LINDOW MACHINE WORKS

Rose Engine News

The Lindow Rose Engine....Setting New Standards In The World of Ornamental Turning

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John Tarpley, Editor

A Letter From David

It was good to see so many of you at the OTI Symposium last fall. It gave me great pleasure to see so many pieces on display that had been made on the LRE. There were great pieces displayed from all sorts of different machines, and I feel the quality and number of pieces displayed exceeded anything I've seen at previous symposia. Anyone who attended went home inspired. The presentations added to that inspiration, and I can't wait to see the projects that come about from that inspiration.

This year will afford several opportunities to get together for instruction. I will be at the AAW Symposium again this year presenting four rotations. The Chicago Woodturners Association has committed to having a hands on meeting with proposed dates of July 21-23 where we will cover the curvilinear slide and making the fish pattern. We are trying to put together a hands on meeting in Louisiana this fall where we now have an adequate meeting place with plenty of space. More information will come soon. That meeting will probably be in October. If you're interested please let me know.

I am excited to once again to have had the opportunity to teach guilloché at Memoria Technica in March. We have done these classes before and are honing our approach and have also reduced the class size. The shop there is exceptionally well suited for the task and is equipped not only with a rose engine and straight line machine, but also with all the support machinery which makes for a very broad and illuminating experience. Brittany Cox will be offering introductory courses, and if there is interest she is likely to have me return for another round in the future.

I am glad to see the instructions for the "fish" box published in a newsletter. Brian Clarry wrote these instructions and they have been tested by several individuals. The testing has allowed the instructions to be honed and improved. The project teaches a variety of techniques which will have broad applications. Perhaps one of the most useful things is that he re-wrote Walshaw's instruction for the "fish" specifically for the LRE. The “fish” has been thought of by many as a "rite of passage" for the ornamental turner to go from a beginner to an accomplished turner. While it's actually not technically difficult, the recipe requires a lot of repetition and some cuts that are much deeper than we're typically used to making. I wouldn't recommend doing the “fish” while texting or listening to a book on tape because it takes concentration. I don't believe it's above the skills of anyone who desires to create the pattern. It may, however, test your perseverance and require more than one try. If successful, or should I say when successful, I believe your confidence will be greatly boosted. It also looks exceptionally nice on the top of a box. The use of the dome chuck in the project will introduce it to some and remind others of just what a tool it can be.

John has once again put together a newsletter that not only informs us of what's going on but stretches our minds. I can't thank him enough. He has certainly driven me to my machine more than I would have otherwise been at it.

Ed. Note: The Fish pattern is a classic design that has long been used as a standard of development among ornamental turners. In his book, Ornamental Turning TD Walshaw says, "…its [the Fish] successful execution is generally taken to mark the transition from beginner to improver in O. T. circles!" Walshaw gives instructions for producing this pattern using an ornamental lathe and David Lindow gave information on producing this pattern on a rose engine which we published in ***vol. 2:*** *no. 1, p 17. Brian has used this pattern for the insert in the box which he has created and he has written two complimentary, but independent articles to describe the project. This article describes the box and the following article concentrates on creating The Fish pattern on our Lindow Rose Engines. Brian also introduces a different background for The Fish. The box lends itself to many possibilities. If you do not wish to use the fish insert you could use an insert of a beautifully figured wood, a cabochon, engine turning, any type of ornamental pattern, or the top could be left unornamented. We hope that you will take this box and make it uniquely your own to reflect your tastes and design perspective. Similarly the accompanying article on the fish insert can also be used in many ways to produce this pattern or a variant on many types of pieces of ornamental turning.—JT*

Fish Scale Box With A Screw Lid

Brian Clarry

The following document describes the steps in making a small box that has a fish scale pattern on the outside and has a fluted lid which screws into the base. 'The Fish' ornament is inserted in the top of the lid. The rose engine used in this project is a Lindow Rose Engine using its Double Eccentric Dome Chuck with the Segment Stop, the Drilling Frame fitted with the eccentric cutter head or an end mill, and the Threading Attachment.

Because the fish scale design requires three separate settings that need to be coordinated together, i.e. the type of sine rosette, the radius of the cutter, and the position of the sliderest; it is suggested that test cuts be made to determine that the correct fish scale required is achieved.

This document also refers to the *Lindow Rose Engine Alignment Procedures (LREAP)* and *Lindow Rose Engine Project Procedures* (LREPP) documents both documents are available on the web at https://lindowmachineworks.com/.

The steps in making the box are:

a. Prepare the wood blank for the box, and part the blank into the base and the lid.
b. Base—remove the inside and cut a female thread.
c. Lid—cut a tenon, and cut a male thread to match the female thread cut in b. above. Ornament the inside of the lid.
d. Make a threaded waste holding block with the same size female thread.
e. Screw the lid and base together and ornament the side and bottom of the base.
f. Screw the waste holding block onto the lid. Cut a recess for inserting 'The Fish' ornament. Cut 18 flutes on the outside of the lid.

1. Preparing the blank.

a. Preparing the wood.

Cut a piece of wood approximately 3 1/8" square and 3 1/4" long. Round the wood to its largest diameter, which will be about 3". Cut a 1 ¾" diameter by 1 /4" wide tenon at each end that will fit into a holding chuck.

The lid portion of the blank will be 1" long using 3/8" for the threaded tenon, and 5/8" for lid.

The base will be 1 1/2" long.

1/8" of the wood is used for parting the base and lid. Both pieces of the blank have 1/4" tenons on their outer ends.

b. Ensure the outside of the blank is smooth. At this point your blank should look like the following photo.
c. Use either the lathe, or a bandsaw to separate the lid from the base. Note: It is very dangerous to cut round objects on a bandsaw since they can be grabbed and rotated into the blade. This can cause injury to the user, damage to the piece, and/or damage to the bandsaw if the work is not properly secured. Use either a v-block or clamps to hold the piece and keep your fingers well away from the blade. If you are uncertain how to make this cut safely, then either part the blank on the lathe or use a handsaw.

2. Aligning the sliderest

Move the sliderest inline with the holding chuck and use a square to ensure the sliderest is 90° to the RE base. Lock the headstock at top dead center so the spindle does not rock. Refer to *LREAP* document Section—1 1.1.

Hint: Every time the sliderest is moved it is important to use a square to ensure it's aligned correctly.

3. Hollowing and threading the base

Step 1—Hollowing the inside of the base

a. Install the base in a holding chuck.
b. Use a dial indicator against the base and check the blank both axially and radially. Refer to *LREAP* document Section 1—1.5.
c. Install the Drilling Frame on the sliderest. Install a ¼" 4 flute single ended end mill in an end mill holder, and screw the end mill holder into the Drilling Frame.
d. Place the bottom of the end mill on the top surface of the rim and smooth the surface. Cut the length of the base to 1 1/2".

e. Using the end mill bore a hole in the wood blank approximately 1 1/4" deep with a 1/4" sidewall for the box base.
f. Slow the RE down for the final, finishing cuts so the sidewall has a better finish.
g. Leave the bottom of the hole flat for an insert, if required.

Step 2 Installing the threading components

a. Select the 8 tpi threading bobbin and indexer. Ensure the threading bobbin is correctly attached to the indexer, and is set at the 1 2 3 4 marked on the edge of the indexer.
b. Install components of the threading attachment to the rear end of the spindle. First, install the mounting block with the lever to the right. Second, install the 8 tpi brass chaser into the holder leaving the chaser a loose fit, and slide the indexer/threading bobbin on the spindle. Finally, use the

lever to gently lift the brass chaser up so that its threads just engage with the threads of the threading bobbin.

c. Tighten the indexer against the spindle. Install a 1/8" or 3/16" cutter with a 60° cutting angle in a fly cutter holder and insert in the Drilling Frame.

d. I use a two lead thread for this box so each lead must be cut separately.

Step 3 Threading the base, First Lead

a. To determine depth of the thread for an internal thread refer to *LREPP* document Section—1 1.2.

b. For 16 tpi the depth of the cut for an internal thread is 0.038" (70% of Sharp V for internal thread). Use this depth even though 8 tpi is being used because this is a two lead thread.

c. Move the cutter in from the rim about 1/8". Move the cutter slowly towards the far side, or to the right of the hole so that the point of the cutter is nearly touching the side. Move the drilling frame spindle by hand slightly up and down and adjust the sliderest so the point of the cutter is barely scraping the side of the base. Set the dial on the sliderest to 0.

d. The base is threaded from the inside of the base to the rim. This is known as a climb cut, where the cutter is going in the same direction as the base.

e. Turn the sliderest handle to move the cutter just outside the rim. It is important not to move this adjustment again. Rotate the spindle by hand to move the cutter into the base where the threading will start i.e. about 3 to 4 threads, which is approximately 1/2".

f. As a trial run turn the spindle so that the cutter moves towards the rim. Ensure the cutter stops just outside of the base. Move the spindle back to where it started.

g. Move the cutter towards the side by 0.038", turn on the drilling frame and start cutting the thread. When the cutter is outside of the base move the cutter away from the side, and turn off the drilling frame.

h. This completes the first lead.

Step 4 Threading the base, Second Lead

a. Return the cutter back to where the first lead started.

b. Rotate the spindle until the marking 1 2 3 4 appears on the indexer.

c. Remove the shoulder bolt holding the threading bobbin to the outer metal ring. Do not loosen the outer metal ring.

d. Turn the threading bobbin clockwise until the shoulder bolt hole appears next to the 2 4 marking. Screw the shoulder bolt back into the threading bobbin.

e. Cut the second thread at the same depth of 0.038". The second thread will be cut in between the first thread.

f. This completes the second lead of the base.

Step 5 Finishing the base

a. Replace the Threading Attachment with the spindle collar. Use a fly cutter holder with a 1/8" flat cutter to cut a groove about 0.050" deep at the lower part of the thread.

b. Use a fly cutter holder with the 3/16" 90° cutter to cut a 45° chamfer on the inside of the rim.

4. Preparing, and threading the lid

Step 1 Threading and ornamenting the lid

a. Install the top in the holding chuck.
b. Use a dial indicator against the lid and check the blank both axially and radially. Refer to *LREAP* document Section—1 1.5.
c. Install the Drilling Frame with the ¼" 4 flute single ended end mill.
d. Place the bottom of the end mill on the top surface of the rim and smooth the surface. Cut the lid to a length of 1".
e. To calculate the final diameter for the tenon that will be used for the external thread refer to *LREPP* document Section—1 1.2. Again, 16 tpi is used.
f. Using a digital caliper measure the diameter inside the base of the box from thread to thread.
g. The calculation of the diameter for the external thread is:
Internal diameter of the female thread+ (2 x 70% of Sharp V for Internal Thread) which is
Internal diameter of the female thread+ (2 x 0.038")

In this project:
Internal diameter=2.430" and the Threads Per Inch=16
70% of Sharp V for Internal Thread=0.038"
Diameter for External Thread=2.430"= (2 x 0.038") =2.430"+0.076"= 2.506".

h. Using the end mill cut a shoulder diameter of 2.506" and 3/8" deep.
i. Use a fly cutter holder with a 1/8" flat cutter to cut a groove about 0.070" deep by the shoulder.
j. Use a fly cutter holder with a 3/16" 90° cutter to cut a 45° chamfer on the inside of the rim.

Step 2 Threading the tenon, first lead

a. To determine depth of the thread for an external thread refer to *LREPP* document Section—1 1.1.
b. For 16 tpi the depth of the cut for an external thread (Depth Of Sharp V Thread) is 0.055". Use this depth even though 8 tpi is being used.
c. Move the cutter in from the rim about 1/8". Move the cutter slowly towards the tenon so that the point of the cutter is nearly touching the side. Move the drilling frame spindle by hand slightly up and down and adjust the sliderest so the point of the cutter is barely scraping the side. Set the dial on the sliderest to 0.
d. Move the cutter out so that it is just not touching the tenon. It is important not to move this adjustment again.
e. As a trial run move the spindle by hand so that the cutter moves along the tenon until it reaches the groove. Move the spindle back to where it started.
f. Move the cutter in towards the tenon by 0.055". Turn on the drilling frame and start cutting the thread. When the cutter moves into the groove set the depth back to 0 and stop the cutter. Return the cutter to the beginning of the first lead.
g. This completes the first lead.

Step 3 Threading the tenon, second lead

a. Rotate the spindle until the marking 2 4 appears on the indexer.
b. Remove the shoulder bolt holding the threaded bobbin to the outer metal ring. Do not loosen the outer metal ring.
c. Turn the threaded bobbin clockwise until the shoulder bolt hole appears next to the 1 2 3 4 marking. Screw the shoulder bolt back into the threaded bobbin.
d. Rotate the spindle until the cutter is again not touching the end of the tenon. Cut the second thread at

the same depth of 0.055".

e. Cut a thread along the tenon until the cutter reaches the groove. The second thread will be cut in between the first thread.
f. Return the spindle to the beginning of the movement.
g. This completes the second lead.

Step 4 Fitting the lid

a. Screw the base on the lid without moving the sliderest dial that determines the start of the thread. If the threads are too tight or the base does not screw on all the way it may be possible to lightly sand both threads. If the threads are still too tight, cut the male threads again to a slightly greater depth.
b. If the lid and base do not close fully, check that the length of the tenon is shorter than the depth to the groove in the base.

Step 5 Ornamenting the lid

Hint: To make the lid lighter, interior wood can be removed and then the lid can be ornamented on the remaining surface, or an ornamented insert can be fitted. In this case an expansion chuck can be used to hold the lid and not a threaded waste block.

a. Return the spindle to the beginning of the movement, and replace the Threading Attachment with the spindle collar.
b. Install the Universal Cutting Frame with the triangular carbide cutters and align the cutting head to the center of the mandrel. Refer to *LREAP* document Section—2 2.2.
c. Lock the headstock at top dead center, and check the base both axially and radially. Refer to *LREAP* document Section—1 1.1 and Section—1 1.5 respectively.
d. Select a rosette and rubber, and ornament the base of the tenon.

5. Preparing threaded waste blocks

Note: A threaded waste block will be used to hold the lid whilst ornamenting. This waste block can be made of either wood or plastic. To determine depth of the thread for an internal thread refer to *LREPP* document Section—1 1.2.

