Casting And Machining An 8” Pulley

By R. G. Sparber

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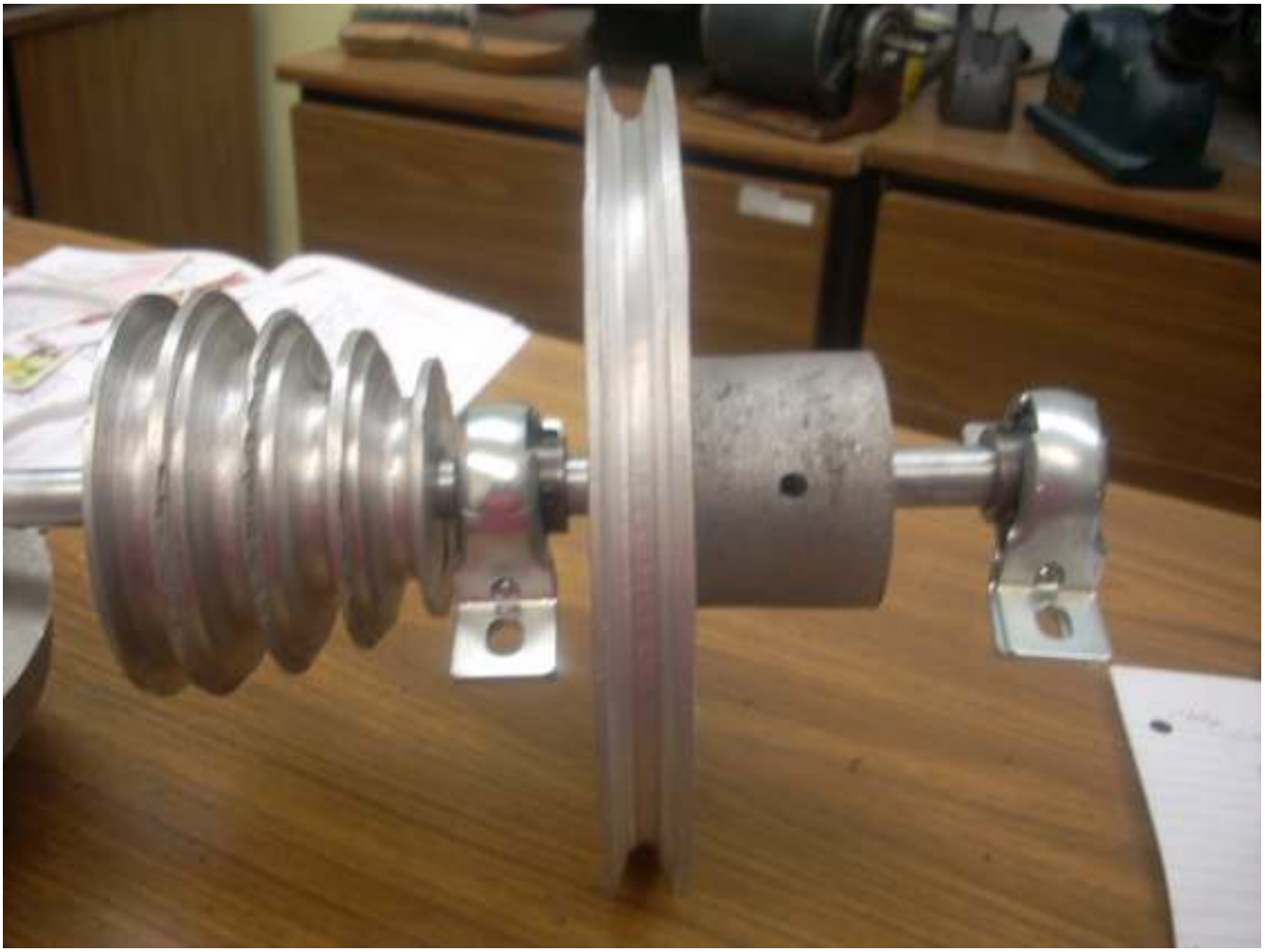
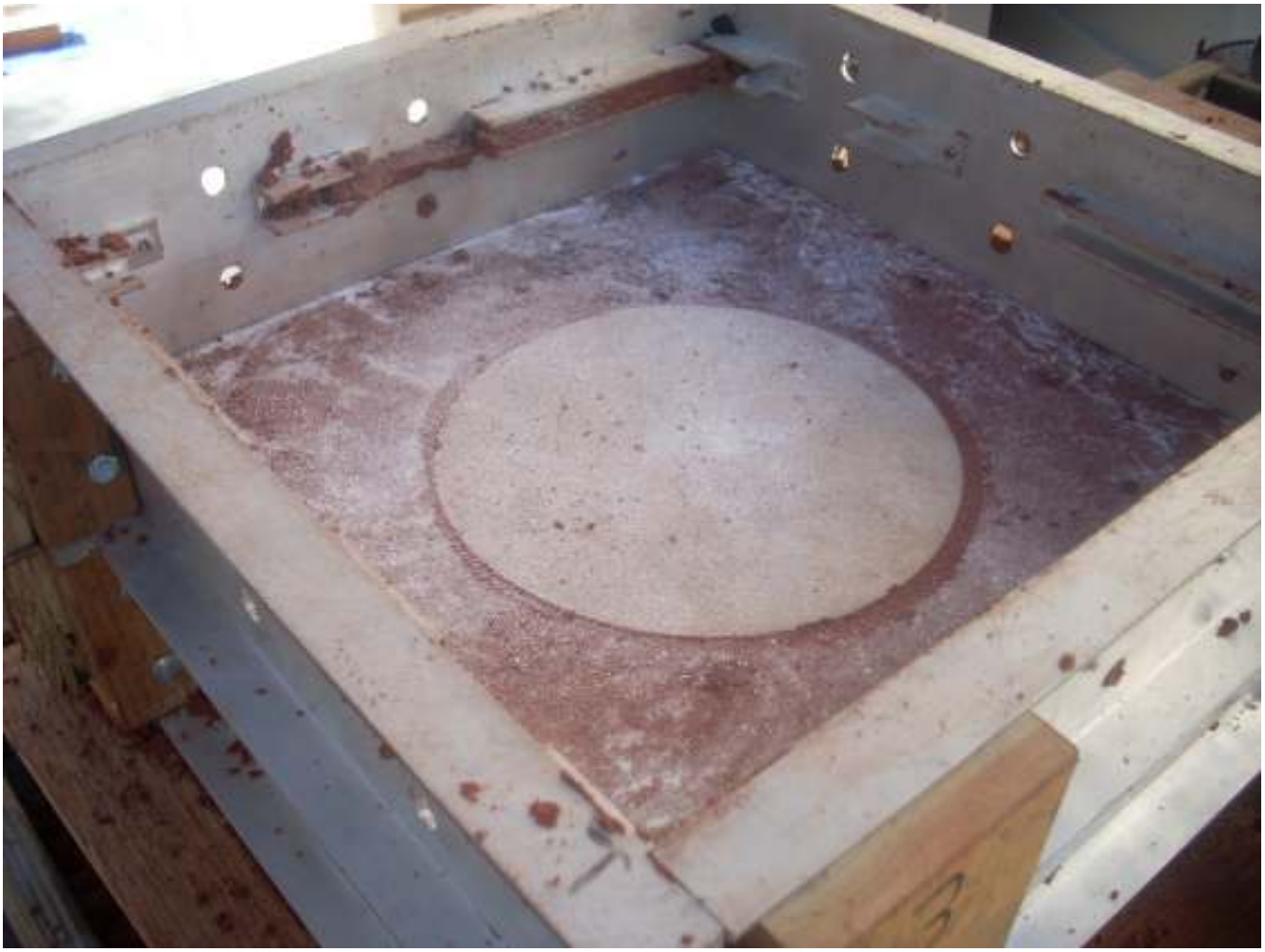


