WOODTURNING FUNDAMENTALS

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AAW | AMERICAN ASSOCIATION OF WOODTURNERS
WE ARE TEACHING THE WORLD TO TURN

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Alan Carter

Sam Angelo

Joshua Friend

Cover: A multitooth drive center powers a bowl mounted between centers. Kurt Hertzog, photo. *See page **5** for more on this topic.*

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222 Landmark Center
75 5th Street W.
St. Paul, MN 55102-7704
651-484-9094
Toll free: 877-595-9094
memberservices@woodturner.org
woodturner.org

The AAW strives to cultivate an organization built on mentorship, encouragement, tolerance, and mutual respect, thereby engendering a welcoming environment for all. For more, tiny.cc/AAWDiversity.

Turn it up!

Although facegrain turning and bowl production have held a place in woodturning for centuries, until the modern woodturning movement blossomed a few decades ago, most woodworkers turned out spindle work. The skills of spindle turning are truly foundational, underlying the best tool control habits and understanding of wood grain that we carry into facegrain projects.

Woodturning skills are built on repetition and muscle memory. As a new turner, there is no way around having to pay your dues. Turn a practice spindle covered in beads and coves, wipe it all out with a spindle roughing gouge, go back and do it again. And again. And again. And again.

There are several articles in the AAW archives about tool handles, but few about turning one specifically for a woodturning tool. Sam Angelo walks us through his approach (page **9**). Handle turning illustrates that even a simple project offers opportunities for personalization, and the obvious place to make a personal statement is with the visible and functional ferrule. Tim Heil shows off some of his favorites (page **14**).

Manufacturers have developed a multitude of ways to drive wood on the lathe. The concept is simple enough, but the choices can be bewildering, and Kurt Hertzog provides a helpful guide to understanding the options and their applications (page **5**).

Thanks to an abundance of marketing hype and confusing labeling, choosing a finish can be a frustrating experience. Mark Palma continues his finishing series with a DIY approach and a list of shopmade oil-based finishes (page **29**).

A few seconds of an off-balance chunk of wood spinning at blinding speed before our eyes leads most woodturners to the speedy conclusion that Personal Protective Equipment is a good thing. So we don safety glasses at the least, though a full faceshield is a better idea. But other systems, like our lungs, need protection too. Steve Forrest takes a look at the options, beginning on page **36**.

And it is not just our lathes that generate safety concerns. If a grinder wasn't part of your shop before purchasing a lathe, it will almost certainly be afterwards. Ceramic wheels come with a list of potential hazards, but John Kelsey argues persuasively that the newer CBN wheels come with their own concerns (page **41**). John offers some easy shopmade solutions to two risks associatied with common CBN set-ups.

We have three additional projects in this issue to keep you busy. John Lucas leads us through a clever solution to a real world problem encountered in repairing a chair spindle (page **17**). Josh Friend demonstrates a classic spindle turning project that is as functional as it is beautiful (page **21**). And Pat Thobe takes us from inspiration-to-execution with her intriguing tree fungus bowl (page **25**).

Finally, we continue our exploration of intriguing timbers for turning with a brief examination of madrone (pages **42** and **45**).

I have been in the background at the AAW for many years, serving as a freelance editor for Josh Friend and Betty Scarpino, and as a contributor to *American Woodturner*. I express my appreciation to previous *FUNdamentals* editors Linda Ferber and John Kelsey.

I welcome your ideas and contributions to this journal.

Don McIvor, Editor
Woodturning FUNdamentals

Drive centers

by Kurt Hertzog

In spindle and some facegrain turning, the work is driven and held captive between centers. Every drive center is engaged with the work in a temporary and non-fastened method.

Most spindle and some facegrain turning can be done with one of four categories of drives: two-spur, four-spur, multitooth drive (MDC), and safety center drives.

Most drive centers are available in various Morse tapers as well as versions to be clamped into a four-jaw chuck. I find that I have use for all of the types of drive centers covered here.

In addition to the most common drive centers, you will encounter pin chuck drives, friction drives, screw drives, and mandrels. As your turning tasks become more diverse, you'll probably find cause to add a few of these specialty drives to your collection.

Chucking a bowl blank between centers offers tool access around the form and allows you to balance grain patterns or align the rim (on a natural-edged form, for example).

Two-spur (left) and four-spur drive centers.

An assortment of four spur drives. Whether taper or chuck mounted, all feature adjustable center points.

Two-spur drive centers

The two-spur drive has two spurs or "wings" to engage the blank. Most have an adjustable center point, allowing the drive center point to be tailored to the density of the blank material. Removing the point makes it easy to re-sharpen, but these centers are always used with the point set in place.

The most common use for two-spur drives in my shop is for driving green wood bowl blanks between centers. I will prep bowl blanks between centers to turn to round, complete the rough outside shaping, and cut the tenon for a chuck mounting or a flat surface for a faceplate. The two-spur model excels in green wood. With the spurs parallel to the grain, it engages the wood with less tendency to bore into the blank like a drill bit. Its use is limited in dry wood, where it tends to act like a splitting wedge, especially in end grain.

Four-spur drive centers

The four-spur drive center is the default driver included with many lathes. The four-spur will work for nearly anything provided it can be engaged into the end of the work piece. For dry wood turned on its long axis, this often requires the four-spur to be driven into the end grain. Whack the Morse taper end of the four-spur into the work to seat the center point and engage the spurs with the wood. Use the closest wooden driver of your choice—a mallet, a 2 x 4, or handy billet from the firewood pile.

