Machining the Crank Yoke and Pivot Supports

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Overview

Gingery intended for the crank yoke to be built from steel bar stock and cast aluminum. The pivot support is also supposed to be cast aluminum. Given my access to a mill/drill and welder, I decided to take a different path.

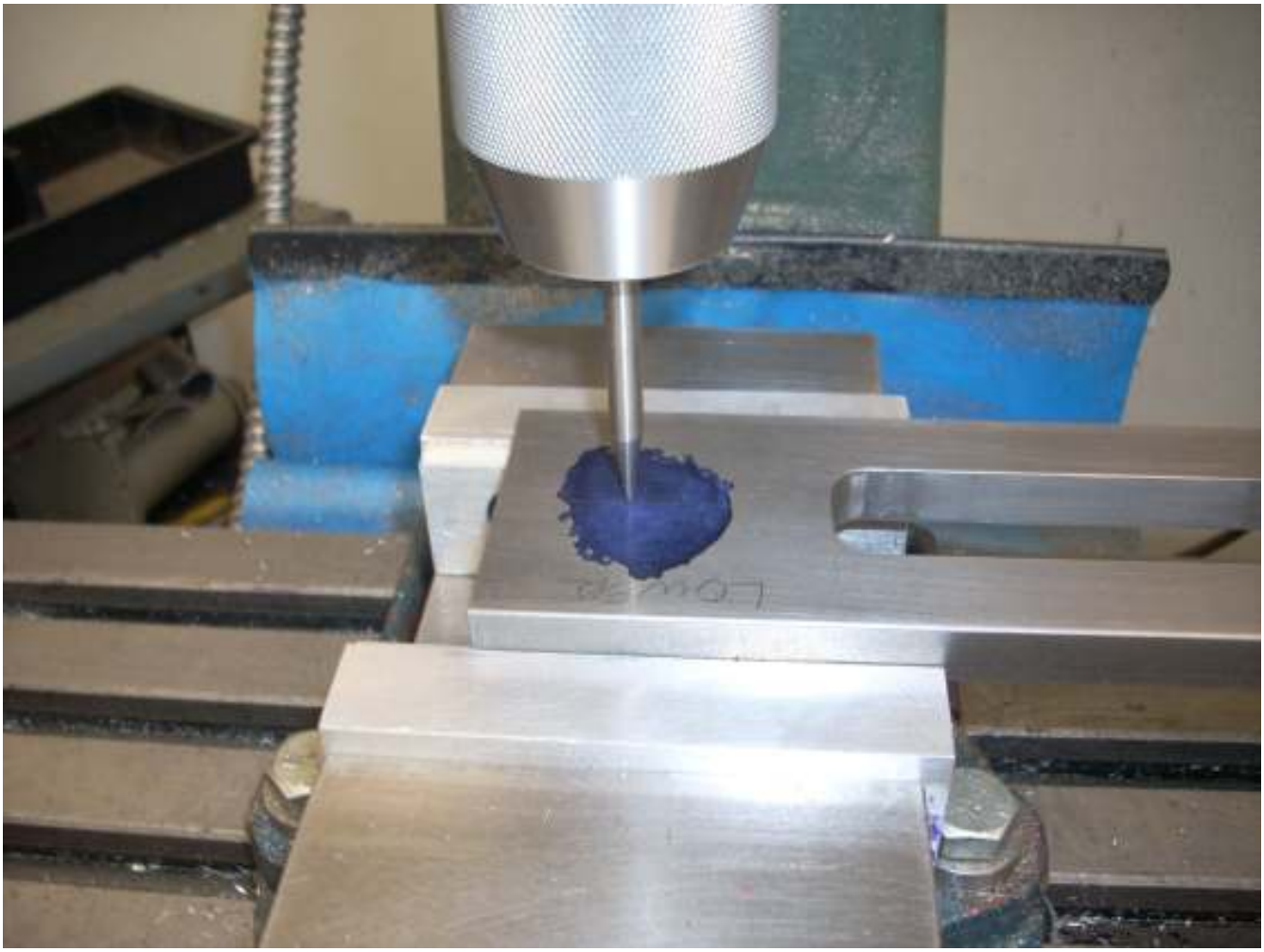
I chose to mill the crank yoke out of a slab of steel. The machining of the slot was described in a previous article.