My 8” pulley pattern was made from a ¾” thick piece of MDF and the hub from a previous pattern. The resulting hub is oversized but usable.

I have my variable volume flask set to maximum which means I'm using all 100 pounds of Petrobond. The drag imprint came out nice and clean. No touch up was needed. I did not use any gaggers.

I cannot lift 100 pounds of sand so first moved the drag next to the furnace and then moved the cope. The cope is on edge when I cut the sprue. It is then moved on edge and rotated next to the furnace.

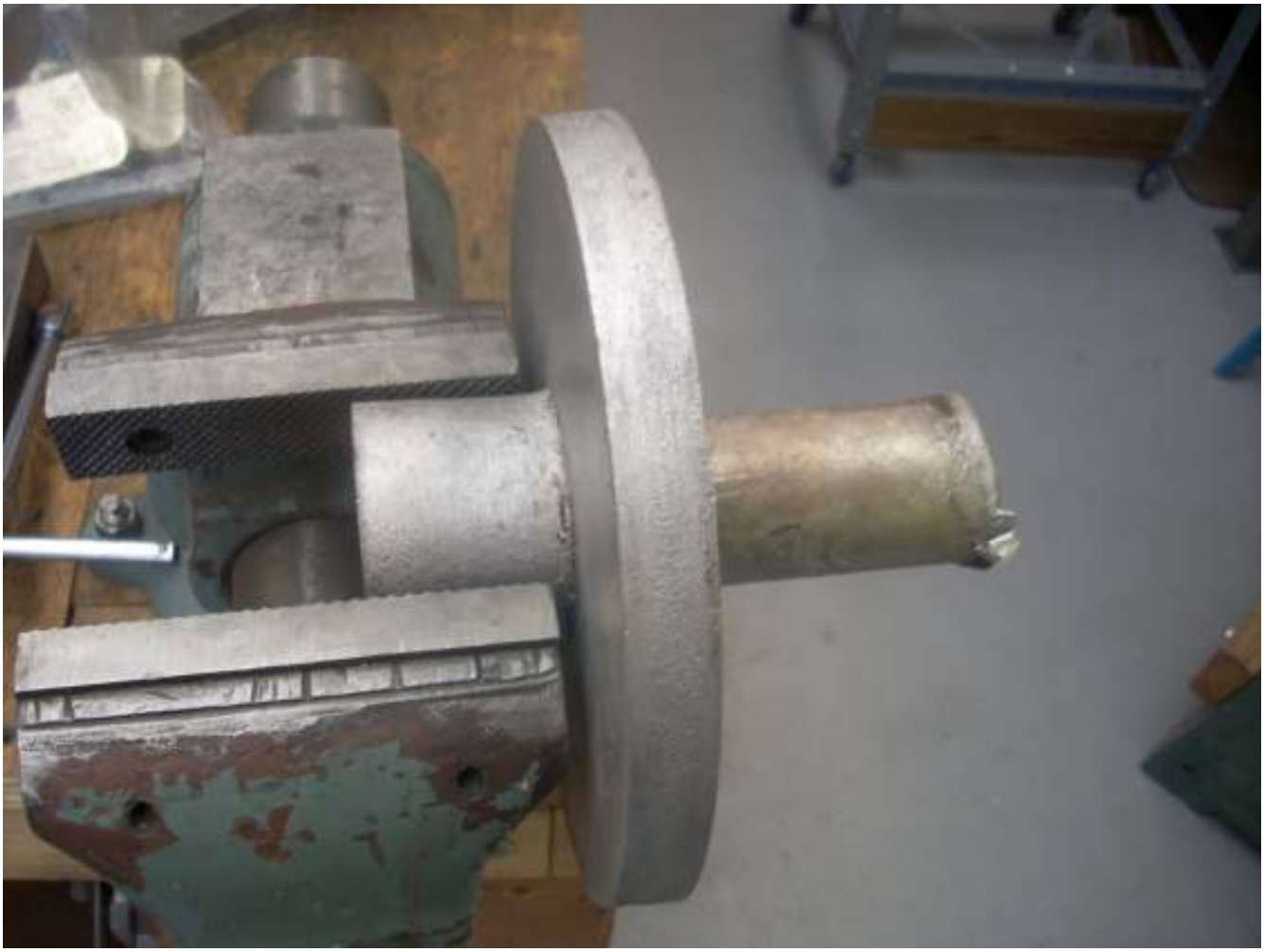
The lack of gaggers became evident when I rotated my cope horizontal for final assembly. Fortunately I did it over a clean, empty tub. About 50 pounds of Petrobond landed. Very little Petrobond was lost so that was good news.



The pattern was put back into the drag and I rammed up the cope again. This time I used a lot more force. No surprises this time and I was able to start my furnace.

I don't like to be rushed so don't start my furnace until at least one flask is safely positioned nearby. This costs me a few hours but, what the hey, this is a hobby and not production.

