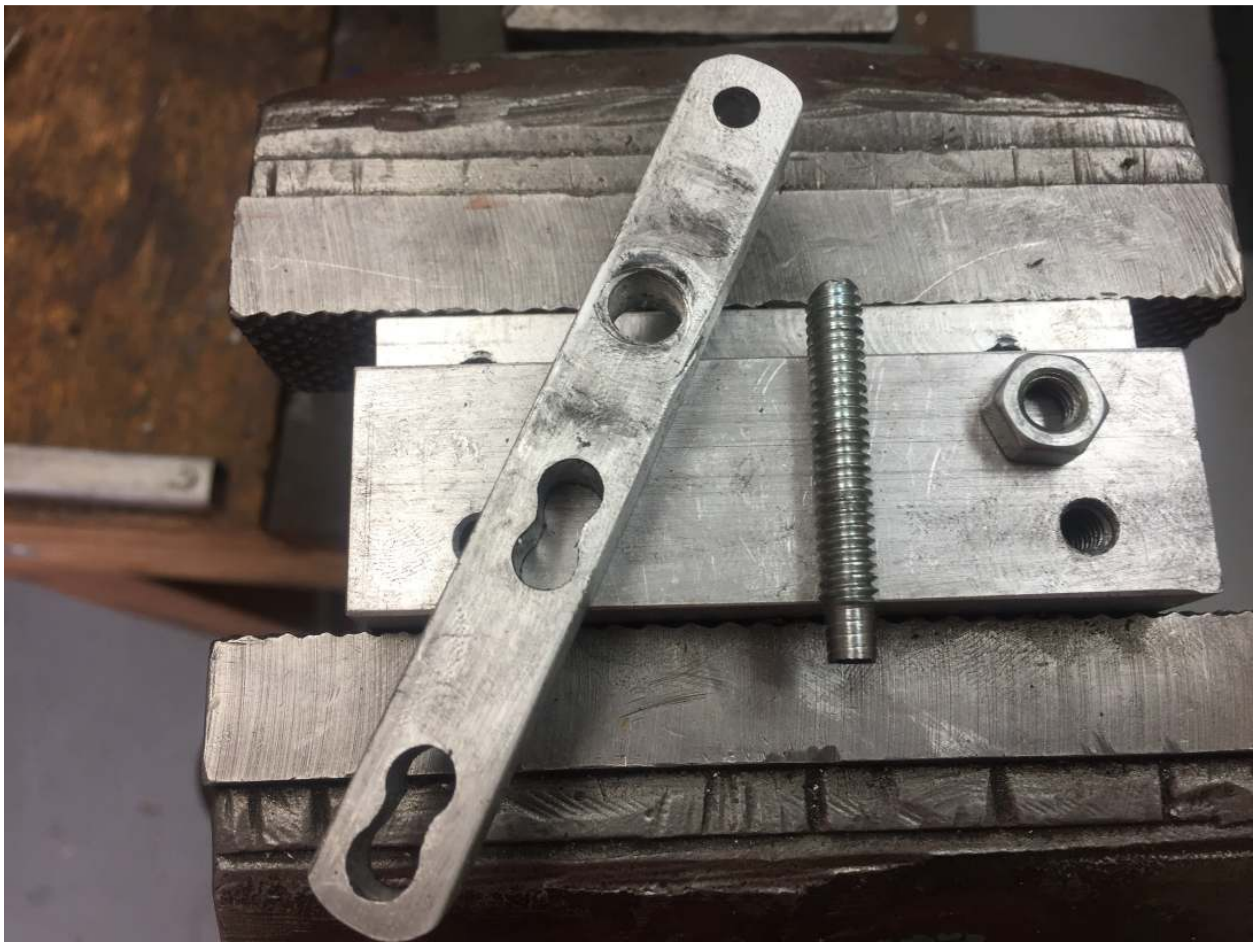
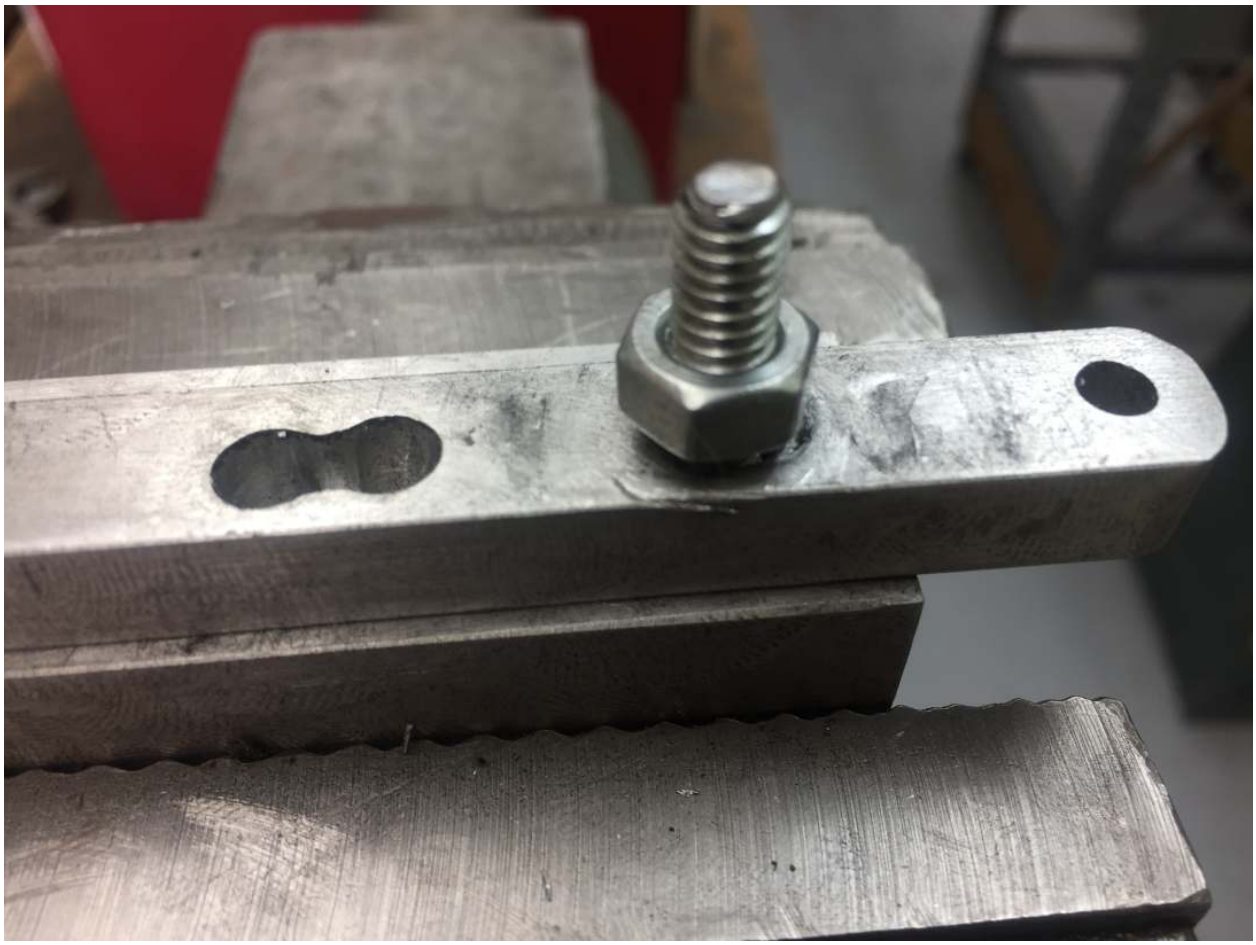
An Alternate Way to Think About Tightening a Nut, version 1.0

