MAKERSMITHS
INNOVATION FORGE

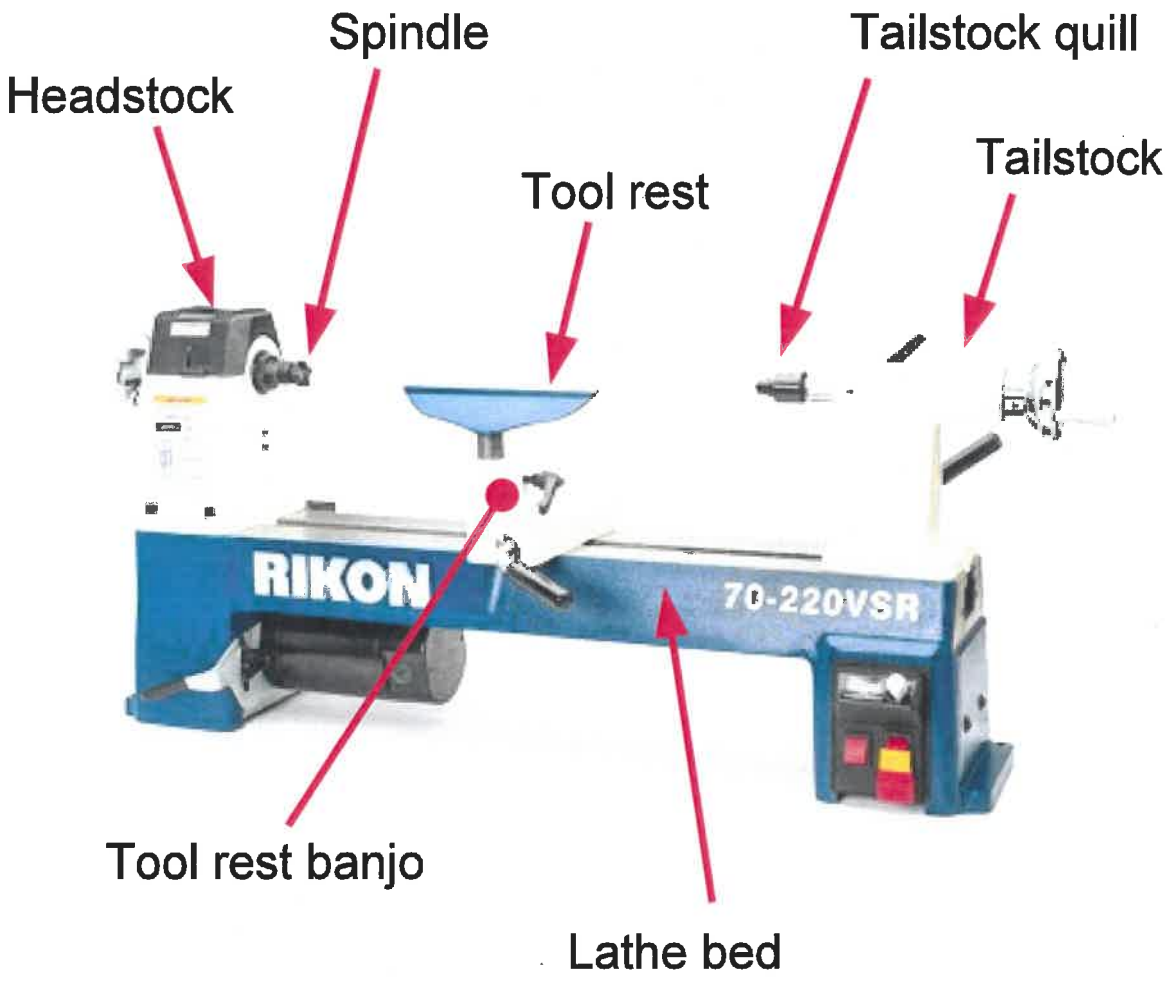
Woodturning

Safety …it's **YOUR** responsibility

- First Aid Kit is located on entry lobby cabinet next to 3D printing room wall.
- Always wear safety goggles or safety glasses that include side protectors. Use a full face shield for bowl, vessel, or any turning involving chucks and faceplates.
- Tie back long hair; do not wear gloves; and avoid loose clothing, jewelry, or any dangling objects that may catch on rotating parts or accessories. Don't wear flip flops or open toe shoes.
- Wear hearing protection during extended periods of turning.
- Keep tools sharp and clean for better and safer performance. Don't force a dull tool. Don't use a tool for a purpose that it was not designed for or intended for.
- Remove chuck keys, adjusting wrenches, and knockout bars. Form a habit of checking for these before turning on the lathe.
- Rotate your workpiece by hand to make sure it clears the tool rest and bed before turning the lathe on. Be certain that the workpiece turns freely and is firmly mounted.
- Check that all locking devices on the tailstock and tool rest assembly (rest and base) are tight before operating the lathe.
- Always **check the speed** of the lathe before turning it on. Use slower speeds for larger diameters or rough pieces and higher speeds for smaller diameters and pieces that are balanced. Always start a piece at a slower speed until the workpiece is balanced. If the lathe is shaking or vibrating, lower the speed.
- Be aware of the "line of fire". This is the area directly behind and in front of the workpiece, the areas most likely for a piece to travel as it comes off the lathe. When observing someone else turn, stay out of this zone.
- Turn the lathe off before adjusting the tool rest or tool rest base, i.e., banjo.
- Never leave the lathe running unattended. Turn power off. Don't leave lathe until it comes to a complete stop.
