Incredible Threading Machine

Contributed by: Bruce Robbins

A.K.A "BRobbins629"

The Incredible Threading Machine

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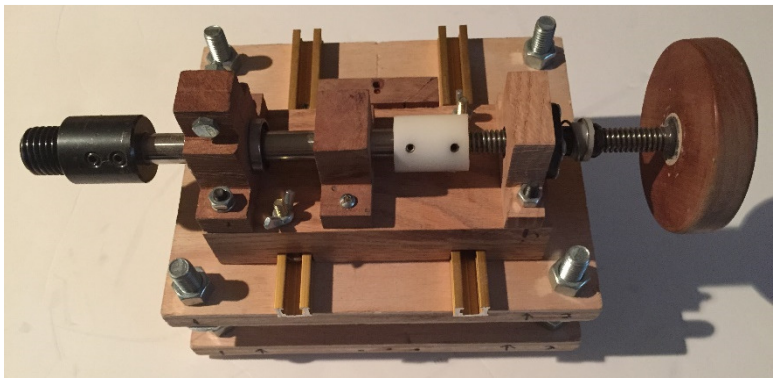


Introduction:

This threading jig is designed primarily to cut 10 TPI “square” or “box” threads using a Dremel #199 bit as the cutter and a Jet mini lathe. With the bit rotating in the headstock, the piece is slowly advanced and turned to cut the threads. With a little ingenuity it would be relatively easy to modify for different thread patterns, however a different lead screw and cutter may be needed. It is also possible to cut multi-lead threads which have the advantage of fewer twists with the same holding power. The dimensions and materials shown are for the latest version one I built and most are not critical. The drawings are not to scale. Modifications and/or material substitutions can be made for different size lathes or to use what is available. Before buying the parts list, read and understand how this work. You may have a slightly different part that will still work.

Things to make:

Base with guide blocks
- 2 – 9 ½” x 7 ½” pieces of ¾” plywood (main base)
- 2 – 1 ¼” x 3 ½” pieces of ¾” plywood (bottom guide – slide fit between lathe ways)

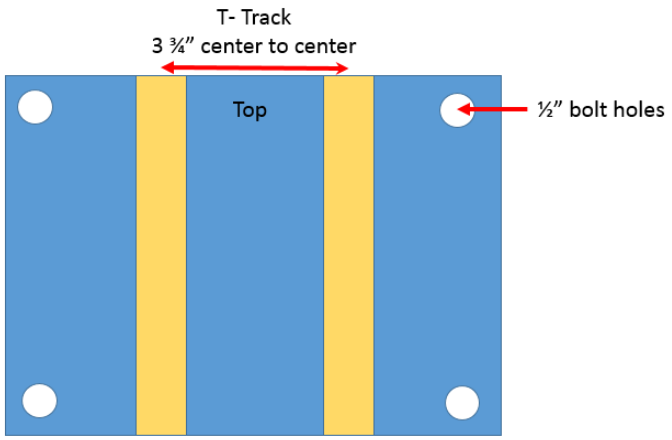
Cross slide assembly – 1 ½” x 7” (can be two ¾” pieces of plywood)
Linear bearing holder
Linear rod support
Lead screw nut holder 5/8” to ½” Coupling
Handle

Things to buy or scrounge

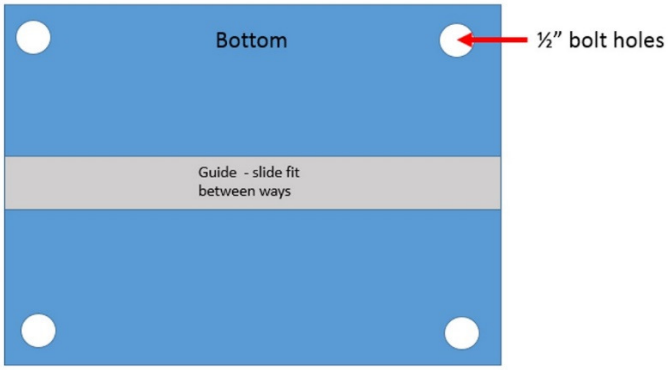
4 – ½” x 4” bolts – threaded all the way to the head
12 – ½” nuts
2 – 7 ½” T-track (¾” x ½”) with 4 - #8 x ½ self-drilling screws (Woodcraft)
T-track bolts (or ¼-20 bolts with wing nuts)
~6” ½” 10TPI single start Acme threaded rod and nut (nut optional for handle)
1 – ½” Acme antibacklash nut single start - http://www.cadcamcadcam.com/acme-nut.aspx
1 – 5/8” linear bearing (NB Systems SW10G 5/8" inch Ball Bushings Linear Motion) EBay
1 – 5/8” linear shaft (NB Linear Systems PC10-12" 5/8" Pre-Cut Slide Shaft 12" inch Length Linear 17358) (cut in ~1/2) EBay
1 - PSI Woodworking L5818 Headstock Spindle Adapter (Shopsmith 5/8-Inch to 1-Inch 8tpi chuck)
Set screws (5mm, 10-24 or similar)
1 ¼” wood screws