But *never* strike a metal drive spur with another piece of metal. This is potentially dangerous and will also peen-over the end of the Morse taper. This in turn will interfere with the fit of the drive in the lathe, and can easily damage the inside of the lathe's Morse taper spindle—an expensive repair.

Four-spur drives tend to spin in green or soft woods. Whether the work is in facegrain or endgrain orientation, a two-spur drive will usually perform better than a four-spur in these situations.

As with the two-spur center point, the length of the center point in a four-spur drive should be adjusted based on the turning stock.

The author's collection of MDCs including an MDC-style revolving tail center. Whether taper or chuck mounted, all work the same and are incredibly versatile.

Multitooth drive centers

The MDC (Sorby's Steb is a well-known example) has a spring-loaded center pin with an outer circle of small teeth to engage the work. Advancing the tailstock center compresses the MDC's center pin and engages the teeth in the wood. By varying the tailstock pressure, the drive can be engaged lightly-to-forcefully.

One of the advantages of the MDC is the ability to manipulate a blank without turning off the lathe. Retracting the tail center sufficiently to disengage the teeth, yet maintain the center point engagement, allows the workpiece to be stopped by hand to gauge progress with the lathe still running. Further tailstock retraction allows the blank to be removed from the lathe. This same technique allows for loading and unloading by simply retracting or advancing the tail center with the work held only between the points. For the professional turner, this improves production efficiency, saves energy, and reduces wear on the lathe.

This drive center, like the others, is available in a variety of sizes to meet a range of applications. MDCs work best on dry or dense wood with a flat surface to engage.

A safety or ring center drive

Safety centers

The safety center goes by several names, including friction or ring-drive center. It has a center point, often adjustable, with the fixed outer ring providing the drive force through friction. Much like a lightly engaged MDC, the safety center slips against the work in the event of a catch. The turner can regulate the amount of force needed to cause the drive to slip by varying the tailstock pressure. For new students and particularly students working on their skew chisel skills, having the work stop while staying securely on the lathe eliminates much of the fear factor. Functional and useful for all turners, this drive center is often provided with a new lathe. This makes for a much safer learning environment for all.

Kurt Hertzog is past president of the American Association of Woodturners, a Pen Makers Guild council member, and past chairman of the Rochester Woodworkers Society. He has had over 185 woodturning related articles published internationally since 2012. An avid turner in all areas, Kurt is particularly interested in pens and ornaments. You can see his work and published articles at kurthertzog.com.

Specialty drive centers

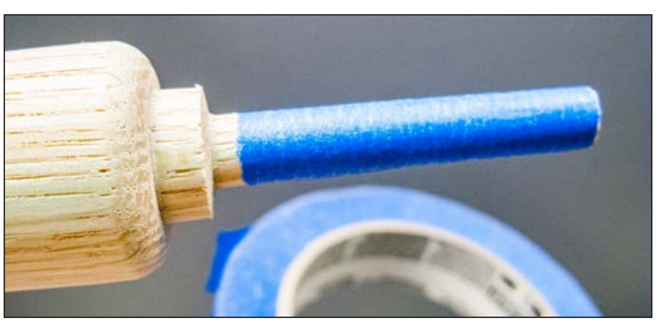
by Kurt Hertzog

This drive center excels at holding green wood. The adjustable spikes are helpful for aligning grain and rims in natural edge bowls.

Closed end and friction drives for spindle turnings can be store-bought or shopmade.

These drive centers mount quickly in chuck jaws, providing greater support for the drives than Morse taper drives.

A friction drive for small-scale work. A hole bored in the end of the spindle captures the drive spur.



The fit of a friction drive can be fine-tuned with tape. With the hole drilled first, the outside turning is always concentric to the hole.

A shopmade tool handle

by Sam Angelo

Turning a wood handle for a tool used in your own shop is an accomplishment you will enjoy for years to come. Every time you reach for that bowl gouge, parting tool, or scraper, it will remind you that your own hand played a role in its creation. Of all the machines and devices in our shop, a tool handle is one of the few items that we can easily make and use successfully. Made with beautifully figured wood, it can be a work of art, but plain, straight-grained scrap wood will perform just as well.

Turning tools are readily available with factory made handles. In fact, finding a tool without a handle was once a challenge. But in the past decade or so, highly engineered handles of metal or composites have become more common and this has motivated more tool makers to sell tool steel without a handle.

Those of us who prefer the look and feel of wood handles are benefitting from the growing abundance of tool steel options.

Choose a blank

Locating a suitable handle blank can be as simple as looking in your wood bin or buying a special piece of wood from your supplier. I have a ready supply of 2"- (5cm-) thick planks of seasoned wood in my shop for platter projects. From this stash I select a 2" x 2" x 18" (46cm) ash blank. The tool is a Thompson 5/8" (15mm) spindle gouge (**Photo 1**).

