

making vise clamps on the milling machine

by **Doc Workingday** on March 4, 2008

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[NOTE: When saving, if you see .tmp as the file ext, rename it to 'angle-iron-clamp.SLDDRW']



angle-iron-clamp.SLDPRT (171 KB)

[NOTE: When saving, if you see .tmp as the file ext, rename it to 'angle-iron-clamp.SLDPRT']

step 2: Rough cut the angle iron

I put an abrasive cut-off wheel on my wood-cutting compound miter saw and cut the angle iron on that. It cut fine, but it got hot enough to melt the plastic part of the saw's table.... That made me feel kind of stupid, I hope no one notices.

Anyway, I cut about a 1 inch wide piece off the length of angle iron. The exact size is not very important.

Then I cut off part of one "leg" of the piece, this will be the foot of the clamp later (where it stands on the mill's table). I learned my lesson about the plastic-tabled saw and made this cut with a hacksaw.

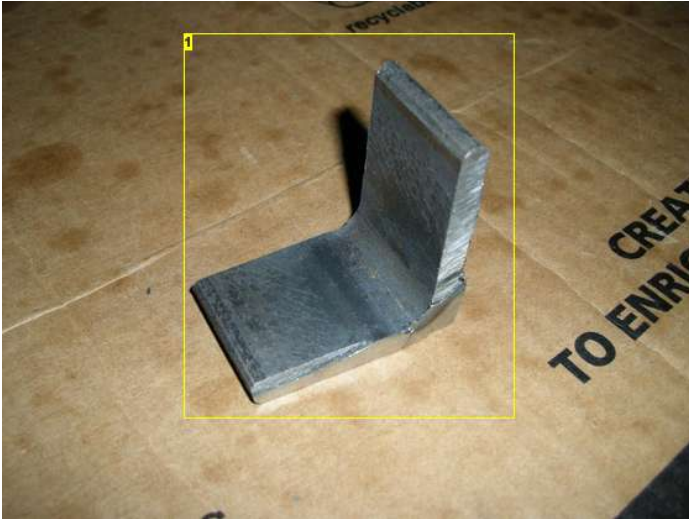


Image Notes

1. 1 inch wide or there about. The cut edges are very rough.



Image Notes

1. A sharp blade helps. I left enough metal on the workpiece to clean up the cut on the mill later.



Image Notes

1. Almost there! Buy a band saw!

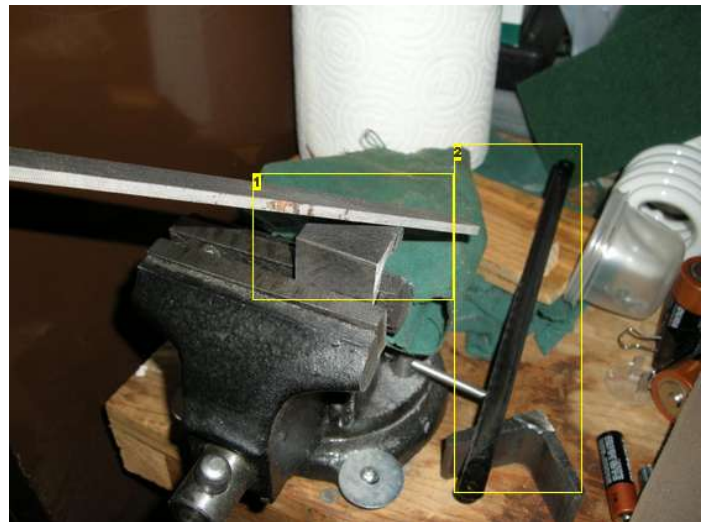


Image Notes

1. I filed off the burr to make it easier to hold in the milling vise later.
2. Throw away the dull blade.

step 3: Clean up the long edges

I set up the angle iron in the milling vise and milled the long cut edges nice & flat (& somewhat to size, though this dimension is not terribly important).