The two holes were first step drilled and then bored out to a press fit for bronze bearings. I chose to use 1” OD, 3/4” ID bronze bearings mostly because I had them in hand. The larger diameter should be a good thing on the pivot end since it will be more ridged than the original 1/2” bar. The top bearing, shown on the left, presented a minor problem in that I must connect to a 1/4-20 bolt. This was solved by making a sleeve with an OD of 3/4” and an ID of 1/4” as will be shown later.

The slide block was machined from a high density plastic that is commonly used for bearings. The crank pin was made from a standard 3/8” diameter bolt with a sleeve added to bring the shank up to 1/2” diameter.

Machining the Bearing Holes

The position of each bearing is not critical. I used my spud and scribed lines to locate each center. A center drill was first used, followed by a 1/4”, 3/8”, 1/2”, and 5/8” drill.



With the hole at 5/8” diameter, I was able to bring down my boring head and open the hole out to 0.998”. It takes a bit of care to be consistent on those last three equal depth passes, but I did get within a thou.

Note that I am using soft jaws and the yoke is securely held with only about 0.1” of contact.

The bronze bearings were pressed into the holes using my bench vise. A block of pine and a strip of 1/8” extruded aluminum scrap protected the crank yoke and bearing.

I cut a 3.1” length of 3/4” CRS to be used as the pivot. Note the slab of paraffin wax flanking the round stock. As the saw cuts the wax, it carries it into the cut. Bits of metal, coated with wax, fall out the other end and the cut has a nice finish.

After deburring, the length of CRS was put in my 3 jaw chuck on my lathe. The ends were trued up and the overall length reduced to 3”.

Next I wanted to get a good sliding fit between the bar and the bearing. Clovis 600 grit lapping compound was smeared on one end of the bar. I then ran it through the bearing with the drill chuck for support. Once done, I used plenty of cleaner to flush the grit from the bearing.

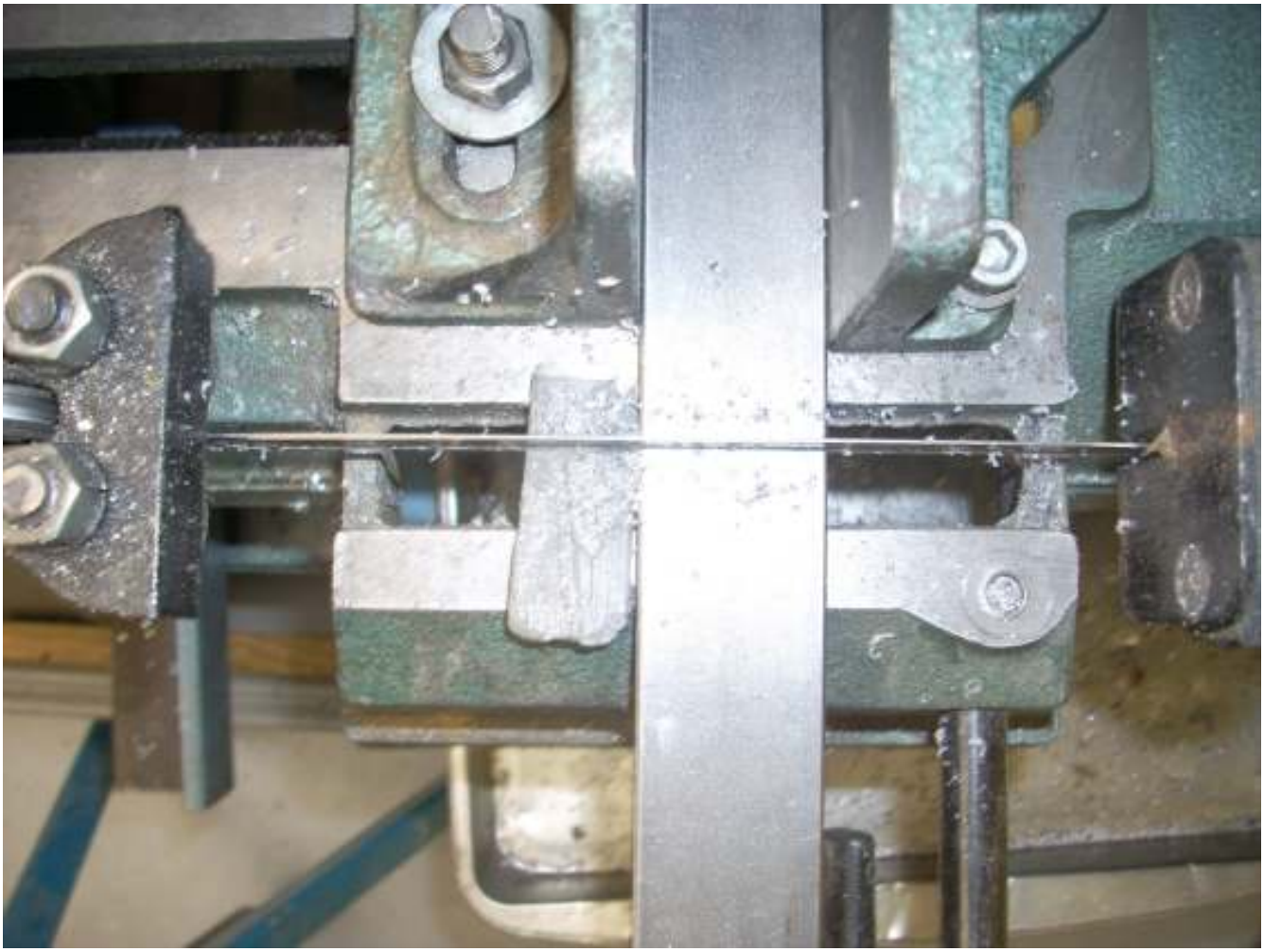
The crank pin is supposed to be a shoulder bolt but I didn't have one in my junk drawer. So instead I made a sleeve. The ID was step drilled to a size U and then I ran a tap to permit the rolled threads of the bolt to pass. I only had to cut in a few thou but chose this route rather than going with a looser fit between sleeve and bolt.