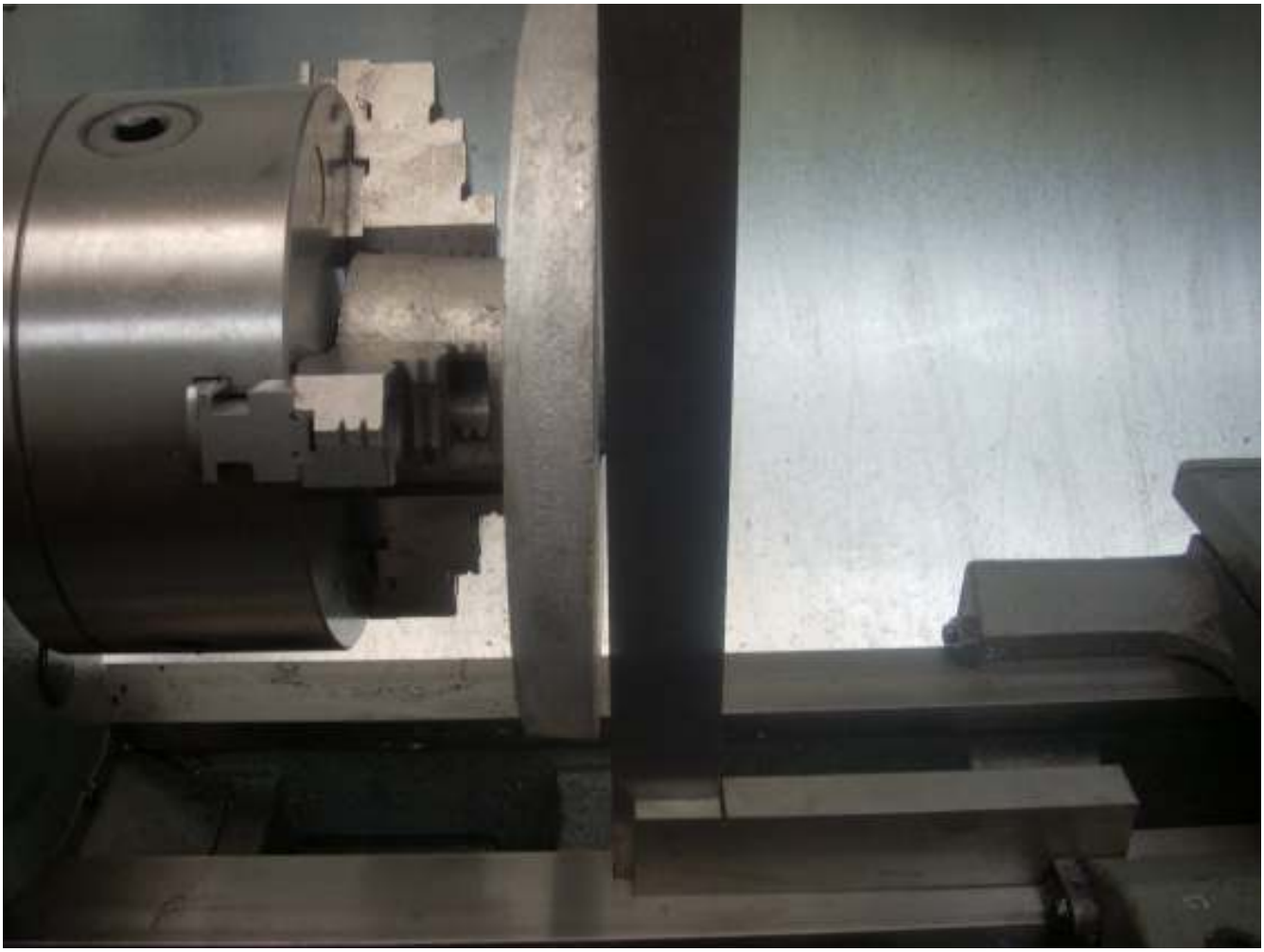
The casting took almost a full crucible of aluminum and the result was one serious hunk of metal.