The pictures show the setup for milling the two long sides. The rounded end of the angle-iron fits into the horizontal V-groove in the movable jaw of the vise. The edge that I'm milling is sticking out 1/4 inch or so past the vise jaws. This setup was plenty secure.

I eyeballed the workpiece to find the part that was sticking out the most, and gently touched off the cutter at that point. Then I started doing cutting passes in the Y direction, front to back, so each pass was done in conventional milling mode (I'm staying away from climb milling for now). Each pass took off about 0.010 inches of material, on whatever parts of the workpiece were sticking out. Eventually it cut along the whole face of the workpiece, and then I did a 0.005 inch finishing cut and called it done.

I used a 3/4 inch 4-flute milling cutter spinning at something like 800 rpm. Feedrate was probably about 5 or 7 ipm. Depth of cut (of each cut) was about 0.010 inch. I occasionally squirted WD-40 on the cutter and workpiece while cutting.

To mill the other long side I flipped the workpiece upside down (as shown in the second picture). The location of the V-groove in the vise jaw and the length of the foot (the short leg of the angle iron) conspire to make this possible. If the dimensions hadn't worked out I could have kept the workpiece in the "foot-up" orientation and slid the workpiece to the other side of the jaws.

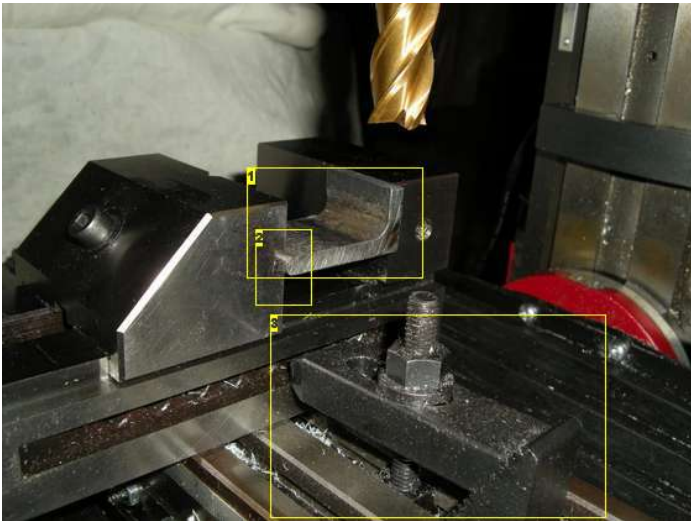


Image Notes

1. The face that's sticking out is rough-cut and needs to be cleaned up and squared.
2. The rounded front of the angle iron fits securely in the horizontal V in the movable face of the jaw.
3. The old clamp, clearly inferior to the one I'm making...

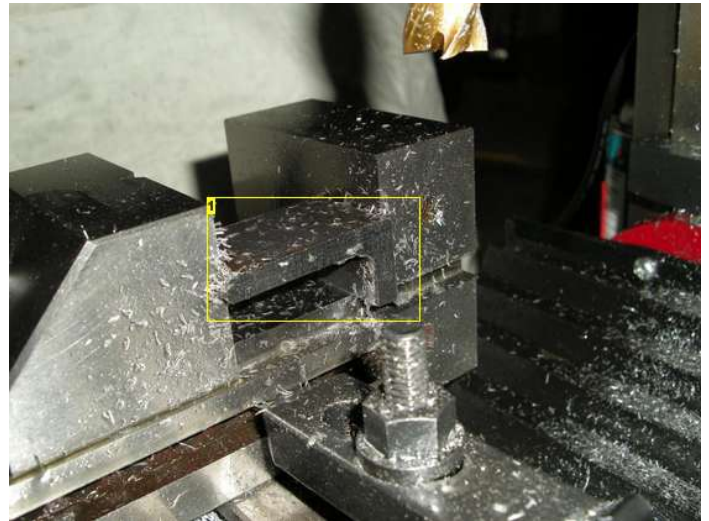


Image Notes

1. The face after milling.



step 4: Cleaning up the foot

Next I did the "foot" of the clamp, the part that rests on the milling table. This operation cleaned up the hacksaw job & established the height of the clamp. This is probably the most important dimension, but even here there's room for some slop.

