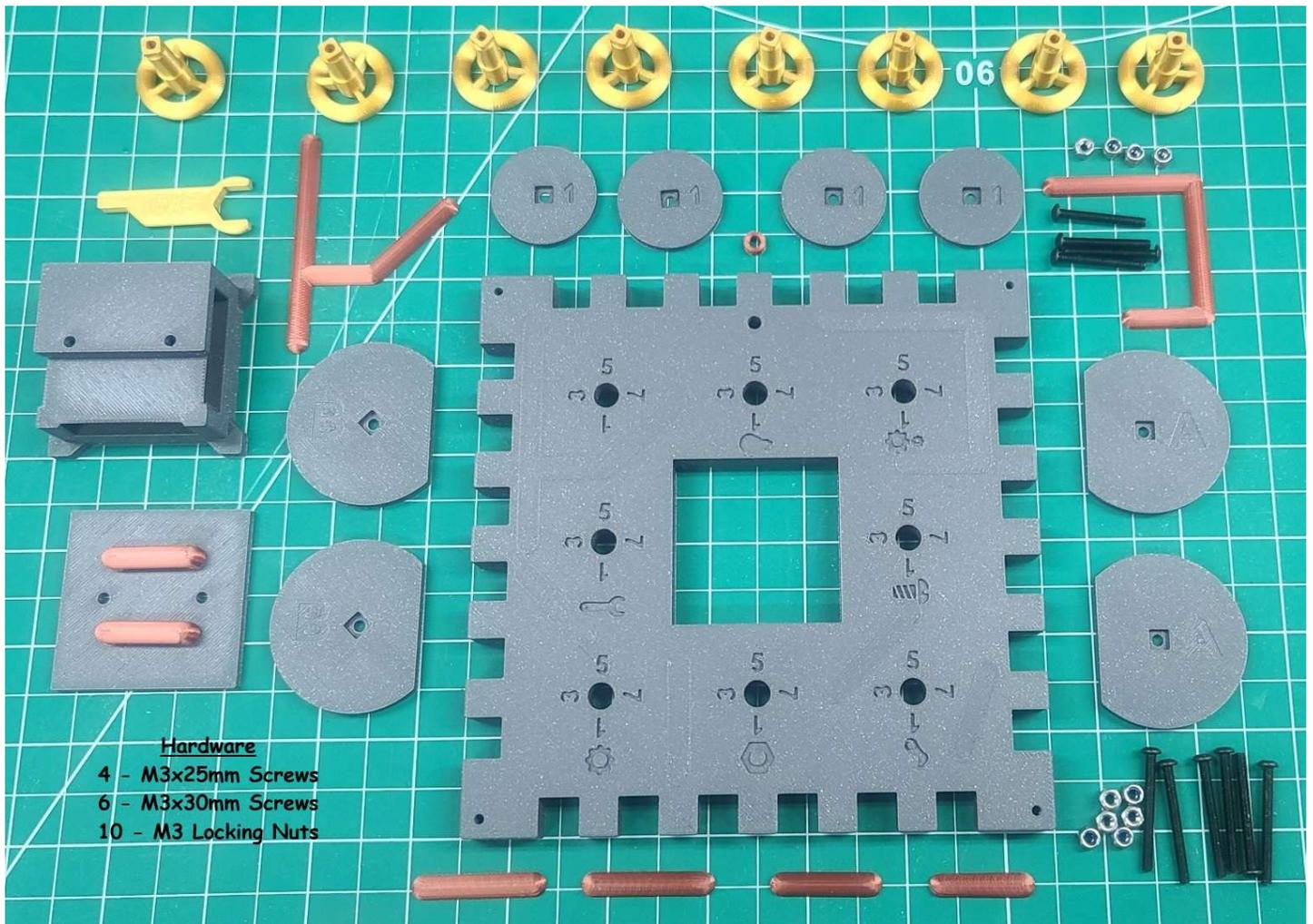