Step 1 Preparing wood for the waste blocks

a. Cut a piece of wood approximately 3 1/8" square and 1 1/2" long. Round the wood to its largest diameter. Cut a 1 ¾" diameter 3/16" wide tenon at one end of each waste block. First, cut a ¾" x 16 thread through the middle of the waste block to thread on the Phasing Chuck.

Step 2 Threading the waste block

a. On the waste block for the lid cut a female thread as follows:
    i. To calculate the final diameter for the bore that will be used for the internal thread refer to *LREPP* document Section—1 1.2. Again, 16 tpi is used.
    ii. Using a digital caliper, measure the outside diameter of the lid tenon from thread to thread.
    iii. The calculation of the diameter for the internal thread is:
    External diameter of the male thread—(2 x 70% of Sharp V for Internal Thread)
    External diameter of the male thread—(2 x 0.038")
    In this project:
    External diameter =2.506" Threads Per Inch=16 70% for Internal Thread=0.038"
    Diameter for External Thread=2.506" - (2 x 0.038")=2.506" - 0.076"= 2.43"

iv. Using an end mill cut a hole 2.43" diameter and 3/4" in depth.

b. Cut a thread in the waste block as described in Section 4.

6. Ornamenting the outside of the base.

Step 1 Cutting the bead, half cove, and straight cut.

a. Screw and tighten the lid into the base and install the lid into the holding chuck.

b. Lock the headstock at top dead center, and check the base both axially and radially. Refer to *LREAP* document Section—1 1.1 and Section—1 1.5 respectively.

c. Move the sliderest 90° perpendicular to the base. Install a 3/16" bead cutter in the UCF.

d. Move the bead cutter about 1/8" from the bottom of the base and cut a bead around the base. Ensure the cutter and base are rotating in the correct direction so the base does not come loose from the lid.

e. Replace the cutter with a 3/16" half cove cutter and cut a half cove around the base about 1/16" in from the bead.

f. Replace the half cove cutter with a 1/8" flat cutter and cut a flat next to the half cove around the base. This depth will be used in section h. below.

g. Install the UCF with the triangle cutters and turn the cutting head to vertical. Cut a groove in the middle of the 1/8" wide flat at the bottom of the base, and on the lower side of the ½ cove.

h. Replace the UCF with the Drilling Frame and an end mill. Rotate the base and use the end mill to cut the side to the depth of the flat cut in section f. above. Slowly move the end mill towards the top of the lid. Sand this area before ornamenting the box side with fish scales.

Step 2 Ornamenting the side with fish scales

a. Replace the end mill with the eccentric cutter head.
To determine the pitch necessary for the cutter:

i. Measure the diameter at the middle of the base.

ii. Use the calculation to find the circumference of the base:
circumference= π x diameter (3.142 x diameter)
In the project the diameter was 2.635", therefore the circumference was 8.279".

iii. Divide the circumference by the number of bumps on the rosette being used.
In this project the rosette used was 24 sine.

iv. The circumference= 8.279" ÷ 24= 0.344" (pitch).

v. Set the eccentric cutter head to 0.469" i.e. 0.344" + 0.125" to guarantee the circles meet.
Refer to *LREAP* document Section—2 2.5 on setting the eccentric cutter head radius.

Note: The larger the radius to which the tool is set, the shorter the fish scale will be. The longest fish scale possible is a radius of one half of the pitch.

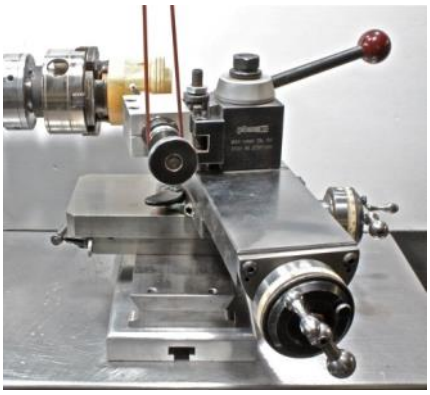
b. Lock the headstock at top dead center, and check the base radially. Refer to *LREAP* document Section—1 1.5 respectively.

c. Check the correct height of the eccentric cutter head to ensure a consistent pattern. Refer to *LREAP* document Section 2—2.3.

d. Move the bottom slide to be perpendicular to the headstock (base is parallel with the spindle), and using the sliderest protractor, set the top slide to an angle of 10°.

e. The eccentric cutter head will cut a partial circle on its right hand side. Install a ½" radius rubber

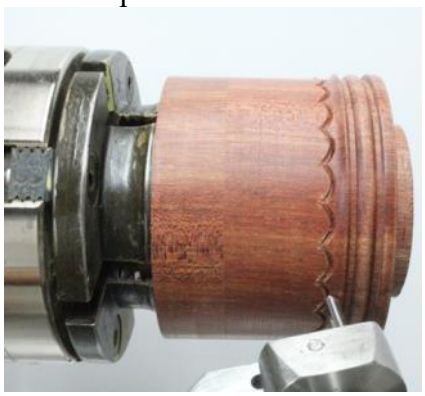
against a 24 sine rosette so that when the rubber is in the valley of the rosette the headstock is at top dead center.



Hint: To guarantee the lowest part of the valley is used at the start of each row, set a dial indicator against the headstock and use the dial and not the rosette to indicate the valley.

f. Move the eccentric cutter head close to the side, but not touching the ½ cove. Set the sliderest dial to 0.

g. To set up the fish scale for the first row:
   i. Set the Crossing Wheel phasing to the 24 mark.
   ii. Move the rubber into the valley of the rosette, and manually move the cutter in until it starts cutting a small partial circle. Set the depth sliderest dial to 0.
   iii. Turn the cutter on and move to the next valley of the rosette so another partial circle is cut.
   iv. If the two partial circles touch the depth is correct. If they do not touch, move the cutter in moving between the two valleys until the circles touch. Note the depth of cut.
   In this project the depth was 0.020".
   v. At this time move the cutter out slightly and rotate the base cutting the fish pattern around the base. Move the cutter in until the noted depth of cut is made.
   vi. Move the cutter out and turn it off.



Hint: For the best results cut the fish scales by manually turning the spindle, and moving the eccentric cutter head in each time to cut the fish scale.

To set up the for the second row:

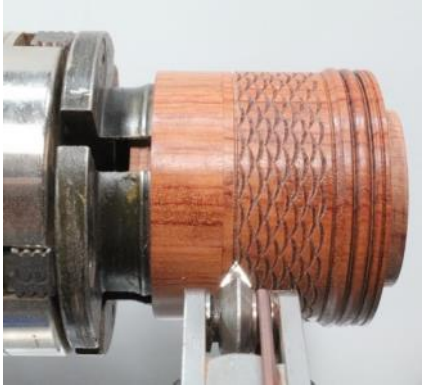
h. On the Index Wheel or Crossing Wheel move the phasing by 50%.

i. Move the rubber into the valley of the rosette.
Note: It is very important to complete this step at the start of each row. If not, you will ruin your pattern.

j. Initially move the cutter along the base by 1 turn i.e. 0.10".

k. Move the cutter in by hand so that it just touches the surface. The cutter should just touch the intersection of the two partial circles in the first row. If it does not, move the cutter so that it does. Note the new measurement and use this measurement for each row of fish scales.

l. Rotate the base cutting the fish pattern around the base. Move the cutter in until the noted depth of cut is made from f. IV above.



m. Repeat as many rows as possible using the process in g. above.

Step 3 Finish ornamenting the side.

a. Remove the rubber, and ensure the headstock is locked at top dead center so it does not rock.

b. Use an indicator against the base to check the base radially. Refer to *LREAP* document Section—1 1.5.

c. Install the UCF with the triangle cutters and turn the cutting head to vertical. Cut a groove against the last fish scale at the

depth used previously.

7. Ornamenting the bottom of the base.

Step 1 Preparing the base.

a. Leave the lid, which is attached to the base, in the holding chuck.
b. Move the sliderest inline with the holding chuck and install the Drilling Frame with an end mill.
c. Remove the tenon from the base, and move the end mill across the bottom ensuring a smooth surface.

Step 2 Ornamenting the base.

a. Set the headstock at top dead center, and check the base blank both axially and radially. Refer to *LREAP* document Section—1 1.1 and Section—1 1.5 respectively.
b. Remove the end mill and install the eccentric cutter head. Adjust the radius of the eccentric cutter head to fit the base.
c. Place the spring loaded lever on the Crossing Wheel (the Bird) in the 24 slot.
d. Using a ½" round rubber and a 24 sine rosette cut 24 circles around the base.
e. Move the Bird to the next slot (phased by 50%) and repeat cutting the 24 circles.
f. The final step is to remove the rubber away from the rosette and lock the headstock to top dead center. Use an end mill to smooth out the center for a space to sign the box.

8. Ornamenting the lid.

Step 1 Preparing the lid of box for an insert.

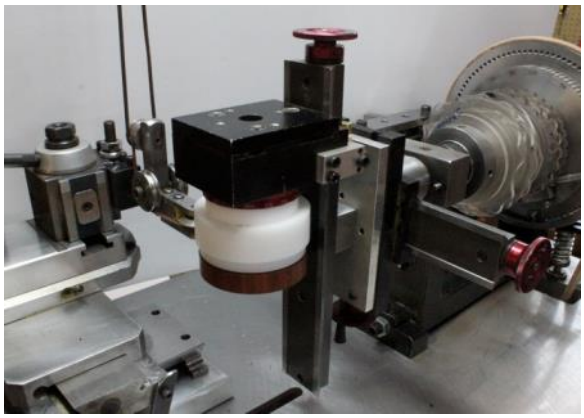
a. Install the threaded waste block in the holding chuck and screw on the lid.
b. Lock the headstock at top dead center, and check the lid blank both axially and radially. Refer to *LREAP* document Section—1 1.1 and Section—1 1.5 respectively.

c. Install the Drilling Frame on the sliderest. Install a ¼" 4 flute single ended end mill in an end mill holder, and screw the end mill holder into the Drilling Frame.
d. Remove the tenon, and move the end mill across the surface ensuring a smooth surface.
e. Measure the diameter of the fish insert and use the end mill to bore out a hole of the same diameter and depth to receive the insert. If an insert is not available this can be left to the end of the project.
f. At this time a rim around the bore can be cut.

Step 2 Setting up the RE for fluting.

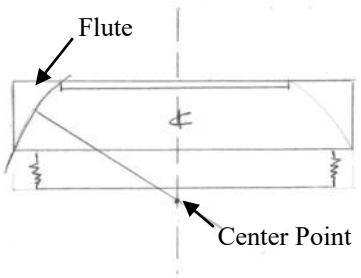
a. Ensure the headstock is locked at top dead center so it does not rock. Refer to *LREAP* document

Section—1 1.1.

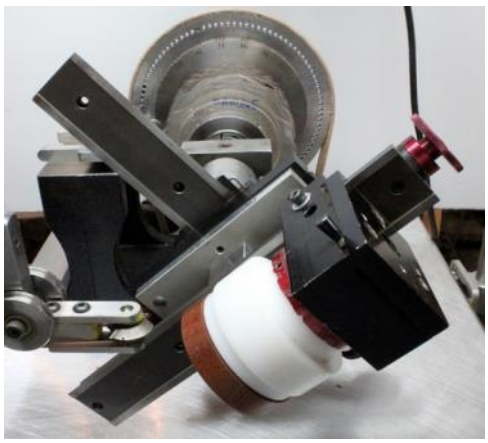


b. Install the Double Eccentric Dome Chuck on the RE. Adjust both slides so that they are lined up central with the spindle. Ensure the Double Eccentric Chuck is aligned correctly. Refer to *LREAP* document Section—3 3.2a.
c. Screw the ¾"-16 threaded waste block with the top onto the Phasing Chuck, and set the index wheel to 0°.
   Hint: Always tighten the index wheel when installing or removing work hold attachments such as the waste block from the Phasing Chuck. If not, the teeth on the aluminum index wheel inside the Phasing Chuck will be stripped.
d. Position the sliderest perpendicular to the top and install the Universal Cutting Frame with the triangle cutters. Adjust and align the cutting head to the center height of the spindle. The cutting frame must be truly horizontal, on center to the RE spindle, and centered to the Phasing Chuck spindle on the dome chuck.

Step 3 Installing and positioning the Segment Stop.
a. Place a level on the horizontal slide and rotate the slide until it is level. Lock the spindle.
b. Move the top up and down, using the red adjustment wheel, to determine the thickness of the rim. This adjustment will not be touched again.
c. Install the Segment Stop on the RE base and install the arm with the screw adjusters.
d. Install the top metal stop in the Index Wheel and adjust the upper adjustment bolt to touch the metal stop. Unlock the spindle and swing the lid to ensure the top stops at the horizontal position. Make fine adjustments to the upper adjustment bolt.
e. Install the lower metal stop and adjust the lower adjustment bolt so that the cutter stops before the rim of the insert.
f. Move the top backwards and forwards to ensure it stops at the correct place.



Step 4 Calculating the offset.
a. To calculate the offset draw a side view of the top with the hole for the fish insert. Determine the shape of the flute and use a compass to draw the shape. If the point of the compass is on the centerline there is no offset.
b. However, if the point of the compass is not on the centerline then the offset should be calculated. Refer to Attachment A for additional shapes that require the offset to be calculated.
c. Swing the top from the top to the bottom ensuring the cutting frame head follows the planned contour of the flute, and the Index Wheel stops are working correctly. Use the same red adjustment wheel and/or the sliderest to make any fine adjustment. Set the Hardinge sliderest dial to 0.



Step 5 Cutting the flutes.
a. This particular top will have 18 flutes set 20° apart. To start cutting the flutes first set the Phasing Chuck to 0°.
b. Turn on the Universal Cutting Frame and bring the cutter head in slowly until a flute is cut. Note the depth of cut

used.

c. Turn off and retract the cutting head.

d. Carefully move the index by 20° counter-clockwise and make another cut to the same depth.

e. If the sides between the first and second flutes are not sharp or have flats between them it will be necessary to deepen the cut and repeat steps b. thru d.

Hint: After a flute is cut a good technique is to increase the depth of cut by just a few thousandths of an inch to produce a polished surface.

