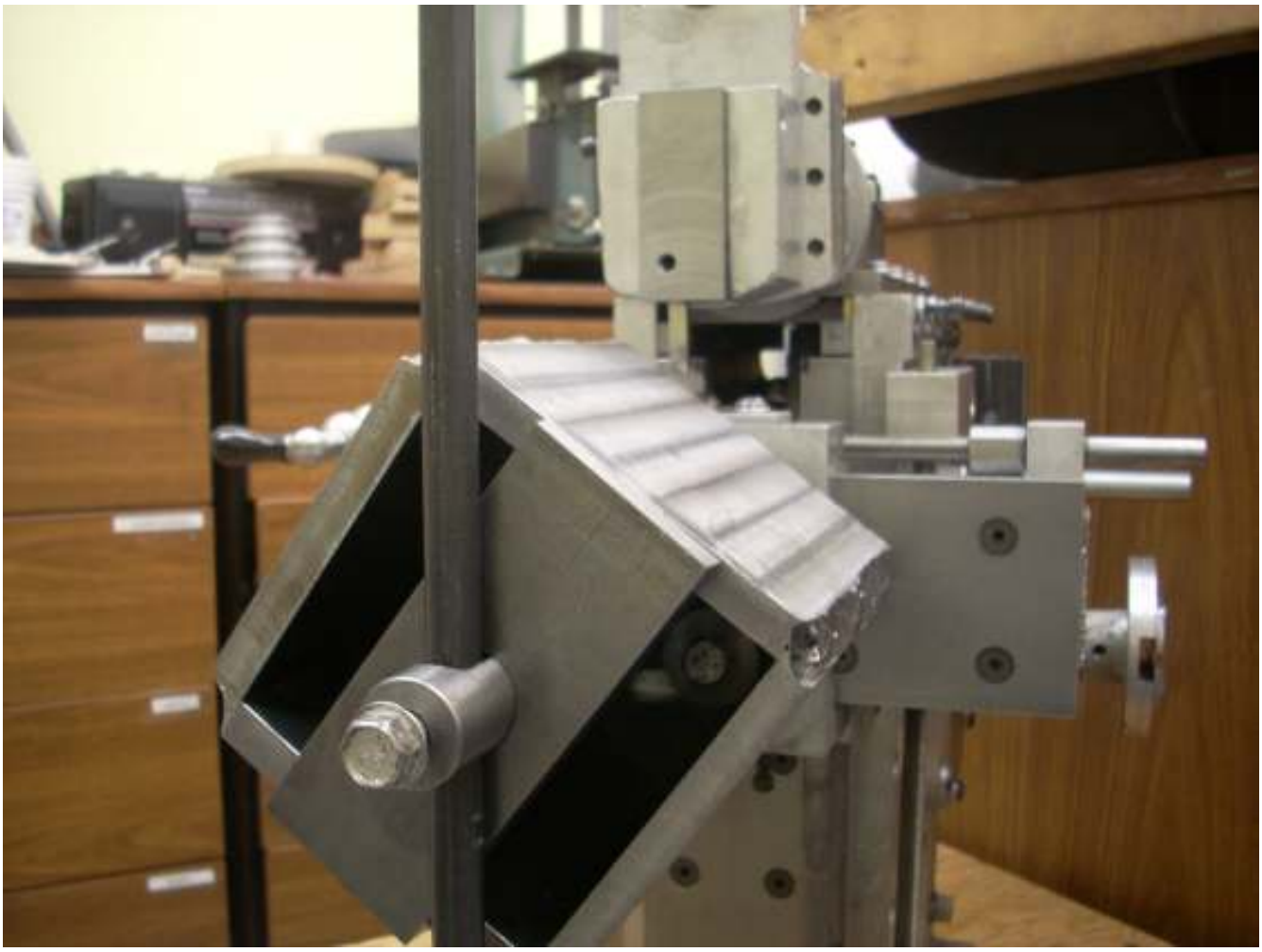
Fabricating the Table

By R. G. Sparber

10/04/2008



In the previous article I presented my best guess at how to build the shaper table. It came out close to this guess but I certainly had my share of surprises. Here you see the table mounted on the shaper with a temporary support bar in front. It has been set to around 45°. So I how did I get here?

I started with a piece of ½” x 4” x 45” CRS. Using my bandsaw I cut 4 pieces of ½” x 5.1” x 5” CRS and squared them up on my mill to ½” x 5” x 5”.

Clamps and a block of square aluminum were then used to fit up the corners in preparation for welding.

I used my flux core MIG with 0.035” diameter wire to tack the ends. It only puts out 80 amps so there is minimal penetration.

With all four pieces tacked together I'm ready for a bit of stick welding.

