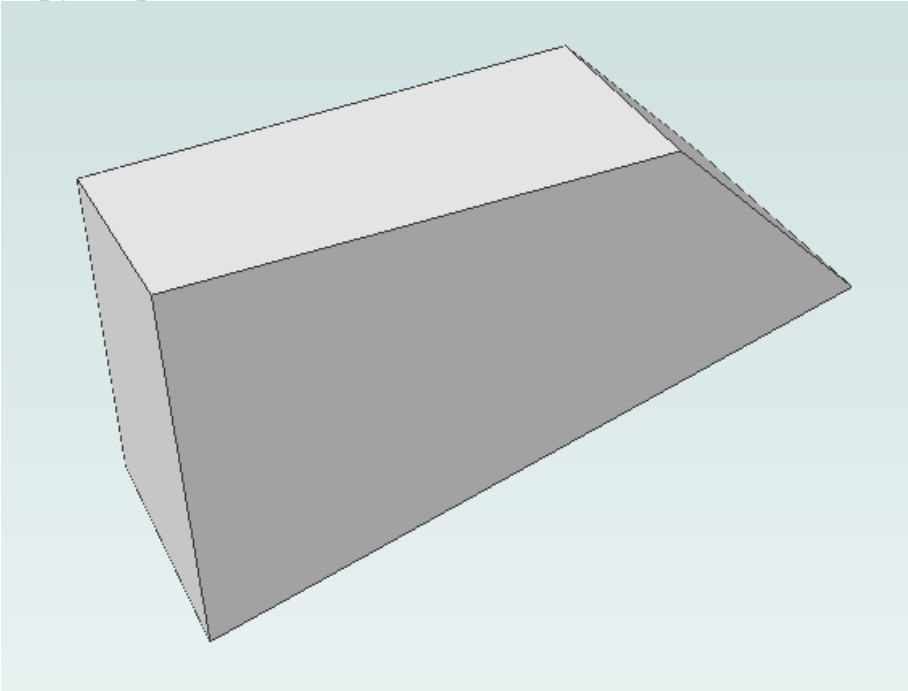
Squaring a Block, version 2

By R. G. Sparber



You found this block of steel in the dumpster. Now what?

Sure it could be a door stop someplace but with a little effort, it can be squared up on a mill as the start of some great project.

Here is how I would do it.

The straight forward part of this procedure involves how to place the block against the fixed jaw. I will present that first. The "artistic" part of the procedure is what to do with the pointed end which must be clamped by the movable jaw. I'll deal with that second.

My first stop would be to my belt sander. Remove all rust and large dings. As I am sanding, I would look for the flattest surface and use that in my first machining step.

[1] You are free to copy and distribute this document but not change it.

The Fixed Jaw End of the Vise

The block can only be as square as the vise that holds it. So before you begin, be sure the vise is square to itself and to the mill. Here are a few articles that may help:

Soft jaws: http://rick.sparber.org/Articles/sj/sj6.pdf

Vise tune-up: http://rick.sparber.org/Articles/ViseDef/ViDef.htm

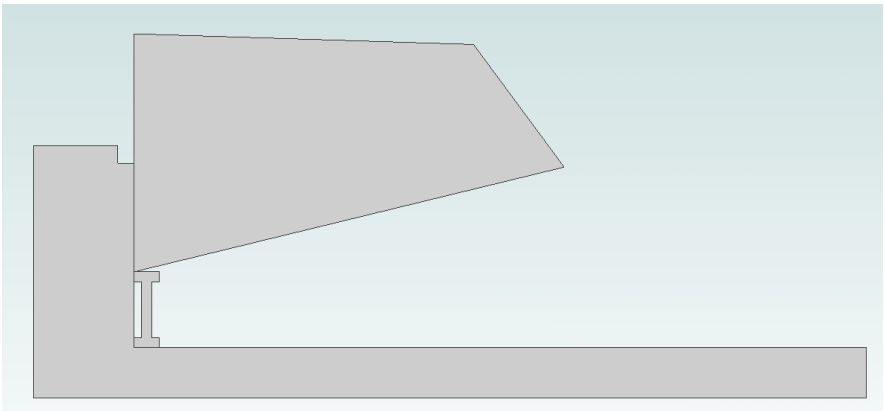
Mill alignment: http://rick.sparber.org/Articles/mde/mde.pdf