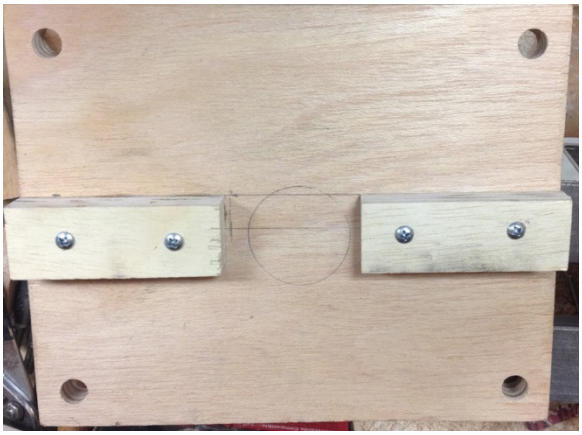
Base:

Start by cutting the 2 pieces of plywood for the base. Line them up, mark top, bottom and number the sides of each. Drill the ½" bolt holes for both pieces while held together such that the holes will line up. Make sure the holes are close enough to the corners so the bolts won't interfere with the lathe ways or cross slide. Don't attach the T-track to the top yet.



(Top View)





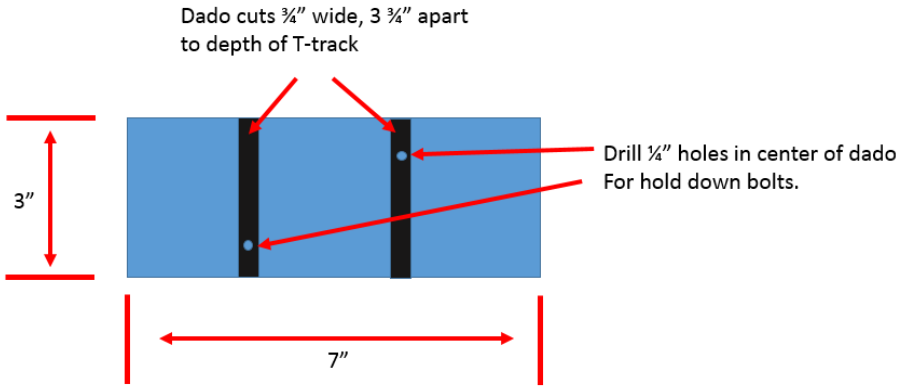
(note – bottom guide can be one piece – 2 piece from earlier design)

(Bottom View)

Cut and trim the guide block so that it is snug, but will slide between the ways. Secure it square to the end of the bottom base piece with glue and screws.

Cross-slide:

The cross slide moves across 2 parallel pieces of T-track. It should be at least 1" thick and preferably 1 ½". I made mine from 2 pieces of ¾" stock glued together. If it's too thin it will have a tendency to flex. Dado cuts should be just wide enough that the cross-slide will move on the track. I made the dado cuts deep enough so the cross-slide rides on the base, but it should also work if the cuts are shallower and the slide sits on the track.

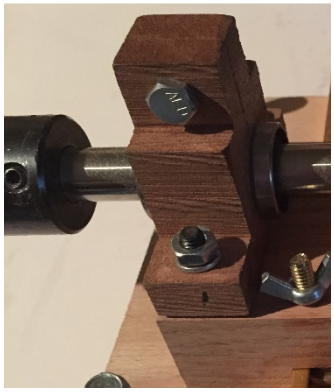


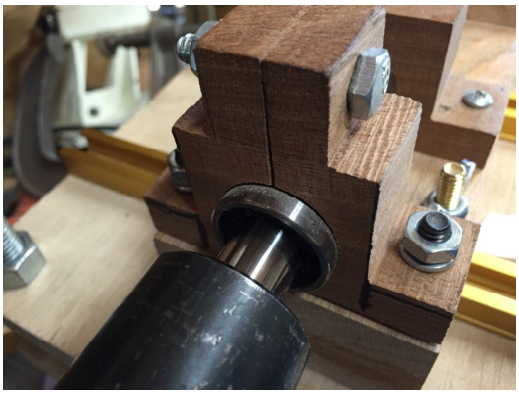
Positioning the slide in the center and on the top of the top base on one piece of T-track. Secure the first T-track perpendicular to the side of the base with screws. With the cross slide in place, secure the second T-track such that the cross-slide moves freely.

