

Casting Pulleys, Feed Crank, Protractor Disc, and Rotating Head

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A Quick Tour of my Foundry



I store my sandbox against a wall and my sand in plastic containers on the patio..

Yesterday was a rather productive day. At about 9:00 AM I faced this rather unassuming plastic shed. Inside is the majority of my foundry along with a few lawn care products.



The sandbox sits on an old folding table. It is not the most solid support yet experience has shown me that the vibration does not damage the molds. The yellow pails on the right hold my 100 pounds of Petrobond. A fair assessment of my foundry equipment would be “crude but effective”. This is even more evident when you see my flasks. I have plans to make new ones out of aluminum U channel but other adventures have gotten in my way so far.





Before I dump out 200 pounds of dry sand, I lay out a cheap plastic tarp. This makes clean up much easier. The open door in the background leads into my 150 square foot shop.

The day started off pleasant but hit 98° F by late afternoon. In a few months this will be considered a bit on the cool side here in Phoenix.



After placing firebricks down to support the furnace, I pour on a layer of sand. Any aluminum that leaks out of the furnace will hit this sand first. Note that the small triangle formed by the ends of the bricks is full of sand. Not a good area to miss. Additional bricks are placed for the crucible and lid.

The sand is about 2" deep and covers all areas that might see molten aluminum. My steel crucible is right in front of my furnace. The space to its right will hold my flask. To its left will be my ingot mold tray. This tray is large enough to take all of the melt if something goes wrong with the flask.

To the right of the furnace you will see two bricks which support the lid.





My furnace is a Hartman electric. My controller is the over sized box with the two big cables connected to it. I also have a thermocouple which feeds through the lid of the furnace and into my crucible. I have been running with it in the melt at all times and see no problems so far. It is nice to constantly monitor the melt and see where I am in the process. I was able to see small but sudden drops in temperature as chunks of ingot dropped into the melt. The phase change is very distinctive.

If you are familiar with the Hartman furnace and are very sharp, you will notice a stupid mistake that was only discovered after 2 cycles of the furnace. Follow the vertical line of screw heads down the face of the furnace. Can you see that the body section is offset? Somehow I managed to assemble the furnace with this center section upside down. This creates significant air gaps between adjacent sections. The melt times were excessively long and at one point I was sure my element had broken. Fortunately I was able to turn this center section over and all was normal for the third cycle. This kind of mistake makes me question my clarity of mind. Not a good thing when you are about to handle buckets of molten aluminum.

Getting Down to Business

About a month ago I cast a pulley. The melt was too hot and the casting ended up with a hot tear on one end. During machining I discovered numerous hard areas inside the casting that eventually lead to me breaking a drive dog. The partially machined pulley went back into the crucible for a second try.



I built a flask that is 8" square and about 14" tall. It permits me to cast the pulley with vertical room to spare. Here you see the molding board with the pulley pattern on top. All surfaces have been dusted.



The bottom of the drag has been struck off.



I then sprinkled it with loose Petrobond. I use a flour sifter both for the Petrobond that is in contact with the pattern and for sprinkling on the bottom of the drag. You can see my main tool for pounding the Petrobond on the right side of the picture.



Once the drag has been turned over and the molding board removed, you can see the top face of the pulley pattern. There is not a lot of clearance between the pattern and the flask. Note the minor burn marks on the wood. The flask has plenty of depth but would have been better if made a bit wider.



With the cope in place, I set the sprue. When I cast this pulley the last time, it did not have a riser and there was no shrink problems.



Before I started to ram up the cope, I decided to go with a larger sprue which would also provide extra melt if necessary. I just dropped a piece of PVC over the wooden sprue.



I then pulled the cope. The enlarged sprue is very smooth so will be easy to draw.



Given the rough finish of the cavity, I believe I did not pound the Petrobond hard enough. There was some crumbling. You can also see that the break out of the top lip on the right side. My pattern probably needs a bit more draft in this area. None of this really matters because I allowed plenty of extra metal.



The flask is in position. Note that the cavity is rather large so I will be pouring at the minimum temperature of 632°C . Even at that, there will be a lot of heat in this small area.



After the pour, I waited about 1 hour before opening the pulley flask. During this time I rammed up the next part. In 7 hours I make a total of 6 pours. The flask you see here contains the rotating head (page 74 in Gingery's book 3). This is my oldest and most worn out flask. During the pour I had melt leak out the sides. What made it a bit painful is that this pattern has a cast in steel core. I ended up just throwing it back into the crucible.

When the aluminum melted off, I was able to rescue the core and try again.



Here is my fun for the day. I cast two pulley blanks, the rotating head in the center (page 74), the protractor on the right (page 77), and feed crank in the upper right (page 68). I sure got a lot of mileage out of just a few patterns.

My first pour of the day took about 90 minutes, second was about 60 (remember the problem with the orientation of the furnace body). Subsequent cycle were about 45 minutes each.

My arm is not sore from all of that sand pounding but I definitely notice a little less endurance today. I still have a hand wheel to cast but will wait until more patterns are ready before starting up the furnace again. This assumes I don't have trouble machining these castings. If I do, it will go back into the pot and I'll try again.

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