- Stay alert. Watch what you are doing. Pay close attention to unusual sounds or vibrations. Stop the lathe to investigate the cause. Don't operate machines when you are tired or under the influence of drugs or alcohol.

Flip over

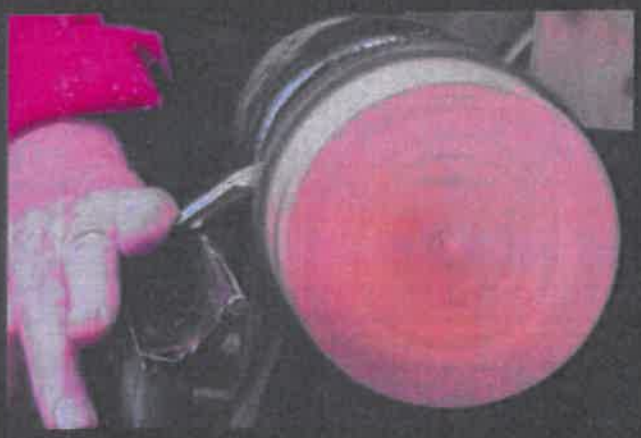
- Always remove the tool rest before sanding, finishing, or polishing operations.
- Fine particles from a grinder and wood dust are harmful to your respiratory system. Use a dust mask, air filtration helmet, proper ventilation, dust collection system, or a combination of these to deal with this serious issue. Be especially mindful of dust from many exotic woods, spalted woods, or any wood from which you notice a skin or respiratory reaction. Sanding is allowed only at lathes with active dust collection turned on.
- Exercise extra caution when using stock with cracks, splits, checks, bark pockets, knots, irregular shapes, or protuberances. Beginners should avoid these types of stock until they have greater knowledge of working such wood. Mainly stay out of the Line of Fire!
- Know your capabilities and limitations. An experienced woodturner is capable of lathe speeds, techniques, and procedures not recommended for beginning turners.
- Don't overreach, keep proper footing, and keep your balance at all times.
- Keep lathe in good repair. Check for damaged parts, alignment, binding of moving parts, and other conditions that may affect its operation.
- Note that, when running a lathe in reverse, it is possible for a chuck or faceplate to unscrew unless it is securely tightened or locked on the lathe spindle.
- When using a faceplate, be certain the workpiece is solidly mounted with stout screws (#10 or #12 sheet metal screws as a minimum). Do not use dry wall or deck screws.
- Hold turning tools securely on the tool rest, holding the tool in a controlled but comfortable manner. Always contact the tool rest with the tool before contacting the wood. Know the A.B.C. of woodturning.