Bedding the part down on the vise:
http://rick.sparber.org/Articles/BedDown/BD.htm

Aligning the vise to the mill: http://rick.sparber.org/Articles/VA/VA.htm

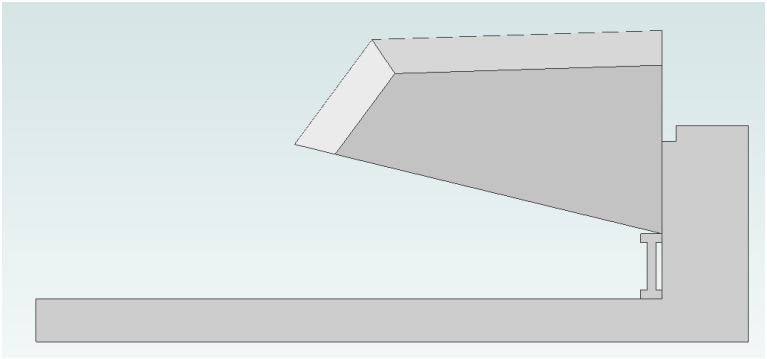
How a lock-down vise works: http://rick.sparber.org/vf.pdf

And finally, if you want to make a new vise, http://rick.sparber.org/ldv.pdf

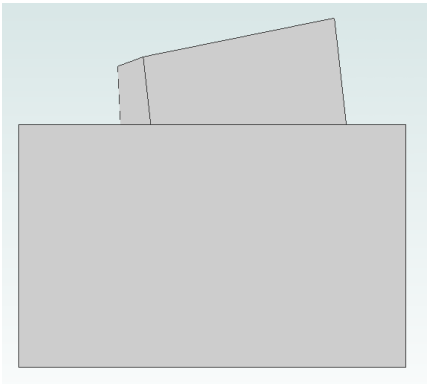


The first machining step is to find the flattest surface on the block and put it against the fixed jaw of your vise. I have the bottom edge resting on a parallel but it could have been put down on the vise ways.

That notch you see in the fixed jaw is my “softjaw”. Normally I would use it rather than a parallel to support my work. But since I will be hogging a lot of metal, I need a larger contact area. I could re-cut all surfaces to a higher precision on the second round.

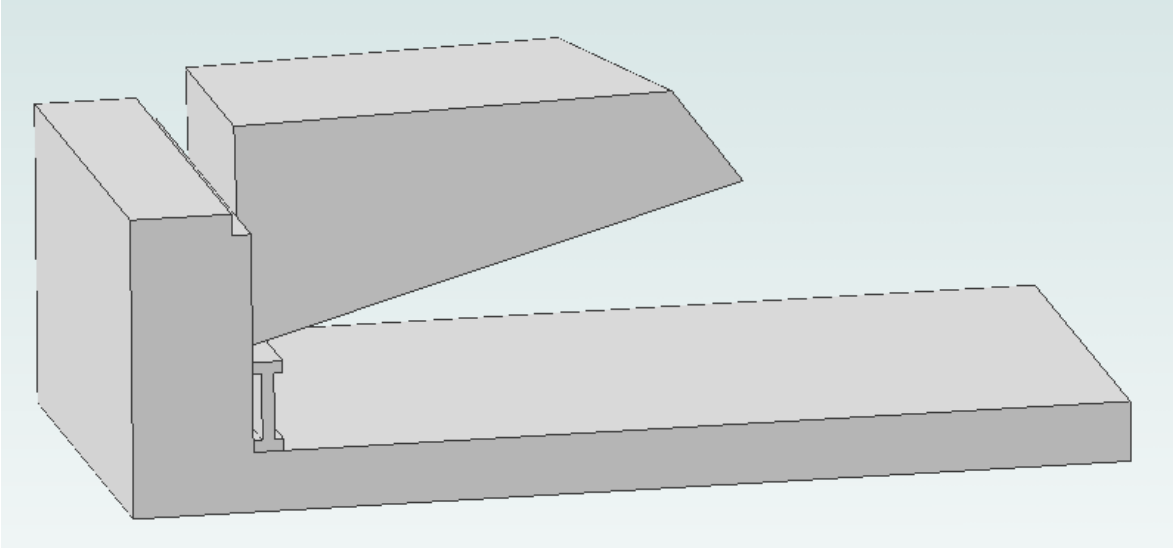


You can see from this view that the block will be hard to clamp with the movable jaw. You might have to take light cuts so the part doesn’t end up being flung across the room during milling.