I clamped the "long leg" of the workpiece in the vise, being careful to clamp on the straight part of the angle iron, not up near the corner where the thickness changes. I positioned the clamp near the center of the vice to keep the clamping force balanced and avoid twisting the movable jaw.

The desired length of the foot (per the drawing) is 0.875 inch. I knew I cut the foot longer than that with the hacksaw, so there is some spare stock at the end of the foot to work with.

First I squared the bottom of the foot by skimming it with the cutter, just like I squared the long sides in step 3 (except along X in stead of along Y). I cut from the left of the workpiece to the right, to stay with conventional milling.

Once it was flat along the whole bottom of the foot I measured the foot height with calipers (I wiped the reference surfaces with a rag so the swarf wouldnt throw off the reading). This measurement told me how much material I had to remove. I took it off in 0.010 inch cuts until I got within about 0.020, then I measured again and took shallow cuts until I got within 0.005 inch, then I called it good.

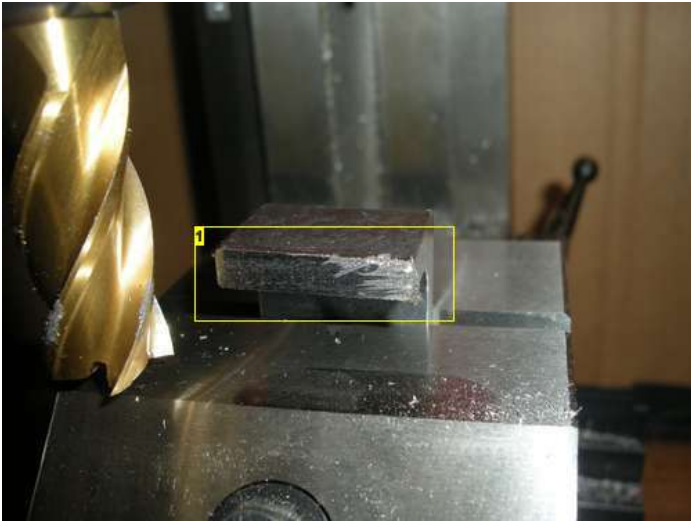


Image Notes

1. the right side is not getting cut yet, need to take another 0.005 inch or so off work with.



Image Notes

1. Measuring the current height of the foot: 0.924 inch, need to remove 0.049 inch more.

step 5: All the facing is done

Here it is with all three faces in order and all the edges of those faces filed smooth.

Now it's all over but the slotting.



step 6: Slotting setup

For the slotting, I set it up like this.

It's nice to have the workpiece roughly centered in the jaws, because it gives even clamping pressure, not so much twisting force on the movable jaw.

I want the slot in the middle of the clamp, so I measured the final, actual width of the clamp, located the edge, and positioned the spindle at the X axis center of the clamp.

Lock the X gibs here, we'll just be moving in Y and Z for a while.

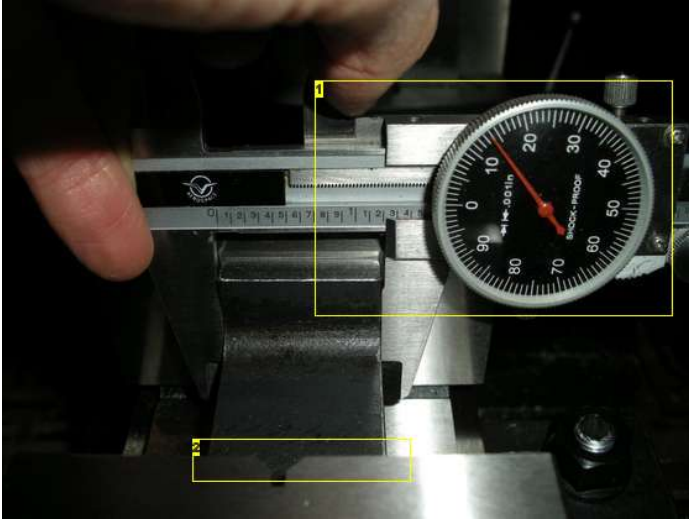


Image Notes

1. 1.214, that's about 1.000 right?
2. Again the round front of the long leg is in the horizontal V-groove of the movable jaw.

