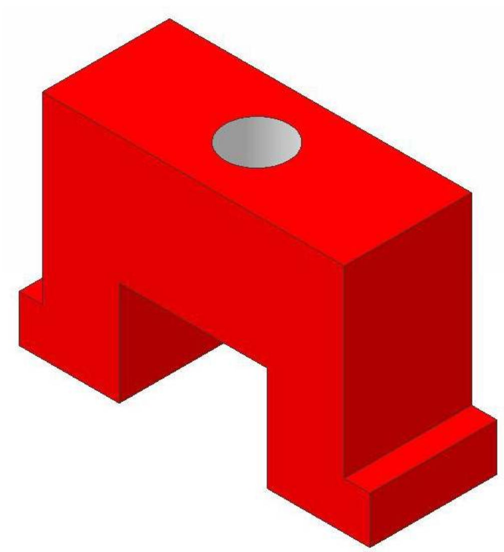
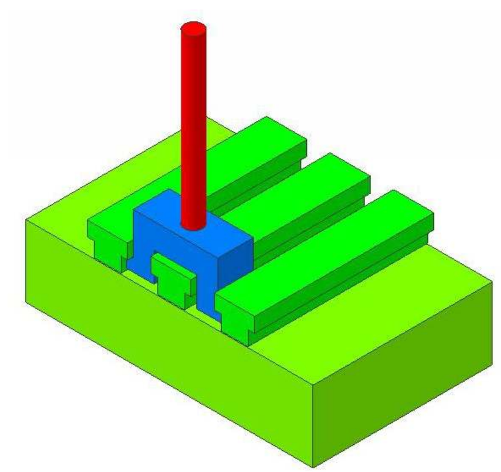
Making an Omega Nut