Headstock
Spindle
Tool rest
Tailstock quill
Tailstock
RIKON
70-220VSR
Tool rest banjo
Lathe bed

WOODTURNING FUNDAMENTALS

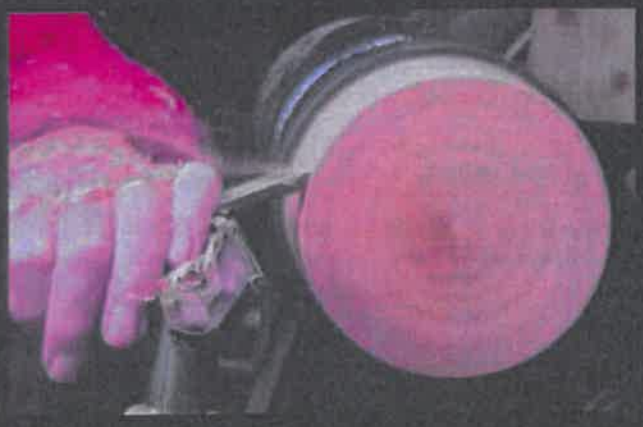
is an informative digital publication and online learning portal aimed at new turners. Whether you're starting a new hobby or plan to become a pro, the projects, techniques, tips, videos, and resources in WOODTURNING FUNDAMENTALS will help you build essential knowledge and skills. The AAW publishes WOODTURNING FUNDAMENTALS digital publication free to members four times each year.

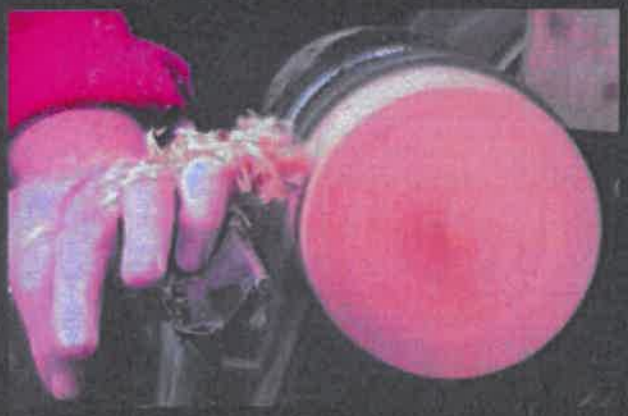
The ABCs of Woodturning



Anchor the tool on the rest.

Bevel rubs on the spinning wood.





Cut by lifting the tool handle to engage its sharp edge. Shavings fly, big fun!

AAW | AMERICAN ASSOCIATION OF WOODTURNERS

Landmark Center 222 | 75 5th St. W, St Paul, MN 55102
877-595-9094 (toll free) | woodturner.org

Spindle Roughing Gouge (3/4")

The Spindle Roughing Gouge is the most efficient tool to remove the square corners from a spindle and to do rough shaping of gentle curves. The gouge bevel is typically ground rather flat across the cutting edge with a bevel angle of about a 50 degrees. The tool handle is held low enough to produce a peeling or planning cut when the handle is raised and the cutting edge contacts the workpiece. This produces a relatively clean surface. If the tool is held at 90 degrees to the wood the result will be a scraping cut which leaves a torn surface.

NOTE: The Spindle Roughing Gouge should not be use for turning bowls or other objects where the grain of the wood is not parallel to the lathe bed.

Spindle Gouge (3/8")

The 3/8" Spindle Gouge is a versatile tool used in turning most of the detail work desired on a spindle. It can also be used for turning details on bowls and other items. It is most useful when the bevel is ground to a rather long angle of about 40 degrees and the sides are ground back forming a "fingernail" grind. With this grind it can be used to turn fine details and work into tight corners. The Spindle Gouge is used to turn beads, coves, tapers, shoulders, ogee curves, and various combinations of these shapes. When sharpened and used properly the spindle gouge will efficiently produce a clean cut.

Parting Tool (1/8")

The Parting Tool is a special purpose tool used primarily to turn wood to a specified diameter. It is often used in conjunction with outside calipers when careful measuring is required. Parting tools are available in a variety of cross-section shapes. For general purposes, parting tools are relatively easy to control and usually produce a scraping cut. Each bevel on a parting tool is typically ground at about 30 degrees making the angle between the two bevels about 60 degrees.

HANDOUT

Tools & Accessories

OVER

Tools & Accessories

Drive Center

The drive center is placed in the headstock and rotates with the lathe to drive the wood while turning. The most common type of drive center is the Spur Center which consists of a center point and four spurs that penetrate into the end of the spindle to provide traction. Some turners prefer a Cup Drive. The cup drive has a centerpoint inside a supporting cup, but no spurs. When turning with a cup drive, if the tool begins to catch the wood, the cup drive acts similar to a clutch and allows the wood to slip. This stops the rotation of the wood rather than force the tool to dig in and tear the surface.

