Inside/Outside Angel Ornament

Introduction

Inside/Outside turning is a technique where four square pieces of wood are held together temporarily and turned, then the pieces are rotated 180° and glued, then turned again. It’s a popular way to turn Christmas Ornaments. Until last year the Inside/Outside ornaments I’ve seen used the technique primarily for decorative effects where the negative space created a Christmas Tree outline or something similar. The lightening of these ornaments due to removing material in the middle was almost incidental. In the Winter 2005 issue of Woodturning Design, Johnny Tolly showed how to turn an Inside/Outside Ornament where the technique was primarily used to hollow the Ornament.

In this article I’ll describe how to make an Angel Ornament where the Inside/Outside technique is used both for hollowing and for decoration by suggesting lacey frills on the Angel’s gown. I’ll start by describing how to make a pair of dedicated homemade chucks to facilitate holding the turning squares. Then I’ll describe using the chucks to make the Angel Ornament. On my web site, where I have more space, I’ll include a gallery of other applications for the technique.

The Chucks

Introduction

Earlier this year I developed an obsession with making a homemade spigot chuck. Since I already have a perfectly fine Bealle collet chuck, I really can’t begin to justify it. I tried any number of ideas. One was using PVC pipe for the compressible body of the chuck and wood for the front cap. It was easy to make, but didn’t work very well, as the PVC was a bit too bendable; adding the natural vibration of wood held only by a tenon to the PVC was a bit much. However it was easy and cheap to make and since the wood front was easily modified, it makes a nice chuck for holding the ends of squares for Inside/Outside turning. I made two chucks, one for the headstock end and one for the tailstock end. As the chucks have a nice flat bottom, they keep the turning squares in better registration than the fixed tapered chucks I’d used previously. Another added bonus is the headstock chuck holds securely enough for minor cleanup of the top of the finished ornament once the tailstock is removed after the second turning.

If you don’t feel like making the chucks, just skip ahead to the Ornament part of the article, as you can substitute a four jaw chuck and a cup center tailstock.

The Baseplate

PVC

I used 2” schedule 40 PVC pipe for the body of the chuck. I wanted to start with squared ends so I could get cutting by hand, so I used my bandsaw. Cutting round stock on the bandsaw can get overly exciting if the stock is allowed to rotate. Set your rip fence, if you have one, as a stop 2-1/2” from the blade. Clamp the PVC to your miter gauge, then advance the PVC through the blade, holding both ends. If you don’t have a miter gauge or this procedure seems unsafe to you, cut the pipe by hand and spend a bit more time later on cleaning up the ends. Cut two PVC sections.

Before starting, I suggest cutting the PVC sections so they are 2-1/2” longer than the square pieces you plan to use. If you don’t have a miter gauge or this procedure seems unsafe to you, cut the pipe by hand and spend a bit more time later on cleaning up the ends. Cut two PVC sections.

Drill and Tap

I used a wood block that is drilled and tapped to fit my headstock for the base of the chuck. I could substitute a wood block screwed to a faceplate but this way I don’t tie up a faceplate nor worry about re-registration issues. I’ll describe how to drill and tap on your lathe, you can find alternative ways described in the Wooden Faceplates article on my web site.

Start by rough cutting a piece of 1” thick of hardwood such as maple to a 2-3/4” disk. Mount it on your lathe. Chuck a drill that’s 1/8” less than the thread diameter of your headstock spindle (7/8” for a 1x8 lathe) in a drill chuck mounted in your tailstock. Drill through the block. Remove the drill and mount a tap guide in the drill chuck. Hold the end of a tap that matches your headstock spindle in the drilled hole and bring up the tailstock so the tap guide inserts into the dimple in the end of the tap. Compress the tap guide by advancing the tailstock ram, and start turning the tap to cut threads. The tap guide will keep the tap aligned until the threads are well established. You could use just your tailstock center and keep advancing it every quarter turn or so, but a tap guide is cheap…it’s well worth it. Remove the tap and tap guide and mount a Forstner drill bit that matches the spindle diameter of your headstock and drill 1/8” or so that the block will thread on all the way to the flange of your headstock spindle.
True and Turn

Remove the base plate from the chuck or faceplate and screw it onto your headstock spindle. Turn the lathe on and make sure that the face of the base plate runs true. If you tried to cut the threads freehand, it won’t. In that case add a wooden spacer behind the base plate so the spindle thread doesn’t protrude through and true up both front and rear faces with a bowl gouge.