By R. G. Sparber



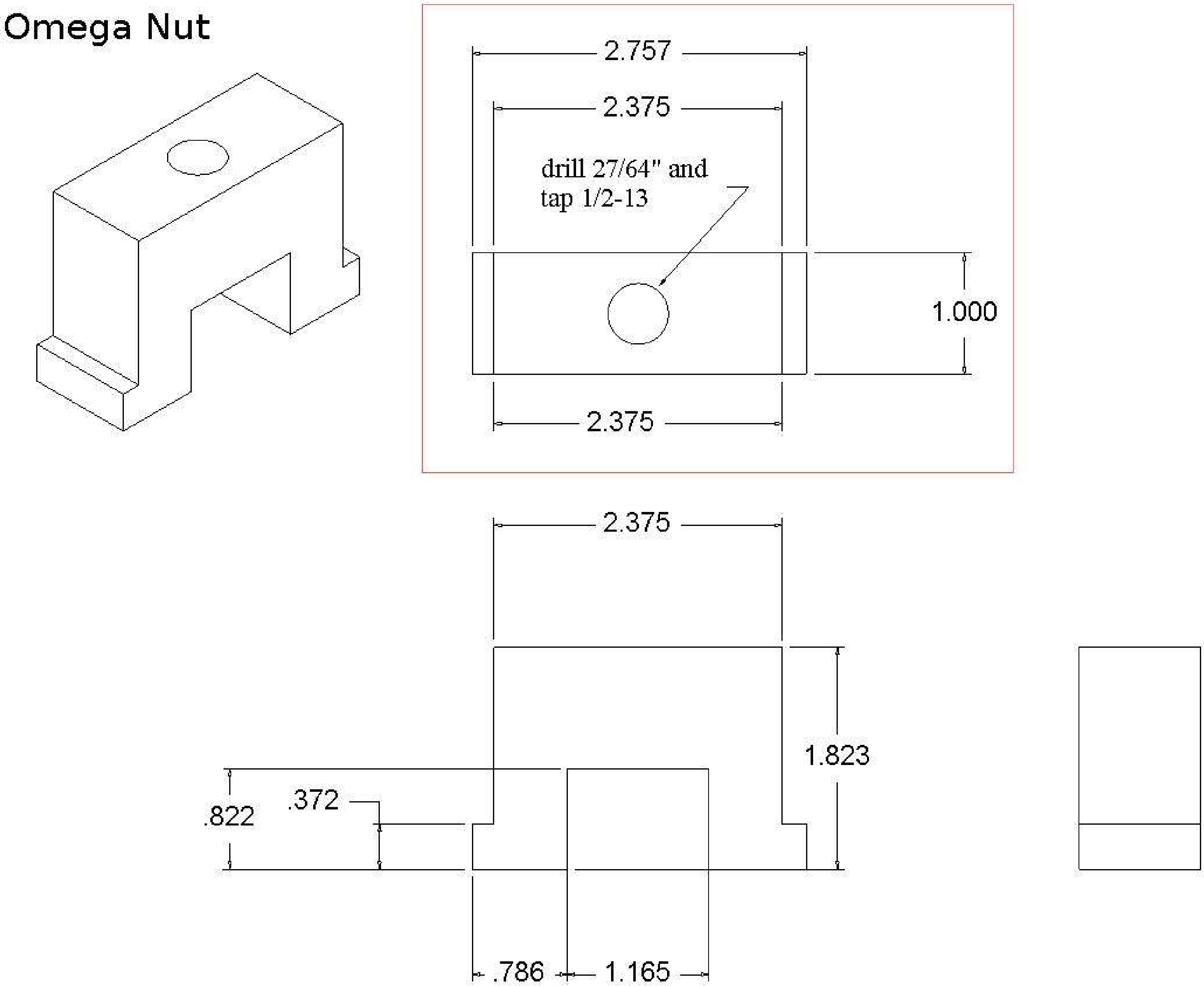


An "Omega nut" is a variation on the idea of a T-nut. While a T-nut slides into a T-slot on a mill table, an Omega-nut slides into two adjacent T-slots and straddles the island between them. Most of the time, a T-nut works just fine as an anchor point for a threaded rod. But once in a while I want my anchor point to be half a T-slot over. That is when the Omega nut is handy.

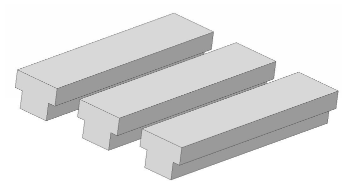
This article has two purposes. The first is to show you how to make an Omega nut. The other is to introduce various machining techniques to those new to our hobby.

The Plans

Often the size of a T-slot is the same between mills. This makes buying standard T-nuts possible. But the spacing between T-slots is not always the same so don't expect to ever see an off the shelf Omega nut. However, if you are making one for yourself, this is not an issue.



The dimensions shown in this drawing are for my RF30 mill/drill. I simply measured my T-slot and spacing and then subtracted 0.04" from each dimension. This gave me 0.02" of clearance between all mill table surfaces and the Omega nut. The overall height of the Omega nut, at 1.823" is arbitrary. If you are using 2" bar stock, make the height 2”. All critical measurements are from the bottom surface.



The drawing was done using Alibre PE. It has a nice tool that lets me define a shape and then uniformly reduce it by a specified amount. So once I had drawn up my T-slots and islands, it was easy to define the Omega nut.