Spur Drive Center

Cup Drive Center

Ball Bearing Tail Center

The Ball Bearing Tail Center supports the wood on the tailstock end of the lathe. The ball bearing action allows the tail center to rotate freely with the wood.

Ball Bearing Tail Center

Morse Taper

The drive center, tail center, and several other accessories are secured in the lathe using a morse taper. The taper on the end of the accessory (drive, center, tail center, etc.) matches the taper on the inside of the headstock and tailstock. The fit between the accessory and lathe is a friction fit. These accessories are usually removed simply by tapping on them with a knock-out rod that is fed through the end of the headstock or tailstock. When removing an accessory that is secured in a morse taper, hold onto the accessory while tapping with the knockout rod so the accessory does not drop and hit the lathe bed or the floor.

HANDOUT

How to Determine Safe Lathe Speeds

Appropriate lathe speed should allow the blanks to be turned with little or no vibration. Vibration is usually caused by the wood being unbalanced in weight, and is particularly common before the wood has been rough turned down to round. Low speeds are needed to reduce the vibration until the work becomes balanced, then speeds can be increased for more efficient turning.

Suggested lathe speeds for various diameters of spindle stock are given below. If there is a question regarding whether a lathe rpm is set too high, chances are it is. It is best to work on the side of caution. A slower lathe speed may require more time to remove the excess stock, but will allow for safer turning. Cutting principles remain constant regardless of lathe speed.

Suggested lathe speeds:

Diameter of Stock	**Lathe Speed**
1" or less	3,000 rpm
1.5"	2,500 rpm
2"	2,000 rpm
3"	1,500 rpm

Bead-and-Cove Sticks—Effective Practice Makes Perfect

By Mike Peace

Like any motor skill—walking, riding a bike, playing an instrument—turning requires practice to develop skills and muscle memory. Repetition develops tool control. Practice leads to experience and lets us recognize when we need to sharpen a tool for a better cut. It takes practice to recognize the difference between a scraping cut and a slicing cut.

I see so many new turners who want to start turning bowls immediately. But many foundational skills are best learned through spindle turning. Tool control, riding (or perhaps more appropriately floating) the bevel, the importance of sharp tools, and the understanding of cutting with the grain will make all future turning projects, including bowl turning, easier and safer. Learning these skills on small, easily acquired wood blanks for spindles is more cost-effective than working with bowl blanks.

After you have mastered the three basic cuts in woodturning, bead (convex cut), cove (concave cut) and the flat or filet (straight cut), you will easily transfer these skills to turning a bowl!

Spindle blanks

Start with spindle blanks about 1-1/2"- (4cm-) square and 10" (25cm) long (**1**). You can use most any wood available to you, green or dry, preferably with relatively straight grain and free of knots and figure. I prefer a relatively soft wood like pine or poplar. Construction-grade pine works well and may be available to you as the common 2" x 4" in your local home center, depending on your region of the country. Eight quarter poplar from a lumber yard may be another relatively inexpensive alternative. Rip your lumber to size with a table saw, hand saw, or bandsaw.

1. *Prepare a stack of 1-1/2" × 10" practice blanks from pine or poplar.*

2. *Use a four-prong drive center (left) in the headstock and live center (right) in the tailstock.*

3. *Center finding jigs are inexpensive and quickly locate mounting points.*

4. *An awl or center punch creates a registration mark to ensure the lathe centers seat in the correct location.*

5. *Seat the drive center prongs with a wood, plastic, or hard rubber mallet. The prongs need only dent the endgrain—in soft wood, this requires little effort.*

6. *Mount the stock on the lathe, capturing the blank with snug pressure from the tailstock quill. Resist the temptation to over-tightening the quill.*