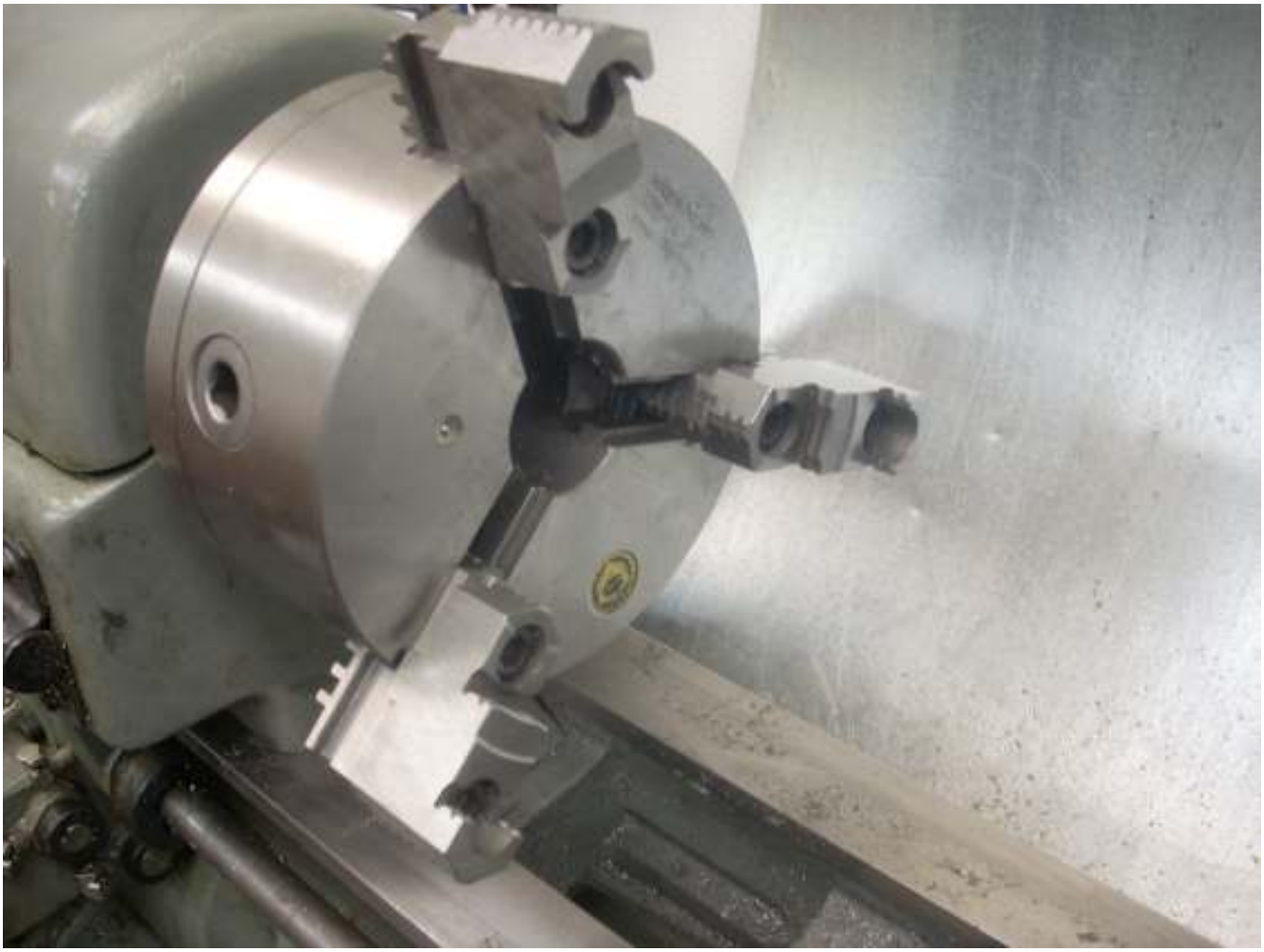
I chose to not taper the sprue since it had to feed that big hub.