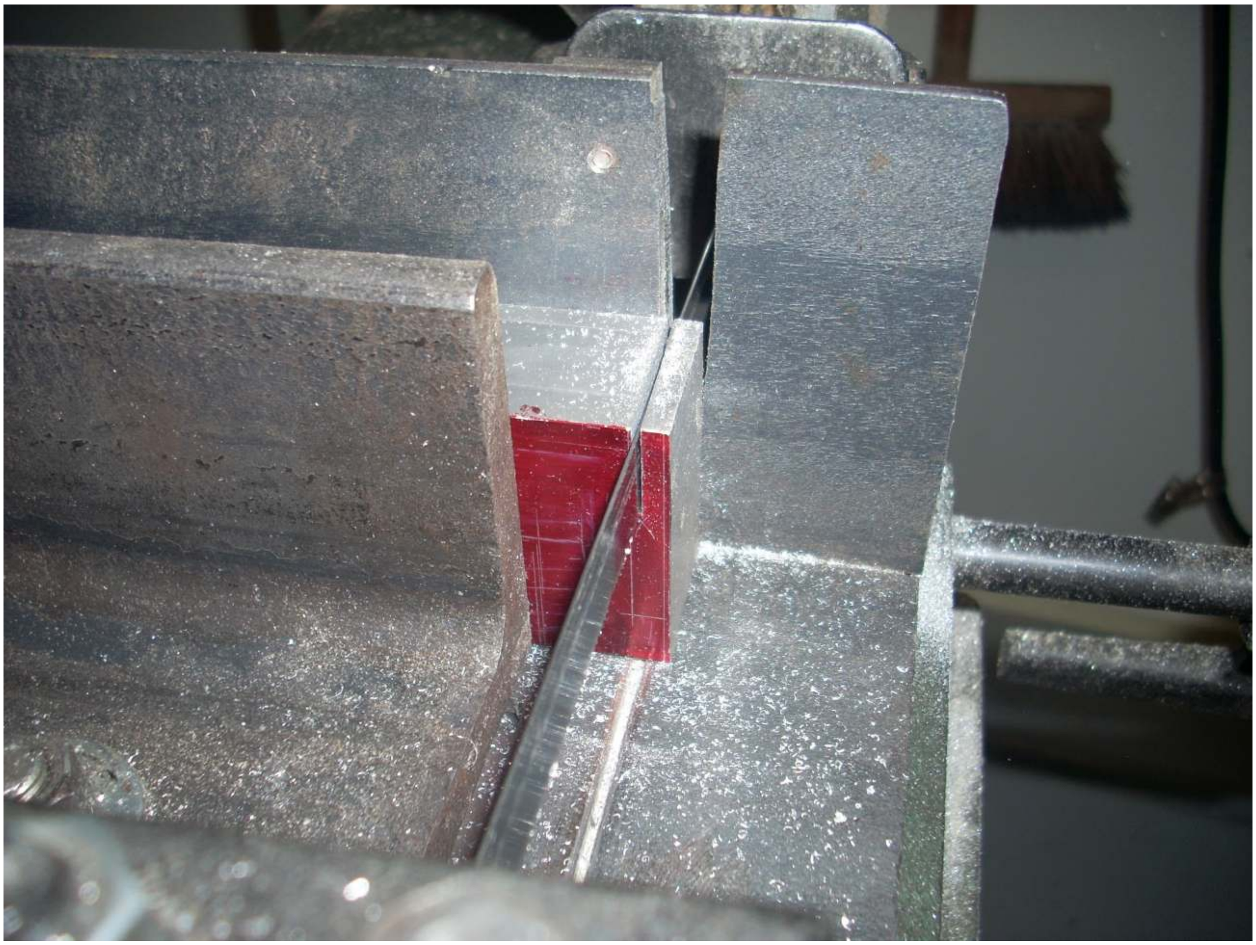
Many T-nuts are cut from 1018 steel. Since this is a prototype, I decided to make it from 6061 aluminum. There was some controversy on various yahoo BBS that the Omega nut might tear out the T-slot. Making it from aluminum reduces that risk. Excessive upward force would likely strip out the tapped hole before hurting the T-slot.

My first step was to find a bar of aluminum a little larger than the finished Omega nut. I then painted the top surface with red dye in preparation for layout lines. The bottom face was smooth so I used it for my reference surface. The right end was a little ragged so I scribed my right finish line about 0.02" away.

On the far left side is where my saw will cut off the unused part of the block. Note that I have scratched "X" in areas to be removed. My hope is to prevent really dumb mistakes.

These scribe lines do not exactly match the plans. That is because I used less accurate plans in order to get a quick result with the prototype. You will later see that I also made an error during machining that caused too much metal to be removed from one leg.

First I sawed the excess material from the block. It is then placed wide face down in order to give me better control over the cut. My bandsaw is not perfectly aligned so the cut tends to wander to the left. Minimize the thickness of the cut and it will minimize this error. I made my side cuts next. Sawing like this is far quicker than milling.

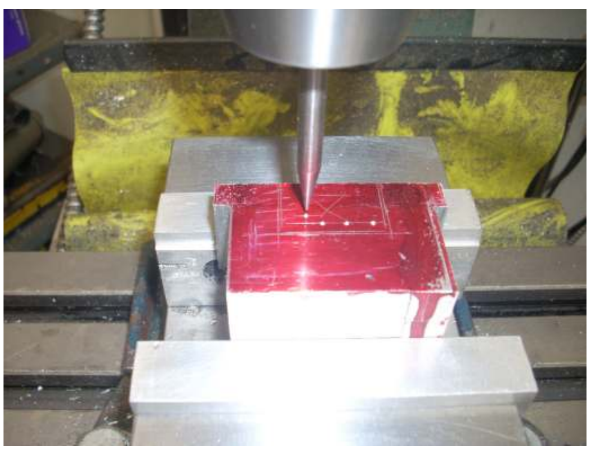


With the block on end, I made my second cut to rough form the first ear of the Omega nut.

