Column Side Plates 11/29/2007

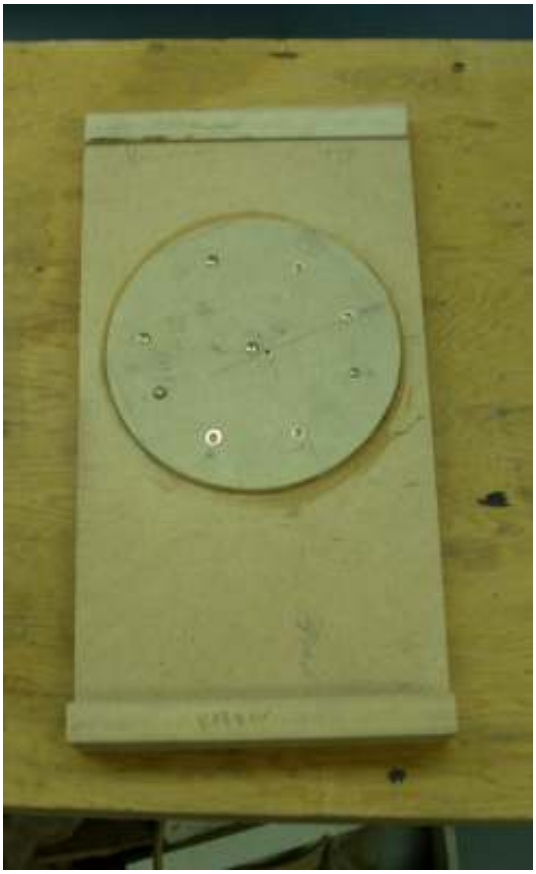
Background

This was the first serious casting that I have done in about 6 years. I'm using my new Dan Hartman electric furnace, which worked great. My old furnace was a Gingery Charcoal furnace and had two problems. First, the home made refractory was failing and had cracks all the way through the side wall. Second, it did not have the capacity needed for these side plates. I also was tired of the mess and "drama" of using charcoal. My electric furnace makes as much noise as a toaster. I figure it costs me $0.60 for the first melt of the day and $0.30 for each subsequent melt if no delay is incurred. My second melt today was about 3 hours after the first and it cost around $0.40. Obviously power costs are not an issue.

One unexpected issue is aluminum. In the past I cast much smaller parts so, without much thought, figured my store of ingots would last a long time. Each of these side plates weighs 8 pounds 4 oz including sprue and riser. My store of 25 pounds of ingots is no longer that impressive to me. I now have about 6 pounds of aluminum left. Time to go round up more scrap aluminum.

The pattern

My pattern was made from MDF. Elmer's glue was used along with Elmer's wood filler for the fillets. After much experimenting, I found that if I cut the wood filler with water, it would flow like toothpaste from a large plastic syringe. This made it easy to lay a bead right in the corner. I then used a dowel to tool it. While waiting for the first casting to cool in the flask, I used an idea learned from the yahoo club "gingery_machines". It is a ball bearing about 3/8" in diameter brazed to a rod. I coated it with car wax and plan to use it to form fillets. This shape should permit me to form a fillet both between both 2 and 3 perpendicular surfaces.



Here is the pattern before I cut the hole. One lesson learned is to write lots of "dummy" instructions on the pieces to be glued together. The draft is only 1 to 5 degrees and it is easy to stick a piece of wood on upside down. It also prevents me from using a finished strip of wood as a glue spreader stick.

The hole was cut with a saber saw and the draft done with a homemade drum sander. This sander was mounted in my Gingery drill press and worked well.

The finished pattern looks much better in the picture than up close on the sand. After the first casting, I had to increase the draft on the hole and add more fillet between the foot and the vertical.