Turn between centers

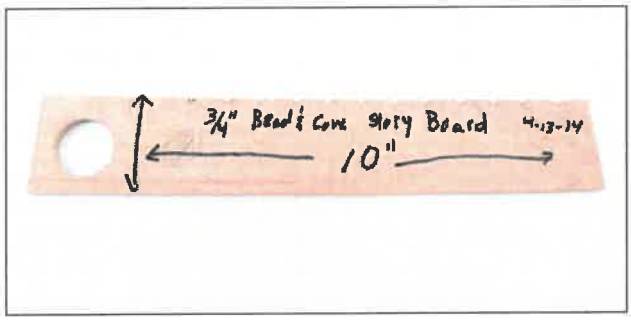
Mount a blank on the lathe between centers using a drive center and a live center. Mounting between centers provides a secure hold and is less complicated than mounting a bowl blank. New lathes typically come with a four-prong drive center and a live center (**2**). Use a pencil to mark the center on each end of the blank using a center finder or by drawing lines from corner-to-corner (**3**). Mark the center with an awl or a spring-loaded center punch (**4**).

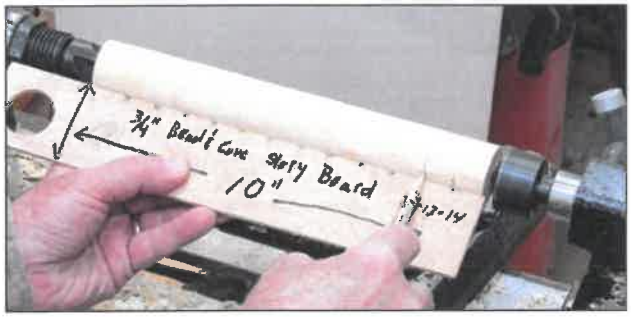
Stand the blank on its end on a solid surface and use a mallet to seat the drive center, registering the prongs in the endgrain (**5**). Do not use a metal hammer or you will damage your Morse taper and possibly your lathe spindle. Hammering the blank onto the drive while the spindle is mounted in the headstock risks damaging the spindle bearings, especially on mini and midi lathes.

With the drive center's location established, mount the practice blank between centers, bringing the tailstock up and snugging the live center against the end of the blank with the quill (**6**).

Adjust your toolrest so the gap will be no more than about 1/4" (6mm) and at a height that will put the cutting edge of your gouge at or slightly above center. The end of the toolrest should extend at least 3/4" (19mm) beyond the end

7, 8. *Use a spindle roughing gouge to knock off the corners of the blank and bring it to round. Stop the lathe and move the toolrest as necessary. When the back of the gouge can ride on the revolving blank without bouncing, the blank will be trued and round.*





9, 10. *A storyboard introduces speed and consistency to the repetitive task of marking features. Rigid cardboard will do, but thin plywood will better resist wear.*

of the blank to prevent your cutting tool from sliding off the end of the rest during a cut.

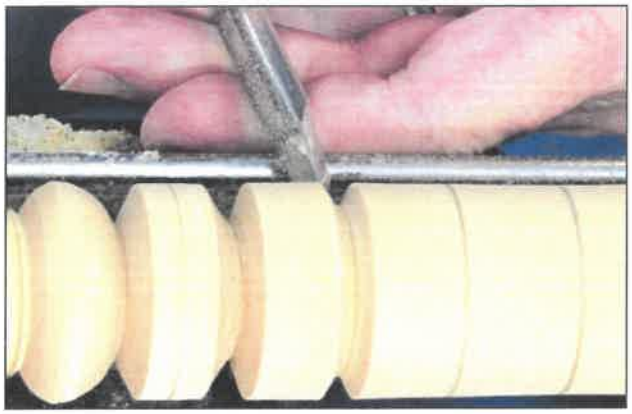
Rough the blank

A lathe speed in the range of 1,500 – 1,800 rpm is about right for roughing a cylinder out of a blank of this size. If your lathe vibrates excessively, reduce the speed until the lathe runs smoothly. Use a spindle roughing gouge (SRG) to round the blank (**7**). You can round small cylinders with a skew, a bowl gouge, or a spindle gouge, but an SRG is the most efficient tool for this task. You can test for roundness by touching the back of the tool against the spinning wood. The tool will bounce if there are still flat surfaces on the blank, and will ride smoothly when the blank is round (**8**).