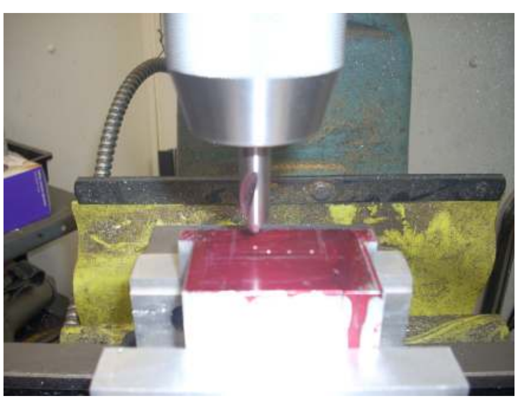
When sawing the other end, this cut was done with the saw in the horizontal position. Alternately, I could have made both of these end cuts first and then gone back to slide from the top.

Sawing out the inside is not as straightforward. I can saw straight down on both sides but the last cut has no room for the saw to enter. Instead, I drilled a 1/2" hole near one inside corner and chain drilled with 1/4" drills the rest of the way. I'll say more on this later.

The first step is to set my mill head at the right height. I take out my largest drill and use it as a gage.



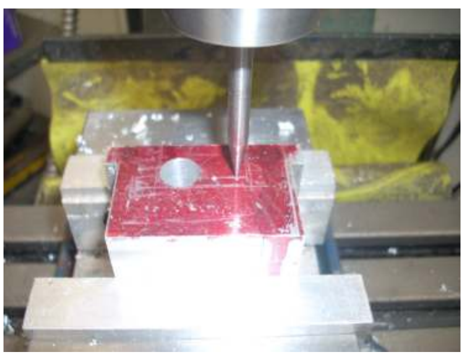
Then I use my spud to set the center of rotation at the center of the 1/2" hole. In order to make it easier to see, I have used a layout punch to mark the hole centers.



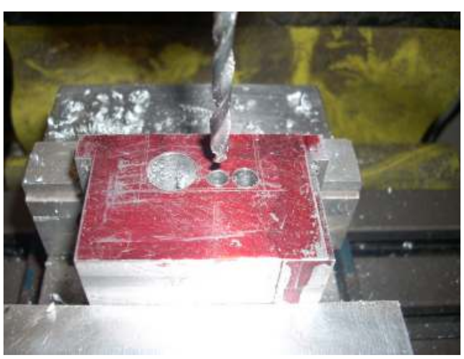
I used my spotting drill to cut a shallow cone into the surface. This prevents the drill from wandering around the surface before it starts to cut.

I started by drilling a 1/4" hole. Rather than one hard push through the block, I "pecked" at it. I drilled down about 1/4" and then retracted the drill to bring up chips. This process was repeated until I was all the way through the 1" block.

I then followed with my 1/2" drill. It was harder to drill the 1/4" hole than the 1/2" hole. The 1/2" drill sailed right through.

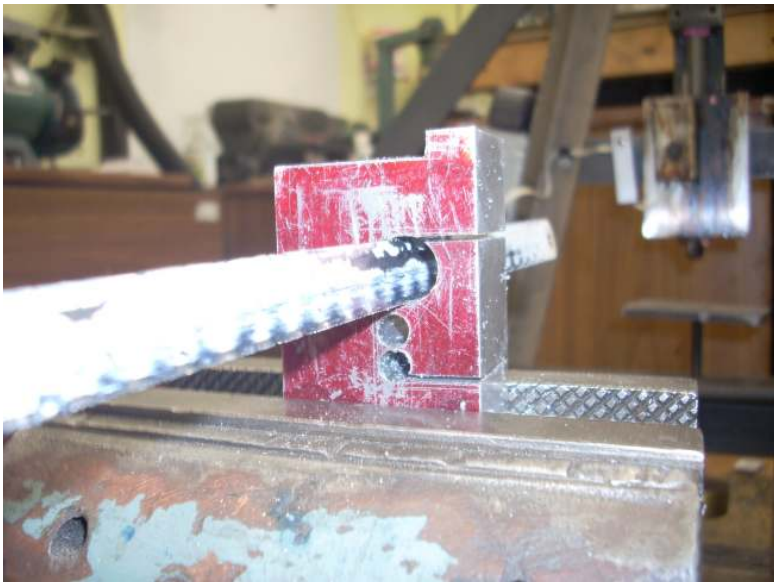


With the spud again in the drill chuck, I moved on to the chain drilling line.