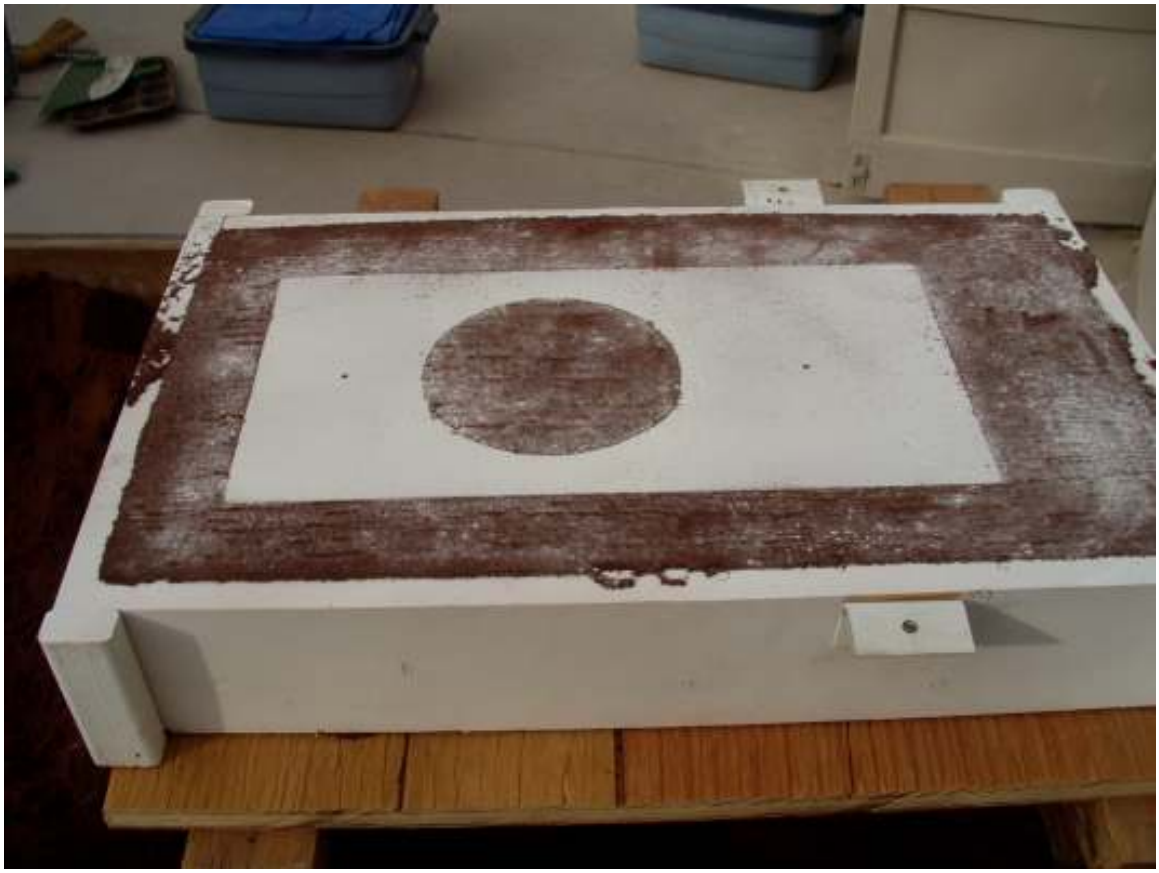
Ramming Up

I never used ribs and gaggers before. A rib is a block of wood that engages the inside ribs of the flask to provide additional vertical surface for the cope sand to grab. The gaggers are strips of metal that bridge these ribs and provide horizontal surfaces to also grab the sand. Well, this is all true if you ram the sand correctly. Ramming is all about feel. It takes a bit of practice to remember

exactly how hard to ram. Too hard and the cope can distort the drag sand. Too gentle and you get drop out. This is where the cope sand falls out as it is lifted. If you are lucky, it drops out after clearing the drag. If you are not lucky, it dumps into the drag and you have to redo both cope and drag.

So I guess I was lucky in that when my cope dropped out, it was away from my drag. You can see the ribs from the bottom and the gaggers too. I just did not ram hard enough.

Not a big set back. I just cleaned out the sand, put the cope back on the drag, dusted, and began ramming again. This time I paid more attention to ramming each corner and using more force. It paid off as there were no more dropouts during the day.
With the cope removed, you can see the drag with the pattern bedded. The two tiny holes accept metal hooks used to draw the pattern out of the sand. I am using Petrobond from BCS and it works great.



With the pattern drawn, you can see some damage to the edge around the hole. I did not ram hard enough. On my second casting with this pattern I rammed much harder. I used my narrowest tool and worked the sand into the pattern at a 45-degree angle. It greatly reduced this problem.

Here you can see the sprue on the right cut into the heaviest part of the pattern void. On the left are my two risers. When metal shows up in these riser holes, I know my void is full. The sprue and riser forms were not pulled out at this time.