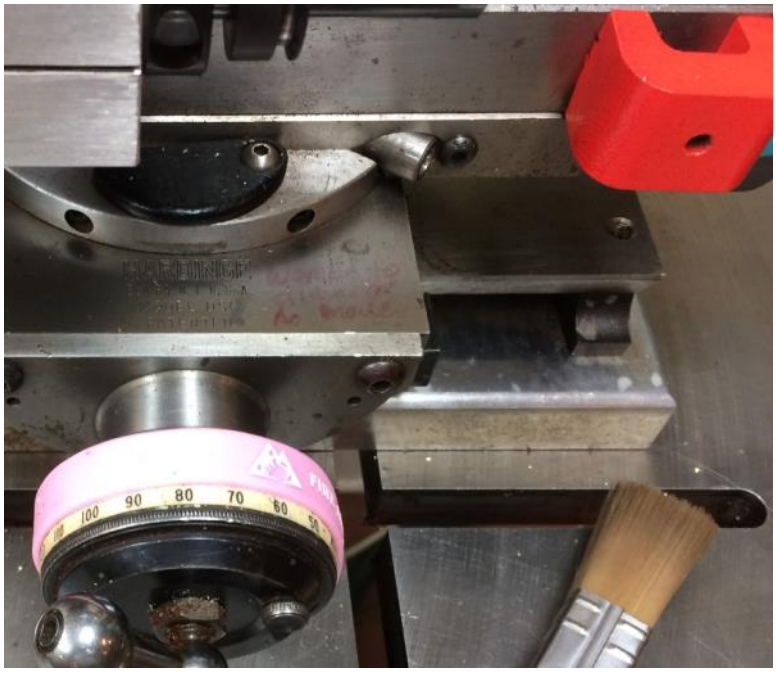
f. Once the depth has been established repeat b. thru d. until all 18 flutes have been cut.

g. This completes the outside of the lid.

9.

Completed Box

Quick Tip

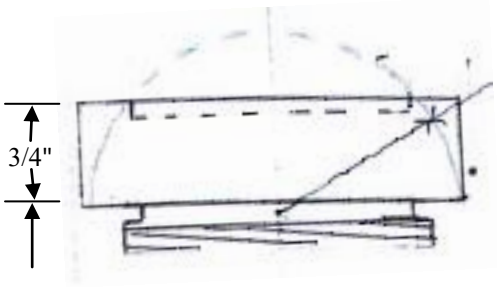


Jim Bodman does a lot of engine turning, and his hands got sore from the sharp edges of the slide rest top. Jim screwed a soft block to the end of his slide for comfort eliminating the problem.

Attachment A.

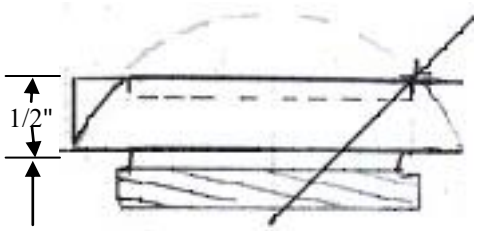
Note: For the correct offset from centerline of the spindle of the Double Eccentric Dome Chuck move the lid AWAY from the cutter by the amount of the offset. Move the other slide until the cutter lines up with the plane of the radius point.

ECH is the eccentric cutter head



Sliderest at 30°
ECH radius 0.590—0.600"

ECH radius must come from centerline



Sliderest at 45°
ECH radius of 0.625"

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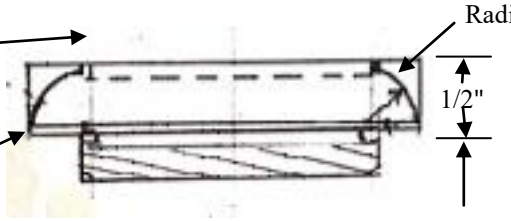
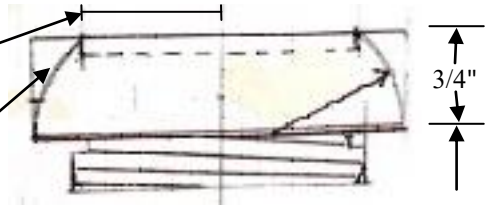
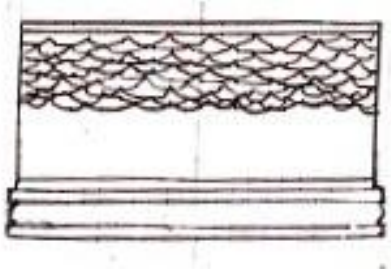






Ornamenting the Fish Design

Brian Clarry

The following document describes the steps in making 'The Fish' as described on page 99 of TD Walshaw's book, *Ornamental Turning*. These instructions for ornamenting the fish follow closely the measurements as detailed in the book. However, removing the surplus wood around the fish is done differently.

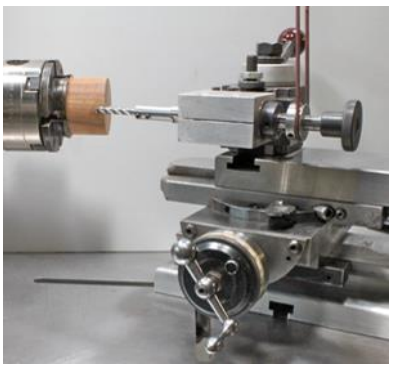
The rose engine used in this project is a Lindow Rose Engine (LRE) using the following equipment:

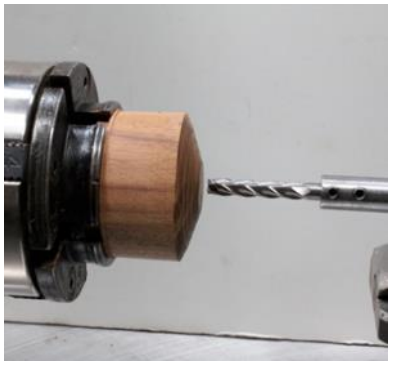
1. Leveling Chuck
2. Dial Indicator
3. Holding Chuck
4. Drilling Frame with the eccentric cutting head
5. Drilling Frame with end mill
6. Segment Stop and detent
7. Digital Calipers
8. 1/8″ half-angle 50° cutter for fish pattern. (not 45° as suggested in TD Walshaw's book)

Note: Cutting occurs on both sides, therefore the long side of the cutter as well as the half-angle part of the cutter must be sharp.

African Blackwood is used for the project.

This document also refers to the *Lindow Rose Engine Alignment Procedures (LREAP)* document available from David Lindow.





1. Preparing the base

a. Turn a piece of wood a minimum of 1 1/4" thick by 2 1/8" diameter. Cut a 1 7/8" by 3/16" tenon on one side for a holding chuck. Install the wood blank in a holding chuck.

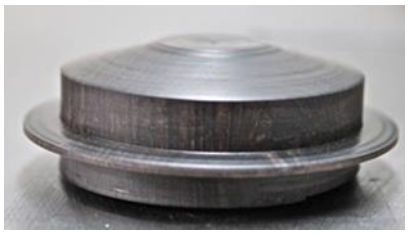
b. Install an end mill in the Drilling Frame and install the Drilling frame on the sliderest.

c. Position the base of the sliderest at 18° to the blank to cut the wood blank face at 18°.

d. Position the end mill along the edge of the wood blank and cut the face at 18°.

e. Install the base of the sliderest inline with the spindle, and align using a square. Cut a 3/4" flat area in the center.

Note: To use the suggested dimensions in the document it is important that the diameter is 2 1/8". This blank was cut using the method above.

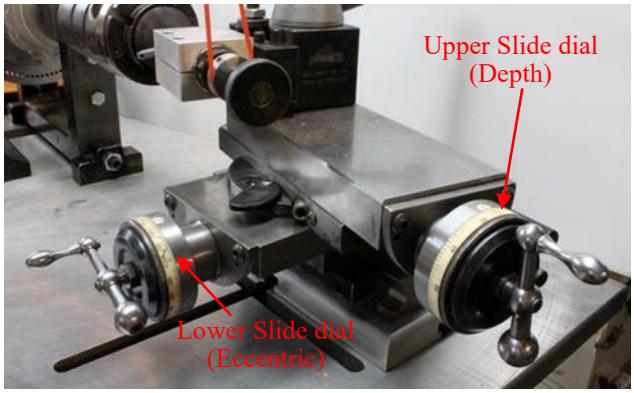


2. Preparing the Lindow Rose Engine

a. Install the base of the sliderest inline with the spindle and align using a square. The protractor on the Hardinge sliderest should read 0. If not, adjust to 0.

b. Important Step - With a spare blank in the holding chuck check that the Drilling Frame with the eccentric cutter head is at correct height to the spindle. Refer to *LREAP* document Section—2 2.3.

c. Install the fish blank in a scroll chuck. Lock the headstock at top dead center, and using the leveling chuck check the base both axially and radially. Refer to *LREAP* document Section—1 1.1 and Section—3 3.4 respectively.

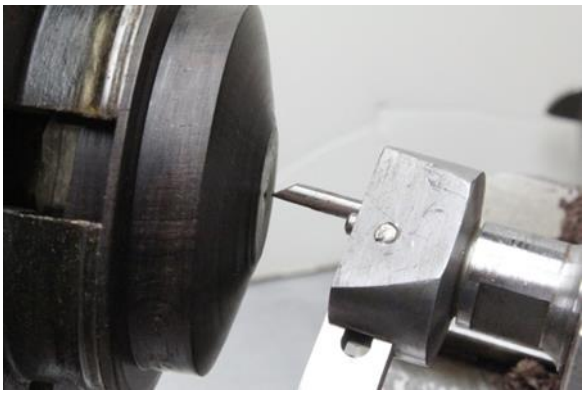


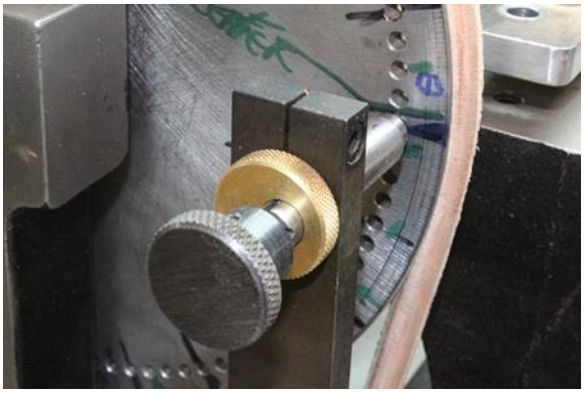
Note: If the wood blank is turned on a regular lathe using a Holding Chuck and then the Holding Chuck with the blank still attached is moved to the LRE with a MT Spindle, the Leveling Chuck is not used.

d. Set the sliderest to 11 ½°, or if the sliderest is a Hardinge, move the upper slide to 11 ½°. (not 12° as stated in TD Walshaw's book)

e. Install a 1/8" half-angle (left hand) 50° cutter in the eccentric cutter head so that the half-angle side (sloping side) of the cutter is to the outside of the cut radius. See position of the cutter head shown below.

Note: Remember, on the Hardinge sliderest, when moving the lower slide dial to change the eccentricity, the dial used is twice the amount stated. Hence each cut requires moving the eccentricity by 0.060" or 120 divisions on the dial.





f. Mark the Index Wheel so that it is divided into four quadrants. Mark a start at the first hole; this is hole 24. Also, mark at holes 48, 72, and 96.
g. Install the Segment Stop arm and detent. Ensure the detent pin fits smoothly in hole 24 i.e. the first quadrant.

3. Cutting the four fish patterns

NOTE: For each of the 8 cuts for the fish patterns the radius of the ECF and the eccentricity are reduced by 0.060". The depth of cut is reduced by 0.020".

It should also be noted that the depth of cut always starts at the same position each time. Therefore, this start position should be remembered before each of the 8 cuts is started. This is because of the 18° angle on the blank. On some of the cuts the blank will be cut before this start position is reached.

HINT: It is important to move the lower slide dial in to ensure the cutter can cut all 8 cuts.

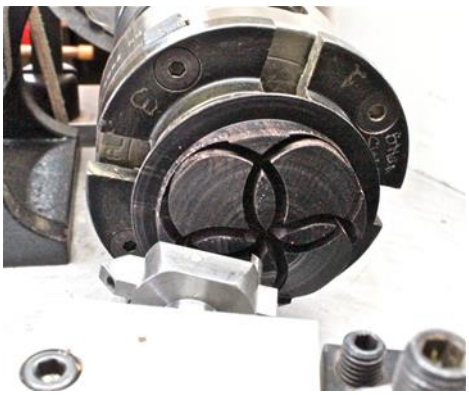
Setting up for Cut 1

a. Set ECF radius to 0.705" using a digital caliper. (0.580" + 0.125" because 0.125" is the diameter of the cutter)

   Hint: As each radius is changed on the dial caliper and eccentric cutter always recheck both to ensure the measurement did not change.
b. Move the cutter so that its point is touching the center of the blank. Set the upper slide dial to 0.
c. Using the lower slide handle move the cutter away from the center by 0.050". For the Hardinge this is 100 on the lower slide dial. Reset the lower slide dial to 0. Move the cutter in so that the point is just touching the blank. Set the upper slide dial to 0.

Cut 1

i. Set the Index Wheel to 24.
ii. Switch on the eccentric cutter head. Move the cutter in so that the point is just touching the blank and reset the upper slide dial to 0.
iii. For the first quadrant move the depth of the cutter in by 0.200". Two turns of the upper slide handle. Note: This is a deep cut.
iv. After the first quadrant is cut move the cutter out 3 complete turns.
v. Cut the remaining three quadrants using the Index Wheel (holes 48, 72 and 96) moving the cutter in 3 turns, and then back to 0.
vi. After the final quadrant has been cut move the ECF out three complete turns.
vii. Turn off the cutter.



Note: For all following cuts moving the cutter out three complete turns will:

1. move the cutter away from the blank and
2. set up the cutter for the next cut.

Cut 2

i. Set the Index Wheel to 24.
ii. Reduce eccentric cutter head radius to 0.645" i.e. 0.520" + 0.125".
iii. Move lower slide in by .060" (Hardinge: Move dial in by 120 divisions. Dial will now read 120).
iv. For the first quadrant move the cutter in by 0.280". Turn the upper slide handle 2 turns until 80 appears on the dial.
v. Repeat as Cut 1 iv. thru vi.