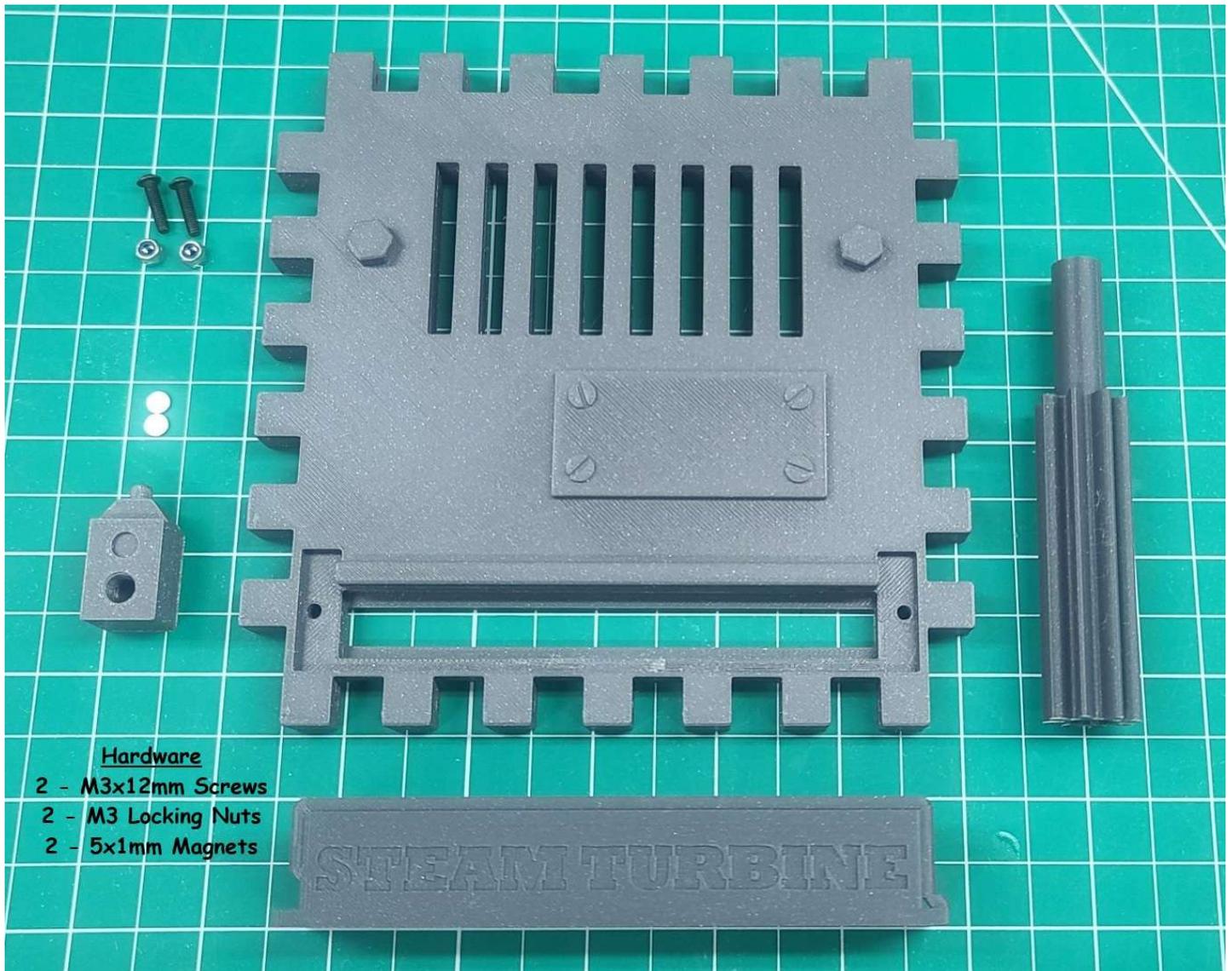