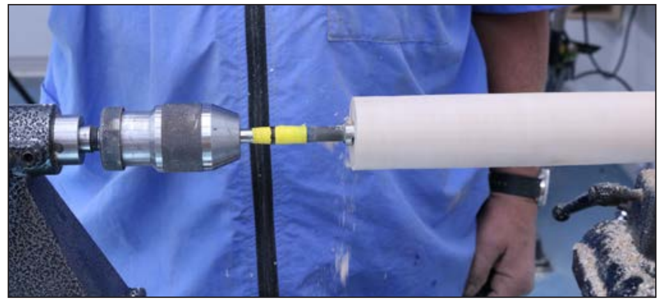
Rough the blank

I reduce the blank with a spindle roughing gouge (**Photo 2**). I must decide the overall

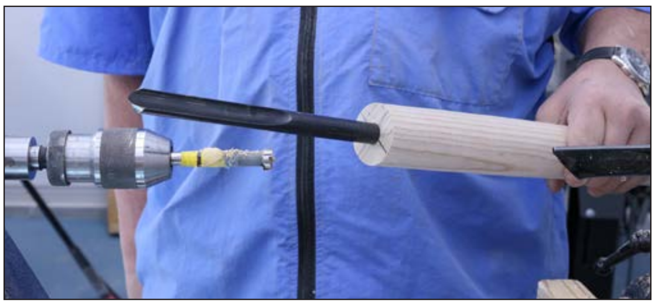
1. *Locate the centers and mount the blank between the headstock and tailstock.*

2. *Use a spindle roughing gouge to reduce the blank to round.*

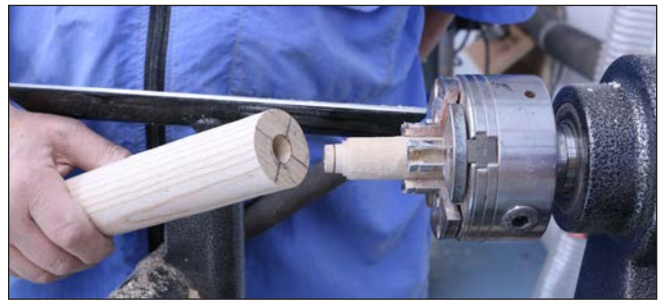
3. *Work from the center out towards either end of the blank.*



4. *Use a drill chuck to drill a hole for the tool steel.*



5. *Test fit the steel before shaping the handle.*



6. *A shopmade friction drive turns the blank.*

dimensions of my handle, how I will use it, and what design features I will add that will best meet the requirements for form and function. Perhaps the most important consideration is how comfortable the handle will feel in my hand.

I decide to use as much of the 18" length as possible. This is plenty long for a spindle gouge that will be used mostly for detail work. I measured several tool handles in my shop and settled on the largest (1-7/8", 48mm) and smallest (1-3/8", 35mm) diameters for the handle I am making.

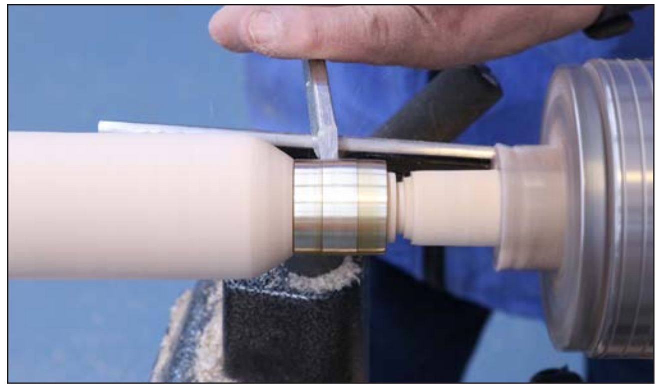
I continue to take off the square corners of this ash blank. I work from the center out-toward each end of the blank, finally finishing up at the center (**Photo 3**).

Ready, set, drill

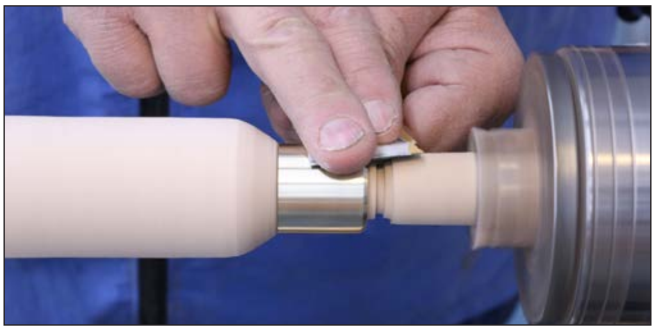
I choose to drill the blank between centers (**Photo 4**). The blank will need a 5/8" hole to accept the tool steel. This tool has a 2" mark to indicate how deep it should be seated. I secure the appropriately-sized Forstner bit in a drill chuck, with the bit marked to indicate the proper depth. As a check before committing my handle blank, I drilled a test hole in scrap wood to make sure the drill bit matches the diameter of the tool steel, with just enough room for a pressure fit and space for glue squeeze-out. I am using a safety drive in the headstock Morse taper. Another option would be to secure the blank in chuck jaws after turning a spigot on the bottom end.

I drill the hole to depth and test fit the steel (**Photo 5**). It is time to reverse the blank and turn my handle to the desired shape. I use a shopmade friction drive turned from a short section of dowel with a tenon to fit the 5/8" hole bored for the tool steel (**Photo 6**). Turning a slight taper on the end of the over-sized tenon and then holding the 5/8" opening over the rotating taper will create a burnish mark. Pare the tenon down to meet the burnish mark and establish a snug drive. I bring up the tailstock live center to support the handle's end.