Cut 3

i. Set the Index Wheel to 24.
ii. Reduce eccentric cutter head radius to 0.585" i.e. 0.460" + 0.125".
iii. Move the lower slide in by 0.060" (Hardinge: Move dial in by 120 divisions. Dial will now read 40).
iv. For the first quadrant move the cutter in by 0.260". Turn the upper slide handle 2 turns until 60 appears on the dial.
v. Repeat as Cut 1 iv. thru vi.

Cut 4

i. Set the Index Wheel to 24.
ii. Reduce eccentric cutter head radius to 0.525" i.e. 0.400" + 0.125"
iii. Move lower slide in by 0.060". (Hardinge: Move dial in by 120 divisions. Dial will now read 160).
iv. For the first quadrant move the cutter in by 0.240". Turn the upper slide handle 2 turns until 40 appears on the dial.
v. Repeat as Cut 1 iv. thru vi.

Cut 5

i. Set the Index Wheel to 24.
ii. Reduce eccentric cutter head radius to 0.465" i.e. 0.340" + 0.125".
iii. Move lower slide in by 0.060". (Hardinge: Move dial in by 120 divisions. Dial will now read 80).
iv. For the first quadrant move the cutter in by 0.220". Turn the upper slide handle 2 turns until 20 appears on the dial.
v. Repeat as Cut 1 iv. thru vi.

Cut 6

i. Set the Index Wheel to 24.
ii. Reduce eccentric cutter head radius to 0.405" i.e. 0.280" + 0.125".
iii. Move lower slide in by 0.060”. (Hardinge: Move dial in by 120 divisions. Dial will now read 0).
iv. For the first quadrant move the cutter in by 0.200". Turn the upper slide handle 2 turns until 0 appears on the dial.
v. Repeat as Cut 1 iv. thru vi.

Cut 7

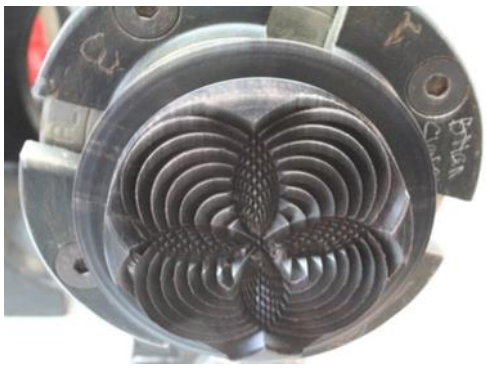
i. Set the Index Wheel to 24.
ii. Reduce eccentric cutter head radius to 0.345" i.e. 0.220" + 0.125".
iii. Move lower slide in by 0.060". (Hardinge: Move dial in by 120 divisions. Dial will now read 120).
iv. For the first quadrant move the cutter in by 0.210". Turn the upper slide handle 1 turn until 80 appears on the dial.
v. Repeat as Cut 1 iv. thru vi.

Cut 8

i. Set the Index Wheel to 24.
ii. Reduce eccentric cutter head radius to 0.285" i.e. 0.160" + 0.125".
iii. Move lower slide in by 0.060". (Hardinge: Move dial in by 120 divisions. Dial will now read 40).
iv. For the first quadrant move the cutter in by 0.160". Turn the upper slide handle 1 turn until 60 appears on the dial.
v. Repeat as Cut 1 iv. thru vi.

Note: If 'fins' appear on the head of the fish it is necessary to have a Cut 9 using the same sequence of dimensions as the other cuts.

This completes the first part of the project. Your Fish should look like this photo at this stage.



4. Cutting a space between the fish

Note: The following instructions and measurements are a guide and some experimentation may be required. After each time the Index Wheel is moved, always check the eccentric cutter radius and depth of cut to ensure the correct part of the fish is cut.

a. First level. (Closest to the center)
   i. Move the Index Wheel to 24 and lock with the index pin.
   ii. Set the calipers to 0.500" i.e. 0.275" + .125". Then set the eccentric cutter head with the calipers.
   iii. To calculate the depth for the first level:
   —first, move the position of the cutter rotating it to insure it does not touch the fish scales or the two 'horns' in between the fish.
   —second, using the upper slide dial, move the cutter in until it touches the wood blank. Set the upper slide dial to 0 and move the cutter out 2 turns.
   —third, move the outside of the cutter i.e. the half-angle side (sloping side) to the edge of the blank and move the cutter in 2 turns.
   Note: In this section, and sections 5 and 6, moving the outside of the cutter to the outside edge of the blank is the starting reference point of all cuts. Do not alter this reference point.
   —finally, start the cutter. Then move the cutter towards the center by approximately 5 ½ turns. Make multiple passes over the area increasing the depth of cut with each pass until the depth of cut is

1.200”and the surface is smooth. Get as close to the fish scales as possible, but not touching. If the surface is not smooth increase the depth slightly.

iv. Move the cutter back to the edge of the blank the same number of turns, and turn off the cutter.

v. Repeat cutting the other three quadrants (holes 48, 72, and 96) moving the cutter towards the center the same number of turns used above.

Your Fish should look like this photo at the completion of this step.

b. Second level.

i. Move the Index Wheel to 24 and lock with the index pin.

ii. Use the same radius for the eccentric cutter head as 4.a. ii. above.

iii. Using the upper slide move the cutter in until it touches the top of the previous cut. Set the upper slide dial to 0 and move the cutter out 2 turns.

iv. Move the outside of the cutter i.e. the half-angle side (sloping side) to the edge of the blank and set the lower slide dial to 0. Move the cutter in 2 turns.

v. Start the cutter. Use the lower slide to move the cutter towards the center by approximately 3 ½ turns. Make multiple passes over the area increasing the depth of cut with each pass until the depth of cut is .060” and the surface is smooth.

vi. Move the cutter out to the side by the same numbers of turns, and turn off the cutter.

vii. Repeat cutting the other three quadrants (holes 48, 72, and 96) moving the cutter towards the center the same number of turns used above.

The Fish will now look like this photo.

5. Cutting the center from the four fish tails.

a. First fish.

i. Use the same radius for the eccentric cutter head as 4.a. ii. above, and do not change the depth of cut dial. Set the upper slide dial to 0.

ii. Move the cutter to the edge of the blank and set the lower slide dial to 0.

iii. Move the Index Wheel to a 24. Move the Index Wheel forward 12 slots to position 36 and lock with the index pin.

iv. Start the cutter and move the cutter in by 2 ½ to 3 turns to cut the center of the tails. Be careful not to cut away too much of the fish tails.

v. Turn off the cutter and move the cutter back to the start by the same number of turns.

b. Second fish.

i. Move the Index Wheel forward by 24 holes to position 60.

ii. Repeat cutting the center of the second fish tail using the same number of turns and depth of cut.

c. Third fish.
   i. Move the Index Wheel forward by 24 holes to position 84.
   ii. Repeat cutting the center of the third fish tail using the same number of turns and depth of cut.
d. Fourth fish.
   i. Move the Index Wheel forward by 24 holes to position 12.
   ii. Repeat cutting the center of the fourth fish tail using the same number of turns and depth of cut.

6. Cutting both sides of each fish tail.

a. First fish.
   i. Use the same radius for the eccentric cutter head as 4.a. ii. above, and do not move the upper slide dial. Set the upper slide dial to 0.
   ii. Move the outside of the cutter to the edge of the blank, and set the lower slide dial to 0.
   iii. Move the Index Wheel to 24. Move the Index Wheel a further 6 slots to position 30. Lock with the index pin.
   iv. Start the cutter and move the cutter in by 2 turns (0.200") to cut the first side of the fish. Be careful not to cut too much of the fish tail away.
   v. Turn off the cutter and move the cutter out the same number of turns.
   vi. Move the Index Wheel by 12 holes and repeat to cut the second side of the fish tail.
b. Second fish.
   i. Move the Index Wheel by 12 holes to position 42, and repeat the cut for the first side of the fish tail.
   ii. Move the Index Wheel by 12 holes to position 54, and repeat the cut for the second side of the fish tail.
c. Third fish.
   i. Move the Index Wheel by 12 holes to position 66, and repeat the cut for the first side of the fish tail.
   ii. Move the Index Wheel by 12 holes to position 78, and repeat the cut for the second side of the fish tail.
d. Fourth fish.
   i. Move the Index Wheel by 12 holes to position 90, and repeat the cut for the first side of the fish tail.
   ii. Move the Index Wheel by 12 holes to position 6, and repeat the cut for the second side of the fish tail.

7. Reducing the blank to 2" diameter.

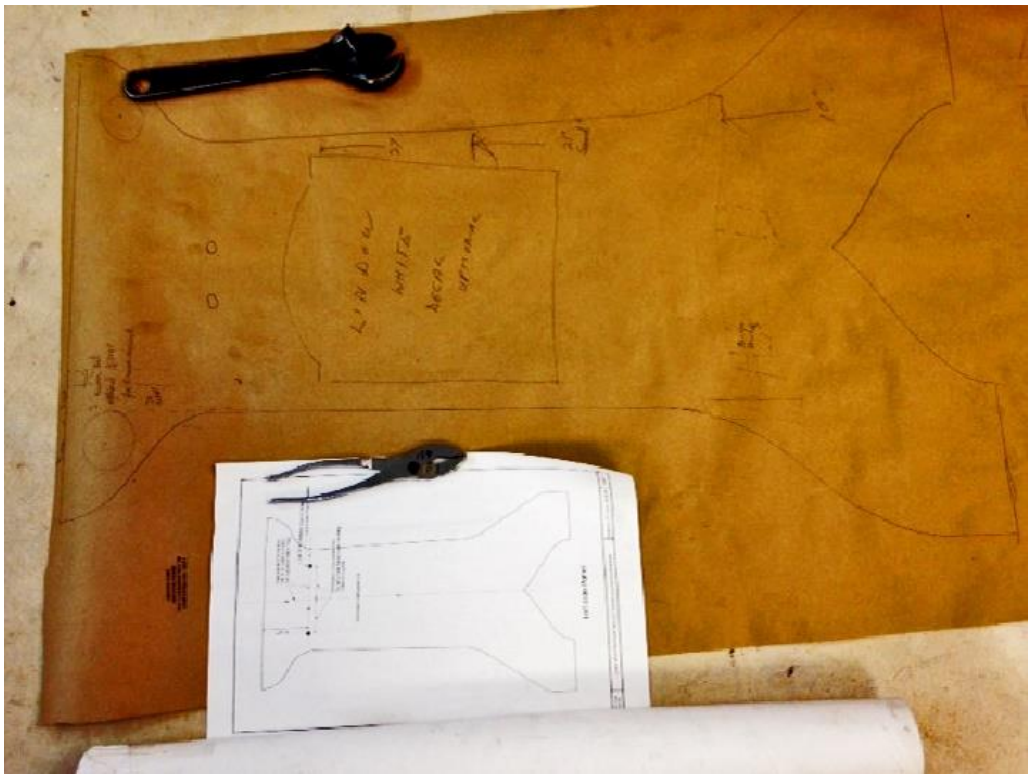
a. Position the base of the sliderest inline with the spindle, and align using a square. Use an end mill to reduce the diameter from 2 1/8" to 2" cutting The Fish from the blank.

8. The completed Fish

Lindow White Rose Engine History

Steve White

This is a photo of the original full size paper drawings of the stand we recommended owners make when they bought a machine. This was a 10 hour job that was a pain. New owners gave Dave and I feedback that they would pay more if a stand came with the machine and this resulted in the current sheet metal stand. The new sheet metal stand's added rigidity and the extra weight was a bonus. The original plans as shown in the photo were mailed to a new owner, and we asked that the plans be sent back to me in two weeks. They were then sent out to the next guy.



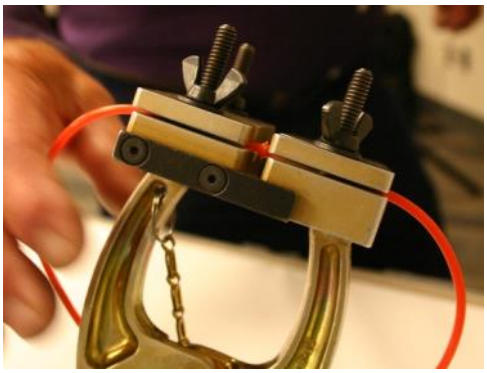
New Book on Ornamental Patterns

A new book, *Sacred Geometry – a 16th Century Coloring Book,* has been published by Brittany Cox and Al Collins. This coloring book is a collection of 72 unique patterns that were originally produced using the MADE lathe. The book is printed on 180 lb. uncoated white paper so your coloring will not fade or bleed. The book is spiral bound with copper so that it lays flat. As a companion there is also a book of receipts showing the steps to produce the patterns on the MADE or other rose engines. More information including pricing and ordering is available at https://mechanicalcurios.com/2016/09/27/ive-published-a-book/.

Welding Round Belting

John Tarpley

In the early years of the LRE we used two sizes of round belts. A larger belt diameter was used for the spindle drive and 1/8" belting was used to drive the cutting frames from the overhead and for the cutting frames themselves. Now that the drive belt has been replaced with a much more reliable V-belt we only need to make the smaller belts. To make a reliable weld the ends of the belting need to be cut at 90°, held in alignment, heated to the belt welding temperature, and held together until the weld cools. Following welding the resulting sprue or bead, also known as flash, is trimmed from the weld. While it is in theory possible to weld the belt freehand, in practice this is a difficult procedure. It is hard to heat both ends of the belt, keep them at the proper temperature for welding, properly align the ends, and supply pressure for welding all at the same time only by hand. Both alignment and welding temperature are critical. If there is a significant offset of the ends at the weld the belt will not operate properly which will weaken the belt resulting in its premature failure. If the belt is not heated to the welding temperature, the weld will not take and the belt will break at the weld.



There are commercially available welding jigs which do an excellent job, but at a cost of from $150-300. Shown here is the Eagle UT-236 belt welding kit which David demonstrated at the 2014 OTI meeting. The ends of the belting are held by the two wing nut clamps attached to the clamping pliers. The supplied electrically heated hot knife is then placed between the ends and they are gently squeezed against each side of the knife heating both ends. When the ends melt, the knife is removed and the ends are quickly clamped together, and the weld is allowed to cool. The jig accomidates a variety of belt diameters. This commercial jig works well and is certainly a good choice if you make enough belts to justify the price.