By R. G. Sparber



I have a block with a threaded hole in it, a length of threaded rod, a bar to be bolted to the block, and a nut.

So what?



I thread the stud into the block, drop on the bar, and spin on the nut.

Put a wrench on the nut and tighten. Anyone out there not done this? I didn't think so.

But now, think about what is going on here in a different way. What happens when the nut is tightened? It may not be obvious, but as the nut pushed down on the bar it is also pulling up on the stud. Think of the stud as a very stiff spring. By tensioning this spring, the nut stays tight on the bar and the bar is secured to the block.

Next, consider the fact that it doesn't matter what stretches the stud. If I stretched the stud enough and just finger tightened the nut, the bar would be secured when I let go of the stud. We have turned a mundane operation on its head.

This alternate way of thinking about the problem was presented to me during a recent tour of the Palo Verde Nuclear Power Plant here in Arizona. In their case, they have 104 studs that are each 7.5 inches in diameter. These studs secure the top of the pressure vessel to the bottom. In order to change fuel rods, the top must come off.

Of course, the more time spent replacing the rods, the more time wasted not making power and therefore not making money. So anything that can safely speed things up is considered.

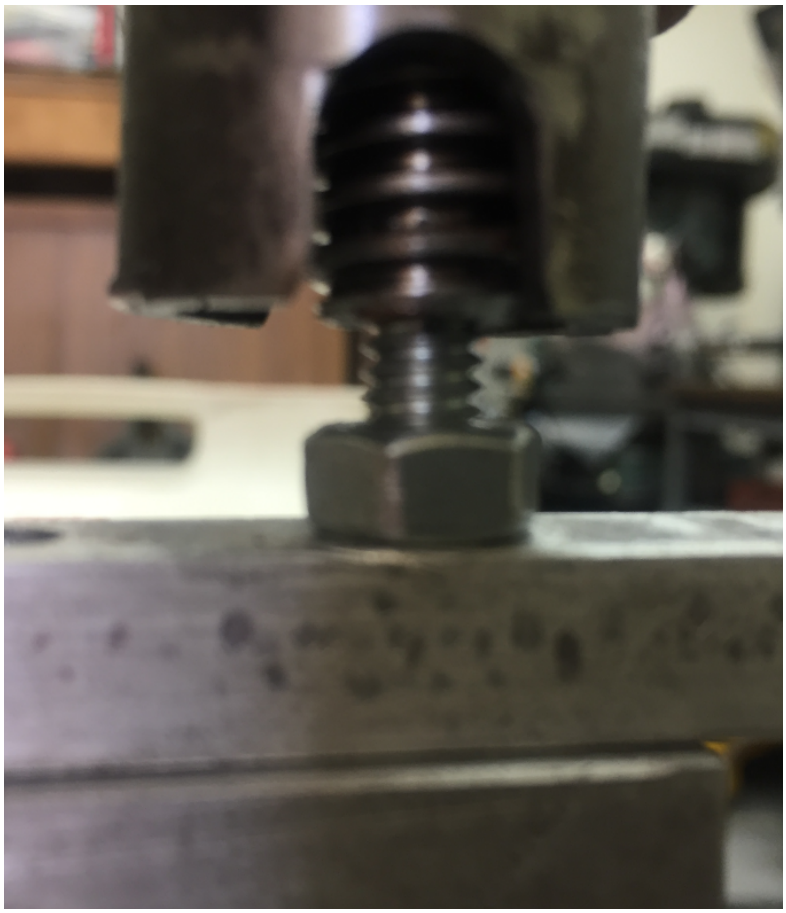
They showed us a machine that grabs 52 studs at the same time and pulls on them. It is then a simple matter to spin up each of the 100 pound nuts a few turns. Then the machine lets go of all studs and moves out of the way. Some very strong men spin the nuts off of the studs and carry them to a bin.

The machine comes back, grabs the second set of 52 studs and the process repeats. It saves many days of downtime. I believe they said the machine paid for itself the first time it was used.

I just had to build a model to see how this idea works.

A short section of gas pipe proves the support for the jack. A length of Acme threaded rod and nut feed through a thick washer. The rod, nut, and washer are all well lubricated.

The end of the threaded rod has been drilled and tapped ¼-20. The other end has flats ground into it to accept a wrench.



The threaded rod passes through the washer and the pipe. Here I have screwed the threaded rod into the top of my stud. The ¼-20 nut is finger tight.

All that is left is to tighten the big nut to pull on the ¼-20 stud. It took a few tries before getting this right. I can tear the stud in half if I get crazy with the wrenches.

With the stud tensioned, I used a small screwdriver to nudge the nut snug against the bar. Then I loosened the big nut and removed the tool.

The bar is secure.

Consider the case of a nut that is frozen on a stud. Could it be that the real problem is that the face of the nut is rusted to the surface? If so, lifting the nut off the surface by pulling on the stud would solve the problem. Cool to think about!

Acknowledgments

Thanks to the maintenance engineer at Palo Verde Nuclear Power Plant for showing me this approach.

I welcome your comments and questions.

If you wish to be contacted each time I publish an article, email me with just "Article Alias" in the subject line.

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