The slide block was very easy to machine. This plastic cuts like wax although it does tend to melt when shaped on the belt sander. You can see some dark and irregular spots.

The sleeve is hidden inside the slide block. As part of the final assembly of the crank pin, I must cut the thread to fit.

Using this plastic is a minor gamble. If it is unable to survive the jarring forces of the ram, I will make a new one from bronze.

Pivot Supports – the good, the bad, and the ugly



I started with a bar of 0.2” thick by 1 1/8” wide CRS. I am sawing it with the stock flat in order to get a decently square cut. Note the bit of paraffin wax flanking the bar. I collect all of the bits of wax in a cup and will melt them down to form new blocks. In fact, I probably will just leave the cup out in the Arizona sun for a few minutes and hope it does not ignite. How's that for being frugal?

Since the pieces are cut fairly square, I needed to mill off only about 0.01”. The bar is held in my soft jaws. A home made stop positions the bar so that both bars are the same length. The accuracy is not critical but this does speed up the machining process.

I drilled a 1/4” hole in the center of each bar to make alignment of the boss easier.

One end of a length of 1 1/8” CRS has a 1/4” diameter button machined into it. I then sawed off a length 5/8” long.

The button and hole permit me to quickly and easily get alignment of the parts as I set up to weld them together.

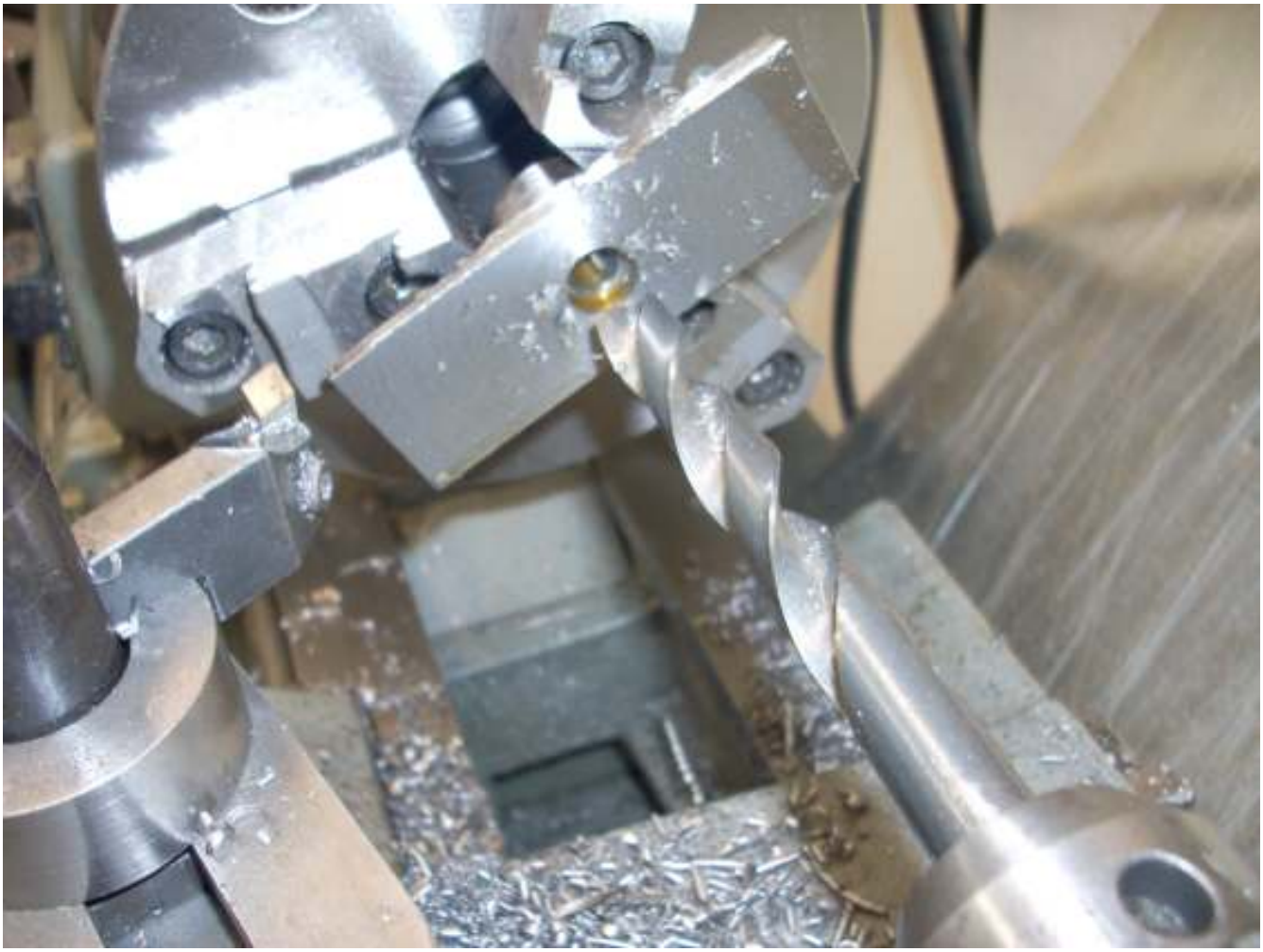
Now it is time for me to move outside so I can run my welder. I weld just often enough to turn out serviceable but ugly beads.

The bead does not look half bad but is probably oversized. This means excessive heating of the bar which can cause warpage.

The part is shiny from being cleaned up with a wire wheel but there is no hiding the lumpy bead.

The bar was warped and the first boss did not stay down on the bar after the first bead was run. Not to worry, machining can help a lot here. I want to end up with the bottom of the bar perpendicular to the hole through the boss. This is accomplished on the lathe.

The boss is held in my 3 jaw chuck. I face the bottom of the bar.



Without disturbing the part, I step drill the hole out to 5/8” in preparation for the boring bar. The drills all wiggled a little because the original hole in the plate was not exactly true. The boring bar cleaned this up. I end up with my bore perpendicular to the base of the support. The rest of the part looks like crap but from a functional standpoint, this is OK.