Use a bowl gouge to true up the side of the base plate. Then reduce the front ¾” of the base plate to match the inside diameter of your PVC pipe. You want this tenon to be a jam fit. Once you have a good fit, square up the unturned flange so the end of the PVC mates closely too. Jam the PVC onto the base plate and use light cuts with a scraper to true up the end of the PVC pipe. Once it runs true, sand the inside of the pipe briefly to enable a good glue joint. Reverse the PVC and true and sand the other end. Repeat with the other PVC piece.

Front

Pattern

To make the front of the chuck you have to start with a pattern. To make the pattern, you have to know what size turning square you’ll use. There’s no need to use expensive wood for the angel, as common pine is a good light color and is light in weight. You could rip up ¾” stock, but I think the angel looks better a little larger. The Home Depot near me has 5/4 stock. After I rip it into squares and run it through the planer to make sure it’s actually square it ends up being 1” square.

Draw a square where each side is twice as long as a side of the stock you’ll use (I used a CAD program) and draw diagonal lines between the corners. Now draw a circle centered where the diagonals cross that’s the LARGER of 3-1/4” or 1/8” past the corners of your square. 3-1/4” is the minimum diameter you need to protect your fingers from the hose clamps. Cut out the pattern and glue it to the front of some 3/8” stock. I used particle board and spray adhesive. Cut just outside the circle with a band saw or scroll saw.
Next cut out a backup disk of 1" stock such as maple with a diameter just a little larger than your pattern. Using a drill press to insure a perpendicular hole, drill a 3/8" (3/8" is arbitrary, it just needs to be large enough that the drill won’t deflect) hole at the center. Pin the disk to the drive plate with your tailstock center in the 3/8" hole and turn it to the same diameter as your pattern.

Remove the backup disk from the lathe. Glue the pattern disk to the backup disk, being careful to keep them aligned. Once the glue has dried, pin the assembly to the drive disk using your tailstock inserted in the 3/8" hole. Turn the back ¾" of the backup disk so that you have a jam fit in the PVC. If my drive plate had been a little larger I could have mounted with the pattern disk against the plate and had an easier time. Learn from my mistake.

Assembly

Glue

You’re now ready to assemble the chuck. Mount the base plate on your lathe spindle. Spread some urethane glue on the tenon of the base plate and mount the PVC on the tenon. Now spread some urethane glue on the tenon of the backup and insert it into the PVC. Bring up your tailstock center into the 3/8" hole in the backup and use it to clamp the three pieces together.

Slot

After the glue has dried remove the chuck from the lathe spindle. The next step is to cut slots to allow the chuck to contract. The slots should stop just beyond the depth of the base plate tenon. You could cut the slots with a hand saw, or hold the chuck in a small V block and use a bandsaw. I wanted a larger kerf to allow more chuck movement, so I used my table saw. I clamped a block to the back rail of my table saw sled so that the chuck would be centered on the blade. I held the chuck on the sled by pushing DOWN and advanced the sled through the blade. Despite how it looks in the picture
wasn’t exciting at all, but obviously using a hand saw would be safer.

![Fig15: This is one way to cut slots in the chuck. Using a hand saw would be potentially less exciting, of course.]

Return the chuck to the lathe spindle for holding convenience and reinforce the chuck by mounting some small wood screws through the PVC into the base plate and backup plate. I used some small ½” flat head wood screws, countersunk into the PVC. Space them evenly for balance.