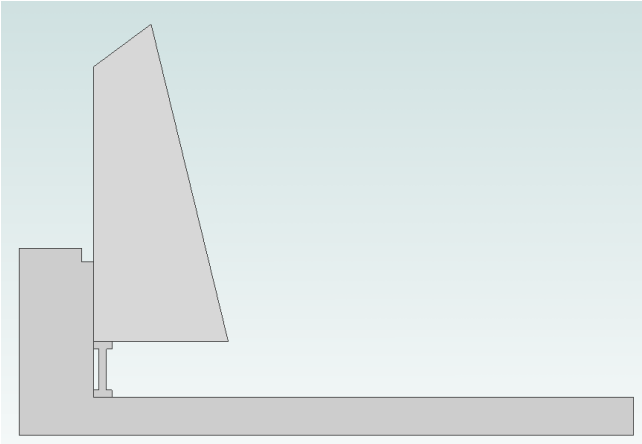


This is the view looking over the fixed jaw.

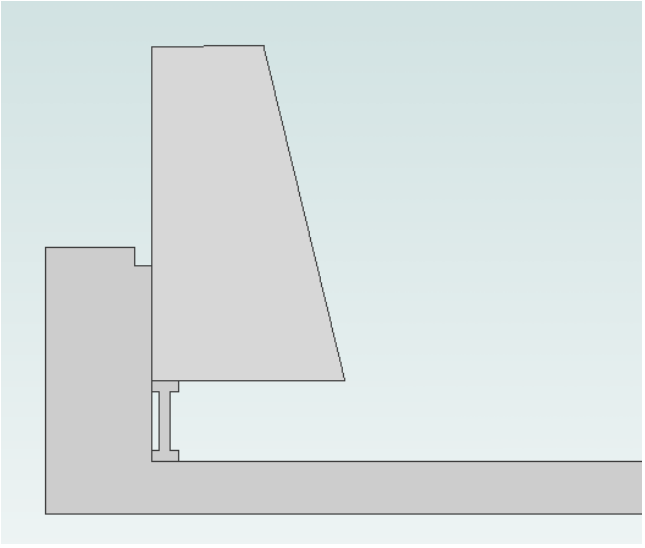
Nothing is square… yet.



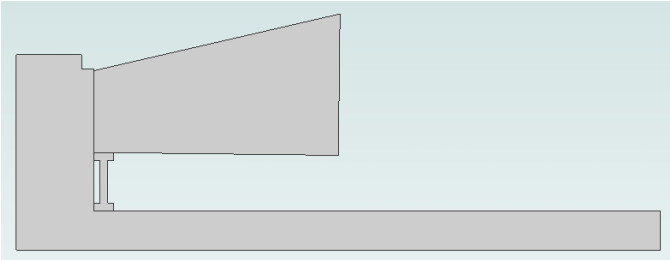
After milling the top flat, I now have my first truly flat surface. The surface against the fixed jaw would be exactly 90° from it if it was also truly flat. At this point we will assume that it is not flat.



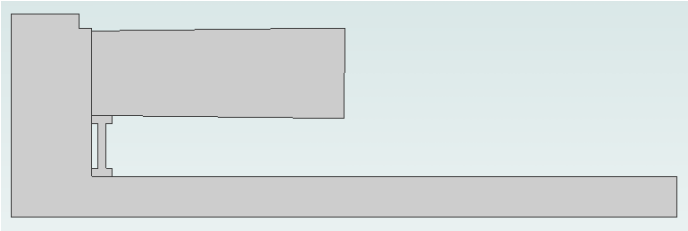
I have now rotated the block so the last cut surface is against the fixed jaw and the first face is against my parallel.



After taking my cut, the top is now flat and perpendicular to the face that is against the fixed jaw. It is also parallel to the top of the parallel. It might be parallel to the bottom surface if it was flat in the first place.