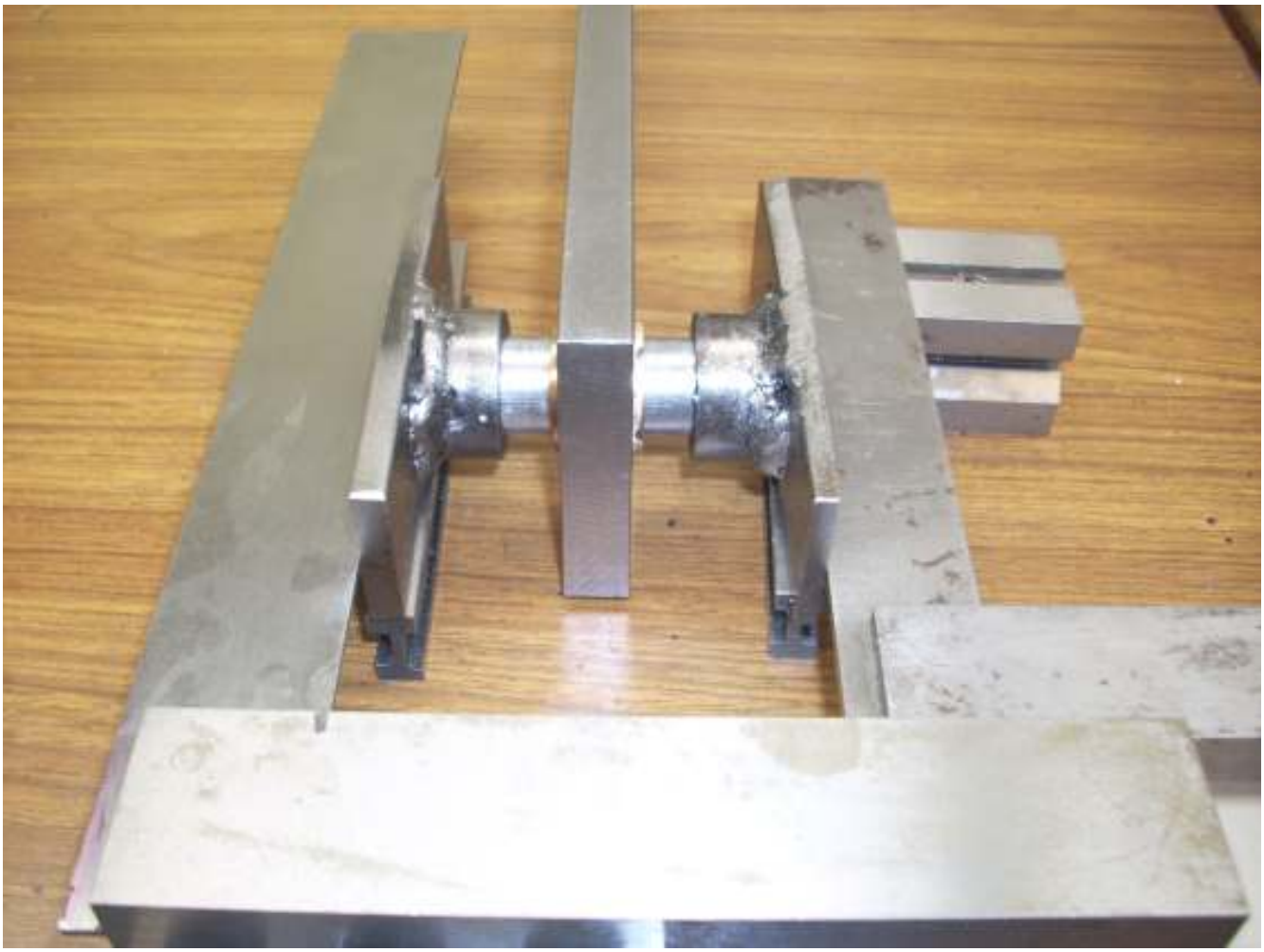
This was my first part and you can see that the left end is a different color. I turned the rest of the base

true but did not want to give up any more metal just to reach this end.

On the second part I first check for warpage and used a few taps of a dead blow hammer to get it within 0.01” of true. I also used a C-clamp to hold down the boss during welding.

Final Assembly

The proof is in the pudding. Here you see the two pivot supports, the pivot rod, and the crank yoke. I have used two squares to verify that the bottoms of the supports are parallel. It is hard to tell from this picture but they did come out just fine.



Note that the support on the right is thinner than the one on the left. I was able to save a lot of metal by first straightening the plate before truing it up on the lathe.

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