Making Cam Action Edge Clamps, version 2*

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The idea of making these clamps came from Brian Lamb. They work great. If you have more money than time, they can be bought commercially but expect to pay big money. No doubt they are superior to what is made here but I enjoyed making these clamps and certainly enjoy spending the money on other things.

The basic idea is to build a clamping system that can hold a piece of metal in such a way that it is solidly clamped while providing full access to the top surface for machining.

Along the top you see a set of cup like washers. They have a ridge around their perimeter that can cut into the metal being held. The screws started as button head screws but have been machined so the heads are eccentric. These screws have a hex hole in the top and are driven with an Allan key.

After people read version 1 of this article, they suggested that I put a small O-ring on the threaded body of the screw to hold the washer in place. It was an easy modification and I'm sure has improved the design.

When one of these screws, fitted with a cup washer is threaded into a block, we get both a horizontal force from the cam action of the eccentric and a downward force from the threads. Together they grab and pull the metal to be machined down to the table.

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* Two changes have been made and the related text is in blue.

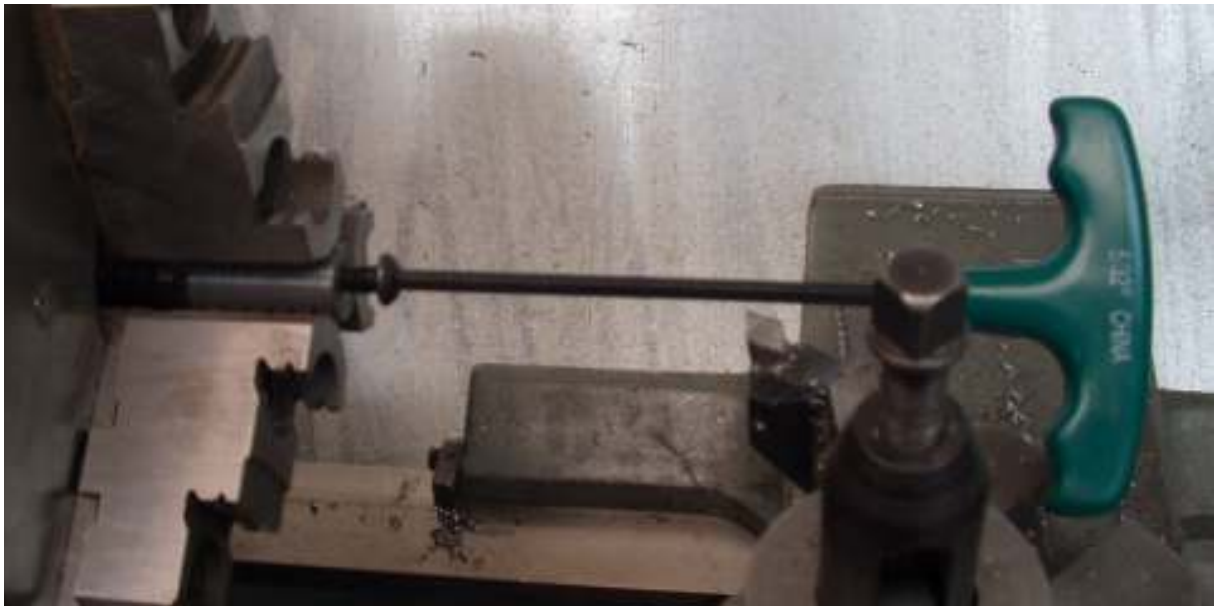
Making the Eccentric Screws

I chose to make a fixture to hold the screws for machining.

I started with a piece of 12L14 bar stock in my 3 jaw chuck. Note the 50 thou spacer between the top jaw and the bar. This provides me the 50 thou offset that will later enable me to cut the screw heads eccentric.

I faced off the bar, drilled it 13/64” for 1” and then followed with 1/4” for 1/2”. The tap will just scratch the 1/4” hole and tap into the 13/64” hole. In this way I am not working so hard doing the tapping yet the screw is fully support and secure. The bottom threads are not fully formed and I did not want the screws to jam in place. To prevent this hassle, I screwed a 1/4-20 set screw down the hole. The screw to be machined then bottoms out on the set screw where the threads of the hole are fully cut.

After drilling and tapping the bar, the 50 thou shim is removed and the bar re-chucked in the 3 jaw. The hole is now off center by 50 thou.



These button head screws have a hex hole in the top. I turn the screw into the fixture until it bottoms. The cutting force keeps the screw solidly against the top of the set screw.

The head of the screw has been cut and you can see the eccentric that forms. These screws came from Enco and were very easy to machine.

Machining the Cup Washers

It is best to use drill rod for these washers but since I am only clamping aluminum and was in a bit of a hurry, I chose to use more of my 12L14.

I started by drilling a through hole 5/16”. This permits the washer to freely move on the screw body as it clamps the block being machined. Since I'm making 6 of these washers, it was most efficient to just drill as deep as possible.