I wanted to find an economical way to make belts so I decided to make my own jig. I remembered a welding jig article by the late Fred Holder from *More Woodturning*. Fred was the originator of *More Woodturning*. He was a man of many interests. In the early days of the publication he did most of the writing, the editing, and he even printed *More Woodturning* in newspaper format on his home printing press. As a woodturner he's probably best remembered for his Chinese Balls and hand thread chasing. He built a MDF rose engine which both he and his wife used. The new publisher of *More Woodturning*, Dennis Daudelin, has graciously allowed me to reprint the article for our readers. You can learn about *More Woodturning*, view the current issue, and subscribe at http://www.morewoodturningmagazine.com/.

A Welding Jig for Rose Engine Belting

by Fred Holder

Feb. *2009 Moore Woodturning*

When we built our Rose Engine lathe, I had never used the belting material that is being used in the kits and that was used on the cutting frame that we purchased to use on the Rose Engine.

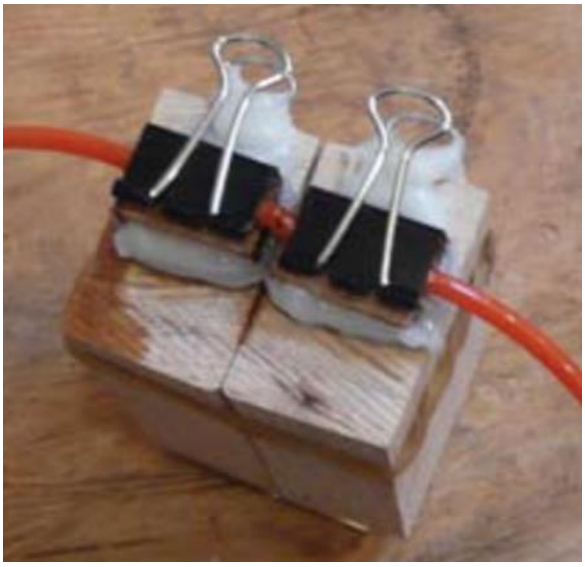
The instructions that came with the kit said to mount a knife vertical and heat it red hot then hold the two ends to be joined against the knife blade, when their surfaces begin to melt, slide them off and hold together for a few minutes and then let it cool for awhile.

Well, I had nothing but trouble with the process, put into use and my belts would break. I tried about everything I could think of, but nothing seemed to help.

Finally, I decided to design and build a fixture to hold the belting while being welded and then I used a

soldering iron, instant heat variety, to warm and soften the belting before sticking it together where it is held in place in the fixture until the belting cools enough (generally overnight) to stand the high speed stresses of operation.

This top view of the fixture shows the two clamps that have been attached to two 1" x 2" boards, which have been joined at the other end with a hinge. A couple of rubber bands provide the tension to press the two ends of the belting together while they cool.



This photo shows the fixture with 1/8" belting secured by the clamps. As the side being held apart is released the two hot ends of the belting are pressed together until they cool.

I tried using a hot knife, but found that the tip of a instant heat soldering gun works extremely well.

I generally place the fixture in a vise to hold it while heating the belting and getting it set up to cool properly. The view that follows is the way in which I do the actually welding of the two ends of the belt together.

This photo shows the belting fixture clamped in a vise while the belting is being welded.

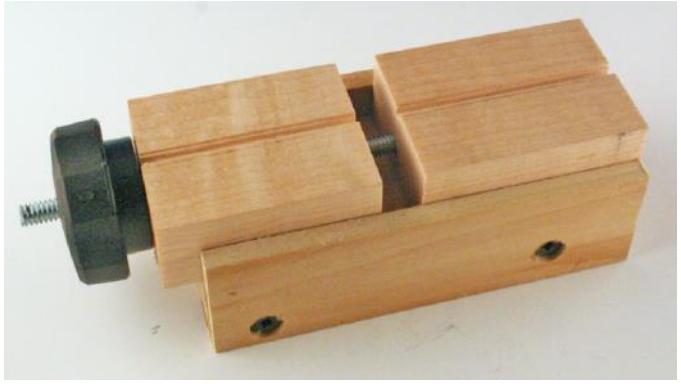
I should also mention that I put pieces of wood inside the clamps with a 1/8" hole drilled through both clamps while they were held together. This helps to hold the belting in proper alignment.

I've also used this fixture to hold 1/4" belting for welding. Larger than 1/4", the wood would have to be removed from the clamps or another fixture made to handle the larger belting.

After reviewing Fred's article I thought that while Fred's jig seemed to work well for him, perhaps I could design my own jig that might overcome some of the issues Fred had found in his fixture and might be simpler to use especially since I only need to make belts of one diameter. First, I decided to check the Internet to see what additional information might be available about belt welding. There are several videos available on YouTube. They range from demonstrations of commercially available jigs, to homemade jigs, to demonstrating welding by hand. One of the most appealing to me is a video by Mike Holmes. He uses two metal V-blocks intended for use with a drill press or mill, a straight edge, base plate, and a blade heated with a portable torch. This seemed like a simple yet accurate jig, however, I don't have two metal V-blocks so with inspiration from Mike I decided to make a wooden jig variation which would essentially be a wooden vice for belt welding that would work with 1/8" belt material.

I don't expect to use this jig very often and this influenced several of my design parameters which are listed below:

- quick to build
- not complicated to build
- simple to use
- inexpensive to make from materials already available in my shop
- easy to store.



This is the jig I developed. It consists of a wooden base plate to which is attached a grooved fixed jaw and a grooved movable jaw which can be tightened by a knob and a piece of all thread rod secured with a T-nut. The movable jaw slides on the base and is held in alignment by two side runners.

I had a piece of 4 quarter (1" thick) hard maple left from a previous project so I used it for the body of the jig. My jig is 5" x 2" which fit the available material, but the dimensions are certainly not critical. After surfacing the maple on all sides I cut it into two 5" long pieces. Since I have a mini mill in my shop I fitted it with a miniature end mill and milled a slot in the center of one piece that makes a good press fit for the belting to be welded.

I then secured the block in my drill press vice and drilled a 1/4" hole through the length of the block for the length of 1/4" all thread. I centered the hole on the slot and on the approximate center of the block's thickness. I started the hole with a center drill and then used a brad point drill to drill as deeply as the drill allowed. I then switched to a long twist drill to complete the hole. The T-nut requires drilling a 5/16" hole for the body of the nut to be driven into the wood so I enlarged the hole with a 5/16" bit on that end of the block deep enough to allow the T-nut to fully seat into the wood.

I then sawed the piece in half giving me two 2.5" blocks. I surfaced the cut edge of these blocks taking care to keep them square to the long edges of the block so the slots are still aligned. Since there is very little pressure exerted on our small belting during welding, the fit in the slot alone has proved enough to hold the belt material in place. You could certainly add a hold down clamp to the top, but since I wanted to make this jig as

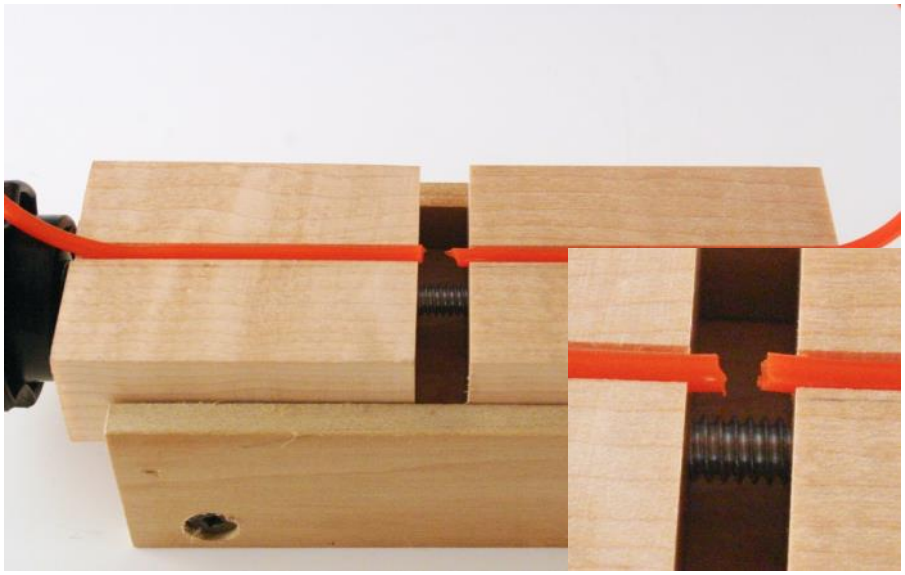
simple as possible to build and use I did not feel this was necessary and clamps can always be added later if they prove to be needed if the slot wears with use.

I then drove in the T-nut and used double sided tape to help me align the block with the ends and sides of the other 5" block which serves as a base plate for the jig. I drilled and countersunk holes for a couple of wood screws in the underside of the base to secure what now becomes the fixed jaw to the base. Depending upon the type of knob you choose to use you may want to make the length of the base block a 32nd to a 64th" shorter than the combined length of the two jaws after they have been cut and surfaced. This is to prevent the knob tightening onto the base rather than the movable jaw which might make it difficult to get the proper pressure for a good weld.

I had some poplar that I had previously resawn and surfaced to 1/4" thickness. I cut two pieces to 1 1/2" x 5". Again using double stick tape I aligned each piece with the ends and bottom edge of the base to serve as the rails of the jig. I then secured them with counter sunk wood screws. The side rails allow the movable jaw to move freely along the base while keeping the slot aligned on both pieces.

I passed the threaded rod through both blocks and screwed it into the T-nut securing it with a couple of drops of Loctite. All that remained was to screw the knob onto the other end of the rod and cut the rod to length. I've left the rod a bit long for now until I've used the jig for awhile to allow plenty of adjustment for the jaws, but I may decide to cut it shorter. You could turn a wooden knob and epoxy in a 1/4" nut which would work well, but I decided this would take more time and violate my first design point.

In addition to the jig and of course belt material, a few additional tools are needed. You need some type of knife to trim the ends of the belting before welding. Here I am showing a craft knife, but any sharp implement such as a single edge razor blade will work. You also need some means of heating and melting the belt. I have a craft type pyrography pen that I purchased many years ago before I learned that pyrography requires much better heat control than a cheap pen like this allows. It comes with a flat blade accessory that screws onto the tip and does a very good job of heating both ends of the belting at the same time. Once the belt is welded the melted plastic will expand outward and form a mushroom shaped doughnut, the flash, around the weld. This needs to be removed before the belt is used. I use a pair of clippers sold as wire cutters for jewelry makers. The clippers have sharp, fine, angled blades with good points theat work well for removing the flash without cutting into the belt.

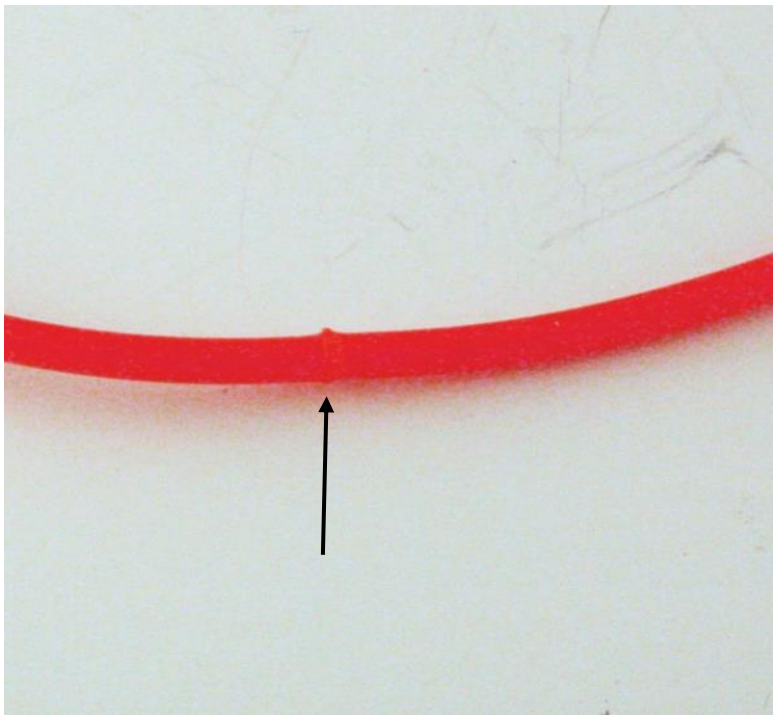


All that remained was to take the jig for a test run. I took a scrap of belt material and pressed it into the jig slot. You'll notice in the close-up insert that I allowed some belting to extend beyond the edge of the jig jaws. This allows me to use the craft knife or razor blade to make a clean, square cut on the ends that will be welded. After making the cut the belt is repositioned in the jaws so that a small amount of the belt extends beyond each jaw. This allows melting the belting without interference from the jaws.

After trimming and repositioning the belt is ready to weld. I don't have a photo of the actual welding process because it requires more hands than I have to do the welding and also operate the camera. I plugged in the hot knife and allowed it to heat for a few minutes. I placed the heated knife into the opening between the jaws and then turned the knob to bring the two ends of the belt into contact with the flat edges of the knife. After a few seconds the belting will soften. At this point I removed the knife and quickly tightened the jaws further to bring the melted ends into contact. It is not necessary and it is undesirable to exert a great deal of pressure on the belting. Excess pressure does not improve the weld and can cause the belt ends to slip out of alignment as they are welding resulting in an offset weld which can lead to premature failure of the weld. The welded belt is then left clamped in the jig for a few minutes to allow the weld to cool.

This photo showed the welded belt in the jig. You can clearly see the flash around the weld which needs to be trimmed before the belt is used.

Note: Just as this issue is going to press, I became aware of an article by Ted Hansen in *Machinist's Workshop* **30**: 2, p. 12-13. This article describes a different type of wooden welding jig which appears to be designed for larger diameter belting.



This final photo shows the finished belt. The weld is shown by the arrow. You will note that there is still a small amount of flash that still needs to be removed opposite the arrow.

I find this jig accomplishes my design objectives and works well for a jig that will only be used occasionally for welding only 1/8" diameter belts. Although commercial jigs are probably more accurate and allow welding of a variety of belt diameters, for me their advantages are certainly outweighed by their costs.