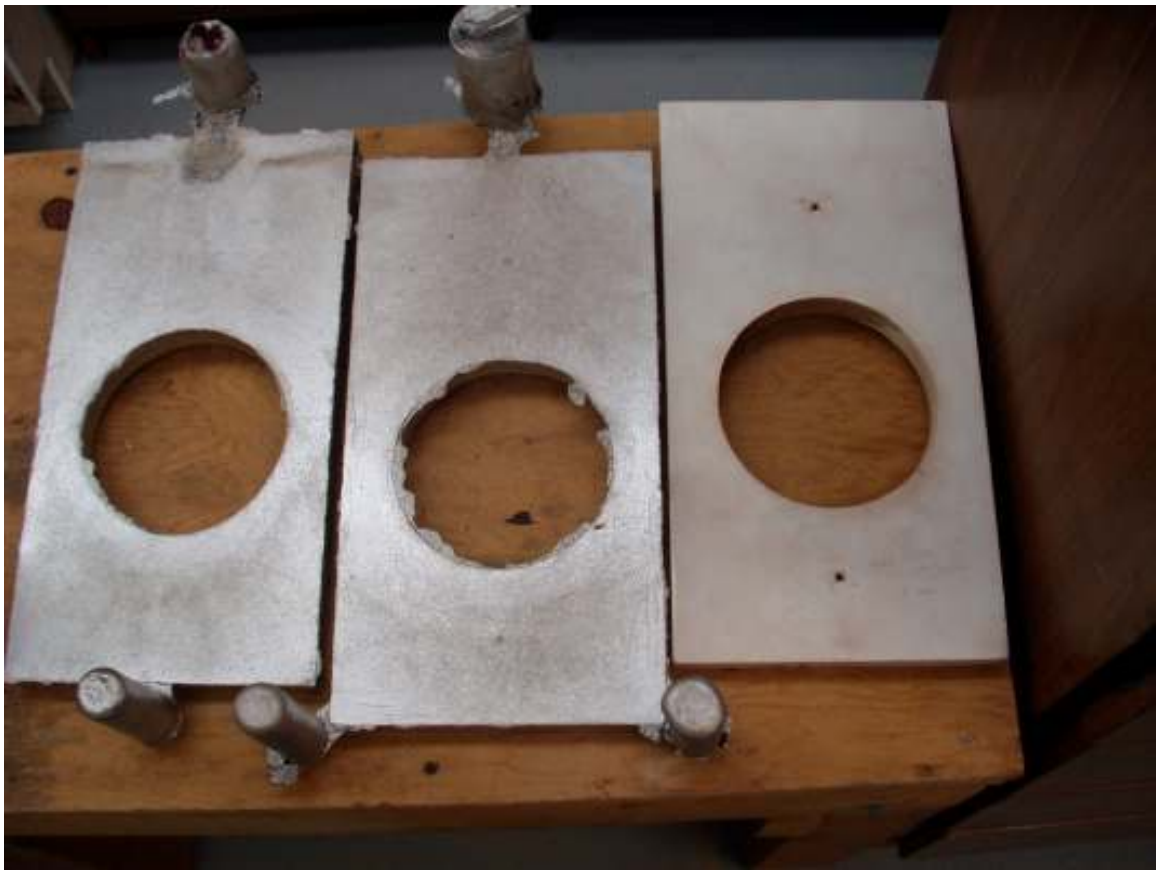
The Pours

The flask is ready for pouring. I have about 75 pounds of sand in that flask. It was not easy to carry from my sandbox seen in the background to the casting area. It was murder gently lowering it down to the ground. My back is a bit tender now. *Next time* I will ram flasks this size on my wagon and then wheel them over. I will still have to flip the drag over but that is not nearly as bad.

Note that I have a muffin tin plus 4 ingot molds next to the flask. If the flask fails, these molds will take the melt. The propane torch is used to heat these molds just before I pour to guarantee no moisture is present. My controller documented on my web site, sits next to a very cheap Digital temperature meter. I slip my thermocouple through a hole in the lid and eliminate guesswork. As the content of the crucible starts to get soft, I push down on the thermocouple and can feel the mush. Only then can I believe the temperature readings. It is interesting and useful to see the temperature rise and then level off. This indicates that we are entering the phase change from

solid aluminum to liquid. I see this at about 610C. Then it begins to rise again as we go to super heat. I let it get to 732C and then do my best to keep it under 760C for 10 minutes. The melt then pours like water and stays that way until after the void is full.

Rough Castings



Here is a full day's work. You are looking at the face that will be inside the metal shaper's column where no one will see it. As usually happens to me, the parts that are not seen look far better than the parts that everyone sees. Such is life. On the far right is the pattern.

The center casting is my first of the day. I used 2 risers. You can see some leakage of metal into the hole. This is easily cleaned up. It is a sign of sand not rammed tight enough.

The casting to the left is my second of the day. I see some minor shrink marks near the sprue (top of the casting) but less leakage. One riser was enough.

These are the faces that everyone will see. The center casting has some damage near the hole. It is ugly but will not effect the part's strength. A bit of Bondo and paint can cover this sin. At this time, I'm not interested in casting another side plate.

The second casting, to the left, came out much better. It is satisfying to see improvement.