A Light Duty Parallelogram T Nut, version 3

by R.G. Sparber

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Acknowledgment

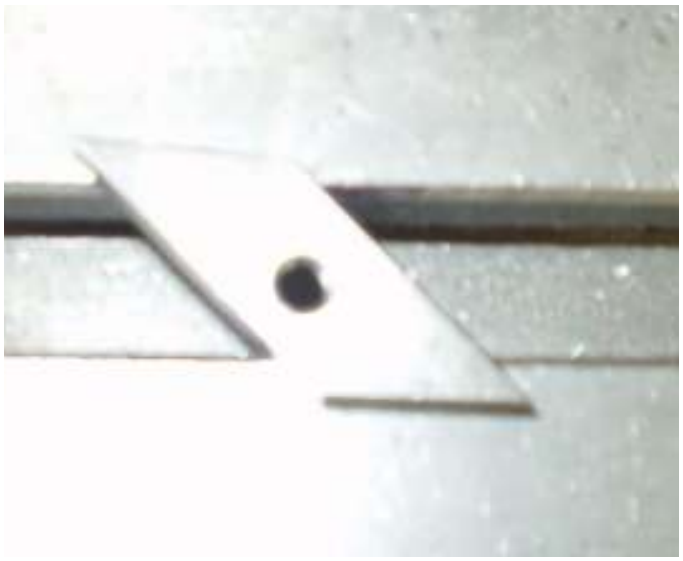
The idea of a parallelogram T nut came from C.R. Nanda of Bombay, India. He published his idea in the exquisite book “Practical Ideas...” by the editors of American Machinist (ISBN 0-932905-05-6). I have simply put some math around it.

Brian Lamb has pointed out to me, after the first release of this article, that these nuts are commercially available. They solve the problem encountered in the following design by making the stud an integral part of the T nut. For example, see

http://www1.mscdirect.com/CGI/NNSRIT?PMPXNO=1766015&PMT4NO=36559308

What's the problem?

No matter how much I plan, I always seem to need a T nut placed between two T nuts that have already been tightened. Wouldn't it be nice to be able to just drop in a T nut and have it magically grow to engage the slot? Well, it really isn't much magic.



Here is a prototype of the T nut invented by Nanda. I placed it over the T slot so you can see how it works. The width of the Parallelogram T Nut (PTN) is slightly less than the width of the T slot.

It is a simple matter to drop the PTN into the T slot with a bolt attached. The turning action of tightening the bolt causes the PTN to rotate clockwise and engage the T slot.

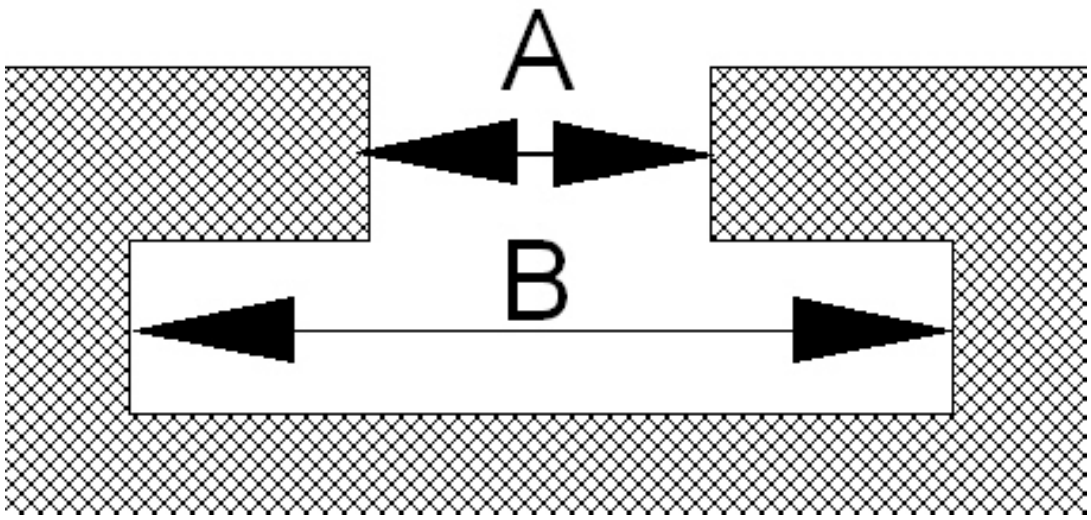
Here you see the PTN engaged in the T slot.