Editor's Chips

—John Tarpley

Please allow me to used my space this month to be a bit philosophical. I've been thinking about why people get interested in ornamental turning. We know that some people get into OT to become makers; some collectors; some because they enjoy the machinery, especially antique pieces that they can restore; some just love mechanical mechanisms; and others because they have learned about OT through another pursuit and think that adding OT skills will make them better in their other work. While all these answers are certainly valid I think perhaps the underlying reason is that most of us enjoy learning something that everyone else does not know and we want to preserve knowledge and skills that would otherwise be lost. When I think of ornamental turners I also think of a term that, I think, Jon Magill may have coined as a description for himself—Polyhobbyist. I can think of very few ornamental turners who do not have other hobbies or interests. These interests range from metal working, jewelry making, horology, knotting and thread work, amateur radio, other types of woodworking, motors and mechanics, sports, natural sciences, and many more. And of course we all seem to be collectors of one type or another. The common thread for all these diverse interests seems, to me, to be learning something new that not everyone knows. So maybe we need to coin another new term—Polylearners.

Thank You

I just want to take a personal moment to thank everyone who called, emailed, or otherwise contacted Jean and me during and after the Gatlinburg wildfires. Fortunately we are located in an area that was between two of the larger fires and our property was untouched. The closest fire was about 4 miles from our house. Our rental cabin was located much closer to the fire in that area, but it was also untouched. There were about 1,700 structures damaged or destroyed in Gatlinburg which is a community of only 3,500 people. Everyone is now focused on rebuilding and making our community even better than it was before the fires. The downtown area, the area most tourists know, was relatively untouched. Most of the damage occurred in the area surrounding downtown where people live or in areas that contained rental cabins. Before the fires the most frequent questions from tourists were, "Where are the best waterfalls? or even What time of day do you turn on the waterfalls? What are the best views? Where can I see a bear? and What are the best attractions?" Now in addition to those questions we are asked where to go to see the most burn damage. Now that the area is beginning to regrow and burned lots have been cleared and are beginning to be rebuilt, we now get tourists who are disappointed that everything looks the same as they remembered from previous visits. The fires were driven by 87 mph winds that night so they moved very rapidly. At least that is best wind speed number we have because at that point the wind indicator was consumed in one of the fires so we do not know if the speed got even higher. Unfortunately that meant that many people had very little time to escape and lost most or all of their possessions. The upside to such a fast moving fire is that while some trees in the national park were brought down by the wind and many have burn damage, most are still standing. Hopefully this means a shorter recovery time for the forest so that everyone can soon enjoy it again. While 17,000 acres burned this is only a small portion of the total park so there are still many untouched areas for everyone to enjoy while we await the recovery of the burn areas. We hope you will continue to consider Gatlinburg and the Great Smoky Mountain National Park as a place you should visit. Arrowmont School is mostly intact. Two dorms and a maintenance shed were lost, but all studios and the permanent collections are intact. The school plans to maintain their planned class schedule.

We have several friends who lost either their house, business, or both to the fires. Some friends lost turned pieces I made that they had either purchased or been given so I will be replacing these pieces. Additionally, I will be making some "remembrance pieces" from pieces of trees that came down on friends' property due to the fires.

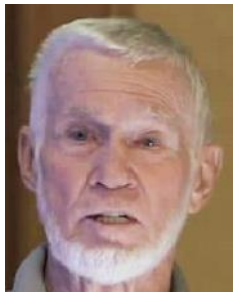
Videos from 2016 OTI Symposium

Couldn't attend the Denver OTI Symposium or you attended but find your notes are not quite as good as you thought on that very important point of one of the presentations? Well, you are in luck because OTI had the symposium recorded in high definition for reproduction. While you don't get the comradery of the meeting, the displays, and the fun of the auction; you can still hear the information from all the sessions. OTI plans to post the videos on an Internet site where you can view or download them. Because the meeting was recorded in high definition to give the best possible quality, the file sizes are very large so be aware of the storage requirements and your connection speed before you decide to download rather than view the videos. I have had the opportunity to preview the videos and both the audio and video are of very good quality. I had hoped to be able to tell you how to access these videos in this issue, but as of the time of publication OTI has not made this information available. At this point I understand that the cost of video access was included in the registration fee for those OTI members who attended the symposium. I am also told that other OTI members will be able to view the videos for a onetime fee. That will be a great value and will help OTI recover a part of what I am sure was a significant cost for the meeting. If this project is successful perhaps it will be repeated for future symposia. Not everyone is able to travel to the opposite side of the US for a meeting so this adds value to your OTI membership. So if you are not an OTI member this is another good reason to join. Hopefully the OTI leadership will make this information available to the membership soon. I certainly look forward to viewing the videos in their entirety. You can get membership information at http://ornamentalturners.com/.

The videos will include the following presentations.

David Lindlow, Cross slide Care and Adjustments

David discusses all those questions you have probably asked about caring for and adjusting your Cross slide, using a Hardinge as the example.



Jeff Edwards, Photographing Ornamental Turnings

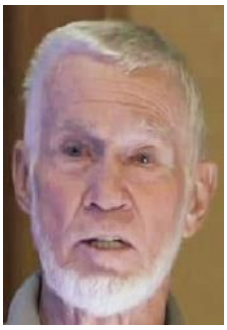
Jeff was unable to attend the symposium. Charles Wagonner, pictured here, gave his presentation. Jeff has a great deal of experience with photography and software so the presentation includes several aspects of successful digital photography of ornamental

Jon Magill, Organic Curves. Convex and Concave Curves Made Easy

John has an interest in producing ornamentally turned, organic shapes. He discusses how these shapes have been made and his explorations to create these shapes.

Jean Claude Charpignon, A Picture and its Processes

Master French turner, Jean Claude discusses how his work has developed, his interests, and design principles showing slides of many of his pieces.

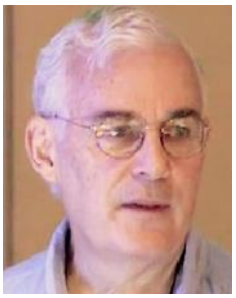


Charles Wagonner, Stabilizing Wood with Resin using Vacuum

Charles was one of the first people to explore the possibility of using stabilized wood for ornamental turning, thus expanding the number of available woods for our use. He discusses the process and equipment needed for stabilization.

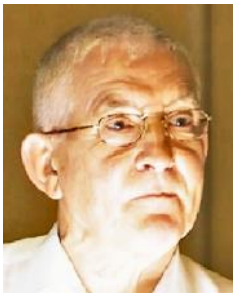
David Wood Heath, Brocade Engine Turning

Brocade Engine Turning is a form of semi-automatic Engine Turning popular in the early to mid 1900s for the production of decorative items. David collects and uses these machines. His presentation includes videos of the operation of several of his machines.



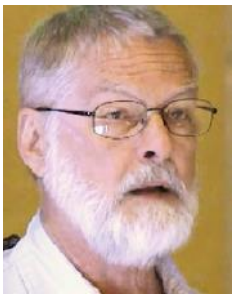
Fred Armbruster, Very Large Radius Flute Cutter as Adapted to Spiral Spherical Boxes

Fred discusses his methods and tooling to make spherical boxes with slow, convex spirals.



David Wood Heath, Engine Turning

David discusses the types of equipment and techniques used for engine turning. He also includes videos of equipment in use.



Bill Ooms, Planning Your Work

Bill discusses free design software that he has written. It can be used for design with a non computerized lathe and also produces G code output for computerized lathes.

Jean Claude Charpignon, My Machines

Jean Claude discusses his lathes and tooling which he has either adapted from other equipment designed for other uses or built himself.

Also included is a video of the Pecha Kucha. For those who may not be familiar with the term Pecha Kucha, it is a series of short presentations. This year's session had the following speakers and topics:

Roy Lindley
Wood Threads—Small Alternative Form

Al Collins
Press Made, Rose Engine Decorated Metal Boxes

Peter Gerstel
Building a Finial Lathe using a Lindow Curvilinear Apparatus

Phil Poirier
Daily Work and New Developments in the Shop

Josh Salesin
How I Make Cool Stuff

Bill Ooms
Making Your Own Modern Ornamental Lathe

Jon Spencer
Complete Rebuild of a Hardinge Cross slide

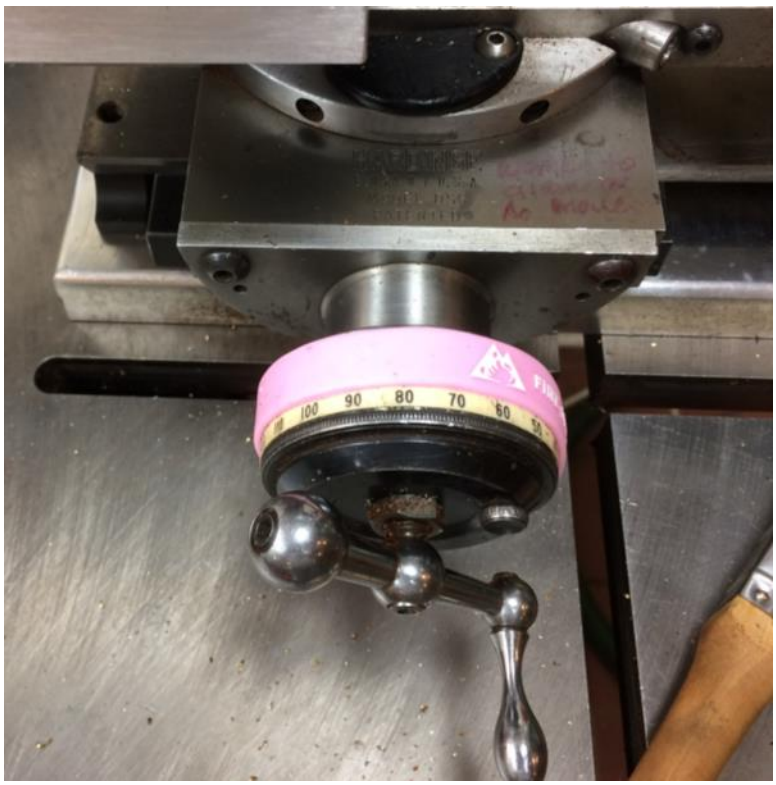
Brad Davis
Holtzapffel Reciprocating Project

David Lindow
Engine Turning on Pottery

Brittany Cox,
Holographic Turning

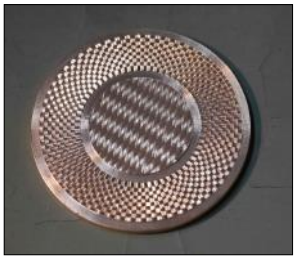
Dan Henry
Hardinge Depth Stop and Alignment Tool

Quick Tip



Jim Bodman found that a typical rubber bracelet is the perfect size and consistency for securing your Hardinge dial. Jim used this because vibrations would often cause the dial to move back a bit, loosening his dial reference. The slide doesn't move, but the dial can move under vibration taking up the backlash. When not in use the bracelet can be pushed back onto the collar.

Engine Turning Workshops at Memoria Technica



Three levels of Engine Turning Workshops are offered at Memoria Technica in Seattle, Washington. All class levels include five 1 3/8" brass practice discs. All other materials are pay as you go. If you have any special material requests let Brittany know beforehand so she can accommodate your interests.

These two day classes are from 9am—5pm each day with a lunch break. The small class size offers one on one teacher to student feedback and optimal machine time. Learn this fascinating craft on two early 20th century machines from the original Bulova watchmaking factory—a Lienhard rose engine and straightline machine. You'll also have access to the workshop library with many books on the practice of ornamental and engine turning.

You can obtain information on future classes and learn more about Memoria Technica at https://mechanicalcurios.com/.

Additional images from previous classes can be seen at https://mechanicalcurios.com/engine-turning-at-memoria-technica/. All photos for this article are by Brittany Cox and can be also seen on her web site.

Engine Turning I Workshops are taught by Brittany Cox. The fee is $400 and each class is limited to 4 Students.

These classes are designed to provide students with a basic understanding of engine turning, set up, and simple pattern development. Whether students are interested in making watch dials, jewelry, or are just curious about guilloché work in general, this class offers a good foundation. Most students leave with at least one finished project, such as a pendant or a writing pen and a set of guilloché medallions of different patterns.

Engine Turning II Workshops are taught by Brittany Cox and David Lindow. The fee is $600 and each class is limited to 6 Students.

These classes are designed for those with a rudimentary knowledge of engine turning or guilloché work. They will include lessons on surface preparation, integration of divergent patterns, how to work with borders, laying out work for more than one center, and other advanced concepts. Whether you are interested in making watch dials, custom jewelry, or decorative arts this class will further your understanding and skills. The projects will vary depending on the students interest, and the course will take a hands on approach. These classes include the use of an elliptical chuck and other attachments. Each student will leave with at least one completed project.

Engine Turning III Workshops are taught by Brittany Cox and David Lindow. The fee is $600 and each class is limited to 6 Students.

This class expands upon Engine Turning II. Students have the opportunity to use a Hauser Jig borer, Schaublin lathes, and a microscope to layout and execute patterns and projects. There are also new additional pattern bar designs for the straightline machine.

Wood Threads: An Alternate Form Suitable for a Small Box

Roy A. Lindley

Ed. Note: Roy is very knowledgeable on the subject of threads and fasteners. Not only has he done extensive work creating threads using the Lindow Rose Engine, written previous articles, and given presentations; but his primary work assignment requires him to understand bolts and other fasteners to provide recommendations for their use in critical applications. This has required him to understand and evaluate standards on many types of threads and other fasteners including their chemistry, heat treatment, quality control, and installation. I thank Roy for adding to our understanding of this important area of ornamental turning.

Background and Introduction

During the PechaKucha at the recent Denver Ornamental Turners Symposium, I presented an overview on a way to define and design threads for the lid of a small 1.875" diameter box. This article recaps much of that presentation and adds a few points including my approach to matching the wood grain of the box lid to the wood grain of the box body. While threading may not add a great deal of visual interest to an ornamental piece, properly executed threads do provide a ready means to secure or unsecure two parts and can give the project a desirable “working” feel.

Because most of my pieces have deliberate dimensions, I commonly create an Excel spreadsheet to relate the various dimensions. The figures in this article are from such a spreadsheet that helped me better understand various compromises, constraints, and even mistakes associated with threading wood. I believe the resultant threads are less prone to chip-out, allow for thinner box walls, and have reasonable proportions to the whole project. In addition, the top of the box is secured with a deliberate amount of rotation.