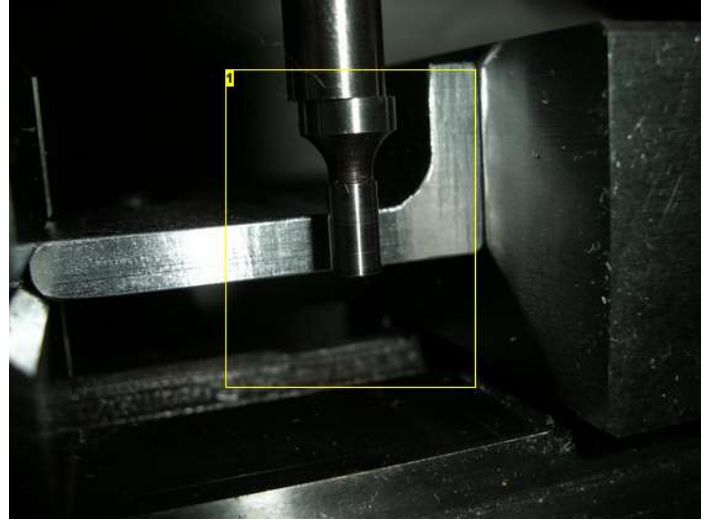


Image Notes

1. Locating the edge of the clamp.

step 7: Locate the foot

Touch off against the "inside" of the foot. Remember to compensate for the radius of the edge finder.

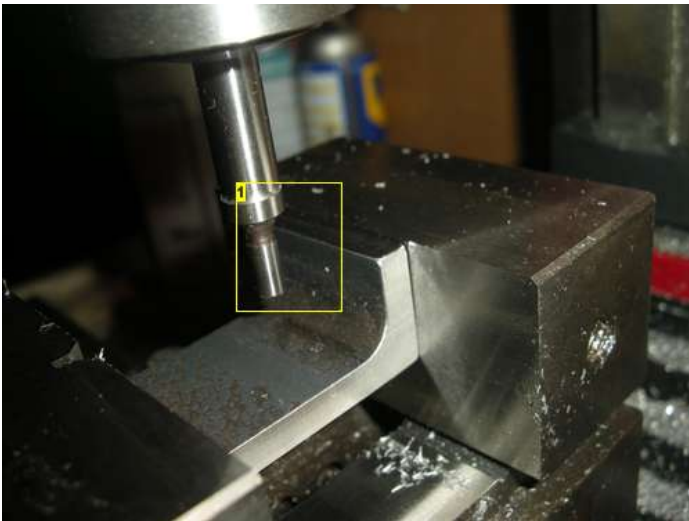


Image Notes

1. Touch off against the "inside" of the foot.

step 8: Pre-drill the slot

Drill bits are easier to sharpen than milling cutters, so I drilled holes to hog out most of the metal for the slot. I started with a smallish bit (I think around 1/4 inch) for a pilot hole, then opened it up to 3/8 inch. I know the drawing shows a 0.500 inch slot, but 3/8 inch plus a little is fine.

When I was done there were three 3/8 inch holes through the middle of the clamp, with their sides just touching.