The PTN is ready to clamp down a small angle plate. There is room to add a second PTN if necessary.

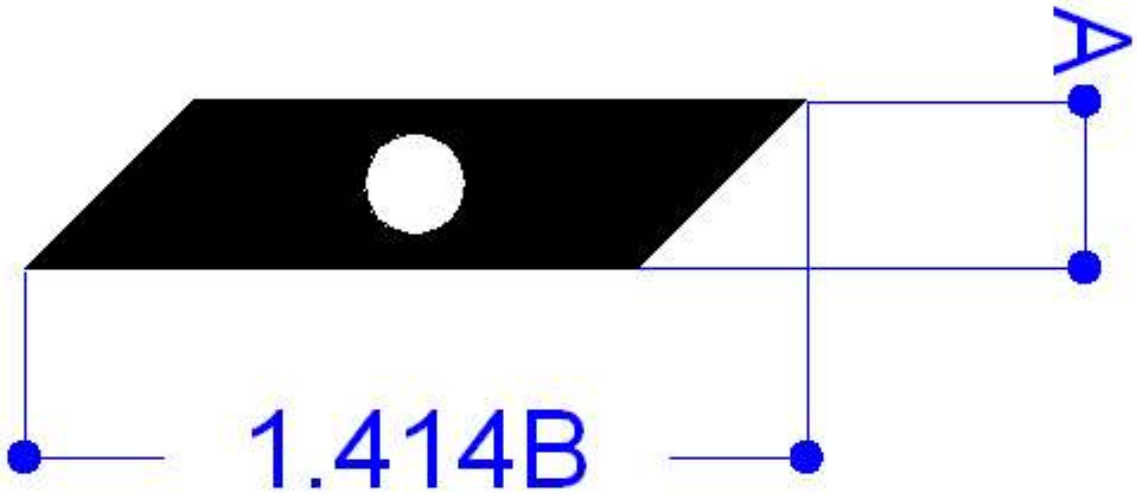
Not the best picture, but you may be able to see the PTN rotated and locked into the T slot.

Design Details

Lets start by defining two parameters of your T slot.



A regular T nut may have a ½-13 thread which engages metal almost " B" wide. The PTN is limited on its width because it must fit through "A" so can't handle more than about ¼-20. Going larger would mean little metal flanking the hole.



The PTN has a width of "A" although making it 0.02" thinner will make it easier to drop down the T slot. The length should be 1.414 times the width "B". In this way the angle is a simple 45 degrees. The hole is tapped ¼-20. The thickness of the PTN is limited by the T slot but I happened to have ¼" plate. This seemed reasonable given I am using a ¼" diameter bolt.

I made just one PTN to test out the design. To make a bunch of them, I would start by cutting the bar's width to A-.02”. Layout the 45 degree lines every 1.414 times B inches with a little extra for the saw's kerf.

Then I would drill all the holes with my F drill followed by tapping ¼-20.

With my horizontal/vertical bandsaw set to cut 45 degrees, I would cut the PTNs free from the bar. A quick clean up on the belt sander and they are ready for use.

In my case A = 0.6” and B = 1” my PTN was cut 0.58” wide and 1.4” long.

How Strong Is the PTN?

Given that the PTN uses a 1/4-20 screw rather than a 1/2-13 found on standard clamp sets, I felt it was reasonable to call it light duty. But how much force can it apply before failing? The best way to test this limit would be to dynamically load the PTN and see when either the T-nut or screw start to bend or stretch. I don't have the equipment to be that rigorous. However, it is not hard to use a torque wrench for a static test.

I used a standard T-nut as my top support, put a washer on top, and dropped a 1/4-20 screw down the hole. You can see the PTN in the slot.

At about 250 inch pounds I started to see a leveling off of the force which told me something was yielding.

My money was on the thread tearing out but it turned out to be the PTN bending. That is good news because it would be easy to make the next model from 3/8” CRS rather than 1/4”.

As a reference point, I then checked the torque I typically use on one of my 1/2-13 studs and T-nuts. It was about 150 inch pounds.

Gee, maybe the PTN is not as light duty as I had assumed. Using 3/8” plate should make them even stronger. I see no reason to to to a larger diameter threaded hole.

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