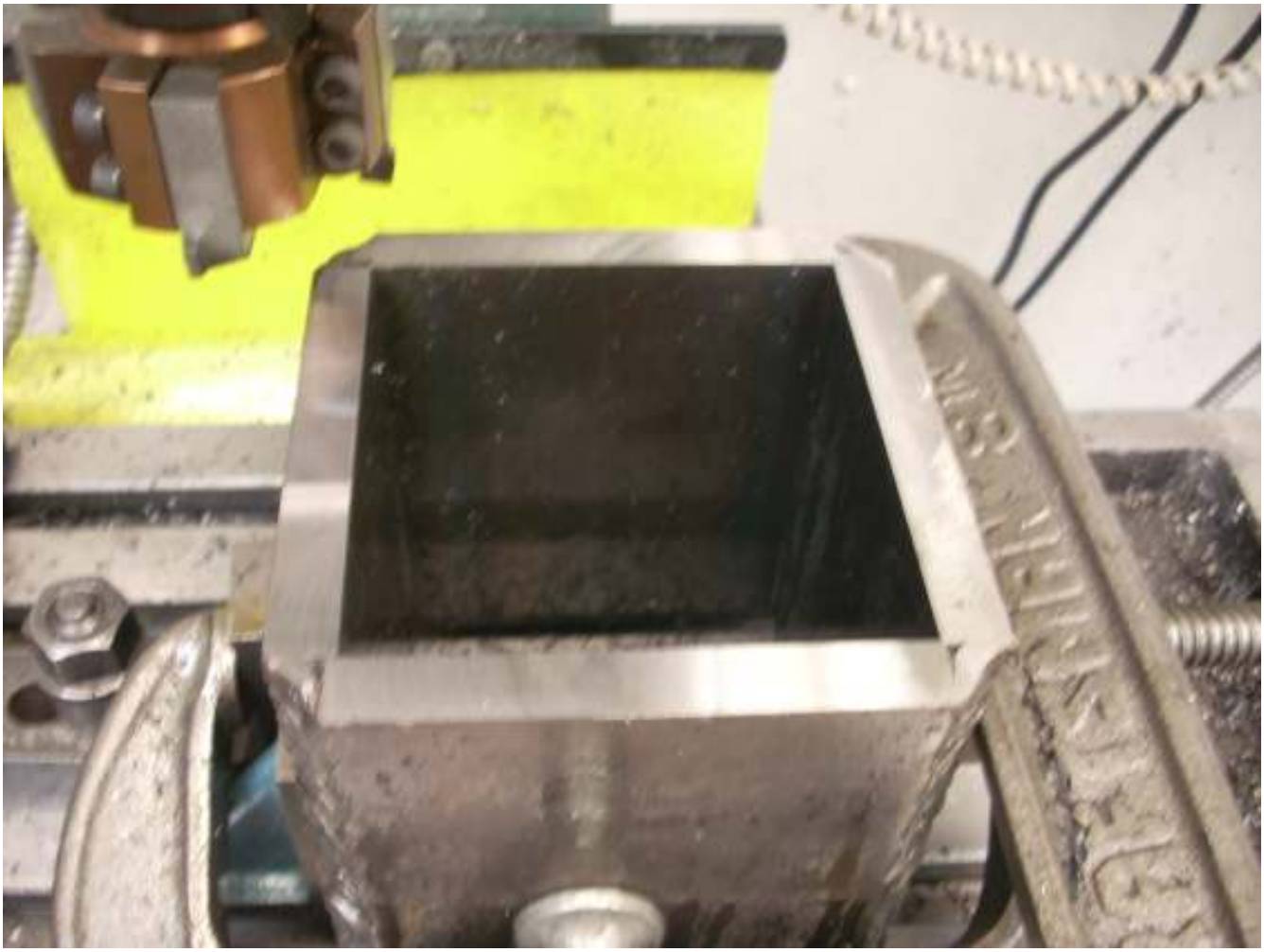
Once I got busy with my stick welder, I forget to take pictures.

I ran 6013 1/8” rod at 120 amps, electrode positive for maximum penetration.