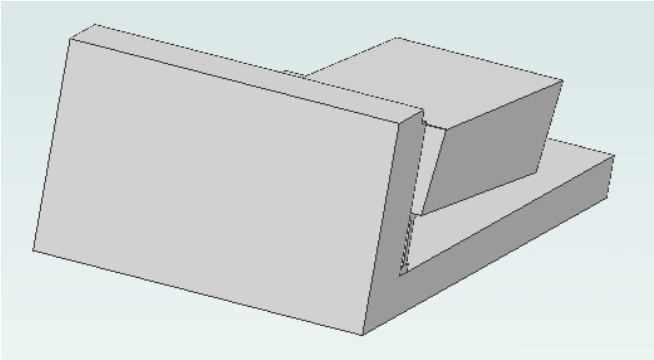


The freshly cut top face has now been rotated so it contacts the fixed jaw.

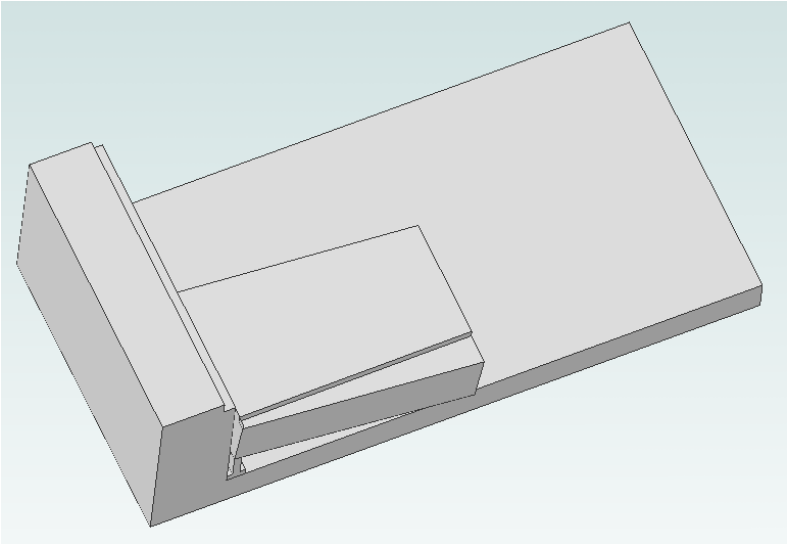


With the last perimeter face cut, we now have four sides perpendicular to each other.

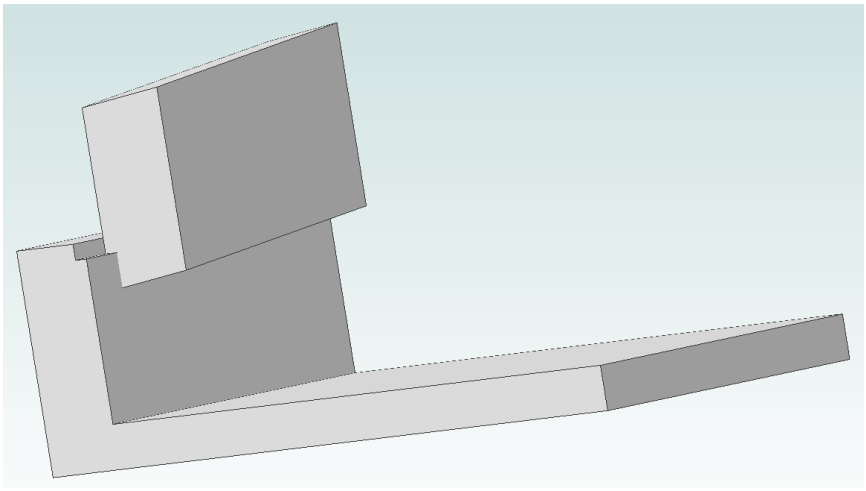
Now we must cut the ends to be perpendicular too.