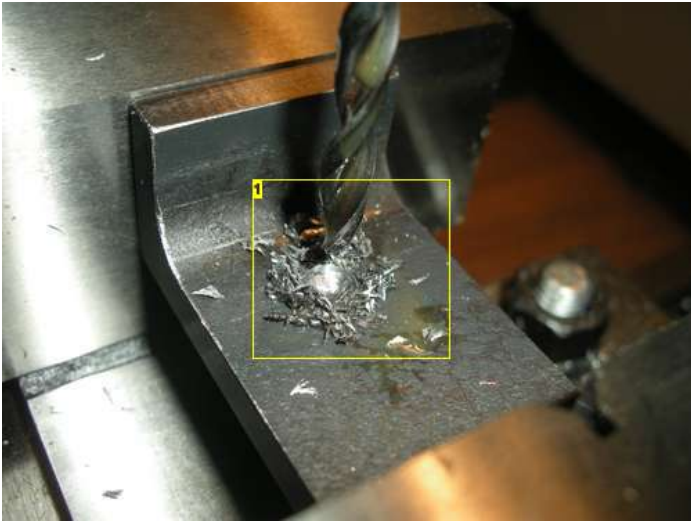


Image Notes

1. Start with a 1/4 inch bit.



Image Notes

1. Then open it up to 3/8 inch.

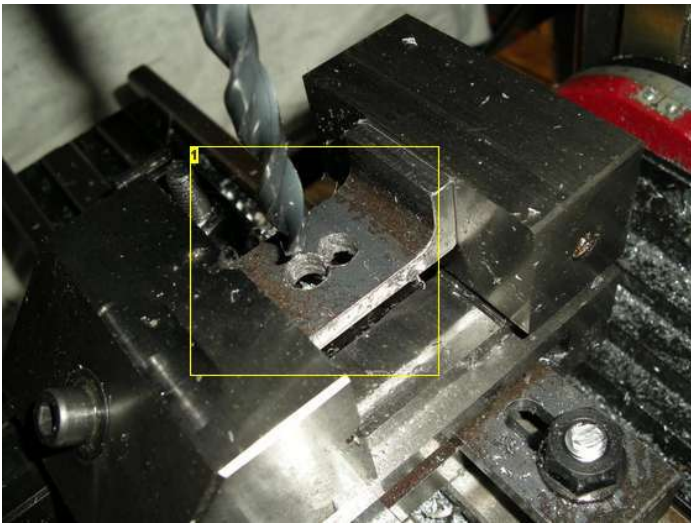


Image Notes

1. *nom* *nom* ... then one more *nom*

step 9: Finish the slot

Next I used a 3/8 inch milling cutter to turn the row of holes into an actual slot. With the spindle running, I lowered the (center-cutting) cutter down into the existing hole at one end of the slot, then moved it to the hole at the other end. I went back and forth in the slot, going down about 0.050 inch or so for each pass, until I was all the way through.

Then I widened the slot by about 0.050 or so by moving the milling cutter in a sort of spiral, cutting the full wall of the slot with a depth of cut of about 0.010 inch. I cut the spiral clockwise, to ensure that I was always conventional milling.

(Note: For the pics in this step I'm showing a clamp where I tried a shorter slot with just two holes pre-drilled. It's working fine, though I think I prefer the longer slot.)