7. *Verify that your ferrule will leave enough wood for support.*



8. *Gently use a parting tool or scraper to reduce the ferrule to round and integrate it with the wood handle.*



9. *Sand the ferrule through 1000 grit abrasive for a high polish.*

10. *Set the handle dimensions with outside calipers and parting tool.*

The ferrule

A ferrule helps bolster the strength of the connection between the tool steel and the wood handle, and, most importantly, prevents the handle from splitting in use. I have chosen a brass plumbing fitting for this project, making sure it is sized to leave adequate wood between the tool steel and the ferrule wall (**Photo 7**). The inside dimension of the brass plumbing connecter at the largest diameter is 15/16". The fitting is also threaded on the inside, which is not a requirement but the threads will help secure the fitting when I apply epoxy in a later step. The simple drive chuck allows the blank to be removed and re-centered easily, so I can easily test fit the ferrule.

One advantage to using non-ferrous metal ferrules is that they can be shaped on the lathe. The octagonal section at the center of my fitting needs to be turned down to round. I first turn the square corners down using a narrow parting tool (**Photo 8**).

I then switch to a wider tool (beading, parting, or scraper) and cut slowly. Frequent sharpening is a must and a lathe speed set around 2000 rpm works best. Be patient and take small bites, first with the narrow parting tool and then while cleaning up the surface with the wider tool. I remove tool marks with abrasives, beginning with 320 grit wet/dry paper and ending with 1000 grit (**Photo 9**).

Shape the handle

I establish the location of minimum and maximum diameters on the handle and, using a parting tool and calipers, set the depths along the handle blank (**Photo 10**). I use a spindle roughing gouge to turn down to my depth marks and create a level surface and

11. *Reduce the blank to the set dimensions with a roughing gouge.*

12. *Shape the end of the handle with a spindle gouge.*

13. *Sand the handle to remove tool marks. The wood should retain enough texture to assure a secure grip; 180 or 220 grit should do it.*

14. *Secure the tool steel and ferrule with a two-part epoxy. Two-ton epoxy offers adequate open time and a strong bond.*

a continuous, flowing curve (**Photo 11**). I shape the end of the handle with a spindle gouge (**Photo 12**) but delay parting off until I complete sanding (**Photo 13**). A tool handle should not be too polished or it will be difficult to control, so sanding to 180 grit, or 220 grit if I am feeling indulgent, is adequate.

Glue-up

Double-check that the tool steel and ferrule fit easily into their places. Roughing-up the tool steel will give the epoxy a better grip, but avoid sanding the section of the steel that will be exposed. You can mark the set-depth on the tool steel with a piece of blue tape, then scuff the metal below that mark with a bit of 100 grit abrasive; not much is needed, just some surface scratches for the adhesive to fill. Two-ton epoxy provides a 20 minute open time and a stronger bond than quick-set epoxy (**Photo 14**).

Finish

A finish is more of an aesthetic decision than a functional issue for a tool handle. It is going to get used (hopefully), knocked around, probably dropped, and acquire a working patina. But I do like to apply one coat of oil finish to the wood. A surface-building finish (varnish) is apt to be too slick. Likewise, avoid wax as it too can make the handle slippery, and it will only wear off rapidly with use.

Increasing versatility

Those metal or composite tool handles I mentioned earlier typically come with a mechanical connection between the tool steel and the handle, making the cutting tools interchangeable with a single handle. This same versatility can be achieved with a wood handle by using a collet system, a set screw, or an adapter. Making a handle for one of these connectors requires only a slight variation on this project. The connector takes the place of the ferrule, and the handle needs to be drilled deep enough that all the tools sized for the collet will seat to the appropriate depth. While offering convenience and flexibility, the connectors can be pricey, but the trade-off is that one handle takes the place of many.

Turning your own tool handle is a natural fit for anyone looking for a project—we are woodturners, after all. It is a simple, straightforward project that can add a personalized touch to those tools you use every day in your shop. I bet you can handle it.

Sam Angelo began woodturning in 1988 using a borrowed lathe. He initially repaired furniture parts for his restoration business; then his interests expanded to lidded vessels, hollow forms, and decorative pieces. Sam's favorite projects incorporate hand-chased threads. He has produced 530 educational videos for his YouTube channel: wyomingwoodturner. View Sam's work and contact information at wyomingwoodturner.com.

More on the friction drive

Have a bored hole that is too small for your smallest chuck jaws? A friction drive will do the job of rotating the blank so that it can be cut. Best of all, a friction drive is a snap to make and costs nothing more than a piece of scrap wood.

To make a friction drive, start with a short piece of scrap spindle stock. A few inches are all that is needed.

The stock should fit in the jaws of your chuck. If not, mount the spindle scrap between centers and reduce the diameter at one end until you produce a tenon that fits in your chuck.

With the spindle scrap in your chuck, true the blank. Using a parting tool or skew chisel presented on its side, peel a tenon on the tailstock end to fit into the hole of the spindle you need to drive.

Sneak up on the fit, removing dust at the end for a tight connection. If you over-shoot your mark, here are a few tricks. Wet the drive tenon to swell the fibers. Wrap the tenon with blue tape. Put a coat of beeswax on the tenon. Or, insert a piece of shop towel between the drive tenon and mortise.

Fancy ferrules from everyday objects

Tib Shaw

by Tim Heil

A ferrule is critical to the strength of a tool handle. Without it, the tool steel will split the handle like a wedge the first time force is exerted along the grain. A ferrule supports the wood, which is sandwiched between the tool's shaft and the ferrule itself.

Ferrules can be made in your shop, found in the hardware store, or crafted from everyday objects. Copper tubing is a good choice; it is readily available, easy to cut, and strong. Copper shines when buffed, appears multicolored when heated with a torch, and develops an interesting patina after weathering.

I have turned several hundred tool handles out of forty different kinds of wood. Every handle needs a ferrule to prevent the grain from splitting.