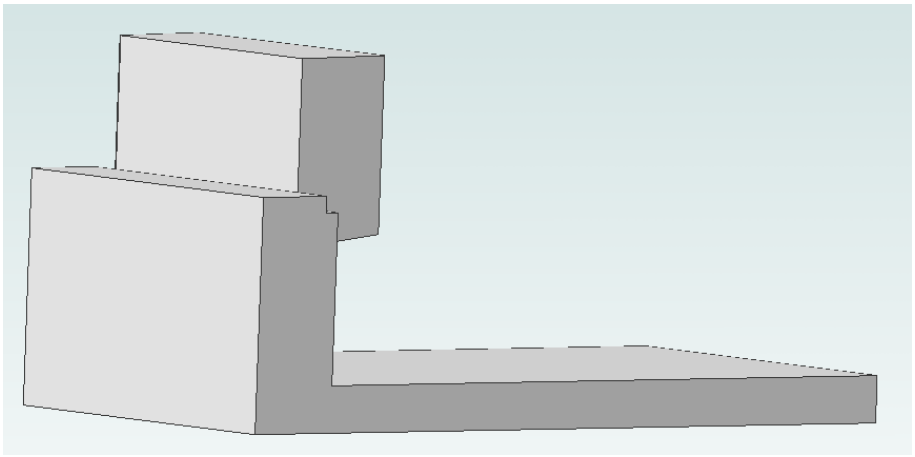
The block is slid over so the side is exposed beyond the fixed jaw.



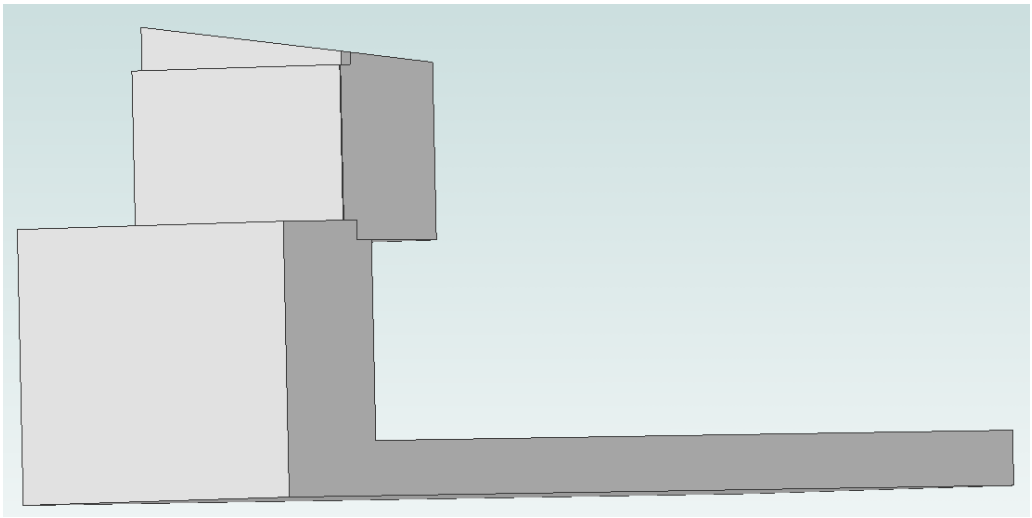
This next step came from Brad Peters. He suggested side milling just enough of the side face so a parallel will support it. Since side milling causes bending of the mill, the shallower the cut, the better the accuracy. Way to go Brad!



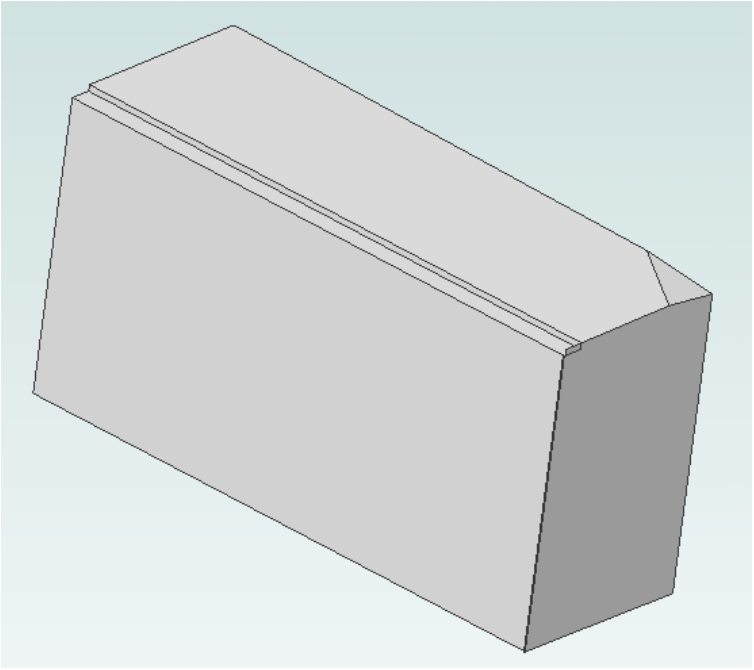
The cut step is now placed on my softjaw. It could have gone on the parallel but that would not have been as accurate. I have more surface to clamp here so will take the risk that the clamping force is sufficient to withstand the cut.