Linear bearing holder, linear rod support, and lead screw Acme-anti-backlash nut holder

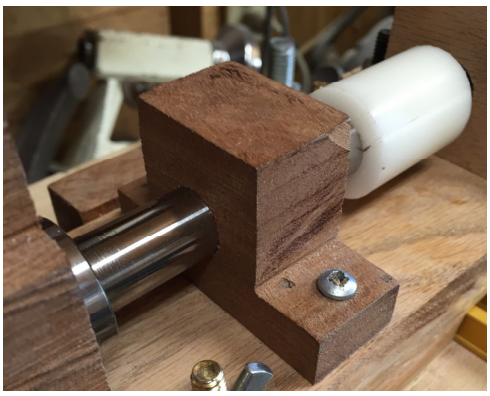
These three pieces should be made at the same time as they need to have the centerline the same distance from the base for good alignment. The centerline should be about 1" up from the bottom of the base to allow for clearance for the lead screw nut to be mounted as well as the coupling and linear bearing.

For the linear bearing holder, drill a hole the approximate outside diameter of the linear bearing or just slightly larger. I made this and the linear rod support from 1" thick hardwood. Cut some notches in the top of the holder and a kerf down the center. Cut some more notches on the sides to make it easier to screw or bolt down to the cross slide. Drill a hole so that the top can be bolted closed to hold the bearing tight. Secure the bearing in the holder, locking it in with the nut and bolt.

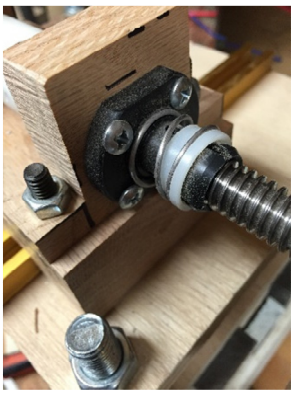




For the linear rod support, drill a 5/8” hole and cut notches out to assist screwing down to cross slide.



For the Acme anti-backlash lead screw nut holder, drill a 5/8” clearance hole and cut notches as above.



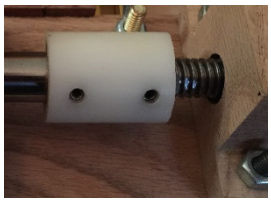
Turning handle:

Turning handles are made by turning circles 3-4” in diameter about ¾” thick. There are many ways to attach to the lead screw but here’s what I did. If you don’t have an acme nut (regular – not anti-backlash for this) try another approach.

Drill a ½” through hole and then a larger hole that the nut will fit, half way through the stock. If a little small, the tips of the nut can be ground off. Place the nut in the larger hole and fill the gaps with epoxy or something like J-B Weld KwikWood. When dry, this can be epoxied to the end of the Acme rod.