You can see a small amount of shrinkage between the pulley and the bottom of the sprue.

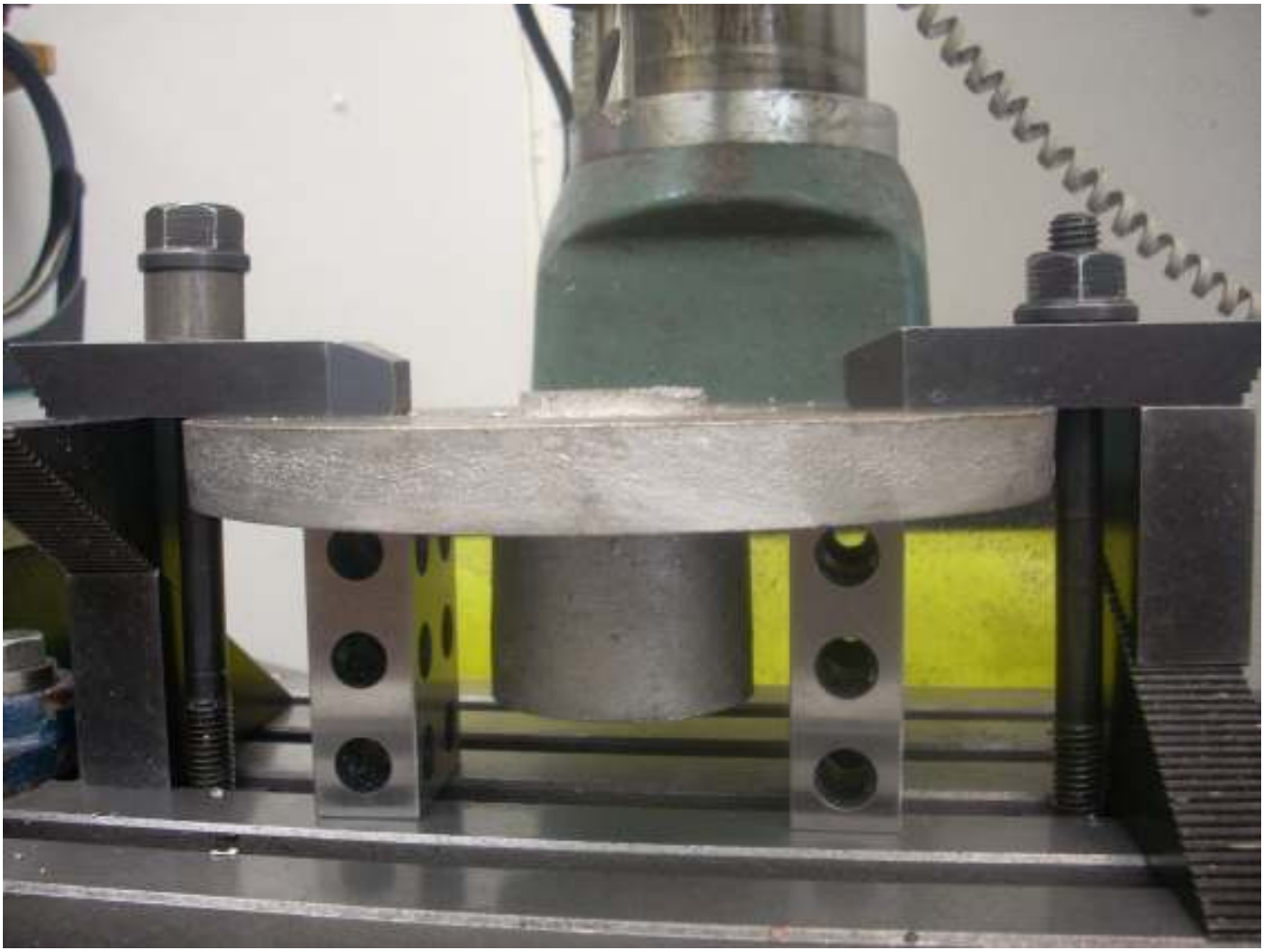
With the sprue cut off, you can better see the shrinkage.