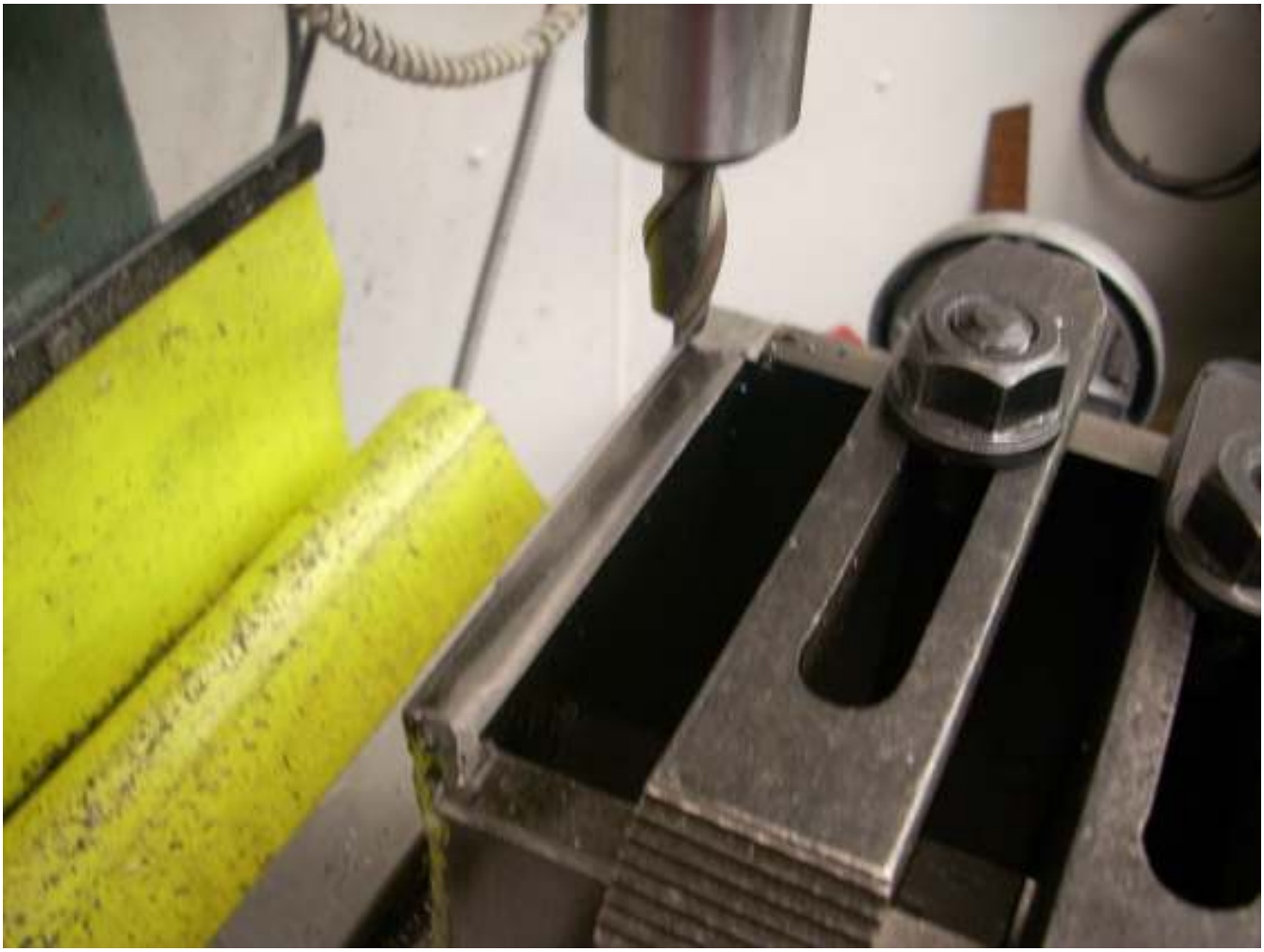
Following great advice from people on line, I started by running 1” long beads on diagonally opposite corners to balance the stress. Then I ran a second bead all the way across the corner again doing opposite corners. This was followed by a cover bead of 6011 1/8” rod at 90 amps, electrode positive.

The result was amazingly undistorted. It took about 2 hours to cool enough to handle without gloves.

The ends must be milled true before I weld on the back plate. I am using my carbide shell mill running at 2500 RPM. It gave a very nice finish but also a shower of very hot swarf that looked like sparks. I was afraid it would set my shop on fire so later changed to a far tamer 5/8” end mill.



