Drawing 3-D Parts

Part of my first order of the white and flexible parts I drew as replacements for the DMI ripper.

Here is one of the white flexible parts I had printed that broke. You can see I tried gluing it back together, with no success.

Hello again! The last time we met, I was getting involved in 3-D drawing by drawing parts for a damaged Gottman Toys DMI disc ripper. I had drawn the parts I was going to need to repair the ripper. Two weeks after I ordered those parts, they arrived.

When I opened the box, I was like a kid at Christmas! I was excited, since this was my first real experience drawing my own parts. Soon after the box was opened, I was checking things over and test fitting parts. The parts were produced by Shapeways with the "frosted white plastic" option. I opted out of the polished option only by mistake so the parts I received had a little extra "fuzz" to them.

So here is my "first-timer" opinion on these parts. First, they were indeed produced just the way I drew them, which can be good and/or bad. Trying to build in the virtual world can be a little more complicated than a person would think. Sometimes, my math wasn't always right or tolerances may have been off. But having the parts in my hands now, I can indeed do some test fitting.

Almost everything was test fitting properly, except for the ripper shank mounts. I had them designed so they would work very similar to the real DMI ripper, when assembled. But when it came to assembly, the springs' mounting locations were about 0.100th of an inch off. In the 1/16 scale world, it would really be noticeable, so I knew I was going to have to fix that drawing.

Making a repair to a drawing took me way out of my comfort zone. I had converted the original drawing into an "STL" file so I could send it to Shapeways for printing. I ended up spending 4-5 hours trying to figure out how to convert the file back to an "ORG" file so I could modify it and make the 0.100th of an inch change to the part. After repeatedly failing, I just decided to redraw the parts, which took less time than I wasted trying to figure out how to change the file. I am sure some of you could make that change in under a minute, but I sure am not there yet!

Here is my second opinion on the parts I had printed. The parts printed in "frosted white" had about the same strength qualities as the familiar resin-casted parts. For many projects, that would be absolutely perfect. But on this project, I would need to have more strength. While doing a test fit, I managed to break a part that was 0.250 inch thick. If I plan on having this ripper built to have all of the features work, this was not going to work.

Realizing that the frosted white option was not going to work for all of the parts of the ripper, I looked into other options. One of those options was having the parts printed in metal. Shapeways offers many options in printing styles, including options all the way up to having the parts printed in 24-karat gold or platinum.

I don't think I need to have the parts printed in gold just yet, but Shapeways offers an option of printing in stainless steel or a polished bronze. So I ordered some of the parts that required strength in both of these options just to see what the qualities were like. The bronze would come polished, so I was hoping the part would come with a smoother exterior texture. Since the stainless steel and polished bronze were priced the same, I figured it would be a perfect chance to experience both.

OK, I better explain 3-D printing a little better and explain how the printers work. I am not an expert in 3-D printing, but I am learning. I have learned there are two basic types of printers. The first is the type you more commonly see available to the public. These printers typically start at around $300 and go up. These printers are known as nylon welding printers.

They have a spool of nylon wire that feeds into a head with a heated nozzle. As the nozzle heats the wire, it causes it to melt, then it gets forced out of the tip. As the nylon is forced out of the tip, the printer head then follows a pattern in the shape of the item being printed, creating the part.

The upside to these printers is the cost. The downside of these printers is that they are hard to control. If the head is too hot, the print will sag out of shape and if the head is too cold, it will produce a very grainy texture that may not even stay together after it is printed.

This type of printer is also affected by the environment. The air conditioning or furnace can create a draft in the air around the printer or something as simple as a door being opened causes a draft. Small changes in temperature can really effect the quality of the print.

The second type of printer is known as a resin printer. These printers work on a completely different principle than the weld-type printers. The printer lays a very thin layer of material, whether it is nylon, plastic, stainless steel or gold. This material will be in a BB powder form and down to 0.004th inch. After the thin layer of material has been spread, the printer head then applies resin into the areas of the part being printed. Layer after layer, the part will be built.

Once built, the excess filler material will be vacuumed up and the parts will remain. The major advantage to this type of printing is that it is not exposed to the elements. The downfall is the money required to have one of these printers. These printers can easily start in the $15,000 range and go up, making it hard to justify owning one as a hobbyist.

So then there are the 3-D printed parts made of metals. This works basically the same way as the resin printers. The print starts as a resin print, where the filler material is powdered stainless steel or bronze. With metal prints, after the resin printing is complete, the parts are heated, burning the resin off the print and replacing the resin with bronze, essentially creating a 100 percent metal print.

Now getting back to the task at hand. My 3-D printed parts have arrived again, this time printed in metal. Let me tell you, these parts are tough. They are as strong as any die-cast part.

The polished bronze has a nice finish. It still shows some texture, but nothing drastic. I would say the texture would be just a little better than a high-quality sand-casted part.

I did find that this material is tough! It is hard on drill bits and taps. When drilling the bronze or stainless parts, a carbide drill bit is a must. I also noticed that the parts seemingly grew a little. In my opinion, when the part is printed, it is 100 percent accurate. But when the print is infused with the metal, it adds a layer of metal to the outside dimension of the print. This led to some issues when I went to assemble the parts. It may not be much, but it's enough to create a fitting problem. Using my grinder and Dremel, I was able to make the adjustments. In the future, I will have to remember to leave larger tolerances.

Next time we get together, I will show you some of the assembly processes as well as a third form of 3-D printed parts.

This bring us to the part of the article I have named "Tool of the Month!" This month, I am going to focus on my 8-inch caliper. I bought this stainless steel caliper shortly after I graduated from high school. My 20-year class reunion was last November, so it has been with me a while.

I use it as a tool of measure, but I also use it as a scoring tool to lay out patterns, edges or reference points/lines. I would be totally lost with out it.

A lot of the tools I own I could go without or find an alternative tool to use, but my caliper is not replaceable. It is hard enough to lay out bolt patterns or keep items fitting with a caliper, but without? Lost, I would be!

I know if I tell somebody that I use the tips of the jaws to score lines in metal, most machinists would frown. But after 20 years, I am still using the same caliper. Mine is still an old dial caliper, but they offer digital models now that even give you a rezeroing option to help you with your math. But for now, I will keep old faithful.

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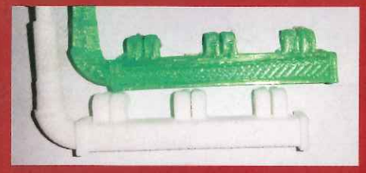
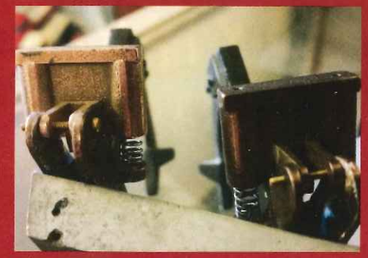


Here is a good example of two identical parts from different printers. The top green one was printed with a nylon weld-type printer and the lower white one with a resin type printer. The detail on the second one is tenfold better than the weld-type printer.



The printed spring assembly on the left is a stainless steel piece, while the one on the right is printed in bronze.

Here are some parts that were printed in bronze that I was able to grind to fit. The strength and ability to modify was second to none.

Living just northwest of Dyersville, Iowa, in the heart of farm country and farm toy replica country, Chuck Steffens has found a niche in the toy world, building high-detailed replicas in his spare time. He shares his experiences with Toy Farmer readers, hoping to lead other collectors to personalize one of their own tractors. Comments or suggestions can be directed to csteffens@wildblue.net.