**Hose Clamp**

A pair of hose clamps is used to actuate the chuck. Don’t use just one, as it will be unbalanced. Join two hose clamps into a hoop and slip on the chuck. It’s easier to tighten if you have the drive end of the actuating screw facing you when it’s on top of the chuck. A nut driver is better than a screwdriver. Now that you’ve got the chuck assembled, insert a set of turning squares and tighten it up. Tighten the hose clamp drives alternately, and they don’t always slip over the chuck evenly. You should find it satisfactorily hard to pull the wood out once the chuck is tightened.

![Fig16: Two hose clamps fastened together will tighten the chuck and keep it balanced.]

**Tailstock Chuck**

Make a Tailstock Chuck following the same steps. The only difference is that instead of a base plate that’s tapped, start with a disk with a 3/8” central hole and turn it true and with a tenon to fit the PVC by pinning it to a drive plate with your tailstock center.

**The Ornament**

**Introduction**

For the design of this ornament, especially the wings, I borrowed from an Angel ornament Nick Cook published in the AAW Journal a few years ago. However mine is hollowed using the Inside/Outside technique and the wings are turned using a different method. My Mother says there aren’t any truly original Christmas Ornaments left. I don’t really agree with her, but she’s right at least in this case.

**First Turning**

**Square Stock**

This paragraph is titled *Square Stock*. It’s important, and it means really square. Having square stock is second only to accurate alignment for successful Inside/Outside turning—and you can’t have accurate alignment without truly square stock. I think the Angel looks best about 2” in diameter, and that requires 1” turning squares. The wood should be light in color and light in weight. Basswood or Soft Maple would work fine, but ordinary pine is a cheaper choice if you can find thick enough stock. You could rip squares from 2x4 construction lumber, but check Home Depot first, as the one near me has 5/4 pine, which is just bigger than 1” thick.

Start by ripping whatever board you use slightly oversize. Then run it through a planer, rotate the strip 90°, and run it through the planer again. If you don’t have a planer, start by ripping the strips slightly oversize on a table saw, then move your fence in a trifle, rerip, rotate 90°, and rip again. The blade is unlikely to deflect significantly when making a light cut, unless it hits a knot, and you should trim knots out anyway.

Once you have square strips, crosscut them into individual turning squares, avoiding knots, using a mechanical stop so that you get identical lengths. I cut mine 6-1/2” long.

**Masking Tape Cauls**

It’s easier to mount the squares in the chucks if they’re held together first. At first I tried clamping them with Irwin Quick-Grips and tapering around the ends, but it was awkward. Instead tape together pairs of squares first. On a Flat surface, squeeze the squares together with one hand and apply a short strip of tape with the other. Reverse the squares, then squeeze and tape the other end. Repeat for the other pair of squares. Then tape the pairs together using the same procedure. Check your alignment and burnish the tape down for a more secure hold.
I sketched my finished Angel on a piece of thin cardboard (like cereal box) 2” wide. I transferred where to hollow her dress from the cardboard to the assembled squares and drew heavy lines at the top and bottom of where to remove stock for the Angel’s gown on one side.

Mount & Turn

Mount the chuck on your headstock and insert the taped square assembly into it. Tighten the chuck enough to hold the pieces in, and put the tailstock chuck over the other end of the assembly and tighten that end slightly. Bring the tailstock center up into the center hole of the tailstock chuck and apply moderate pressure. Now tighten up both hose clamp actuators on both chucks securely.

Now you have to figure out how deep to turn the half-cove to hollow the Angel’s gown. While there’s no substitute for experience, the diagonal of the assembly minus the side plus 3/8” (2.8-2+.375=~1-1/8) is a good starting point.