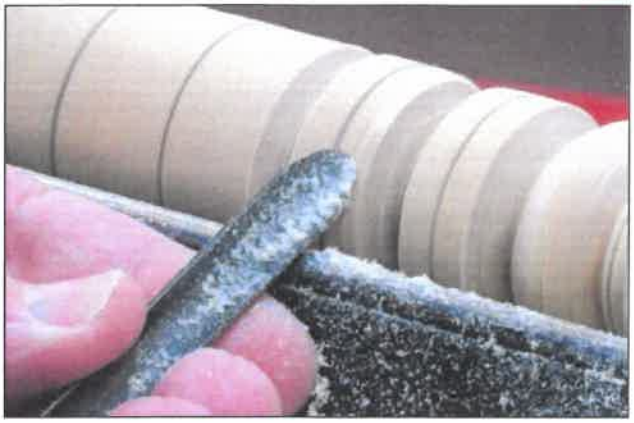
Use a storyboard

You are going to turn a lot of these bead-and-cove sticks, so I recommend a storyboard (**9**). The storyboard should have notches at 3/4" intervals. This will make consistently marking your blanks for 3/4"-wide beads fast and easy (**10**). Once you have the blank turned round, use a pencil and the storyboard to mark off a series of 3/4" beads.

Using a skew, make a vee cut at each pencil mark to locate the side of each bead. Use the long point, starting the cut with the skew in a vertical position. Then take small alternating cuts to enlarge the vee on each side (**11**). Start the cut and move the handle away from the cut ever-so-slightly so the bevel will follow the vee. Do not try and cut more than 1/16" (2mm) at a time or you risk stalling your cut. Make the finished vees about 3/8"- (10mm-) deep. Now take your pencil and mark the center between the vees; this will be the bead tops and the lines will help you maintain the symmetry of the bead.



11. *Cut a vee groove on each line to about 1/4" – 3/8" deep using a skew. Alternatively, you could mark with a parting tool.*



12. *Start shaping your bead by cutting near the bead edge with the bevel rubbing the wood.*

13. *The bead cut ends with the gouge on its side in the bottom of the vee and the handle at about a 45 degree angle to your body. This keeps the bevel in contact with the side of the bead all the way to its base.*

Turning beads

A 3/8" spindle gouge works best for turning these beads, but a 1/2" gouge will work. A fingernail profile will make help you reach into the narrow space between beads. Avoid the flatter profile spindle gouges—typically called Continental gouges—that come with some woodturning sets; those gouges make this exercise difficult.

You are learning cuts without the pressure of completing a project, so enjoy the activity! With the blank round, and the lathe off, adjust the toolrest to reduce the gap with the wood to about 1/4". With the blank trued and spinning smoothly, increasing the lathe speed to about 2,400 rpm will produce a cleaner cut, but keep the speed lower if your comfort level lies below that threshold.

A bead of this size should not be attempted in a single cut. Instead, cut a series of increasingly wider convex curves until your last cut starts at the center peak and ends in the valley. Start cutting at the edge of the bead—adjacent to one of the vees you made in the earlier step—starting each cut progressively closer to the center with each successive cut.

Hold your spindle gouge with the tool horizontal, flute up, so that the tip of the gouge just contacts the top of the bead (**12**). As you push forward with the cut, you will gradually lift, twist, and swing the handle. With deeper cuts, you will be swinging your handle through the arc toward the vee cut at an increasing rate, as the tip of the gouge gets closer to the bottom of the vee, ending with the flute facing away from the bead (**13**). If you are cutting the left side of a bead, the tool handle will start at 90 degrees to the lathe bed but finish at almost a 45 degree angle across your body.

Failure to keep the bevel on the curve by swinging the handle will result in flat sided beads. This is why a relatively short handle on a spindle gouge is desirable, as it will move across the front of your body. The cutting edge is not far off the toolrest, so you do not need much leverage. My spindle gouge handles vary in length from 7" to 10" (18cm – 25cm).

Coves

Use the SRG to flatten every other bead in preparation for turning coves. Presenting the SRG on its side offers a cutting edge that will easily create a flat surface (**14**). Use a pencil to mark a line about 1/8" in from each end of the flat to designate sides of the cove (**15**).

