The Crank Bearing Support

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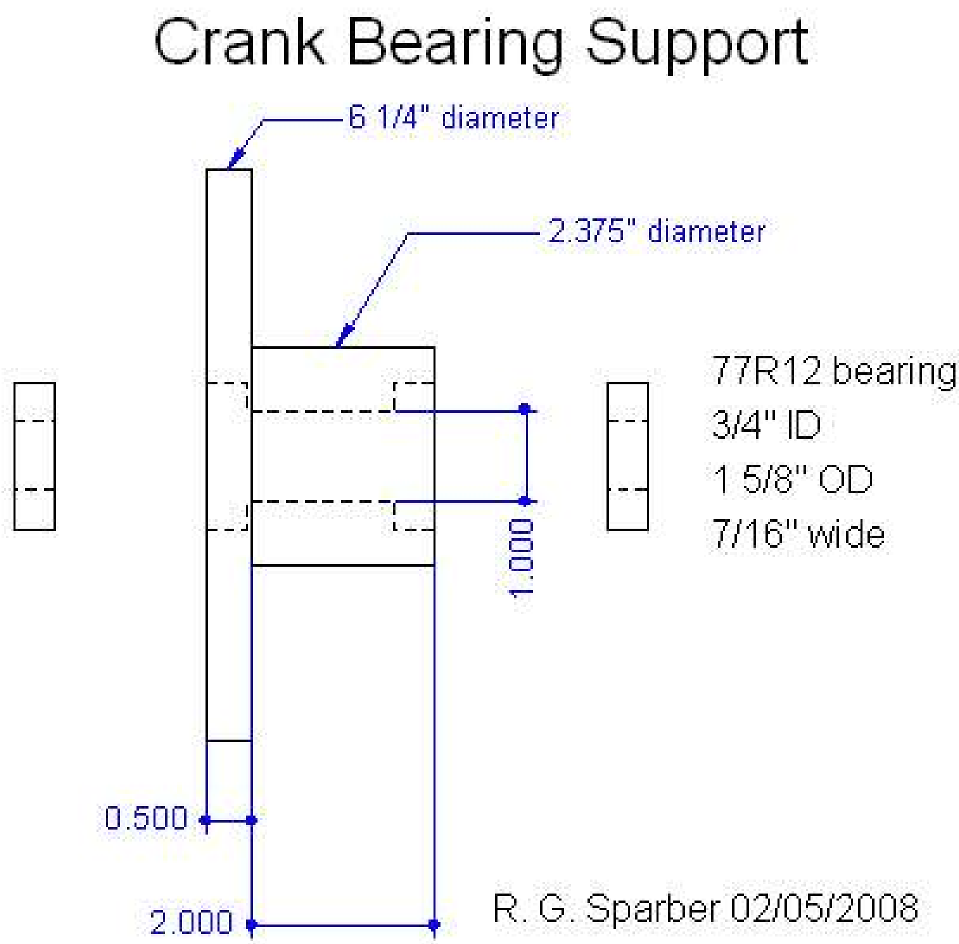
This article starts with the casting process and continues through the complete machining of the part plus its attachment to the shaper's column.

Originally I had planned to use ball bearings to support the crank shaft but later had my mind changed by people on the gingery_machines Yahoo group. The impact force of the cutter would be concentrated into a very small area within the ball bearings which is bad news. A bronze bushing has far more contact area so would withstand the impact force better. My original design is shown below.



I had already made the pattern assuming ball bearings and decided to just use it. The result is that the hub is larger in diameter than required. So far I don't see any harm in that. The only deviation from the above drawing is in the machining phase where I will bore the hole a uniform 1” diameter and not cut the ball bearing pockets.

Casting the Crank Bearing Support

Here you see the pattern partially covered in finely sifted Petrobond. I use a flour sifter for sand that will contact the pattern. The large white cylinder is the hub. The smaller cylinder is part of the sprue and gate system.

On the left you can see some of my extremely sophisticated foundry tools. In tight spots I ram the sand with the wooden triangle and the bar of CRS. You can also see half of my larger square end rammer.