Standing to the side, switch on your lathe. Start turning with your skew by making a V-Cut just to the inside of the bottom mark of the Angel’s gown. Deepen the cut until you’re slightly below the point where you stop cutting air. Now take a parting tool and cut down to the diameter you determined in the last paragraph. Use a spindle gouge to cut the half cove. Start well to the inside of the mark for the top of her gown so you can remove even layers, like coring an onion. Trim the bottom with a final continuous skew cut and take a last very light cut with the gouge.
Mark off evenly spaced intervals with a pencil (they’re easier to erase if wrong) and then use a mini-cove tool (see WTD Fall 2005 or my website) to cut mini-coves to suggest lacy frills on the Angels dress. A thin parting tool or even a sharpened reciprocating saw blade could be substituted.

Now sand the inside and bottom of the half cove using progressively finer grits. To keep your fingers away from the spinning corners use long strips. Apply the finish of your choice to the inside of the half cove. If you use a friction polish, use a long strip to apply the finish.
Second Turning

Glue and Trim

Remove the assembly from the chucks and remove the tape. Now you need to glue the squares permanently together. Masking tape cauls make it easier to keep them lined up. Start with pairs. Align a pair of squares so that you can see the gown outline as negative space. Apply a thin coat of glue to the mating surfaces (avoiding the half cove) then place them together making sure to align the bottom of the half cove. Squeeze and tape each end in turn, then repeat for the other pair. Now line up the pairs, apply glue to the mating surfaces, then squeeze and tape. Check your alignment once more, make sure you have an outlined gown on each face, then burnish the tape. Finally, clamp the squares together with a pair of clamps at each end.

Turn

After the glue cures, remove the clamps and trim up both ends of the assembly on your table saw. Make a small dimple in the top end of the assembly with a center punch or small drill. Now insert the assembly into the headstock chuck and tighten enough to hold it lightly. Bring up the tailstock center and insert it into the dimple you just made. Tighten both actuators of the headstock chuck and snug up the tailstock. Avoid excessive tailstock pressure as you don’t want to split apart your glue job.
Standing to the side, turn on your lathe and then begin turning with a roughing gouge to bring the assembly to round. Use a parting tool cut to mark the bottom of the Angel’s gown, and a Skew V-Cut to mark the top of her gown. Now use your skew to gently cut the gown. You should be able to see the outline of the inside of the gown when the assembly is turning and follow it for a uniform thickness. Don’t be discouraged if you cut too deeply or too roughly the first time and end up with a broken Angel, just start again, maybe leaving a bigger diameter on the first turning next time.

Using your pattern, indicate the top of the Angel’s midsection with a pencil line, and mark it with a V-Cut. Reduce the diameter with your roughing gouge then use a skew or spindle gouge to round over the midsection. Use the pattern and mark the top of the Angel’s head with pencil and V-Cut. Reduce the diameter, then round the head with a spindle gouge. Add a neck with the spindle gouge. You can use an undercut bead for the Angel’s halo or add it later with a contrasting ring of wood or metal. Cut off and clean up the top of the head using gentle cuts. You need a centered hole to mount a hanger, so go ahead and bring the tailstock back up.
Next deepen the parting tool cut at the base of the Angel to indicate her feet. Cut deeper to mark the bottom of her feet leaving a nub about ½” in diameter. Use a skew or spindle gouge to round over her feet a bit and clean up the bottom of her dress and feet.

Sand

Sand the Angel with progressively finer grits. Again you should use long strips of abrasive to keep your fingers safe. Apply your favorite finish. Cut off the nub (use a saw or hang on to her head) and sand the bottom of her feet off the lathe. Apply finish to the bottom of her feet.

Wing

Drill Jig and Drill

The Angel’s wing will be held for its second turning and glued to her midsection with a ¾” tenon so you need to drill a matching mortise. This is most easily done on the drill press with an angled V-Block. Start making the Drill Jig by cutting a 5” long section of 2x4 lumber. Draw a 90° V on one end, stand the piece on end with the V up and cut out the V on your bandsaw. Screw a wood screw part way in near one end of the V to serve as a stop. Put your Angel in the V with her feet against the stop, and holding the Jig up against a horizontal surface such as your workbench, adjust the angle of the Jig so that the orientation you want the wing to be is horizontal. Without moving the jig, run a pencil along the workbench to mark the cut line. Return to the bandsaw and cut along the line. Flip the off-cut over, and draw a notch so that it will have a flat horizontal area you can clamp with, and cut out the notch. Glue and/or screw the notched piece to the jig.