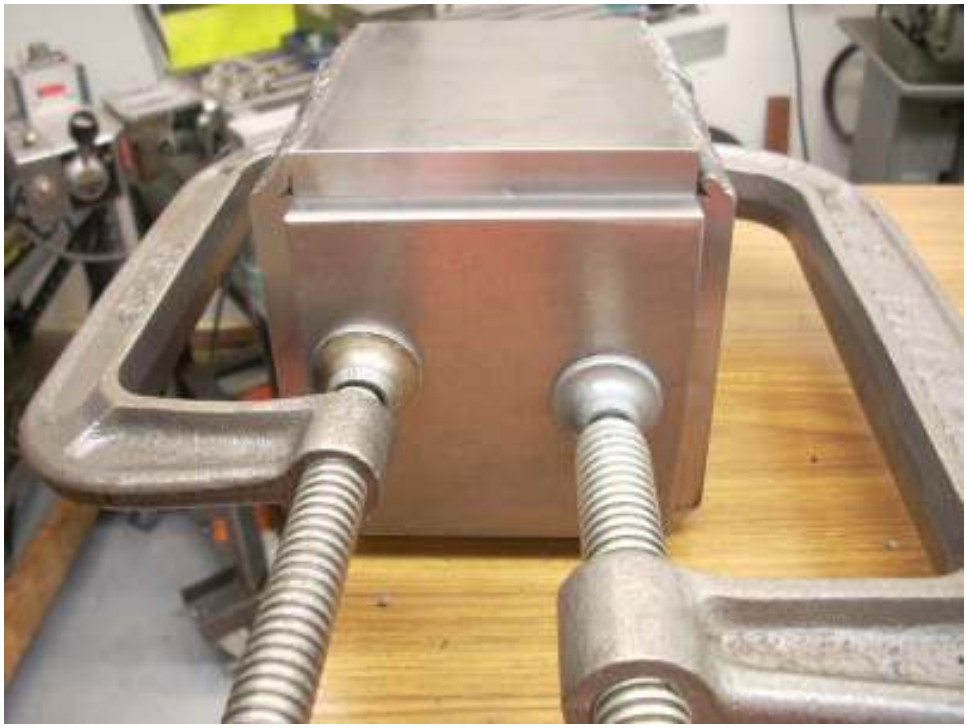
First end done and ready to turn the box over to true up the side that will take the end plate.



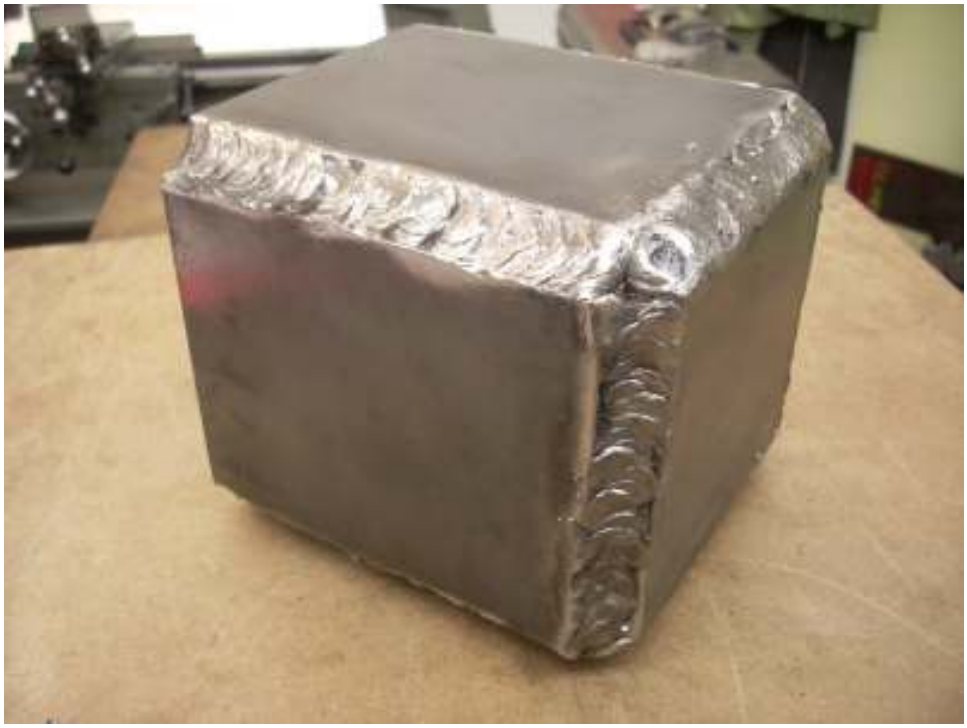
I have the machined end down on the mill table and hold down bolts to secure the box. After cutting each edge, I moved the clamps to provide full access to the next edge.

The box is now ready to accept the back plate.

It looks like I dumped a bottle of bluing on the box but it is just funny lighting.



There is a small overlap between backplate and the rest of the box which permitted me to clamp the plate without having it fall through.