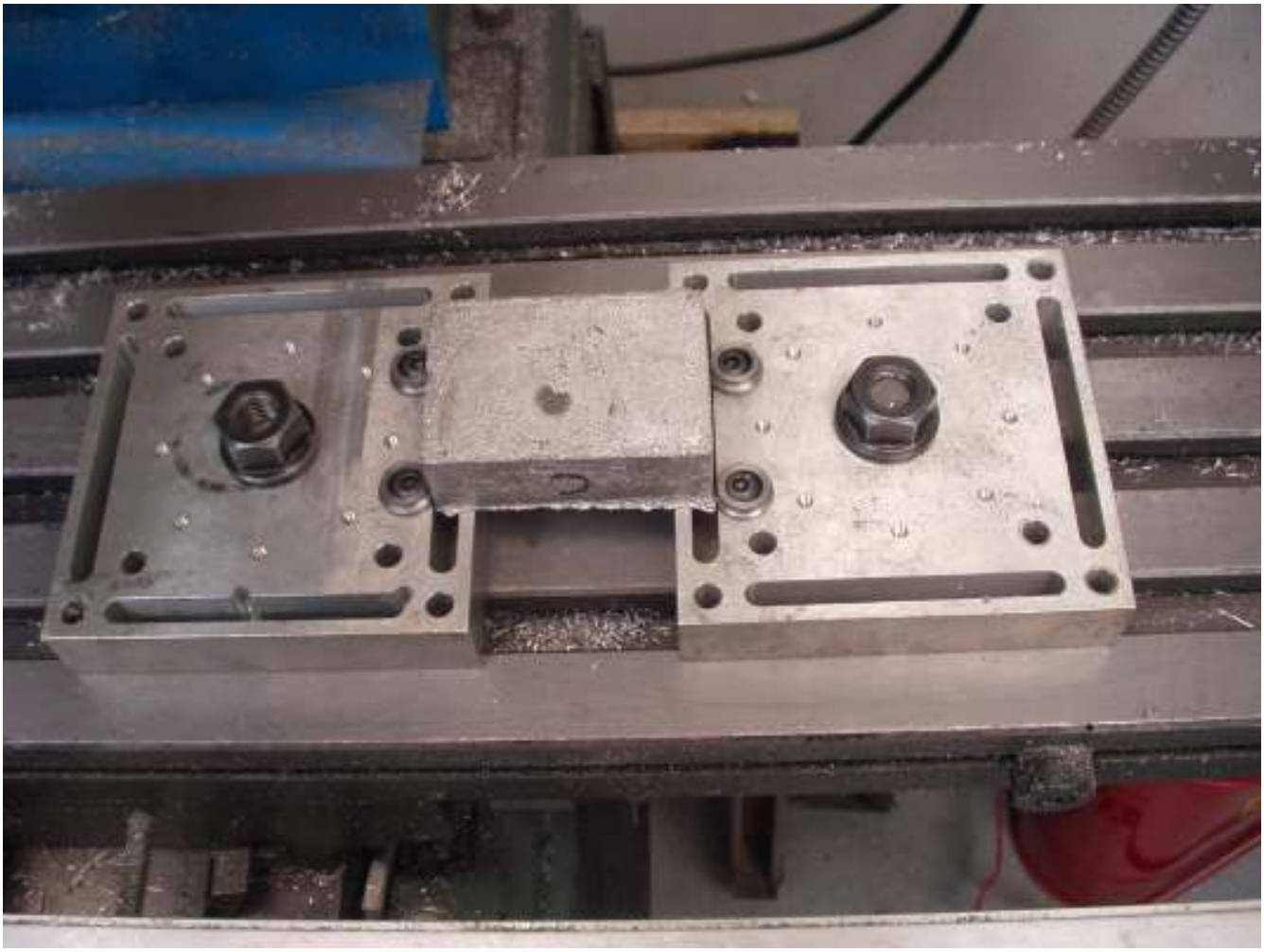
To form the cup, I put a 3/8” 4 flute end mill in the drill chuck. I went in about 1/8”.

Forming the outside cutting edge was simple. I started by positioning my cutter as shown above. Then I measured over 1/8” from the edge. The lathe was started and I fed in just enough to make a line. The cutter was then moved to the right and fed in about 50 thou. I then fed in until I reached the line. The cutter was backed off and the lathe stopped.

For even better grabbing of the block to be machined by these washers, you can cut a series of ridges similar in cross section to teeth as found on a saw blade. The top of each ridge is horizontal and the bottom is angled at about 45°. In this way the clamping force will tend to push the block down on the table.

I moved the cutter so it was now 1/4” from the end. The lathe was started and I again fed in about 50 thou. This time I cut towards the tailstock until the cutting edge was fully formed. I then changed to a cut off tool and parted the washer off. As long as there was enough of the 5/16” hole down the center, I could just run in the end mill to form the cup and then use the cutter to form the ridge. Switch to the parting tool and the piece was done.

One Example of How to Use These Eccentric Clamps



Four of these eccentric screws have been used to hold this casting. It was a simple matter to drill and tap the two 1” thick plates of scrap aluminum. The casting is not square yet this fixture still solidly holds it. The first step is to tighten the hold down nut on the left. The two screws in this left plate are turned so their lobes point to the left. The two screws on the right plate are turned so their lobes point to the right. The right block is then pushed against the casting. You may be able to see that this right plate is not perfectly lined up with the X axis of the table but it is a good fit to the casting. The right hold down nut is then tightened. I then turn each of the screws to dig into the casting and pull it down onto the plates. It is held solidly. My fly cutter now has unobstructed access to the top face of the casting.

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