Almost anything that can be wrapped around a tool handle can become a ferrule, as long as it is strong enough to support the wood. I have looked beyond the commonly used materials to find interesting alternatives.

The right ferrule is a jewel on any tool handle.

Tim Heil has been a member of the Minnesota Woodturners since 2001. A version of this article originally appeared in the April 2011 edition of American Woodturner.

Photos by Jordan Schroeder, unless indicated.

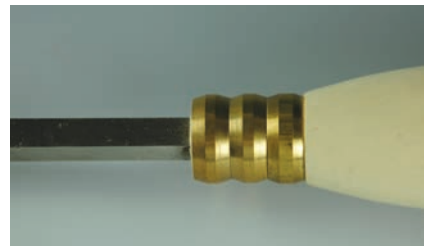
I used a pipe cutter to add a shallow cut to the end of a copper ferrule.

I salvaged this brass ferrule from a worn-out garden hose.

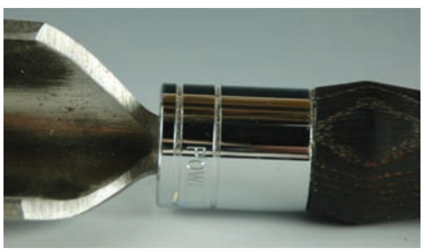
This ferrule started out as a tip used for frosting cakes.

A spacer-lug from a truck tire becomes a sturdy ferrule.

I cut this ferrule from a textured bathroom towel bar.



This ferrule is made from three brass natural-gas fittings.



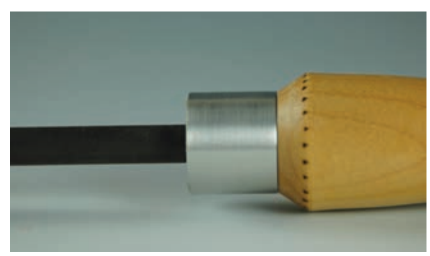
Sockets have a durable finish, are inexpensive, and come in a variety of sizes.

Ball bearing chases are made in many different sizes; I find a variety of uses for them.

Springs make excellent ferrules because they are strong and attractive.

This ferrule is a bushing from an electric motor shaft. They come in a variety of sizes.

A stainless steel ferrule from pipe that I salvaged from a boat. Stainless steel is hard to cut but it is strong and looks good with any wood.



Aluminum is easy to cut and readily available—it is a good starter ferrule.

Easy chair spindle repair

by John Lucas

If you are a woodturner, sooner or later someone will ask you to fix a broken chair spindle. This is the top of a slippery slope. I do a fair amount of antique repair that usually involves disassembling the chair. When taking a chair apart, it is not unusual for another spindle to break from age and fragility; now there are two spindles to fix. On antique chairs with any value, even knowing the likelihood of breaking another part, this is still the way I approach the project.

I also get approached by relatives and friends with this request, and often the chairs they bring aren't worth the expense of the repair. But because they are friends, I find myself saying, "Sure, I can do that." That is exactly what led to my scarf joint repair technique. This is an easier fix than disassembling an entire chair (though I sometimes remove the seat). It is not the approach I take for a valuable antique, but it is perfect for a quick and sturdy repair job.

Save the pieces

First, I remove what is left of the old spindle and keep it as a model for the new one. I try to keep the old spindle as intact as possible, but quite often one or both tenons are broken in their mortises, so I dig or drill out the broken parts that are left in the leg. A trick worth trying is to drill into the broken part, screw in a lag bolt, and heat the lag and the joint with a heat gun. On a good day this softens the glue enough that I can pull the broken tenon out with a pair of pliers. This works about half the time.

The rest of the time I have to drill out the debris. A chair obviously won't fit in the drill press, so a hand drill is the tool of choice. Most drill bits are too long for this task, so I purchase a spade bit and shorten the shank (**Photo 1**). With my smallest hand drill, I can usually fit between the chair rungs and drill it out the tenon. Chiseling or carving away some of the broken material is sometimes helpful to establish a good surface for the center of the drill. I take careful measurements and mark the dead center of the spindle stub. Eyeballing the angle of the drill works well enough and I drill and clean out the mortise hole (or holes).

Prepare the stock

With the chair ready for its new part, it's time to make the spindle. With the chair fully assembled, it is impossible to defy the laws of physics and squash a long spindle into the short span between the legs. This is one of the beauties of the scarf joint. The scarf joint allows us to cut the spindle at an extreme angle and then glue it back together. For this project we will create the scarf, temporarily glue the joint together, turn the spindle, take it apart, install it, and glue it back together.

1. *Shorten a spade bit (bottom) to drill in tight spaces.*

*From timber framing to furniture repair, a **scarf joint** overcomes the challenge of joining two pieces of wood endgrain-to-endgrain, an otherwise weak joint. Cutting two matching tapers exposes more long-grain fibers to the adhesive, achieving a joint far stronger than a butt joint. Carefully executed, the scarf joint can be nearly invisible.*

2. *Cut the scarf joint in square stock. A decent table saw blade should leave a glue-ready surface. Note the stock is taped or glued to the sled to keep fingers well away from the blade.*

3. *Use a paper joint to reglue the scarf. This clever use of clamps keep the joint from sliding apart before the glue dries.*

I select a piece of stock of the same species as the chair, and just a little larger than my final target diameter. Straight grain is best, and if the grain runs all the way through the blank from end-to-end, all the better. I cut the blank at a pretty extreme angle—less than 45 degrees, but the actual number doesn't matter. The idea is to get that long glue surface. The easiest way to safely accomplish this task is to place a square piece of wood on the table saw miter gauge. I use double-sided tape or CA glue to hold the wood at the proper angle, then pass the stock through the saw (**Photo 2**).