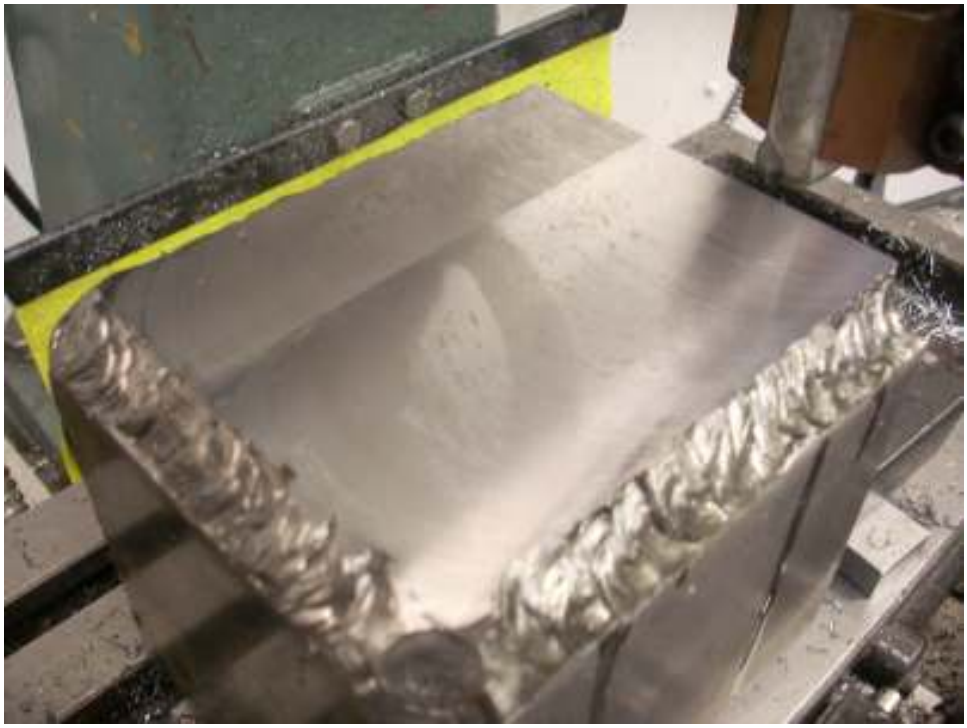


The back plate is now welded in place and I'm ready to start machining all faces true.

Some of my first 6013 beads came out really ugly so I was relieved to be able to hide them with the 6011.

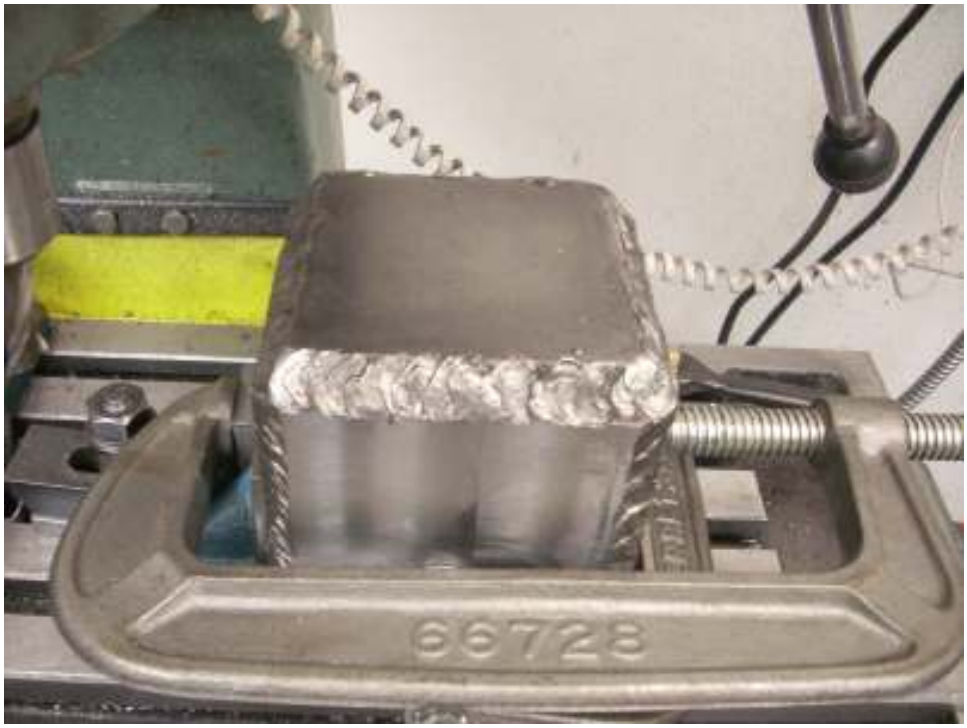
The inside came out nice and clean.

The face that will contact the table was touched with an angle grinder to be sure no spatter would prevent full contact.