This end has now been cut. It is parallel to the softjaw and perpendicular to all of the other faces.



The opposite end that just had a step side milled into it can now be cut.



I thought I had taken enough from this last side but you can still see some of the step plus a corner left uncut. But I hope you get the idea…

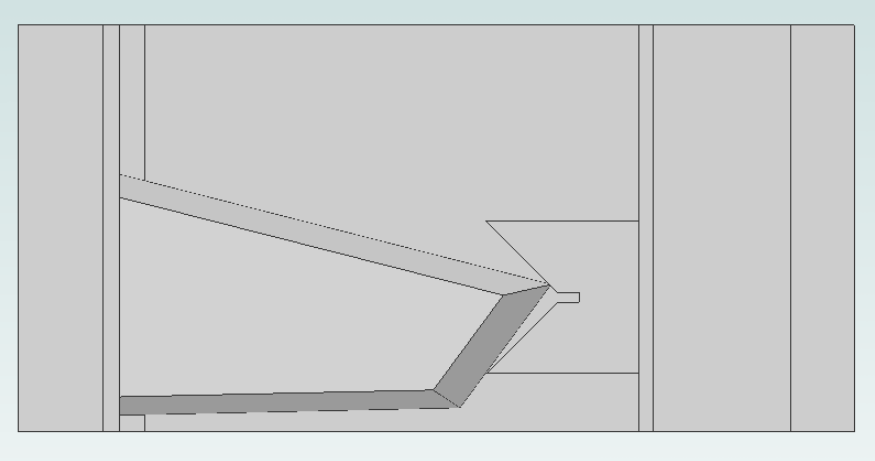
The key to this machining is that the surface about to be cut will be perpendicular to the surface in contact with the fixed jaw and also parallel to the edge of the bottom support (which is usually a parallel but could be the ways or a softjaw).

The Movable Jaw End of the Vise

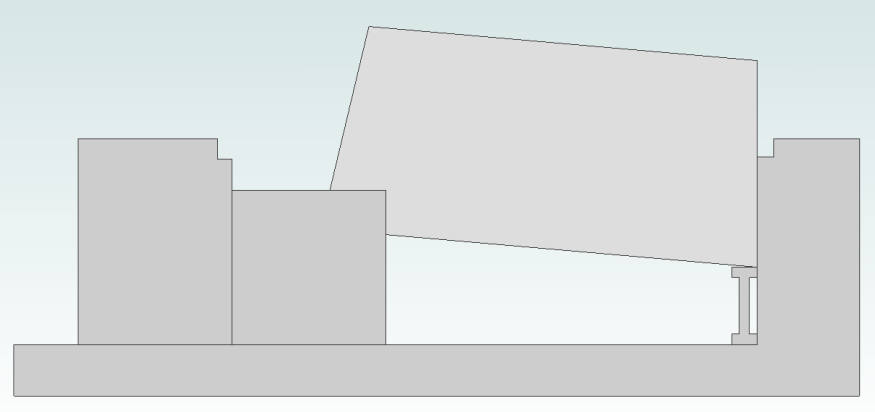
It can really strain the brain trying to figure out how best to clamp an irregular shaped block in a vise. My best advice is to try things and see how they work.

In all cases, test the clamping action by trying to move the clamped block. Then take a light cut and see if anything shifts. A poorly clamped block can become a deadly projectile if the cutter snatches it out of the vise.