A good saw blade leaves a glue-ready surface, and I glue the scarf together with a paper joint. I use a scrap of newspaper trimmed to fit the joint. I apply yellow glue to both wood surfaces and then put the joint back together with the paper in the middle. Clamping a joint like this is fun. Think of putting pressure on a lubricated tapered ramp. I put a clamp across the joint and tighten it just enough to touch both surfaces. Then I put a long clamp on the ends. Now I carefully tighten each clamp until the joint is aligned and tight. Watch the joint slip as you tighten each clamp and stop when everything is aligned (**Photo 3**). I leave the blank clamped overnight because the paper slows the curing.

Turn the replacement part

Time to put the lathe to use. I keep the old spindle close at hand to use as the pattern for the replacement. If the old spindle is intact, I can hold it against the new spindle and mark key features. Otherwise, I transfer measurements with a ruler and outside calipers. Getting the tenons to fit securely in their mortises is the critical step, so take your time measuring the mortises and carefully reducing the tenons. You will also need to measure the depth of the mortises to set the tenons to the correct length, as well as to determine the overall length of your replacement spindle. It is better to turn the spindle slightly short, which assures a good fit and allows space for glue to move inside the joint.

A roughing gouge quickly removes the stock's corners, and this simple spindle is quickly shaped to final dimensions with a spindle gouge or skew (**Photo 4**). I then sand to my

4. *Turn the replacement spindle.*

final desired surface. I try to approximate the quality of the finish job on the rest of the piece of furniture, which rarely necessitates sanding beyond 220-grit. At this stage, the scarf joint has all but disappeared. I usually apply the first coat of stain at this point. It helps cover up glue bleed-out later.

Separate the scarf joint

Remember how the scarf joint wanted to slip when it was first glue-up? The paper joint will now be disassembled, and it will want to slip again at the next glue-up. To stop the slipping, I drill a couple of holes the size of a round toothpick, perpendicular to and through the glue joint. I don't drill all the way through the spindle, just through the glue joint (**Photo 5**). These holes are used for alignment and to prevent slipping when clamping the final joint.

I split the paper joint by driving a knife down through the joint (**Photo 6**). I use a knife that I purposely dull for this operation. A sharp knife may split the wood and you only want it to split the paper (**Photo 7**).

I soak the joint with white vinegar and scrape off the glue and paper with the end of a chisel. Patience is the key here.

Fit the replacement part

Now I place the tenons in their mortises and hold the spindle together in the chair to check the fit of the tenons. It's not uncommon to have to shave the tenons with a carving knife to get them to fit and everything to align. The toothpicks help hold the spindle together while inspecting the fit (**Photo 8**).

5. *Drill for the toothpick dowels. The tape on the drill bit indicates hole depth.*

6. *Split the paper joint with a dull knife and mallet.*

7. *Clean the remnants of the paper and glue from the separated joint using white vinegar and scraping.*

8. *Test fit the spindle, using toothpicks to temporarily hold the scarf joint.*

9. *Glue the scarf joint and clamp until the glue dries. The author used an old innertube to place pressure on the joint.*

Once everything fits satisfactorily, it is time to glue the spindle back together. I use epoxy. This joint has a lot of endgrain, and in my testing I found that regular wood glue might not be strong enough. Also, hand drilling the chair legs and trimming the spindles with a knife may create a need for a gap-filling glue. Add to all this the challenge of having to glue two tenons and the scarf joint at the same time. The long open time of a slow cure epoxy is a welcome addition.

I remove the leg and apply epoxy to the scarf joint and to the tenon holes. I leave the toothpicks in place to function as little dowels. I install each spindle half into a mortise in the legs and then squeeze the Scarf joint together. I temporarily apply one clamp across the scarf joint to hold it together and clean off all the epoxy I can with a rag and alcohol. Once that's done, I wrap a bicycle inner tube tightly around the joint, remove the clamp, and wrap some more (**Photo 9**). I leave the toothpicks at their full length for now. If need be, I clean up more squeezeout around the tenons. Any epoxy left on the wood surface will cause problems later when trying to match the finish.

When the epoxy cures, I go back and sand or scrape off any glue residue and cut the toothpicks flush. I complete a final sanding and then start matching the finish—a challenge I will describe another time. The joint will be almost invisible at this stage and will be even further disguised by stain or finish. The replacement part in this project is in the top rail in front of the seat. Only a close inspection reveals the scarf joint. My customer (sister in-law) loved it and couldn't wait to show it off (**Photo 10**).

I haven't done any serious strength testing of these parts but I have kind of forcefully put my full weight on the chairs and haven't broken one yet. I hope this saves you some aggravation and lets you help a friend.

Retired photographer John Lucas has been working in wood for more than 35 years and also dabbles in metalworking. He enjoys modifying machines, making tools, and sharing his knowledge through written articles and videos. He has taught classes at John C. Campbell Folk School, Arrowmont, and The Appalachian Center for Craft

10. *The completed chair. The scarf joint in the top rung beneath the seat is all but invisible.*

Simple, elegant weed pot

by Joshua Friend

A simple and elegant way to bring nature into your home is to display dried flowers in a dry-bud vase, or weed pot.