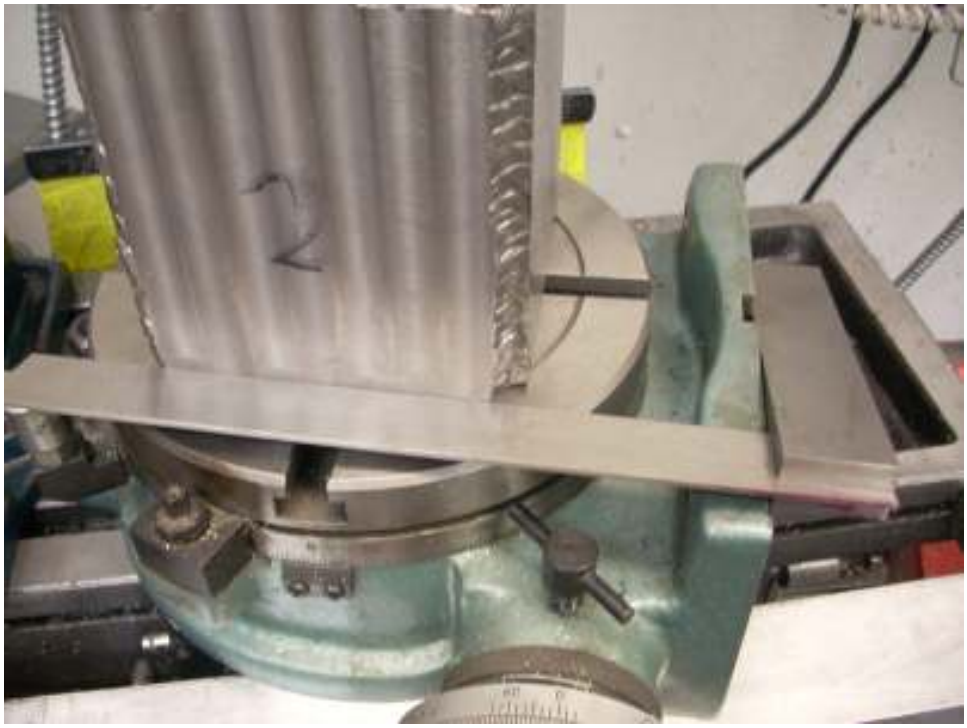
The first face was done with my shell mill. Great finish but terrible shower of very hot swarf.

This face is my first reference face and will contact a set of knees as I cut the adjacent face.

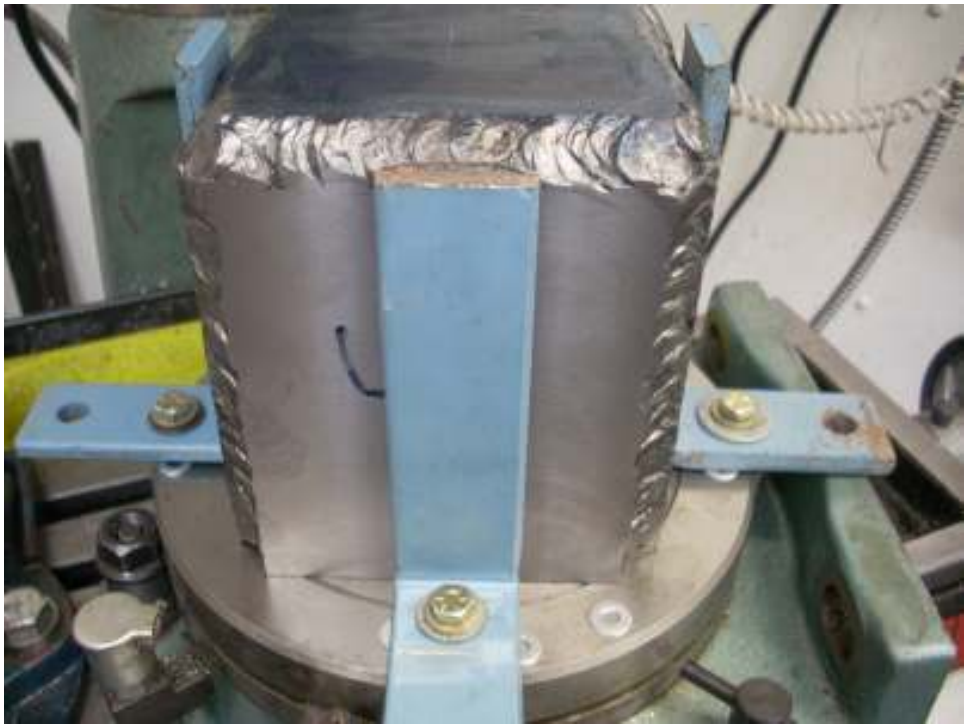


After all 4 sides of the box were milled true, I set up to mill the end plate.