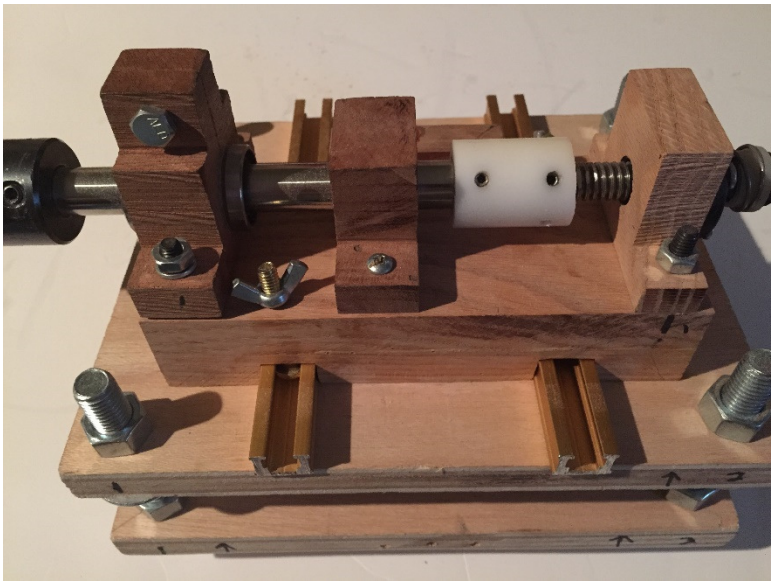
Coupling

I used a piece of nylon for this, but can be made from any material that you can tap for set screws. The piece I had was about 1 1/8" in diameter and about 1 ½" long. Drill a 5/8" hole halfway through on one side and a ½" hole halfway through from the other side. Drill and tap for 2 set screws – one to secure the linear rod and the other to secure the acme rod. (It may be beneficial to grind a flat on the acme rod for better holding – It's important that only things that are supposed to move actually do). I now use 2 set screws for the Acme rod side and when I drilled for the set screw, went slightly into the rod to make it more secure.



Securing the holders to the cross slide:

With the handle on the acme rod, thread in through the antibacklash nut about 1". With the nut still not attached to the holder, pass the rod through the holder and secure it to the ½" hole side of the coupling. Secure the linear rod to the other side of the coupling and tighten set screws. Slide support on the rod and then the linear bearing. Position the pieces onto the cross slide and clamp them in place, adjusting as necessary for the rod to move freely when the handle is turned. Note that the linear rod support is off center to allow more movement of the lead screw. When adjusted, secure the holders with screws or bolts and screw in the lead screw nut.



Attach chuck holding adapter to the 5/8 linear rod and the jig should be complete.

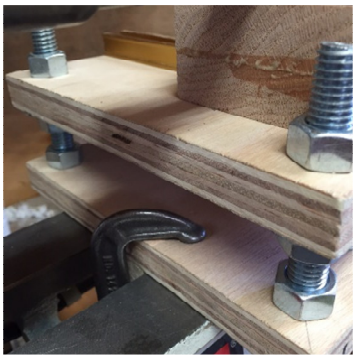
Adjusting the height

With a bit in the head stock and a small piece mounted in the chuck the threading jig, use the nuts and bolts on the base to adjust the height of the jig so that the bit is approximately on the centerline. Use a

caliper to check that the distance between the top and bottom of the base is equal on all four corners. This may require a few tries. The center height doesn't have to be perfect, just "eye-ball" close.

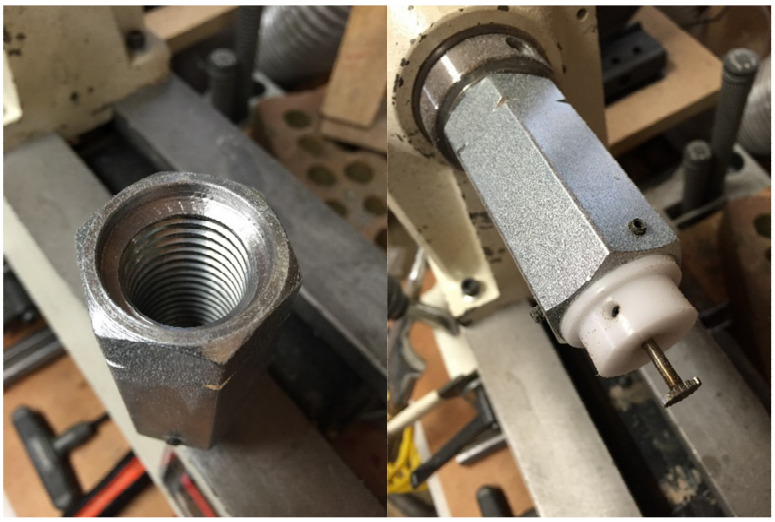
Securing the base to the lathe:

After several attempts at more sophisticated methods, I found the most practical is just to use a small C-clamp to secure to the lathe ways once it is in position.



Bit Holder:

The cutting bit is held in the headstock when cutting threads. This can be done with a collet chuck or drill chuck (if you secure with a draw bar). I wanted to use my collet chuck to hold the piece rather than the bit, so I made bit holders from long 1x8 TPI nuts.