Figure 8 - Side 1 Printed Parts and Misc. Hardware

Next I printed everything I would need for Side 3. This included the main Side 3 panel, S3 Slide Cover, S3 Spur Gear, and S3 Slider STL files. All of the parts and hardware required for Side 3 are shown in Figure 9.



Hardware

- 2 - M3x12mm Screws
- 2 - M3 Locking Nuts
- 2 - 5x1mm Magnets

Figure 9 - Side 3 Printed Parts and Misc. Hardware

OK, after having several issues with extruder and nozzle clogging when using the Polymaker PLA PRO Metallic Chrome filament, I decided to stop using it for any more parts. All the internal parts already printed using Polymaker will be used, but any external visible parts that are already printed with the Polymaker (basically Side 1 & 3 panels) will be reprinted using Grey Creality Hyper-PLA.

With a new 0.4mm nozzle and extruder installed in my Ender-3 V3 printer, I continued to print the parts needed for Side 4. All of the parts and hardware required for Side 4 are shown in Figure 10.

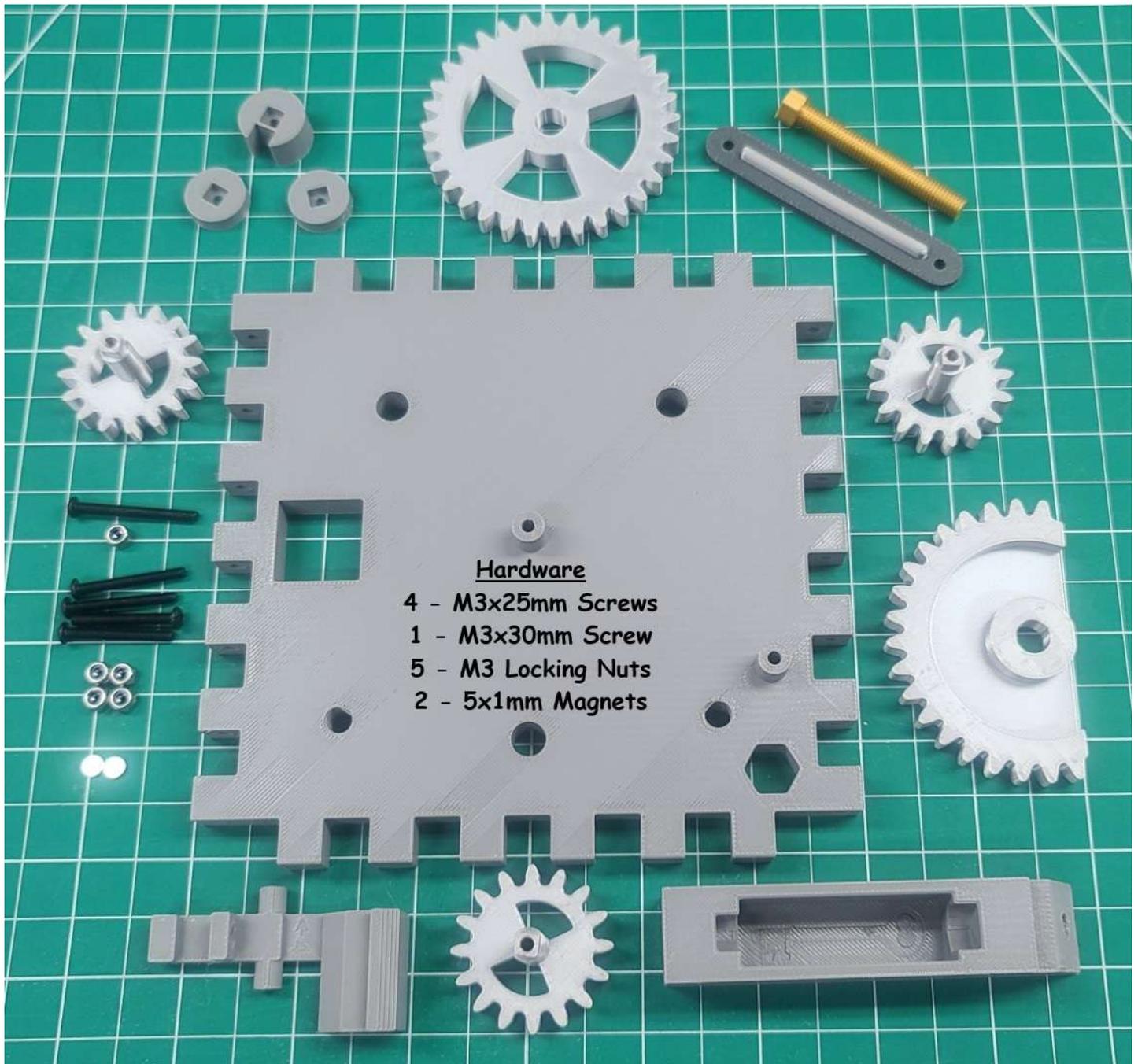


Figure 10 - Side 4 Printed Parts and Misc. Hardware

With those finished I next set out to print everything needed for Side 2. All of the parts and hardware required for Side 2 are shown in Figure 11.