Switch to the spindle gouge and make starting cuts just inside the lines, widening the cove with successive cuts on each side. Think of a cove as an inverted bead. The tool presentation you used to end the cut on a bead is the same you will use to start your cut on a cove. Your tool will be parallel to the floor with the flute rolled over on its side pointing to the cove. The tool will be at about 45 degrees to the work at the start (**16**). Push into the cut and rotate the tool as it approaches the bottom of the cove. Take the cut with a scooping motion as you twist. Riding the bevel, lower the handle and push through the cut, ending in the center. The flute will always be facing the center of the bead (**17**). Repeat the cut from the other side.

Conclusion

Turn about twenty bead-and-cove sticks out of that 2" x 4" and you will develop the tool control and skills to confidently cut these features. Put a date on each spindle and toss it in a box. After a week, note your progress! For experienced turners who teach, try turning a bead-and-cove stick using your non-dominant hand. It will help you teach the nuances that you know but overlook! It can make you a better turning instructor, as well as a better turner.

Mike Peace is active in three woodturning chapters in the Atlanta area. He is a frequent demonstrator and regularly uploads woodturning educational videos to his YouTube channel, Mike Peace Woodturning. Before retirement, Mike worked as a software project manager. After serving on active duty in the U.S. Army, he continued service in the reserves, retiring with the rank of Lieutenant Colonel. For more, visit mikepeacewoodturning.com.

14. *Presented on its side, the SRG quickly flattens beads in preparation for cutting coves.*

15. *Mark the edge of the coves about 1/8" in from the beads.*

16. *The cove cut starts with the gouge on its side, flute pointed towards the cove interior.*

17. *At the cove bottom, the flute points up.*

Brief Description of the Project and/or Project Strengths:
- An easy, quick project
- Requires minimal tooling
- Fun to use
- Inexpensive, requiring very little wood

Suggestions for Simple Decoration:
- Decorating with wire burners
- Coloring with dyes and markers

Estimated Time for Instruction:
- 10 to 15 minutes

Estimated Time for Participants to Complete:
- 15 to 25 minutes

Project Materials Needed for Each Participant:
- 1.5" x 1.5" x 5" dry hardwood cut with parallel ends

Tools and Accessories Needed for Each Participant:
- Drive center
- Ball-bearing tail center
- 3/4" spindle roughing gouge
- 3/8" spindle gouge
- Parting tool

Materials and Accessories Needed for Use by the Group:
- Center punch
- Mallet
- Abrasive paper in various grits
- Friction polish
- Finish rag

Advanced Preparation Needed by the Instructor:
- Prepare the turning blanks by cutting straight grained wood 1.5" x 1.5" x approximately 5" long.

Procedure

1. Mount the turning blank on the lathe. Draw diagonal lines across the ends of block to find the center, then mark the center with a punch. Mount the wood between the drive center in the headstock and a ball bearing tail center in the tailstock.

2. Remove the square corners. Set the lathe speed at about 1500 RPM. Starting approximately 2" from tailstock, and using a spindle roughing gouge, rough turn the blank into a cylinder shape. Move the spindle roughing gouge towards the tailstock. Make sure you explain the reason for the direction of cut and placement of tool rest. The tool rest should allow roughing gouge to cut slightly above center.

HANDOUT

Finger Spinning Top

OVER

Finger Spinning Top

Spinning top blank with turned Morse taper secured in headstock

Alternative chucking method — turning block glued to waste wood which is attached to the faceplate

3. Layout the sections of the top. While the lathe is running, mark a pencil line on the cylinder approximately ¾ inch from tailstock end.

4. Turn a Morse taper to fit in the headstock. Using a Morse taper drive center as a guide, shape a taper from the line on the tailstock end of the blank to the headstock end. This taper should match the Morse taper used in headstock. This can be done easily by trial and error, or use calipers for measurements and a parting tool. When the taper is formed check the fit into headstock spindle. It should fit snug with at least ½ inch of contact into spindle.

5. Mount the top blank for final turning. Bring the tailstock forward and align the live center with the center point of the blank. Knock out the drive center from headstock spindle and snug the taper of the cylinder into the spindle. Back off the tailstock and give a few quick raps with a mallet to better secure the block. Turn on lathe and check for trueness of cylinder, re-cut true cylinder if needed. Next, mark a line on cylinder ½" up from tailstock end.

NOTE: An alternative method for holding small projects is to use a faceplate with a glue block attached. Workpieces can be fastened to the glue block with CA glue or regular wood glue. This can be safer than a chuck and sometimes more secure. The tailstock may be brought up for extra support.