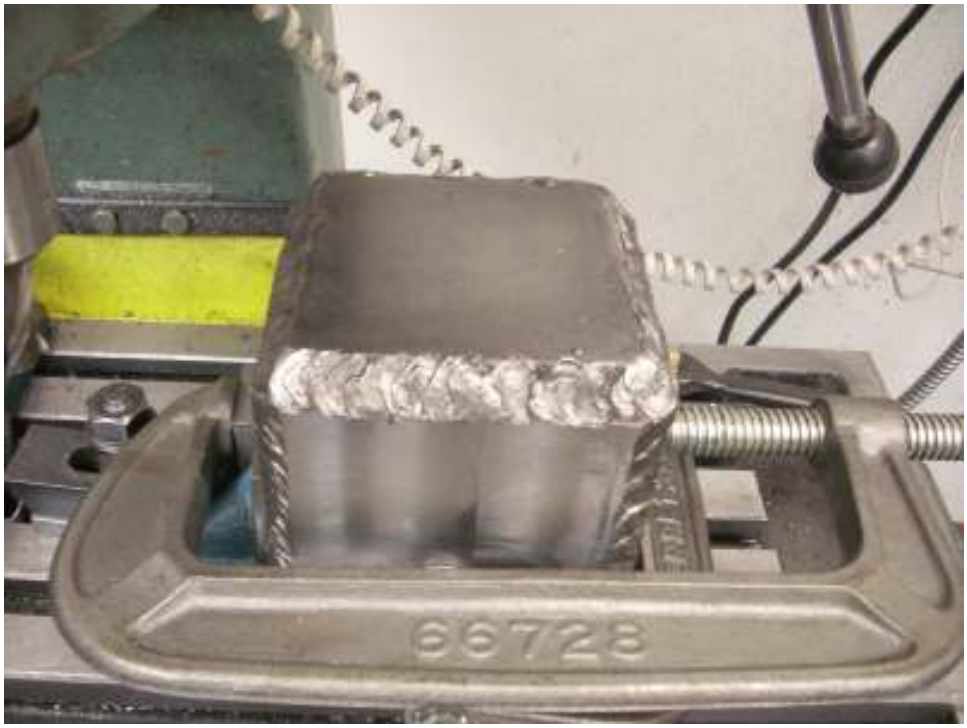
The finish is not as nice with the end mill and it takes longer but I really didn't like all of those glowing bits of swarf.



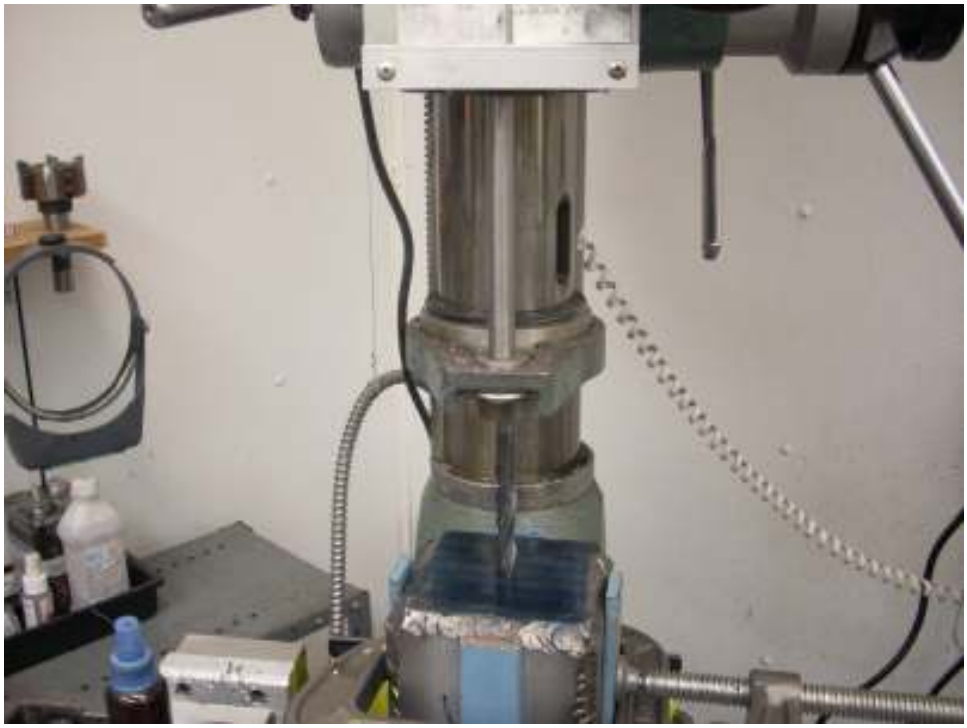
The next step is to cut the pivot hole and arcs in the back plate. After aligning the spindle's center over the rotary table's center, I placed the cube down. The RT was set to 0° and a square used to set the cube true with the RT's base. Not shown is a dimple made at the center of the end plate and a spud held in my spindle to align the cube to the RT's center.