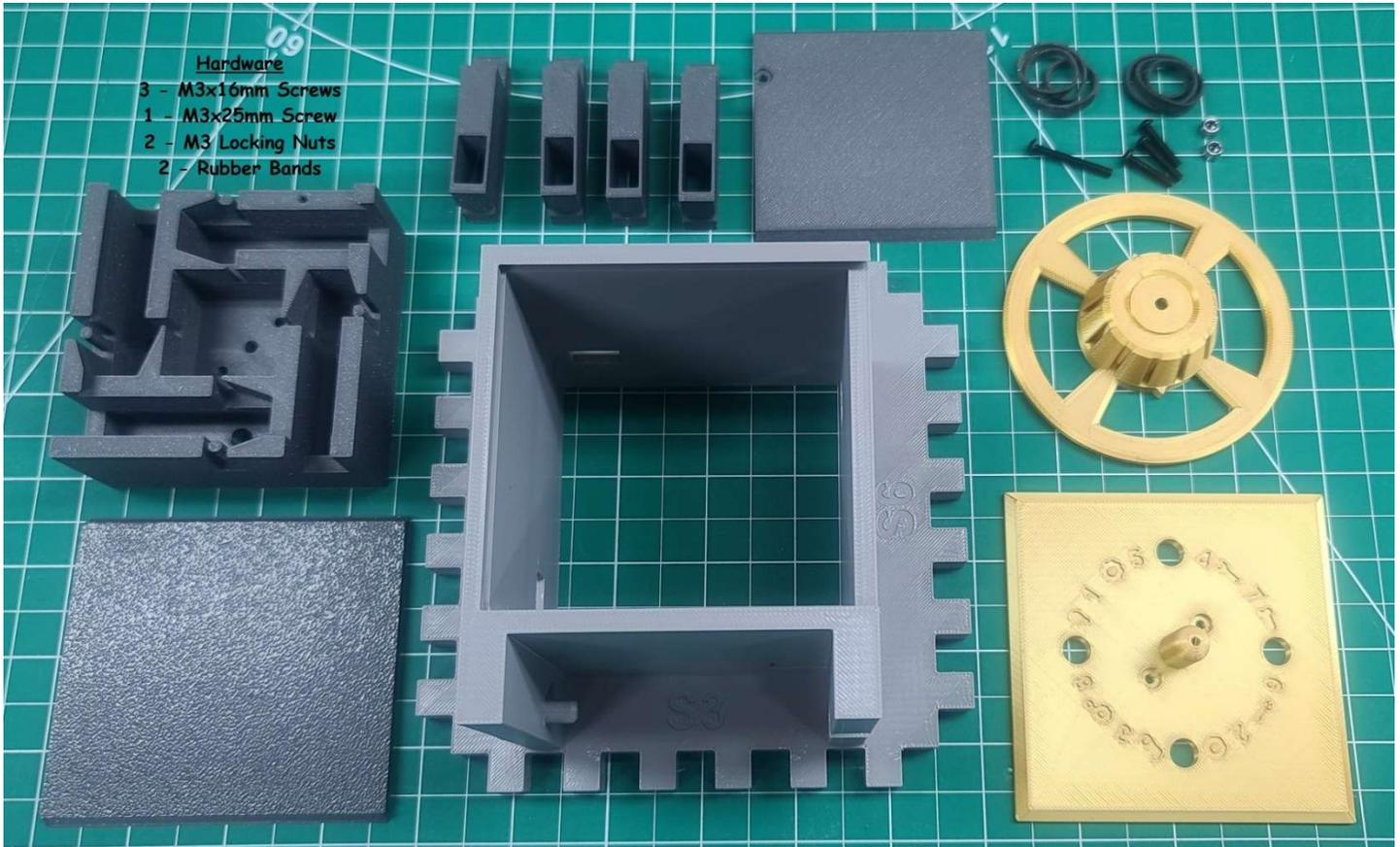


Figure 11 - Side 2 Printed Parts and Misc. Hardware

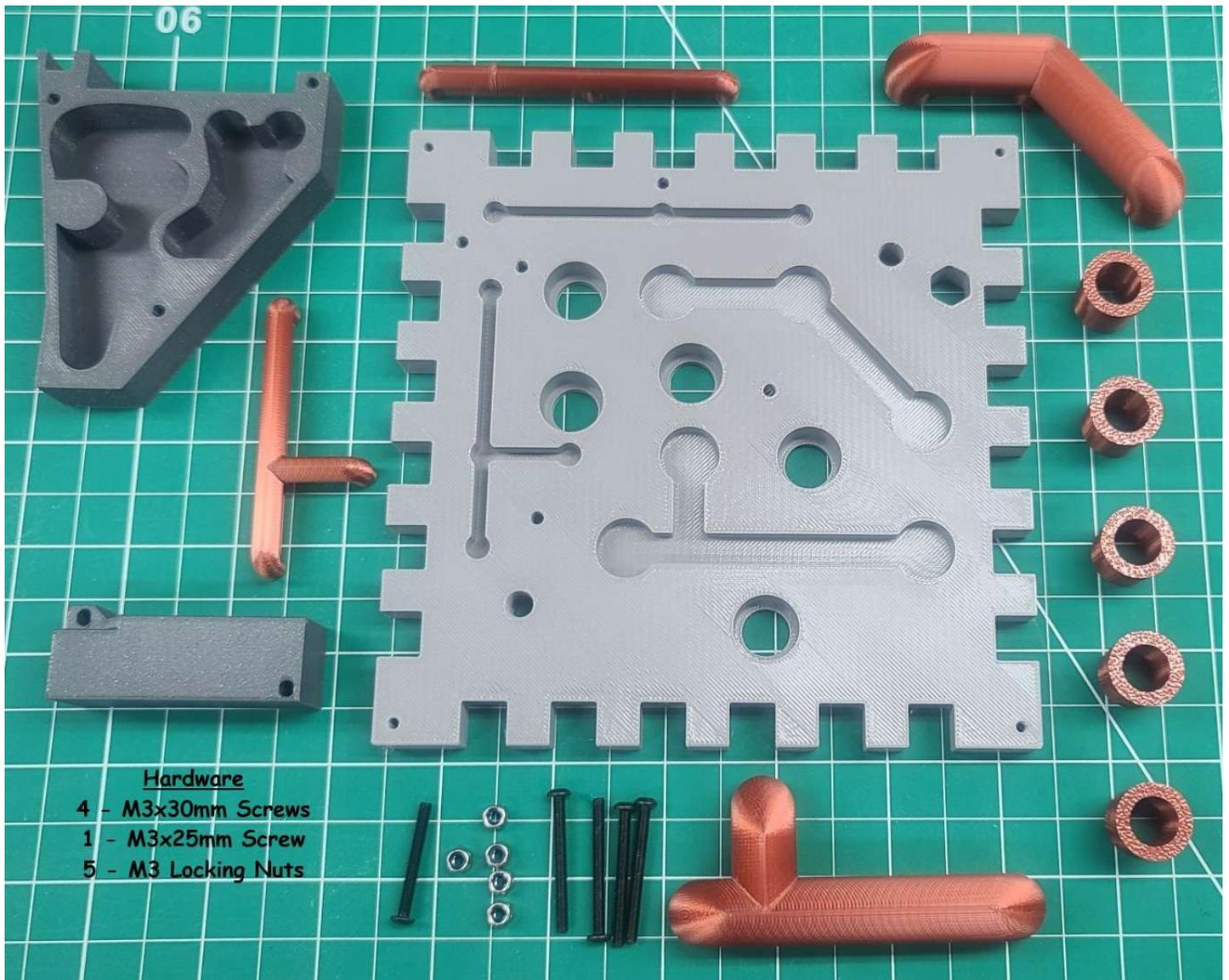


Figure 12 - ALT Side 6 Printed Parts and Misc. Hardware

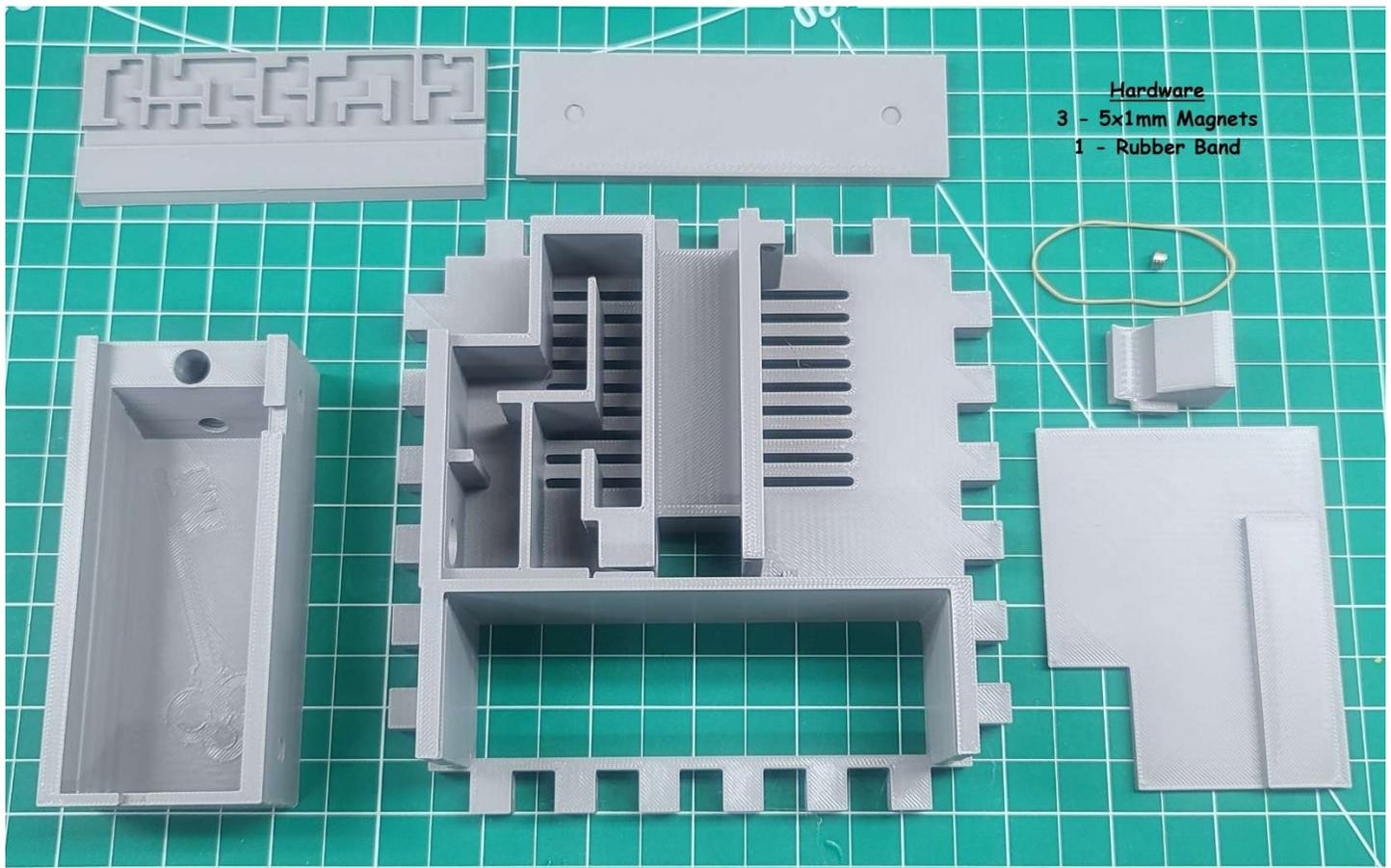


Figure 13 - Side 5 Printed Parts and Misc. Hardware

With all the 3D printed parts finished, the next thing on the list was to put all these parts together. I'm not going to go through all the steps of my Steam Turbine Puzzle Box assembly. The provided instruction manual covers the assembly in a lot of detail and the online YouTube video assembly instructions are really nice, which can be viewed at: <https://www.youtube.com/watch?v=gPLOP75x8r8>. One thing I will mention about the puzzle box assembly. I highly recommend you run a 3M tape into the various holes in the pieces that receive a 3M screw. This makes the assembly **MUCH EASIER**.