The next step is to decide how best to hold the casting in order to minimize cutting. Holding the hub is not such a good idea. You can see how much the disk deviates from true. With such a massive hub, the best approach is to use the face of the disk as my reference and bore through the hub with what ever offset results. I can cut a lot of this hub away and still be solid.

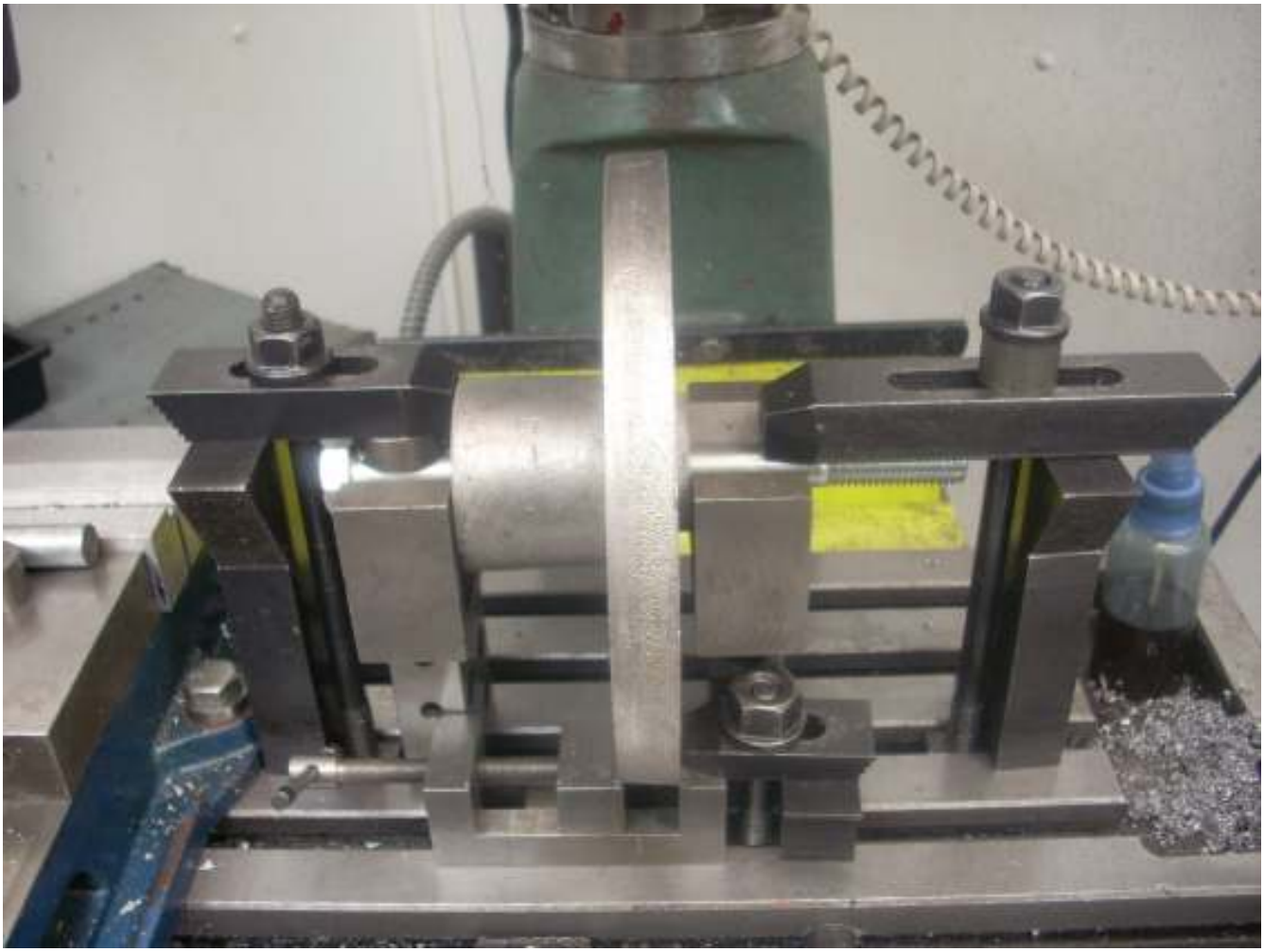


My first idea was to hold it in my 3 jaw chuck but the casting was about ¼” too large.