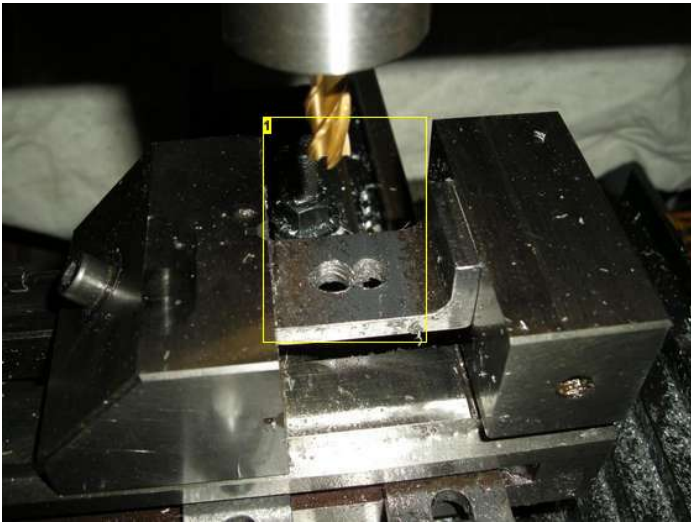


Image Notes

1. All three of these round things are 3/8 inch in diameter, the camera lies.

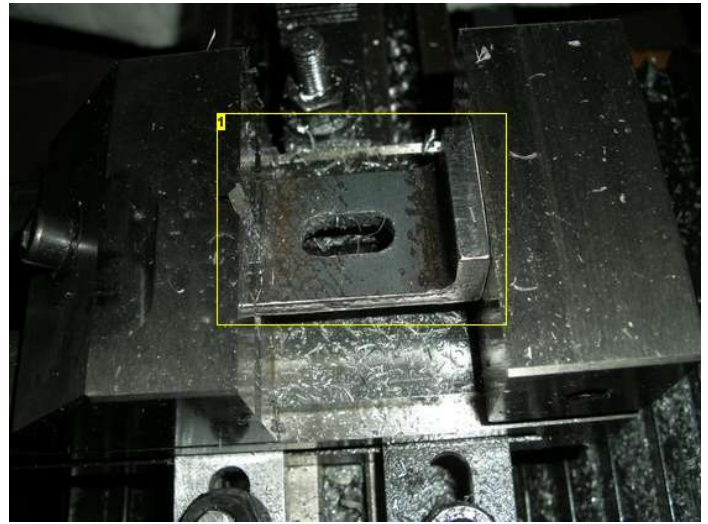


Image Notes

1. And there's the slot!

step 10: Cut the threaded rod

I bought some 3/8"-16 tpi threaded rod from ye olde hardware store. It was cheap and it came with three pies.

I cut it to length with the hacksaw and cleaned up the cut edges with a file.



Image Notes

1. About.... *yay* long.

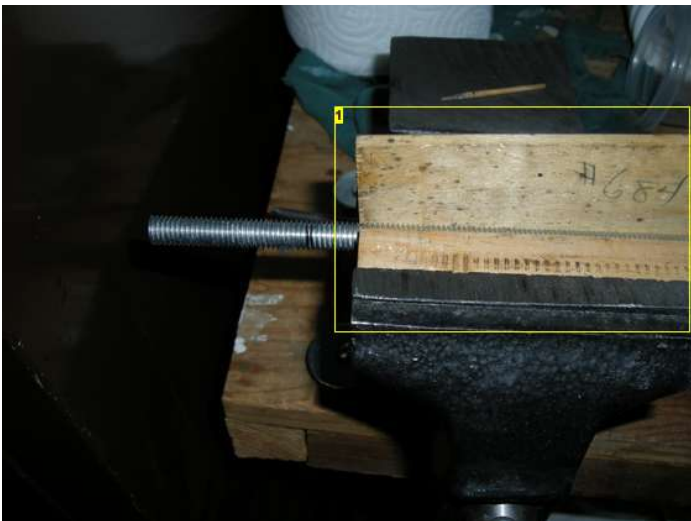


Image Notes

1. I used some wood to protect the threads from the vise jaws.

step 11: Done!

It looks good!