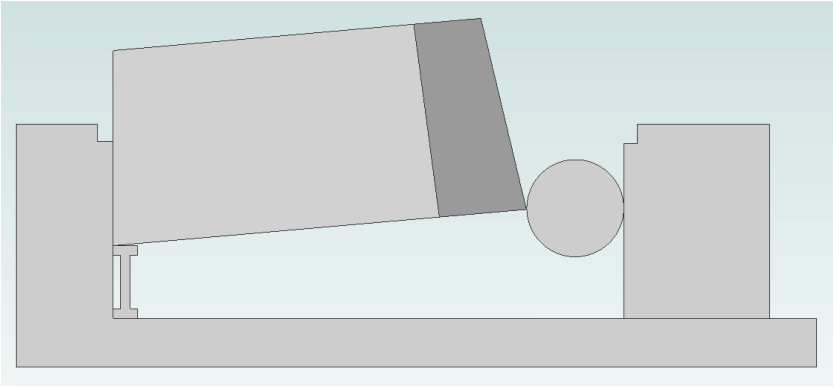
One technique that works some of the time is to use a V block:



This is a view looking down on the vise.

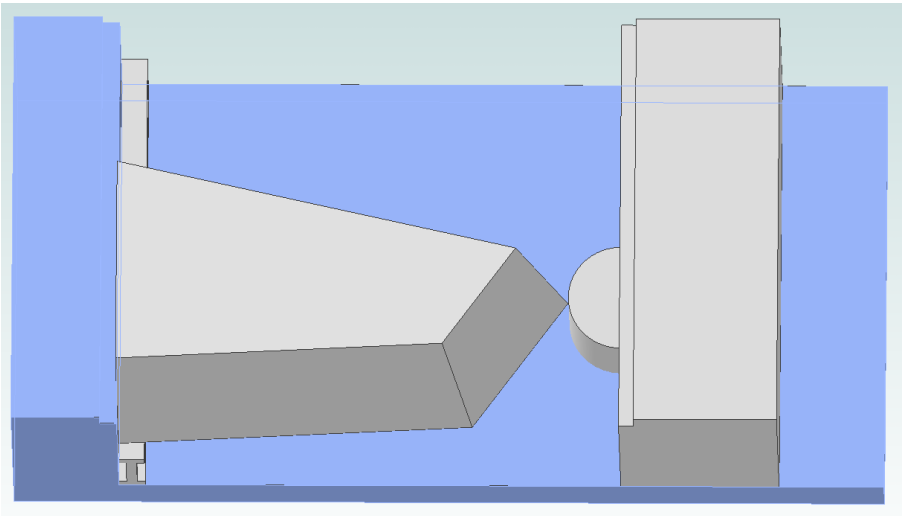


Here is a side view.



A cylinder can be used some of the time. Here it is used horizontally but it is common to also orient it vertically.

This could also be a picture of a ball bearing being used to transfer the movable jaw's clamping force to the block.



If the cylinder is too unstable, you might want to try a half cylinder.

If the end of the block nearest the movable jaw is incompatible with the above methods, you may need to make a custom addition to the movable jaw. For example, if you cut a V block that was a better fit to the block being clamped, you might be able to achieve a solid arrangement. You might also want to take the block back to the bandsaw and cut a flat to match the movable jaw.

David of the Yahoo group metal_shapers wrote:

“One trick which works for clamping a random shaped workpiece is Bondo! Use it like clay, mold it to the shape needed and then make a flat for the movable jaw to lock down.”

I suspect that if the block is first coated with oil, the Bondo will not stick to it.

Glenn N of the Yahoo group atlas_craftsman wrote:

“On the part about the movable jaw, I find a ball works well to give me a single point of pressure. Especially handy on castings with irregular shapes. If you take a ball joint or tie rod end apart you get a nice ball with a handle on it for clamping. Or weld a rod on a ball bearing.”

I am not aware of a single clamping method that can handle any shape. The closer the block is to square, the easier it will be to clamp it securely.

Acknowledgements

Thanks to Brad Peters for improving this procedure. Thanks to David and Glenn N their comments. Thanks to Steve T. of metal_shapers for suggesting that I include material about squaring up the vise and mill.

I welcome your comments and questions.

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