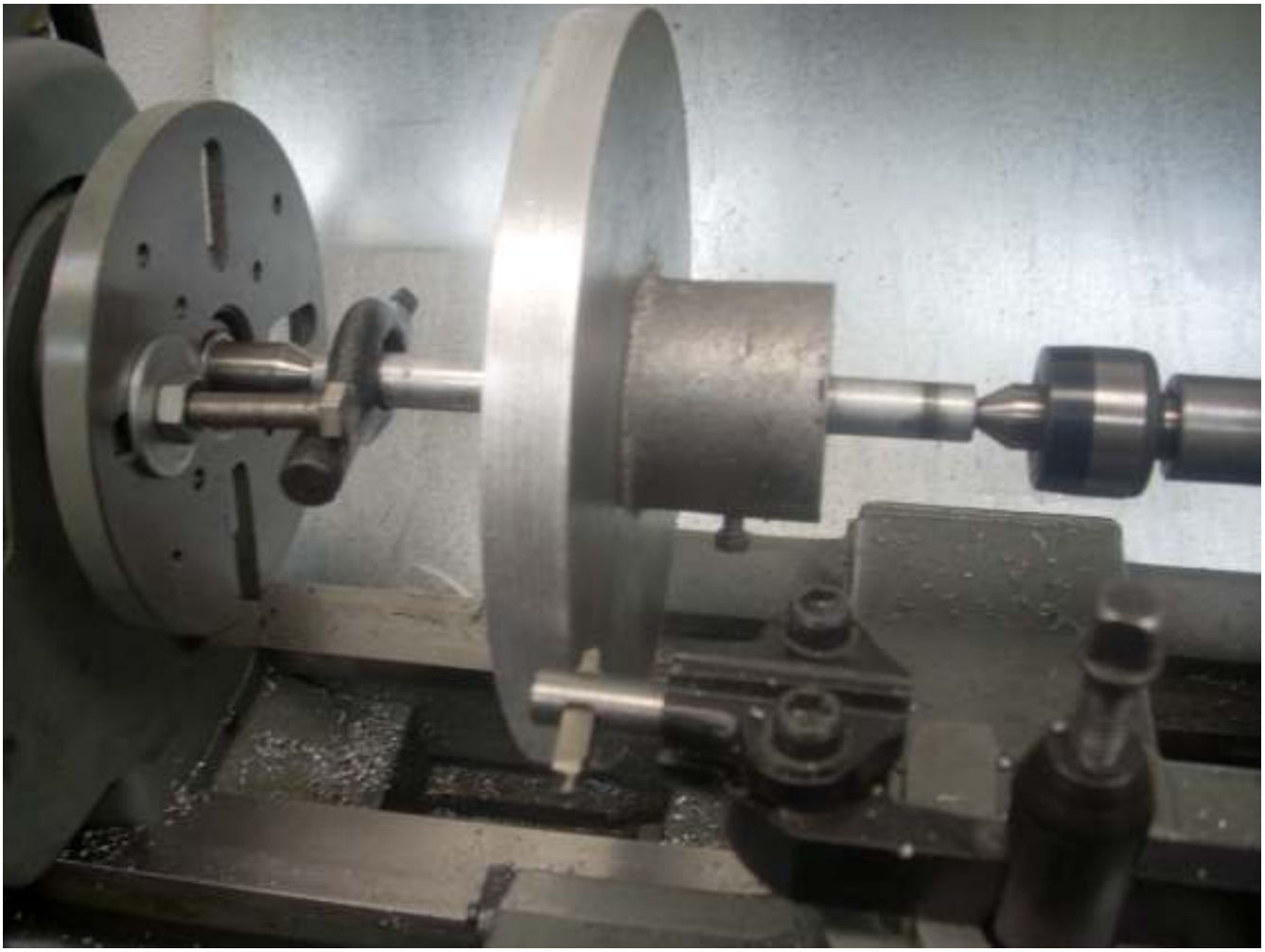


I could have bolted it to a faceplate but chose to put it on a mandrel instead. In hindsight, the faceplate would have been more solid.