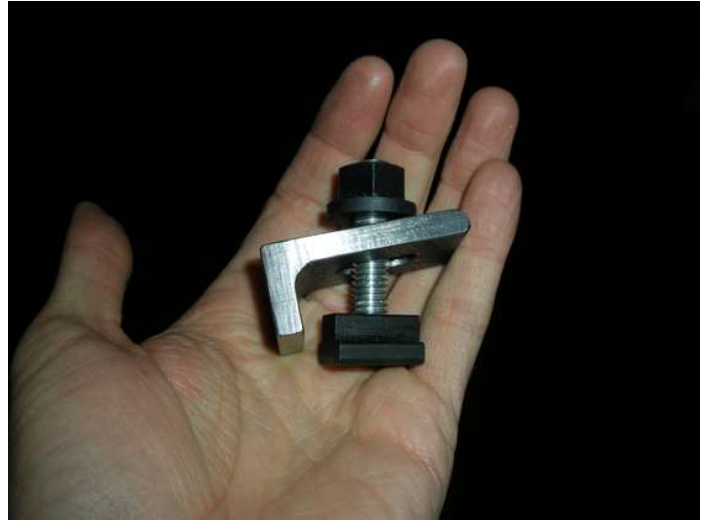
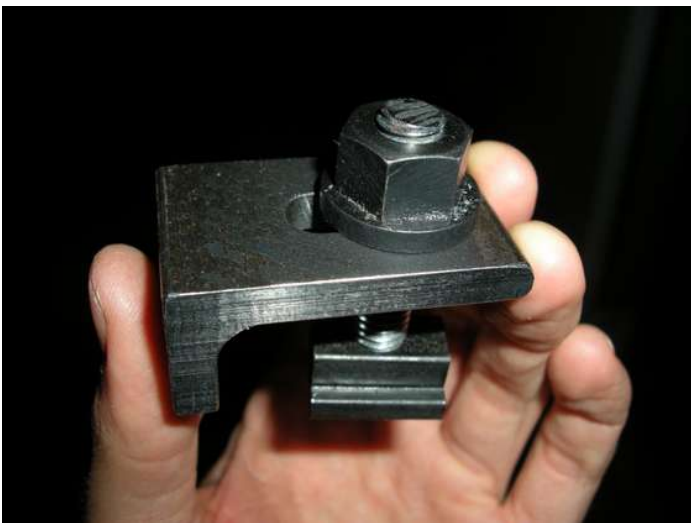
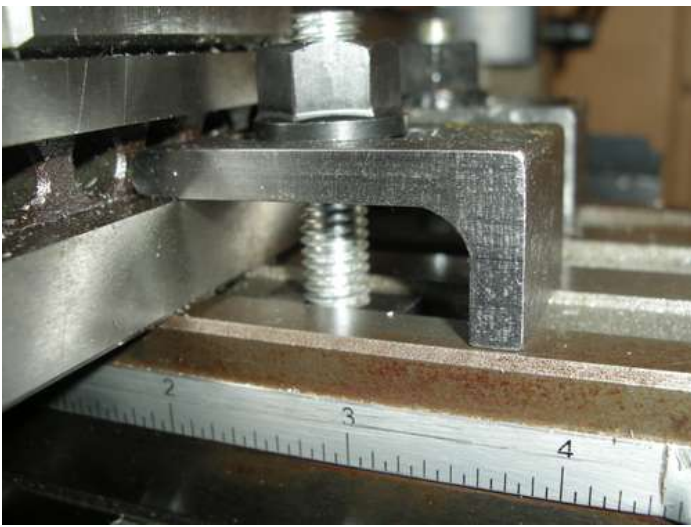


Image Notes

1. Bought these from LMS.





Related Instructables



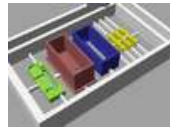
600W Electric Trike by smegger



Easy to Build Desk Top 3 Axis CNC Milling Machine by Tom McWire



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make plastic 3D models from CAD designs using an automated "milling machine" by leevonk



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Comments

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Hands Without Shadows says:

Oct 7, 2008. 2:53 PM [REPLY](#)

I like it, but I hate having to tighten the same nuts frequently. I would change those nuts out for lift and set levers but thats another project in itself.



CameronSS says:

Oct 7, 2008. 7:55 AM [REPLY](#)

Which came first, the milling machine or the milling machine vise?



Hands Without Shadows says:

Oct 7, 2008. 2:51 PM [REPLY](#)

The milling machine came first. Its easy enough to mill just by clamping parts to the table, its just a pain to realign everytime you move the piece.



Doc Workingday says:
First came the charcoal foundry ;-)

Oct 7, 2008. 8:35 AM [REPLY](#)

Build your own metal working shop from scrap, by David Gingery



ncorison says:
Nice work, Doc!

Oct 7, 2008. 6:27 AM [REPLY](#)