At first glance, these vases look like small-scale hollow turnings, but the hollowing step is simply a hole drilled from the tailstock into the wood. The weed pot is not intended to hold water, although it is possible to purchase a glass tube to line the hole.

This straightforward project is ideal for practicing basic spindle skills. Project steps include roughing the cylinder, forming a chucking tenon, chucking to bore the stem hole, shaping the opening, and stabilizing the work with a live center in the opening to shape the outside, shape the foot, sand, and part off.

Stock selection

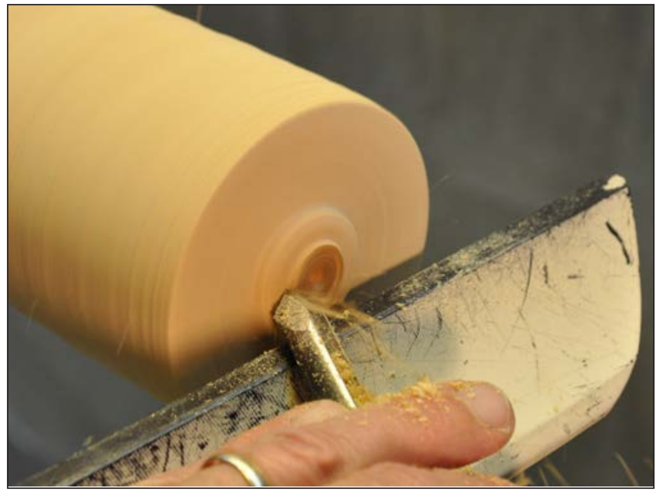
Almost any species of wood can be used, as long as it is sufficiently dry. To choose the size of your blank, imagine the height and width of your completed vase. Cut your blank slightly larger than these dimensions and add about 3" (8cm) to its length to give you ample working room near the chuck.

Prepare the blank

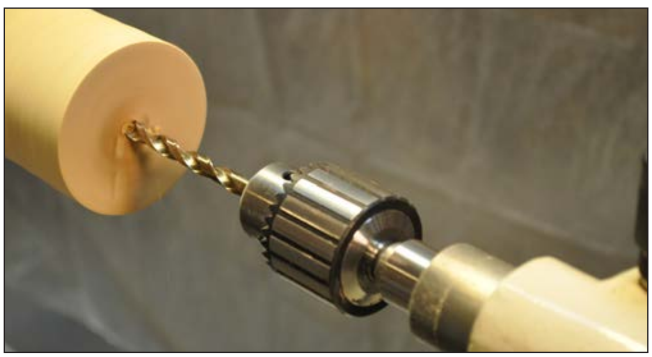
Mount the wood onto the lathe between centers and rough it to round with a spindle roughing gouge (**Photo 1**). Use a parting tool to size a tenon on the tailstock end to fit your scroll chuck jaws (**Photo 2**). The shoulder of the tenon should rest against the top of the jaws and its length should be short enough not to bottom out in the chuck. Remove the blank from between centers and mount the tenon in a scroll chuck.

1. *Turn the blank into a cylinder with a spindle roughing gouge.*

2. *Use a parting tool to form a tenon to fit your chuck.*



3 & 4. *Clean the endgrain. Slice across the end to clean up torn grain, finishing the cut with the tailstock removed. Mark the center with a skew point.*



5. *Advance the drill bit in stages, withdrawing frequently to clear chips.*

Clean-up the top

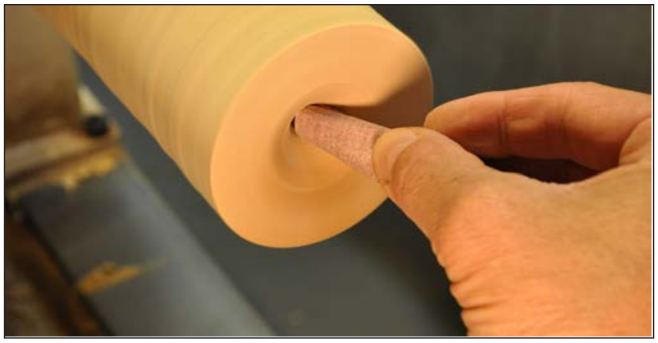
Bring up the tailstock for support and cut across the endgrain at the tailstock end to clean up any torn grain (**Photo 3**). A small bowl gouge offers easy bevel support for the cut, but you may prefer a spindle gouge or skew chisel. With the tailstock in place, you will not be able to cut all the way to the center. Cut as far as you can, remove the tailstock, and gently finish cleaning up the endgrain (**Photo 4**).

Using a skew chisel presented flat, make a small indentation in the center of the cylinder with the chisel's long point.

"Hollow" the center

A drill chuck in the tailstock ensures the stem hole is on center and parallel with the workpiece. Slide the drill chuck into the quill and chuck a 3/8" (10mm) drill bit. Bring the tailstock up so the drill bit is almost touching the wood and lock the tailstock. The same general rules apply for drilling here as in other drilling situations, except the wood is spinning and the drill bit is not. The larger the bit, the slower the wood should be spinning. Back the drill bit out often to clear the chips, being sure to hold onto the drill chuck if it has not been secured in the quill.

Turn the quill wheel to advance the drill bit into the spinning wood (**Photo 5**). The depth of your hole will depend on the height of your bud vase, but leave about 1" (25mm) thickness at the bottom so you don't end up with a hole in the vase after parting it off the lathe.