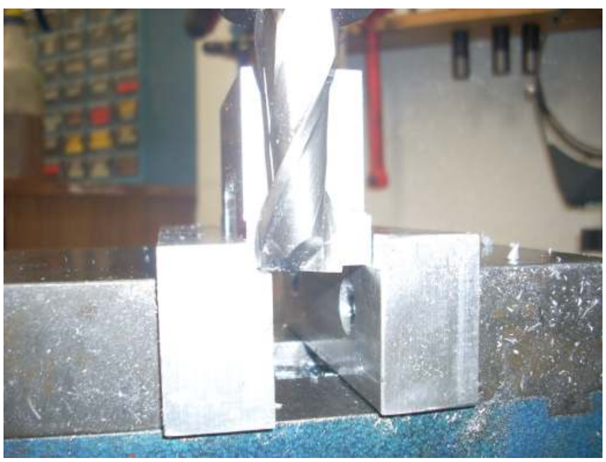
I have just finished drilling my second 1/4" hole.

I brought the block back to the bandsaw to make the two vertical cuts.

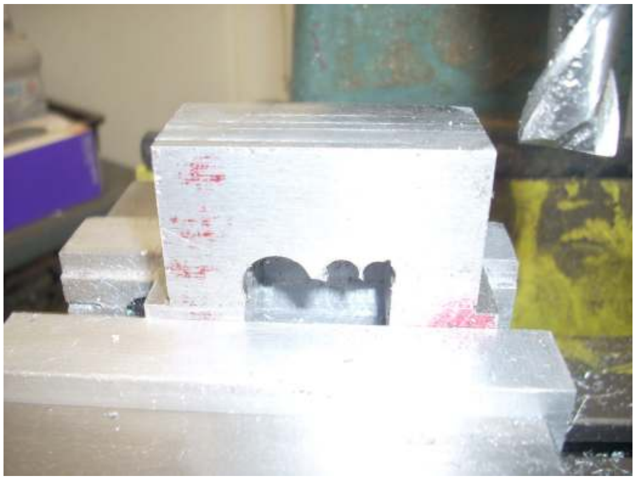


The blade from my hacksaw just fits into the 1/2" hole. I then reattach it to the hacksaw frame.

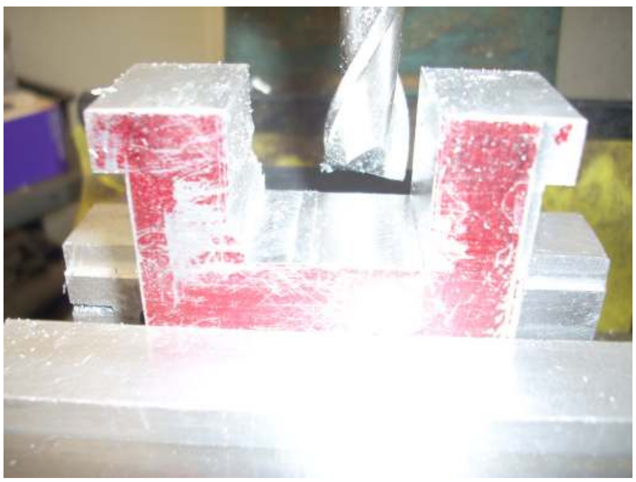
Just a few quick passes with the hacksaw and the majority of the inside metal has been removed.



I have clamped the block into the soft jaws of my vise. With the end mill sitting on the horizontal surface of my soft jaw, I set my Z axis to zero. Consistent with my drawing, all height measurements will be relative to this bottom surface.



The ears have been milled along with the top surface. Here is one of those bone headed moves that I make far too often. I mounted the block with the layout lines facing away from me! I am using a Digital Read-Out (DRO) to position my end mill but the layout lines keep me from making those big mistakes.