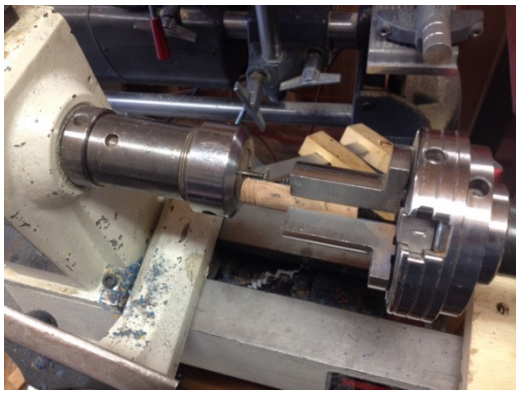
The first step to making these is to bore a hole by cutting away some of the threads on both sides of the nut. For the rear of the nut, this will allow the nut to seat properly on the lathe spindle and for the front will allow for an insert that will be used to hold the bit. These steel nuts can be cut with high speed tools by going slowly with the nut mounted on the spindle. I went about ¼" deep on the rear and about ½" deep for the insert.

Next I turned apiece of nylon so one side would fit in the nut recess. Any material that can de drilled and tapped could be substituted for the nylon. I drilled and tapped for 3 set screws to secure the nylon to the nut. Any convenient size set screw will do. With the nut mounted on the lathe. I carefully drilled a hole to hold the bit – in this case with a 1/8" shaft. It's a good idea to start the hole with a centering bit as you want the bit to run as true as possible. Drill and tap the nylon for a couple of set screws and now you have a holder.

Piece holding chuck:

Virtually any chuck that fits on the adapter and can hold the piece you are threading will work. For pens, my preference is a collet chuck, but I have used others.

This picture show a nova chuck with pen jaws on the threading jig and a collet chuck holding the bit.



Preparing the pieces to be threaded:

I like to start with all my pieces round, but larger in diameter than the final dimension. For the female threads, drill a hole the appropriate size. Then using a reamer, lather tool, or drill bit bore out a short length ~ 1/8" or less (it can later be trimmed). The inside diameter of this bore should be about the diameter of the hole plus 2X the height of the threads and a little more for clearance – you may need to experiment. There is no rule, but I think the shallower threads look better, about .020". This bored out section will be used to set the position of the cutter.

For the male threads, cut a tenon on the piece a little longer than you will want for final length of threaded section. The OD of the tenon should be the diameter of the female hole + 2X the height of the threads. If this tenon fits on the hole you drilled, it will be too small. It should be smaller in diameter than the bored out front of the female section. Now cut an additional short tenon on the end of the first that will be used to set the bit height. The outer diameter of this tenon should be the diameter of the first tenon minus 2X the thread height. The small tenon must fit in the drilled hole of the female piece.

Cutting threads:

With the bit mounted in the headstock and the piece to be threaded mounted in the jig, first adjust the position of the jig on the lathe such that the bit is near the start of the area to be threaded. Clamp the jig to the lathe ways.

For female threads, now adjust the cross slide so that the bit is at the edge of the bored section. Lock the cross slide down. Turn the lathe on and start turning the hand wheel. Usually ½" or less is more than enough threads. Preferably less.

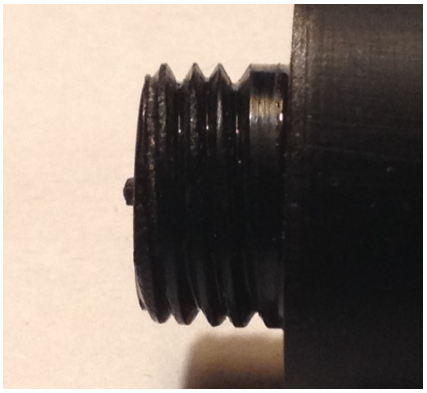
For male threads, do the same, adjusting cross slide so the bit will be the depth of the smaller tenon.

Once threads are cut, you can trim off the smaller tenon and some of the threads to whatever length you desire. This piece only uses 1 turn of thread.

Multistart threads

I have also been able to make some multistart V shaped threads with this jig. While the bit is a little more expensive, finer looking threads can be made in some materials. This technique uses a thread mill which looks like this:

Here's an example of a 2 start thread made with this.



The setup and cutting technique is similar however the threads should be a little shallower. As before threads are cut for the first pass. After the cut, rather than taking the piece out of the chuck, it is backed out using the hand wheel to prepare for the next cut. With a 10TPI lead screw such as the one I use, for a 2 start tread either the bit or the piece needs to be moved forward .050" (or .050" + 2*0.100 such as .150" or .250") This will allow the next past of the bit to start cutting 180^{o} apart from the first cut and cut groves between the first set.

Here's a picture of a .150 thick shim used in the threading jig moving the piece forward. Be sure not to adjust either the piece or the bit before making the second cut.

HAPPY THREADING – WORK SAFELY