In the industrial world threads are a very complex subject and, as the ornamental turning antique restorers amongst us know, threaded items might even be handmade with limited interchangeability. Modern machines come with the ready ability to obtain appropriate replacements that not only fit but work properly. This is possible because there are standards from organizations such as the American Society of Mechanical Engineers and many others who have defined not only fundamentals such as diameters, pitch, and geometry of the thread cross section; but also application limitations, tolerances, many metallurgical aspects, fits, corrosion resistant coatings, grades, classes, and strengths. While standard forms are important for scores of matching items, a one off thread is fine for most ornamental turning projects. A possible exception might be when one must make an internal thread to fit a lathe spindle such as the common 1" diameter 8 threads per inch (TPI).

There are many standard thread forms today. One important entity in history is the US National Bureau of Standards (now National Institute for Science and Technology). Congress established this organization in 1901 and they were part of the process leading to several standardized forms. These include: Acme, Stub Acme, Buttress, rolled threads for screw shells of electric lamp holders and unassembled lamp bases, microscope objective and nosepiece threads, surveying instrument mounting threads, photographic equipment threads, ISO metric threads, miscellaneous threads (Whitworth, modified square, 60° stub, dairy sanitary fittings, glass bottle and jar threads, Buttress), and interference-fit threads. Certainly this is the tip of the iceberg but technical mastery of all this is not necessary for successful one or few-of-a-kind wood situations.

The 60 Degree Form in Wood

For ornamental turning, an easy to create form is to use a 60° included angle cutter. While far from satisfying detailed technical requirements of industrial standards, such a thread with a single start appears much like a bolt from a local hardware store. However, sharp wooden edges and thin sections tend to chip or break making the result unattractive. Further, the total cutting depth may not be commensurate with the proportions of the remainder of the work or the resultant clearances may not work with wood movement. Nevertheless, for some woods and situations the form is useful but others, maybe not. For discussion and comparisons in this article, I will assume a 16 TPI baseline example. This could be a single start using a 16 TPI master, a double start using an 8 TPI master or even a four start based on a 4 TPI lead master. In all these situations, the dimensions of the removed section are identical to the remaining section.

Attributes of a 60° Reference Case

Figure 1 is a cross section of a 1.875" OD box and 16 TPI threaded lid with the thread form close to centered in the wall (the box body is the on the right and the lid section is on the top and left). From experience and the recommendations of others, a 70% contact between the external and internal threads is used. In this example and others to follow, the tenon diameter for the external thread is 1.75" and the total wall thickness is 0.157" (0.938-0.781). For a general application the tenon dimension can be anything and the cutting depth from that surface is 0.054". Cutting depth is found dividing 0.866 by the equivalent TPI. In this instance 0.866/16 which is the 0.054 (an 8 TPI thread would be 0.108" deep). To create a pleasing fit, the inside diameter of the internal thread must be fairly accurate and (for 70% contact) be 1.4 times the cutting depth smaller than the external thread tenon. In this example case, the inside diameter is 0.076" less than 1.750" or 1.674" (1.875 -1.4 X 0.054) and as before the cutting depth is 0.054". Close attention to these dimensions is important. Keeping these dimensions within a few thousandths of an inch requires careful measuring and helps achieve consistent results.

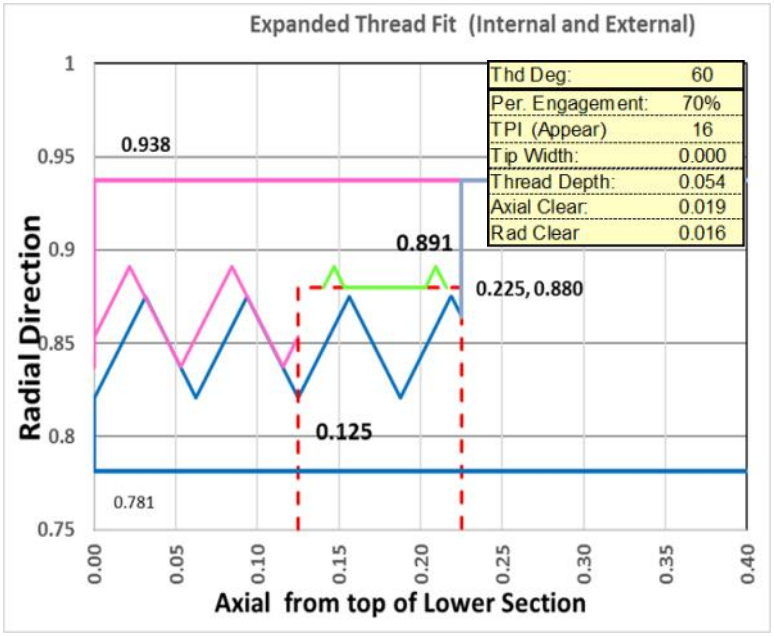


Figure 1 Cross Section of 60° Thread Form in Wall of Small Box

When threads match the theoretical radial and axial clearances are as shown in the yellow data box in the upper right hand corner of Figure 1. Notably total axial clearance is 0.019° and total radial motion possible when wiggling a loose lid is twice the radial clearance shown. (For reference, since 70% engagement is assumed, radial clearance on one side is 30% of the cut depth—0.3 times 0.054.)

16 TPI with 50 % Engagement

Should one deliberately seek to reduce percent engagement, the tenon-to-bore diameter difference decreases as shown in Figure 2 where the inner bore diameter is larger than the baseline. This could also occur from unintentionally decreasing the difference between the inside and outside diameters. Arguably the resultant thread is not as strong as the reference case because there is less material in the cylindrical shear plane (assuming the longitudinal direction of the grain is from left to right) but there is substantially more axial and radial clearances (0.031" versus 0.019" and 0.027" and 0.016" respectively). This situation lessens the thickness of the backup walls slightly since the total thread "thickness" in the wall is 1.5 times the thread depth instead of 1.3 times for the 70 % engagement (i.e. the total wall thickness for backing the thread is reduced by 20% of the

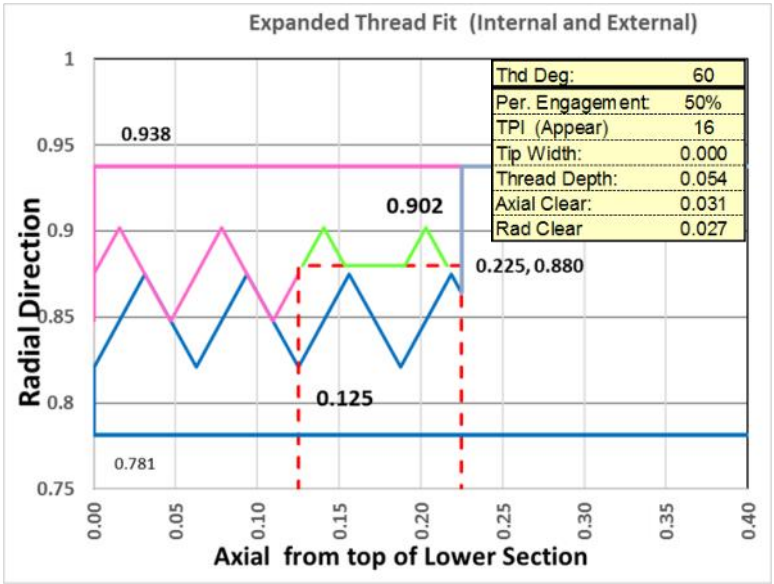


Figure 2 Cross Section of 60 Degree Thread Form with 50% Engagement.

cutting depth). While absolute values differ, these differences apply generally.

Thread Cutting Limitations

A practical issue associated with threading discussed here is the ability to cut fully to the box shoulder as shown by the blue lines approaching the vertical blue and red dotted lines in the figures. One can cut a relief area in the tenon with a parting or other tool, but my preference is to cut as close as practical and them cut a matching internal cylindrical area at the beginning of the internal thread as depicted by the dotted red lines. I have found if the inside diameter of this cylindrical area is approximately 0.010" greater than the external thread outside diameter, this arrangement tends to bring the outside surfaces of the box into close alignment as the parts are tightened. This cylinder matching approach also lessens the amount of rotation needed to tighten compared to the relief approach (with the same number of actual threads). When the dimensions are correct for most situations there is a small amount of residual thread on the inside bore of this fitting cylinder as shown by the green peaks. If these are not visible as you are cutting the internal threads, there is often an error and the fit will not be correct.

Additional Threaded Box Criteria and Reference Box

Having subjected many of my small boxes to woodturners critiques, I have heard a number of criticisms.

- The most common is making the lid release in about a single turn. Thinking a bit, this parallels the experience of removing a jelly or mayonnaise jar lid; you rotate the lid and body each about a half turn. Unlike removing some bolts, you do not grab, turn, grab, turn again and repeat until separated.
- The thread should look proportionate to the remainder of the piece; not too short and not too long.
- One does not want the box to become heavy or “clunky” because the walls must be excessively thick for the thread depth.
- A lengthy thread can force one to increase the depth of the lid which may negatively impact the look and feel of the piece.

These criticisms necessitate compromise and flexibility. As I will explain moving away from the common 60° form can provide that flexibility and make the results less prone to chipping or breakage.

Moving Away from Sharp Crowned Reference Form

A simple change is to flatten the thread crowns. This is equivalent to lightly sanding the finished threads on the inner bore and tenon. This helps conceal or avoid crown chipping but the roots are still sharp “vees” and do not need to be. The remedy then is to grind a flat on the cutter to create a flat bottom (root) which also reduces the cut depths. If the box wall thicknesses remain the same, this increases the amount of material holding the thread form compared to the full 60° form. In addition, one can reduce or increase the included angle as shown in Figure 3 and Figure 4. In the first figure, the included angle is 30° and in the second, 70°. Importantly the width of the flat tip is different (0.022" versus 0.007") in these two illustrations and the total thread depth is now 0.035" instead of the 0.054" to create flat crowns. While the larger angle results in an axial clearance close to the 60° design (0.015" versus 0.019"), the radial clearance decreases from

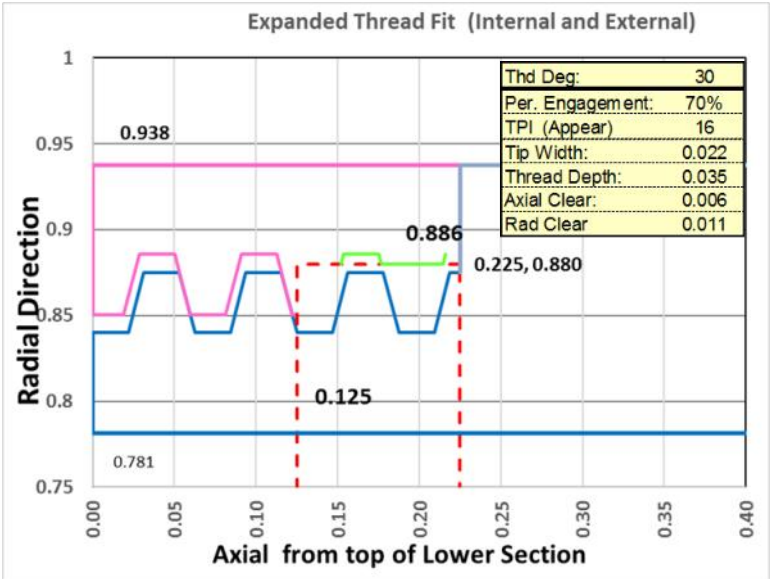


Figure 3 Modified Thread Form: 30° Included Angle

0.016" to 0.011". (Figure 1, Figure 3, and Figure 4 are all 70% engagement.) Comparatively, this change has dramatically reduced axial and radial clearances while lessening the required wall thickness. The larger angle reduces the width of the crowns and roots. A reasonable compromise here would be to adopt a 50° included angle. Also, as before, all cases to this point are symmetrical in the sense that the remaining form is the same size and shape as the cutout section.

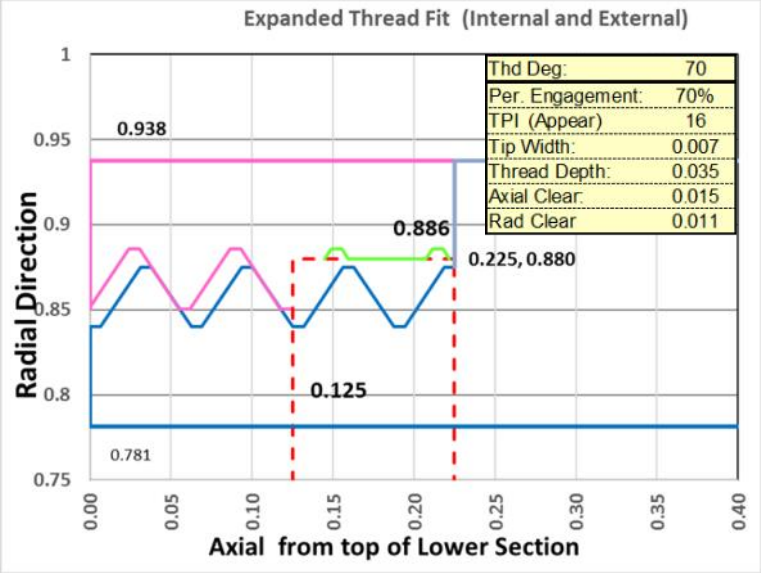


Figure 4 Modified Thread Form 70° Included Angle

Thread Depth Impacts Clearances

Thread cutting depth is another variable which can be adjusted. Adopting the 50° included angle and reducing cut depth to 0.020" while using the same cutter tip width as Figure 3 results in the configuration shown in Figure 5. Compared to Figure 3 the axial clearance is unchanged but the radial clearance is even smaller. Plus, since the cutting depth is greatly reduced, there is less room for measurement or cutting errors than for

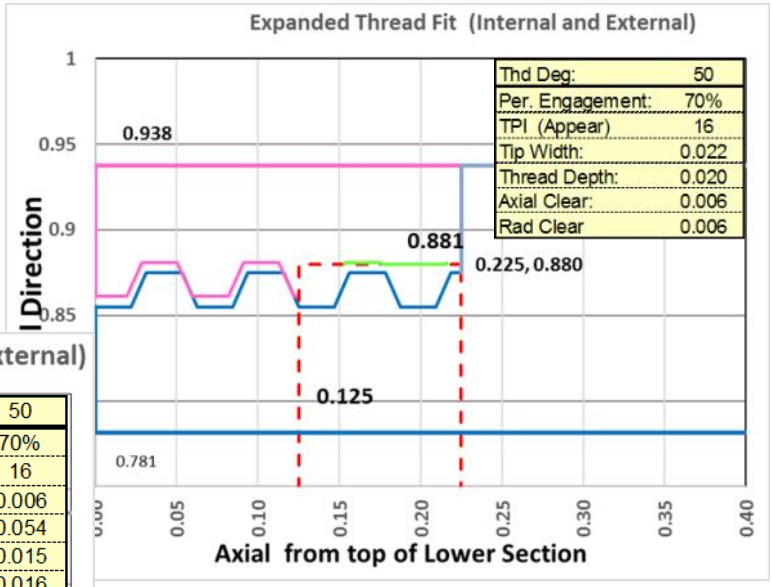


Figure 5 Reduced Cutting Depth at 50° Included Angle and

the original 60° thread. As shown in Figure 6, if one cuts the full 60° depth, 0.054", the axial clearance is slightly less than the original 60° design and radial clearances are identical. But, in this last case, the tip width is narrowed and would essentially be the lightly sanded situation.