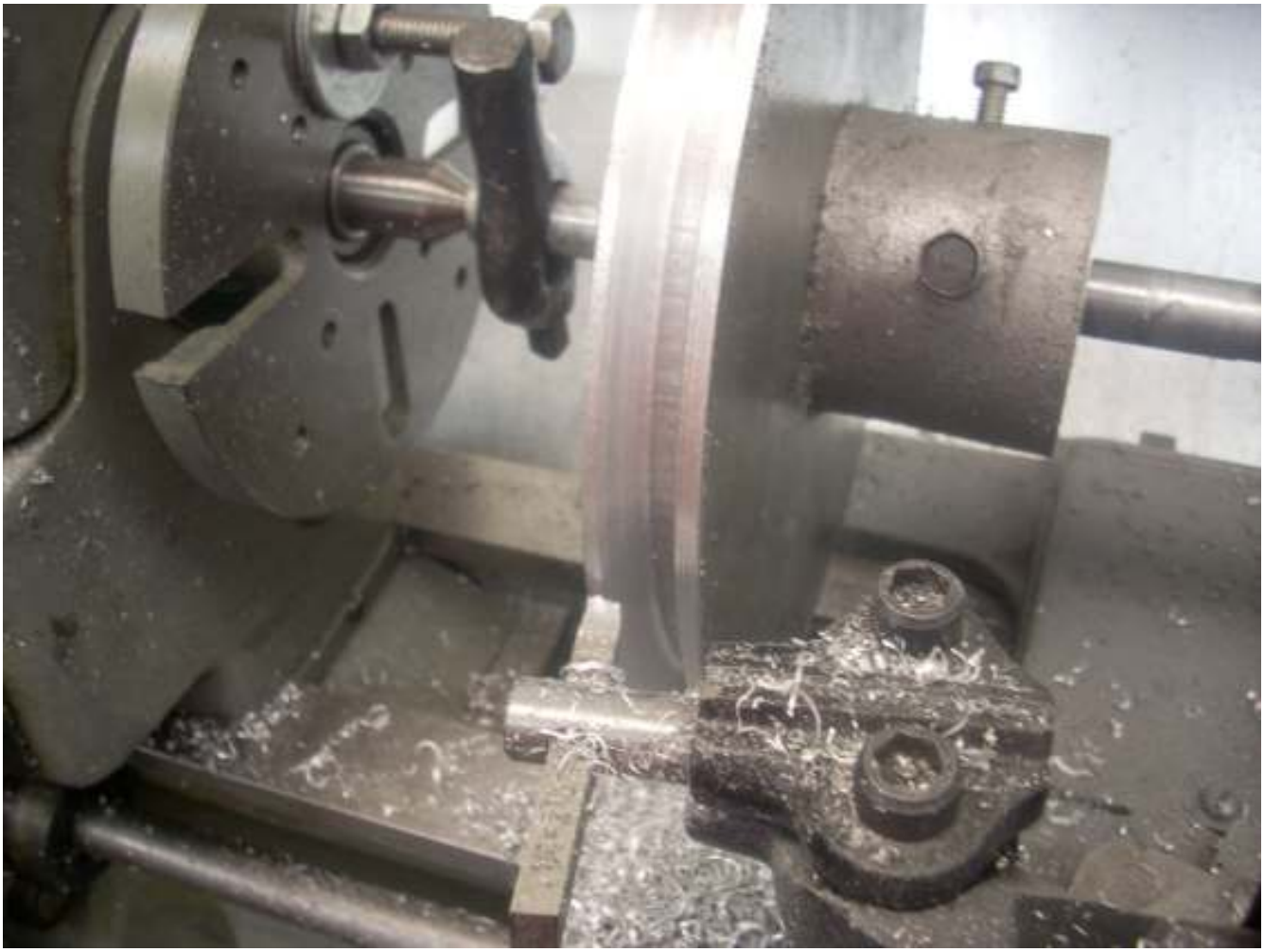
Here I have put the casting up on 1-2-3 blocks on my mill. I scribed the center of the disk and am about to drill a ½" hole through the disk and hub. I then bored the hole to a sliding fit on a 5/8" mandrel.



With the casting supported by a 5/8” diameter bolt on V blocks, I am about to drill and tap two set screw holes. The small vise prevents rotation as I drill. The holes are separated by about 90°.



The casting is now on its mandrel and run between centers. My lathe has a 12” throw but that does not mean I can get a tool around it. This 8” disk was a challenge. In the end I found that a boring bar off to the side was able to reach the edge. Note that the cutter is upside down from a normal boring bar but right side up for this arrangement. I started at 49 RPM but found that 70 RPM worked better. Before starting the lathe I realized the cutter was too small so changed that out.



My first pass was a plunge cut down to 0.490”. Then the tool post was turned 17° and one side of the V groove done. Turn to -17° and cut the other face until the width was right.

That plunge cut was a nasty task. The 5/8” mandrel was not strong enough so there was some deflection. I often dug in and stopped the lathe. Sometimes the motor would run but the set screws didn't hold. This scored the mandrel. After a while I learned how much I could push without wasting my time and not jamming the lathe.

The showdown came when I went to remove the mandrel. It was solidly stuck. I solidly supported the casting and started tapping on the mandrel with a small ball peened hammer. No joy. Went to my large ball peened hammer. No joy. Went to my hand sledge. Saw a little motion. I decided to cut off both ends of the mandrel and drill a ¼” hole down the center in hopes of weakening the rod. No change so chased this hole with a 3/8” drill.

Using a drift and my hand sledge I was able to finally eject the remnants of the mandrel.

I drilled the hole with a hand held drill and you can see that I blew out on the end. I also broke out a small amount of aluminum on the casting. Otherwise, the casting survived.

A second casting will be used for a combination flywheel and hand wheel. I only need to round the edge so will probably go with a mandrel again. Time to go find another mandrel...

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