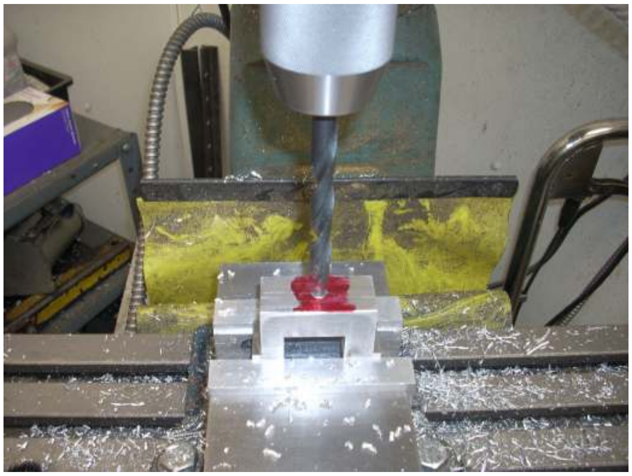


I then removed the part, deburred it, cleaned the clamping surfaces on my soft jaws, and mounted the part upside down. My reference surface is now facing up.

I first rough cut this inside area to within about 0.02" of the finish line. Then I made one more pass for my finish cut.

At least my layout lines are now facing forward where I can see them.

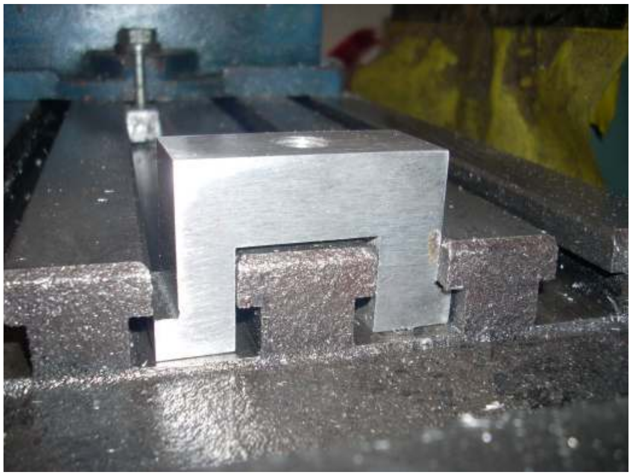
All milling is now done so I removed the part from the vise, deburred it, and placed it right side up. With my drill chuck holding my 27/64" drill, I reset the mill head for proper clearance. It would have made more sense to drill this tap hole when I was drilling the 1/2" chain hole. However, I have to tap the hole too and would not want to do it with that center metal in place. It is far easier to tap a through hole than a blind one. With a through hole I can use a spiral tap that is machine driven. A blind hole is best done with a hand tap.



After using my spotting drill, I drilled a 1/4" hole. This was followed with my 27/64" drill which is specified as the correct tap hole for a 1/2-13 thread.

I could hand tap but having just acquired this beautiful Tapmatic tapping head, I just had to use it. To my surprise, I stalled the motor twice while running this tap. But eventually it got through and spun out quickly. The 1/2" tap is at the top of the range for this tapping head. It had no problem driving the tap even though the forces were large. Note the vertical stop rod bolted to the mill table on the left. You could lose a finger trying to hold that bar during this tapping operation.

The final step is to spoil the last thread in the hole to prevent the threaded rod from feeding through and marring the mill table. I took a small ball peen hammer and fitted the rounded head into the hole. The part is solidly supported on the anvil of my vise. I then struck the face of the hammer with my lead hammer. The result was a nicely formed cone with that last thread crushed into the one below it. Do not try this with a hardened faced hammer as it can shatter one or both faces.



I have placed the prototype Omega nut into the T-slots. My error is now very clear. The left leg is too thin which causes an excessive gap between it and the left T slot overhang. After much head scratching, I traced the problem back to a mistake in my drawing. Lesson re-learned: verify the drawing against reality. Can't win for losing...

That left leg would be a real problem give how little it engages the T-slot. Since this is a prototype, I sawed that left leg off and added a spacer. A bolt was used to reattached it. Not pretty but it lets me try the Omega nut out with less risk to the T-slot.

Here is the Omega nut in use. Note that the support blocks are resting on the island between T-slots.

Contrast that with the use of a T-nut. Here the support blocks span the T-slot. Now, these support blocks are wide so this is not an issue. But I have had cases where the blocks had to be turned 90º causing the blocks to be just partially supported by the overhang of the T-slot. If a slightly thinner support block was needed, it might jam into the T-slot.

I believe that in the overwhelming majority of cases, the T-nut is still the right answer. But once in a while I think I will be reaching for my Omega nut as the best solution.

What's Next?

I welcome your comments and questions. All of us are smarter than any one of us.

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