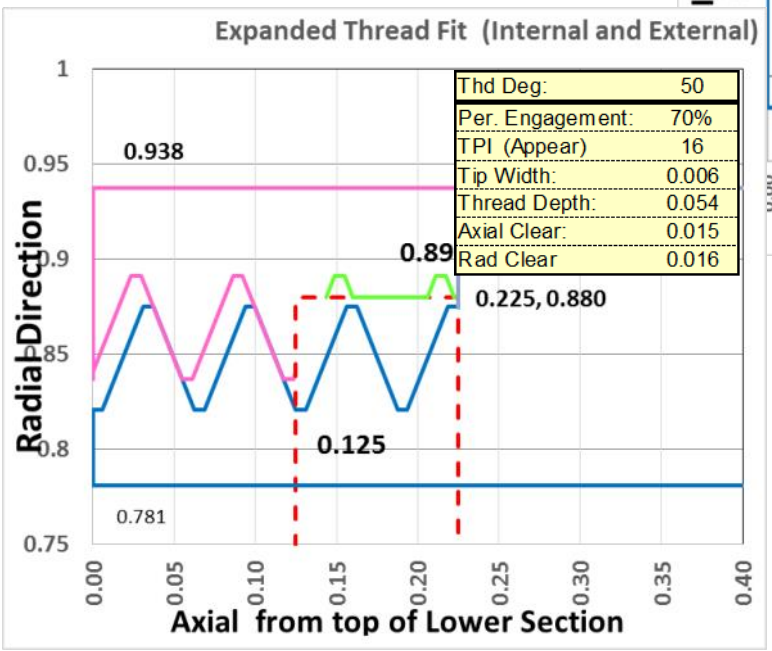


Figure 6 Standard Cutting Depth with 50° Included Angle and

A Workable Compromise

A workable compromise might be to use a cutting depth midway between the two extremes just shown (0.035") and continue with a 50° included angle. One such result is shown in Figure 7. However, while the total thread thickness is less than the 60° form and the crown flats are well established, the axial and radial clearances are still a bit tight. A change to increase these would be to depart from a symmetric design by increasing the cutter tip width slightly. Figure 8 quantifies the impact of this; a mere 0.003" increase in tip width to 0.018" brings the axial clearance to 0.016" which is only 0.003" less than the original 60° form. Now we have a design that requires much less wall thickness, is less prone to crown breakage, and has good thread wall backing thickness. A downside is that one must be fussy about dimensions since small changes affect fit much more so than if one were doing a 60° 16 TPI form. Also, the required customized cutter is useable for only a 16 TPI situation even though thread tenon diameter can be anything (An exception would be very small diameters where the cutter diameter becomes a significant factor in defining the cut shape.)

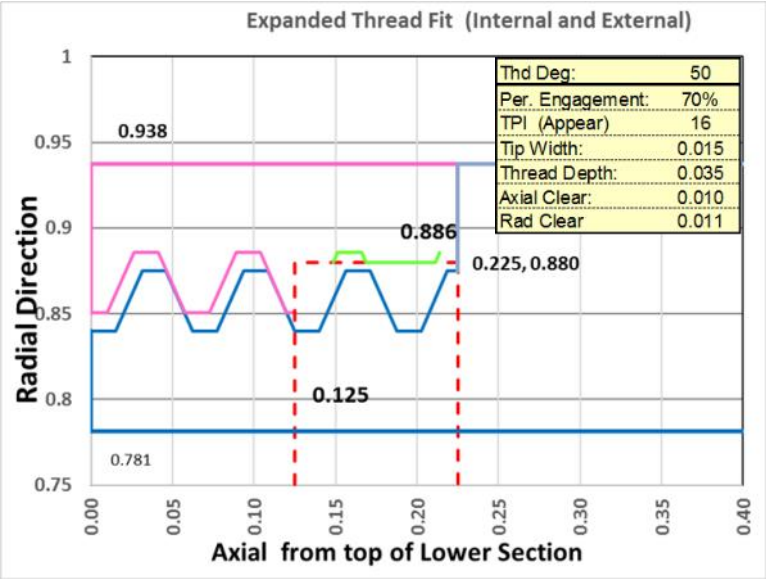


Figure 7 Compromise at 50° Included Angle and 0.035" Cutting Depth

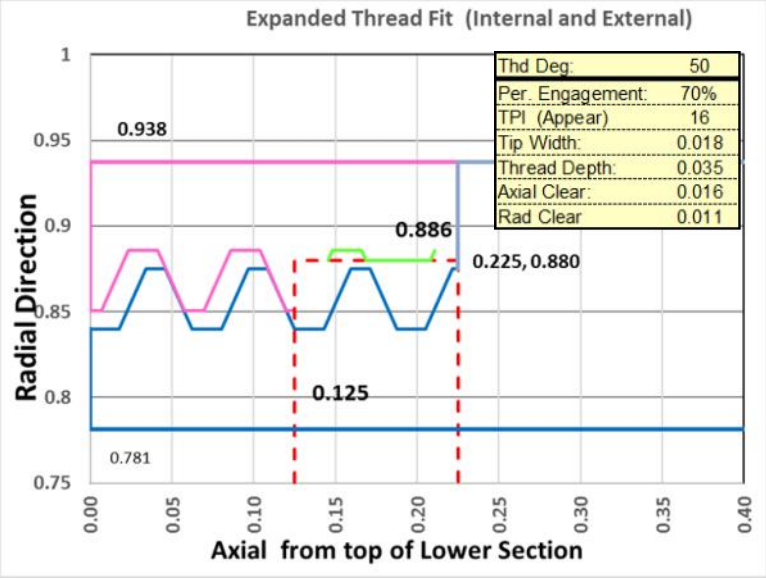


Figure 8 Compromise at 50°with Wider Tip for Non Symmetric Shape

Cutter Geometry Notes

I use a single point cutter mounted in a WW Collet mandrel as shown in Figure 9 that mounts in a L-W cutting frame.

Figure 9 Cutter Mount for L-W Cutting Frame

Figure 10 shows the key dimensions of the cutting tip. I began with an 1/8" diameter Accupro blank and move the tip toward one side to enable cutting closer to the box shoulder. Not being a machinist, getting the exact tip width is a challenge.

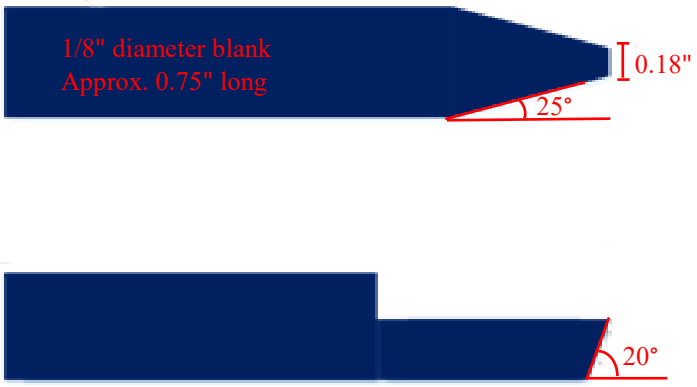


Figure 10 Plan and Side View of Cutter for Non Symmetrical 50° 16 TPI Thread

I used a standard micrometer as well as a scale on the handheld SPI optical comparator shown in Figure 11. In addition, I cut sample threads on scrap and measure the crowns with a trip back to the grinder a time or two to get the results I want. Both the comparator and blanks are available from MSC.

Figure 11 Hand Held Optical Comparator Used to Measure Tip

A Method to Match Grain Between Lid and Box Body

A usual wood turner's critique is whether the grain on the bottom of the box exactly matches the pattern on the lid with the lid secured. This can be frustrating to achieve. One can adjust this by trimming the box shoulder or the end of the internal threads (These are the two faces that meet when tightened). If one pays no attention to where the thread starts on each part, the maximum to be removed will be one thread lead (1/16 " or 0.0625" for 16 TPI). However, such trimming can require the cylindrical length be extended and in some cases require the lid depth to be redone. To reduce the likelihood of having to remove this much, I set the cutter edge relative to the matching surfaces at a specific rotation point. Usually I use a particular chuck jaw number on each of the two chucks I use because I match the blocks that way when first mounting them in the chucks. With experience one learns a dimension to move for a chosen part, away or closer, to reduce the amount of trimming. Considering practical realities, I have been able to get this down to something in the range of about 0.030" but certainly have never been able to get the same result each time when doing several pieces of the same sizes. Also, never do I assemble the two halves and cut the full amount. Instead I will cut about half the prediction and do another trial fit thus sneaking up on the final fit. For reference, the amount to remove is the percent of turn needed times the actual lead per turn. If one fourth turn is needed and you are making a double lead thread with 8 TPI master (16 TPI form), this would be 0.031", [(1/4) x (1/8)]. If the match is close, sometimes, I trim working on a flat sheet of abrasive paper. Finally another step is to use a fine file or 320 grit

abrasive to remove the thin thread sections near the exposed starts. If this step is omitted these thin areas will often chip during the trial fittings.

Reference Box for Final Tread Design

My original OT objective was to make small threaded boxes using 2" square stock such as African Blackwood. Considering the realities of making such a square round, I adopted a maximum diameter of 1.875". Then, using golden triangle guidelines, the remainder of the dimensions evolved. The inside diameter is 1.5625" and overall height with the lid closed is about 1.32". Figure 12 is a simple line sketch of this box showing the lid separated from the body. I make the top internal and external domes using the eccentric cutting head positioned at an angle off center that results in a uniform top thickness. All the information is in an Excel spreadsheet that enables changes if desired or, yes, accommodating a mistake every now and then otherwise termed a design opportunity in the wood turning community.

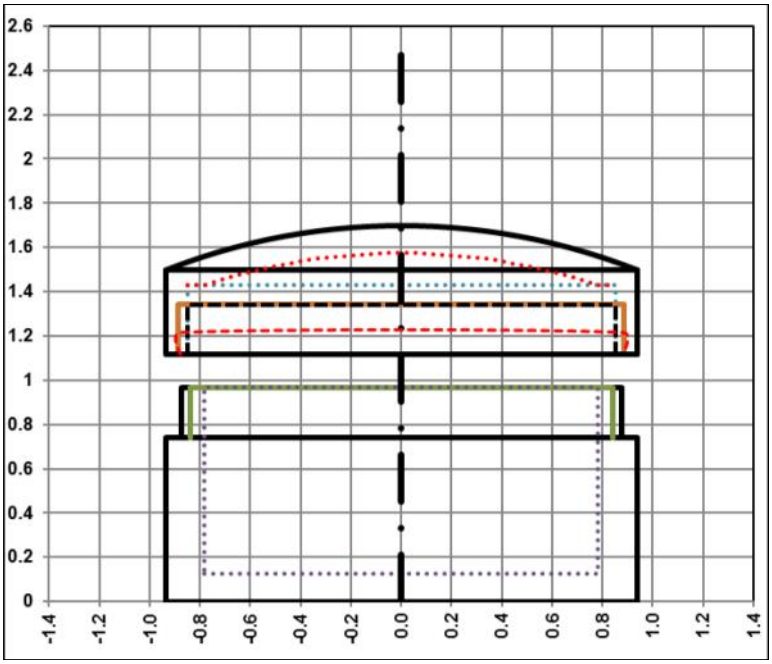
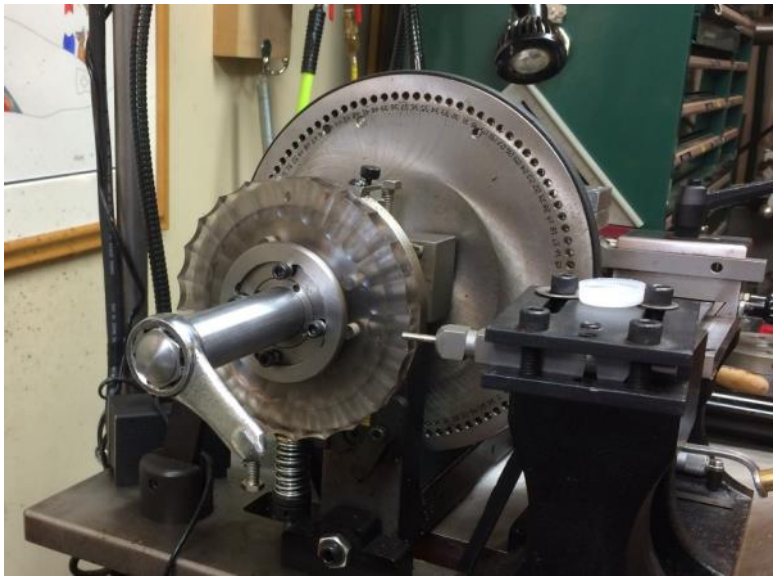


Figure 12 Cross Section of Reference Box for Thread Design Described

Quick Tip



Jim Bodman glued a cut off wrench to his drawbar. The glue can easily be broken to remove the wrench if need. This solved two issues. First, finding the wrench when needed. Second, over-torqueing the MT2 taper. With a wrench cut this short the risk of over tightening the taper is reduced exponentially.

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