After the drag was rammed up, I added my bottom board and turned it over. You can now see the flange's plate plus more of the gating.

The sprue has been fitted to the gate. I added a block of wood between the disk and riser to provide more space to hold molten aluminum in hopes of preventing a shrink void. If you are familiar with the casting of this part, you may notice that I am not following Gingery's plan of placing the riser on the end of the hub. It seemed to be unnecessary effort to me. If my approach fails, I am out a bit of time. If it works, I have avoided hassle plus learned something new.

Well, I got away with it! No shrink voids at all. You can see the sprue still attached to the edge of the plate.

I did have some crumbling of the edge between plate and hub but this should be easily cleaned up during machining.

The sprue and riser are visible here. Note that the sprue has a slight taper on its body. This was formed with a tapered sprue cutting tool formed from 4 wires attached between two disks of different diameters. The top of the sprue has a larger angle taper which was cut after the body was cut.

The molten aluminum falls down the sprue and hits the bottom of the well. It then fills up the well and gently flows out into the disk, into the hub, and finally up the riser.

I cut the gate and riser off with my bandsaw. Admittedly, sawing off the block from the plate took a bit of patience but was not difficult.

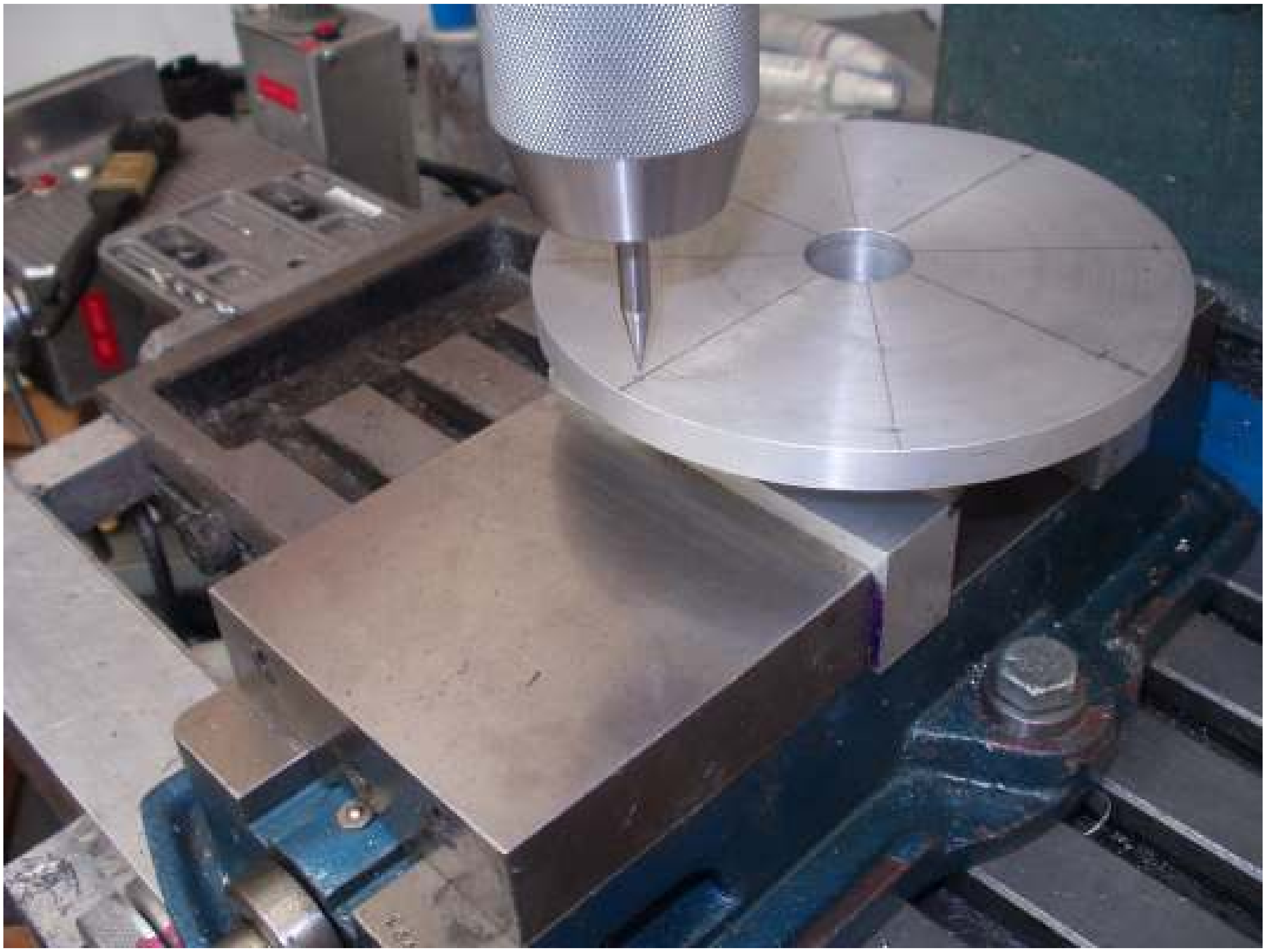
The part is held in a 3 jaw chuck and the edge cleaned up first. I then faced the plate removing the remnants of the riser. To my surprise, the plate was not all that flat. I ended up having to take about 0.04” from the face before it was true.