To drill, place the Angel in the jig with her feet against the stop. Align the jig on your drill press so that a ¾” Forstner bit is centered on her midsection, and clamp the jig in place. Make sure that one of the gown openings is centered upwards, drill carefully a hole ½” deep or so.

Template

To make a template for cutting out the wing after turning, draw a 3-3/4” (or however big you want the wing to be) circle on a piece of thin cardboard. Cut out the circle, and cut or drill a ¾” hole in the center of the circle. Fold the template in half. Draw the outline of the wing you want on one side of the line. Fold the template in half again and cut on the lines.
A scan of the wing pattern. Right click on the scan, "Save as" something, then print it out if you don't want to design your own.

**Wing Turn Jig**

To make a jig to turn the wing using a collet chuck (you could substitute #1 jaws or collet jaws in your four jaw chuck, or by publication time I'll (probably) have a jig posted on my web site that will work with standard jaws) draw a 3-3/4" circle on construction lumber. Cut out the disk on your band saw. Drive a 1-1/4" Phillips or square drive screw into the center of the circle to reinforce the future tenon. Pin the disk against a drive plate (an empty collet chuck works) with your tailstock inserted in the screw head. Turn a 3/8" tenon about 1/2" long. Reverse the jig and mount in your chuck using the tenon.

[Fig50: The wing turn jig blank. I've reinforced the future mounting tenon with a 1-1/4" screw driven into the center.]  
[Fig51: The wing turn jig mounted for turning. I've pinned the jig against the face of my collet chuck with the tailstock center inserted into the screw head.]  
[Fig52: The wing turn jig after turning.]
Turn Front of Wing

Cut out a 3-3/4” disk of ¾” stock (pine or whatever you choose) and mark the center. Pin the wing against the Wing Jig with your tailstock inserted in the center. Using a bowl gouge, turn a ¾” tenon about 3/8” deep on the tailstock side. Curve the wing away from the tenon, leaving a rim about 1/8” thick and true up the rim. Sand with progressively finer grits and apply finish.

Turn Back and Cut Outline of Wing

Remove the Wing from the lathe, and remove the Wing Jig from your chuck. Insert the wing tenon in the chuck and bring up the tailstock to steady the wing as it’s mounted by a short tenon. Use a bowl gouge and turn the back to match the curve of the front leaving a nub to support it as long as possible. Retract the tailstock and remove the nub with your bowl gouge. Sand with progressively finer abrasives, then apply the finish of your choice.

Drop the template over the tenon. Trace the outline with a pencil. Use a scroll or fret saw and cut out the Wing. If you cut so that the lines are on the off-cuts you won’t have to erase them. Touch up the cut edges by sanding and applying finish by hand.
Assemble

To assemble the Angel, apply some glue to the drilled edges of the mortise in her mid-section. Insert the wing tenon into the mortise. If you have to push, be certain to push in the very center, not on the weaker rim of the wing (alas, experience speaks). Drill a hole in the top of her head and insert whatever you wish to use for a hanger. Hang on your tree and enjoy.

Tools and Materials

Chuck and Jig Materials
- 2” diameter schedule 40 PVC pipe
- 1” hardwood
- 3/8” hardwood or sheet goods
- 4 each ½” to 1-1/2” hose clamps
- 2” construction lumber scraps
- Urethane glue

Angel Materials
- 5/4” pine
- 1” pine
- Wood glue
- Various abrasives
- Finish of choice

Tools
- Tap matching your headstock spindle
- Tap guide

Me

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