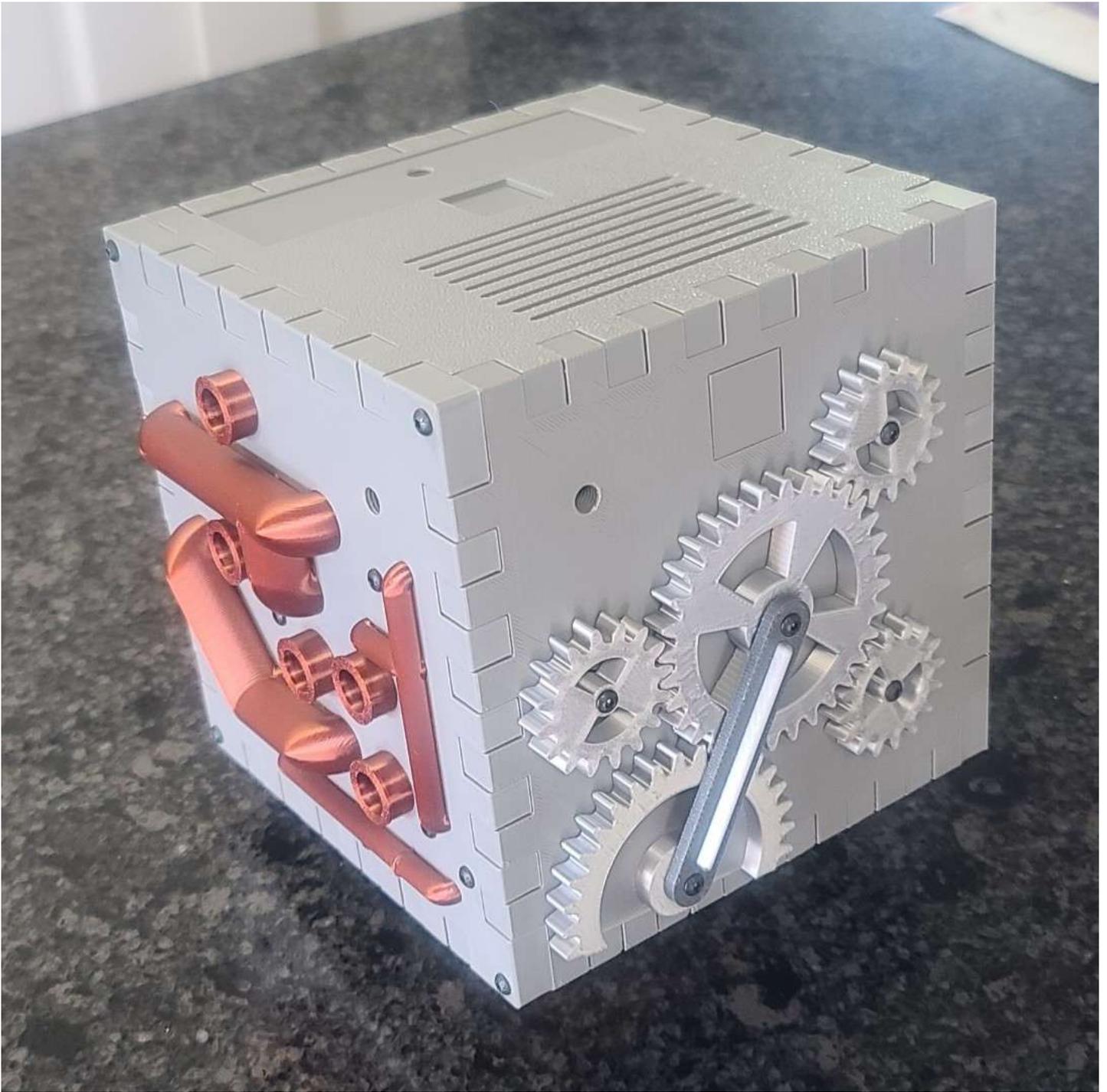
One problem I did have during my assembly was when I tried to attach the S2 Knob to S2 Top using a M3x25mm screw, I twisted the center post off on the S2 Top part. The first time I printed S2 Top, I used a 10% infill, which turned out not strong enough when running the M3x25mm screw down through it. So, I printed the S2 Top a second time, but this time using a 60% infill, and that fixed the problem.

Overall, other than the issues I had using the Polymaker PLA PRO Metallic Chrome filament, 3D printing was straight forward as long as you follow all the print setup recommendations in the instruction manual. All required hardware items were available on Amazon, as were the various PLA filaments I used. The puzzle box design engineering and 3D modeling is excellent, and everything fits together and functions like a champ! I highly recommend this puzzle, and I plan to purchase the **flarPuzzles** other puzzle box titled "The Steam Machine Puzzle Box" to make as a Christmas gift for my youngest son Ryan.

I guess I need to provide a couple images of my final product. Below in Figures 14 & 15 you can see all of the sides of my 3D printed Steam Turbine Puzzle Box. Have fun making one yourself.



*Figure 14 - Three Sides of the Steam Turbine Puzzle Box*



*Figure 15 - The Other Three Sides of the Steam Turbine Puzzle Box*