After facing the plate, I step drilled the center until I could fit in my boring bar. Then I opened the hole out to 1.000”. I ended up at 1.002” but still had a slight interference fit with the bronze bushings. Luck was with me. This bar has a lot of spring in it so it is very easy to open the hole too much.

Note that the face of the flange was machined along with the bore without disturbing the part. This insures that the bore is perpendicular to the flange's bottom. The shaft that runs in the bronze bushings should then be perpendicular to the flange.

I then turned the flange over and held the perimeter in the 3 jaw chuck with its jaws reversed. It was then possible to face off the top side of the flange and the end of the hub.

The next step was to roughly lay out the bolt holds. One of the suggested mods was to use 6 screws rather than 4 because it looked better. As my good friend Ed used to say “If more is better, then too much is just right”. So I used 8 screws. I decided to use 1/4-20 screws given that the bolting flange on the side of the column is only about 0.4” wide and I wanted to stay in the center of it with plenty of metal on both side. I'm sure that eight 1/4-20 screws is stronger than four 5/16-18 screws.



The flange was simply clamped into my mill vise. This is a first for me. I have never had a need to drill a bolt circle before. The job was made exceedingly easy because I own a Shumatech DRO. It has a bolt ring function built in. I simply had to tell it the radius of the ring, number of bolts, starting angle, and stopping angle. The starting and stopping angle are equal which means that I want the 8 bolt holes to cover a full 360 degrees.

For once I was smart enough to follow a past lesson learned. I did a dry run of the drilling sequence with a spud fitted to the drill chuck. Much to my surprise I was unable to move to the bolt position shown above. I needed 0.015" more travel in my Y axis. Not to worry, I just changed my start and stop angle to 22.5 degrees. As you will see below, it avoided this Y axis limitation.

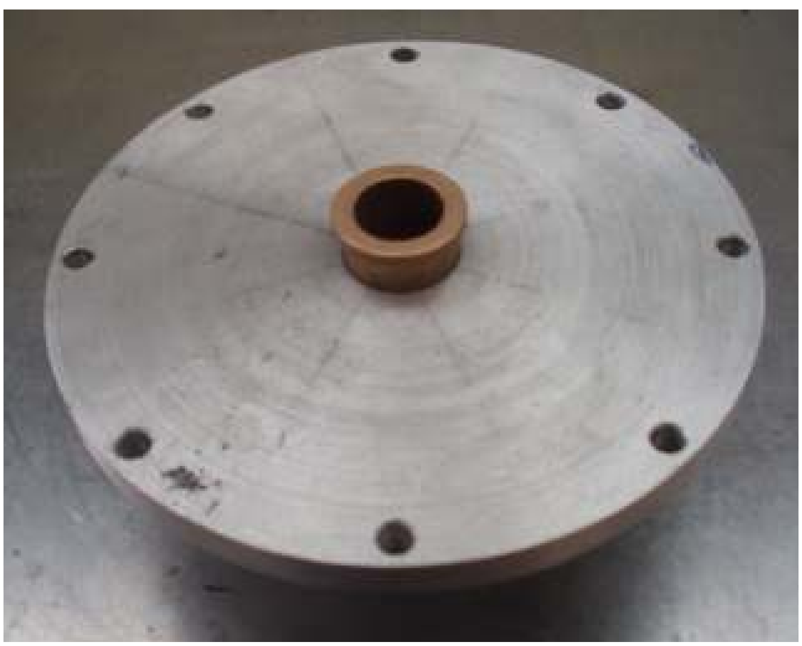
The holes were all drilled with a #7 so I could spot through to the bolt ring on the column.