6. Form the base of the top. Using the spindle roughing gouge make downhill cuts to rough form base of the top.

7. Turn the handle. Mark a pencil line ⅜" above the tapered base. Using a ⅜"spindle gouge cut downhill toward the headstock and form a vee groove to ¼" diameter. Mark a pencil line 1" above the groove and using a spindle roughing gouge tilted slightly toward tailstock, cut a tapered handle to intersect the v groove. Continue to taper this handle until you have a pleasing proportion to the tapered base of the spinning top.

8. Make the finish cuts and forming the tip. Cut a slight crown on top of the handle. Back off the tailstock and using light cuts with 3/8 spindle gouge form a sharp point on the end of the base. The angle to this cut may be 45 degrees or greater. This is the tip which the top spins on.

9. Sanding the top as needed. Sand any sharp edges or round over any desired surfaces except the very tip of the base.

10. Apply the finish. Friction polish applied while the lathe is rotating works well.

11. Remove the top from the lathe. Separate the top from block using a pull saw and sand off any nub, or separate it using a 3/8 inch spindle gouge.

12. Give it a spin. The top should be ready to use.

Brief Description of the Project and/or Project Strengths:

- Inexpensive
- Good introduction for use of basic spindle turning tools
- Good for training the eye to see the classic egg shape
- A challenging project to do well, better for adults than children

Suggestions for Simple Decoration:

- Coloring with markers or dyes

Estimated Time for Instruction:

- 10 to 15 minutes

Estimated Time for Participants to Complete:

- 20 to 30 minutes

Project Materials Needed for Each Participant:

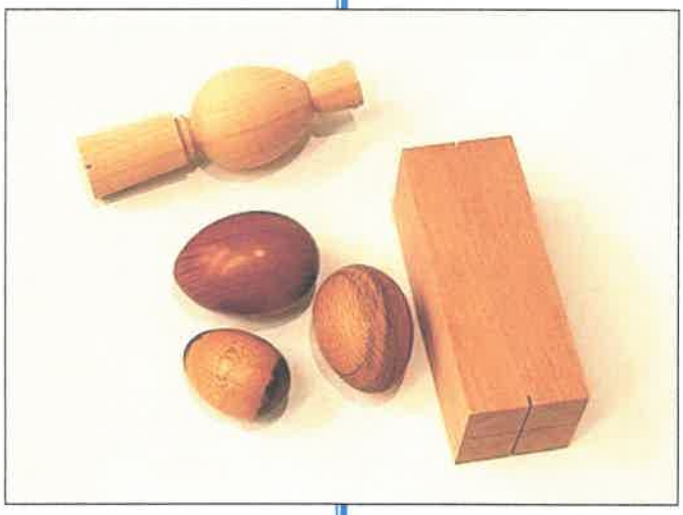
- 2" x 2" x 3.5" straight grained wood

Materials and Accessories Needed for Each Participant:

- Drive center
- Ball-bearing tail center
- 3/4" spindle roughing gouge
- 3/8" spindle gouge
- Abrasive paper in various grits
- Finish such as friction polish or oil
- Finish rag

Advanced Preparation Needed by the Instructor:

- Prepare the turning blanks by cutting straight grained wood approximately 2" x 2" x 3.5" long.



HANDOUT

Wooden Egg

OVER

Wooden Egg

Procedure

1. Mount the turning blank on the lathe. Use a drive center in the headstock and a ball-bearing tail center in the tailstock.

2. Remove the square corners. Use a 3/4" spindle roughing gouge. A peeling or planing cut works well for this.

3. Shape the spindle as desired. Rough shaping can be done with the 3/4" spindle roughing gouge. Finish shaping should be done with the 3/8' spindle gouge. Work close to each end of the egg but leave about 1/4" diameter of wood for support during sanding and finishing.

4. Sand the apply finish to the egg.

6. Remove the spindle from the lathe. Turn the wood at each end of the egg to about 1/8" diameter and about 1/4" long, then remove the egg from the lathe. Break off the waste wood on each end or cut it off with a small hand saw.

7. Sand and finish the ends of the egg. Hand sand each end of the egg and apply finish as needed.

8. Admire your turned wooden egg. It can be the beginning of the a great collection of turned eggs.