I used angle supports to anchor the cube to the table. The washers were part of an idea to increase hold down force but it didn't work.



Large C clamps were used to hold the cube to the angle stock. These clamps had to be moved, one at a time, as the RT rotated them into the mill column.



I needed to raise the head on the mill in order to drill a hole in the center of the end plate. Due to poor planning, I didn't consider that my boring head would then be working on the end of a fully extended quill. Not good for rigidity.

Fortunately this is not a super precisely placed hole. I started by fully extending the quill. Then the head bolts were loosened and the head lower. The drill bit in the hole did an adequate job of keeping head alignment.

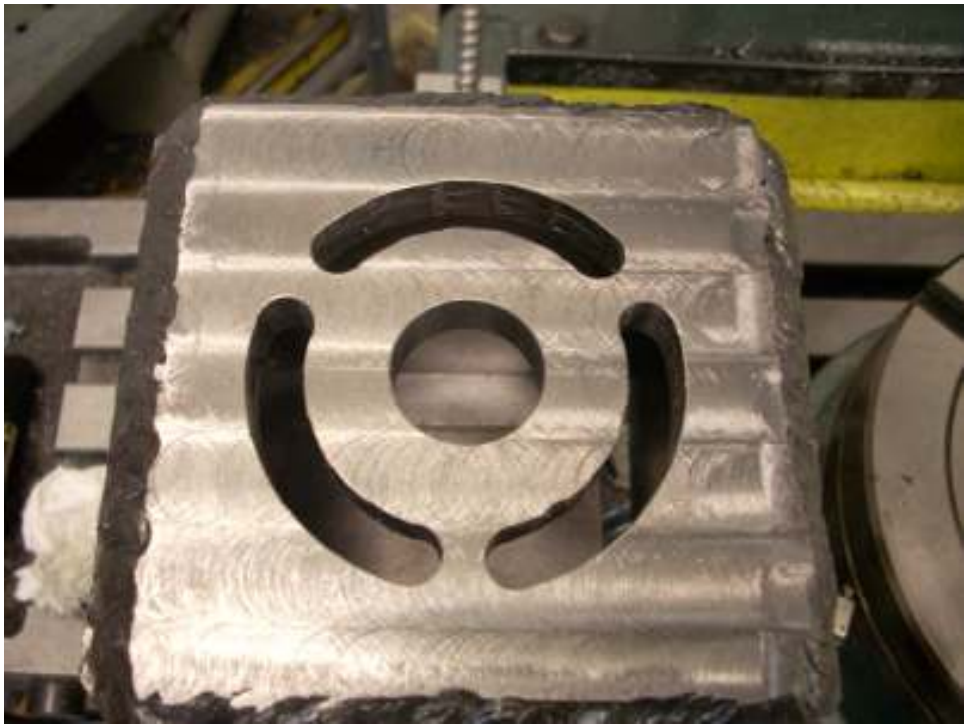
The head is now down and the entire drill bit is inside the cube. The quill is then raised and the drill removed. If I needed more accuracy here, I would use my DTI to realign the spindle to the hole just drilled by moving the head.

The pivot hole was bored out to 1.000 5” using a new C6 carbide cutter.

I then used a 3/8” drill to chain drill the first arc. The procedure was to drill holes in each end of the arc and then eyeball holes between them. You can faintly make out dimples in the surface with black marker around them to show me the start and stop points for each arc. These marks kept me from being way off on my holes. The RT's precise angle markings were used to drill the end holes.

All holes now drilled so I'm ready to start milling. Sorry about the blurry picture.

I'm using a 3/8” four flute end mill here. Each pass was 0.1” deep to minimize stress and flexure on the end mill. The original plan was to cut on the center line of the arc and then make run the end mill at a radius 0.011” smaller. This was to be followed by a second run at a radius 0.011” larger. That would give me a slot the same width as a letter drill of size X for a loose fit on a 3/8” -16 bolt. After making the centerline cut, I felt I could be accurate enough with the bolt locations to not have a sloppy fit. Dream on. I later had to re-setup the cube and widen the arcs. So much for visions of grandeur.



The arcs have been placed half way between the pivot hole and the inside surfaces of the cube. The arc width was set to 3/8” to accept the bolts specified by Gingery. I wanted to be able to turn the table a full 45°. The result of all of these constraints is that there isn't much metal left between the arc ends. My solution is to make three 1.25” diameter ¼” thick washers that will spread the clamping force over a larger area. But that is for another day.

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