I used a countersink permanently fitted to an old brace and bit to clean up each hole top and bottom.

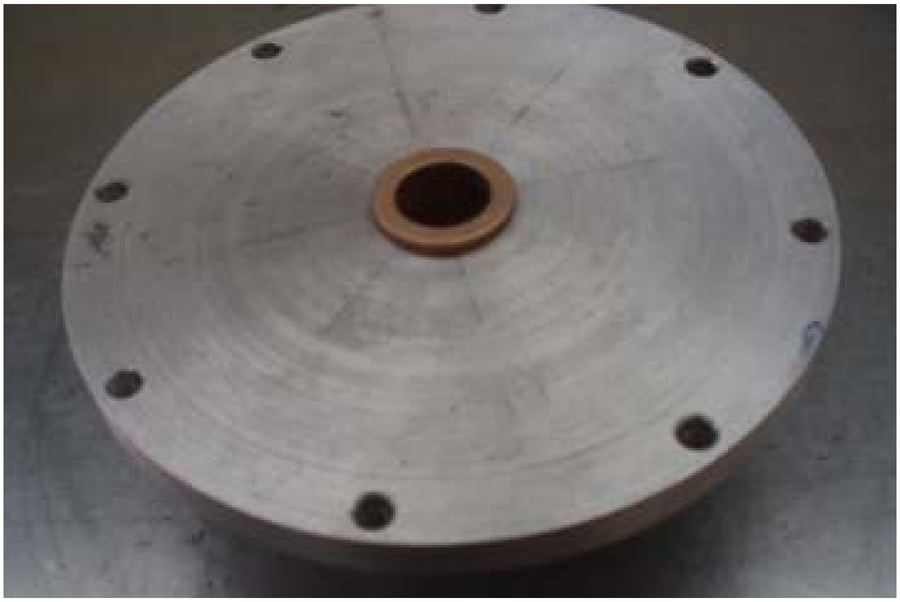
This picture is a little deceptive. I started by clamping the flange to the column's bolt ring and drilling through with my Gingery drill press. After drilling 4 holes I realized that the flange had shifted a little. This is an old lesson I just relearned. The right way to drill a series of holes like this is to drill the first hole, follow with a clearance drill, and then tap. Fit the screw and move onto the next hole. Only then can you be sure the holes will line up. Once a few screws are secure, it is possible to drill the rest of the tap holes before changing to the clearance holes and tap. So here you see 4 screws installed and the remainder of the tap holes being drilled.

Not visible is a scribe line that indicates which hole is at the bottom. Although the holes should all be within a few thou of their ideal position, it is still best to keep the matched holes together. Once the oil hole is drilled, it will be obvious which face is up on the hub.

Now doesn't this look nice? The outside bushing pressed in solidly. But wait, why is the flange not sitting on the surface plate?



Could it be because the two bronze bushings are too long? Fortunately I was able to press them out and cut off about 1/2” from each one. I now have about 0.4” between the ends of the bushings that will be my oil sump.



Ah, that's better. Maybe everyone else has smooth sailing during this project, but I certainly do not. No show stoppers, just a constant flow of minor screw ups and surprises.

One more machining step to go. I need to drill an oil hole that feeds the sump. A strip of felt will go down this hole. Gingery calls for an oil cup but I don't have one. I might just put in a threaded plug. But that is for another day.

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