6. *Shape the vase opening with a sharp bowl gouge and light cuts, then sand.*

7. *A peeling cut is useful for removing material quickly.*

Shape your vase

With the drill chuck removed and the tailstock out of the way, use a small bowl gouge to take gentle, light cuts toward and into the hole. You will be cutting against the grain; if the wood does not cut cleanly, switch to a small round-nose scraper and lightly cut from the center toward the rim, with the grain. Use a small piece of rolled-up abrasive to clean up any frayed fibers around the hole (**Photo 6**).

The overall proportions of your vase are a matter of preference. I favor a narrow neck that flares at the top. Before starting to shape your vase, use the tailstock with a cone center for support.

To remove a lot of wood quickly from a cylinder, make a peeling cut with a skew chisel (**Photo 7**). It is easier to learn this cut using a small chisel than a wide one, which requires a heavier cut. The peeling cut is similar to that of a parting tool. With the handle down and just the bevel lightly touching the cylinder, ease the cutting edge into the wood by simultaneously lifting the handle up while pushing the cutting edge toward the center axis. This motion helps to keep the cutting action just under the surface of the wood as the diameter is being reduced. Imagine peeling the skin off an apple with a knife to visualize the dynamics of this cut.

Bead the top

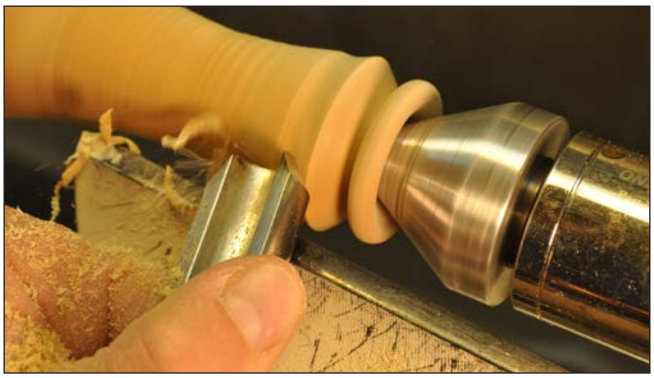
When the flare of the neck is a pleasing length and diameter, add a bead at the top of the vase. Visualize where the center of the bead will be and start your spindle gouge in that location with the flute wide open (facing you). Lift the handle slowly until the cutting edge engages and the bevel is rubbing. Twist the tool clockwise to begin forming the bead. To form the left side of the bead, make the same cut, twisting the tool counterclockwise (**Photos 8 - 10**). Make repeated cuts to refine the smoothness of the bead.

Add an angular cut leading to the base of the bead. Refine the top of the bead so it blends smoothly into the slope at the top of the vase

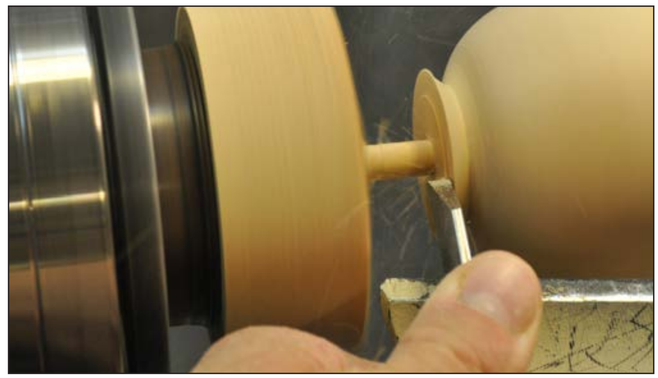
8-10. *Form a bead at the top of the vase. A revolving cone center makes it easy to turn and blend the bead down into the hole.*

11. *Add a transition between the bead and the neck of the vase.*

12. *Refine the opening of the vase using light cuts.*



13. *Cut in a downhill direction to go with the grain of the wood.*



14. *Give the foot a concave surface. Part off the vase with a small handsaw.*

(**Photo 11**). With the tailstock out of the way, make light cuts (**Photo 12**).

Shape the body

Using the cone center for support, shape and refine the neck and body of the vase. A small spindle-roughing gouge offers plenty of control on long gradual curves. Cut from larger-to-smaller diameter (**Photo 13**). Remember the hole drilled in the neck and leave enough wall thickness—in this case, no smaller than 3/4" (20mm). Use calipers to check your progress.

Take a peeling cut using a parting tool or skew chisel to provide more room to work on the bottom. Leave extra wood between the bottom of the vase and the chuck to act as a buffer between your tool, your hand, and the chuck. In this tight space, use a small spindle or detail gouge.

Sand & part off

After sanding the vase, use a parting tool to reduce the waste wood. Slightly undercut the foot to ensure the vase will sit flat on a table; lightly angle a parting tool to the right and using its top edge to cut the wood (**Photo 14**).

With the lathe off, use a fine-tooth saw to cut the vase off the lathe. Carve the nub off by hand and sand the bottom smooth. Apply finish.

All that is left to do now is find some attention-grabbing flowers to display and surprise that special person with your handmade bud vase.

Joshua Friend is the editor of American Woodturner. *A version of this article originally appeared in the April 2014 edition.*

Turn a tree fungus bowl

by Pat Thobe

Alan Carter

Turning a tree fungus sounds potentially toxic, but not if you do it the safe way--that is, turn a bowl with a tree fungus designed into the side. I nurtured this idea during walks in the woods with my dog, and turned my first tree fungus bowl about four years ago.

Having worked through the design issues, I have since turned many successful bowls exploring this theme. I will take you through a project-based approach to show you how to make your own tree fungus bowl.

Wood selection

For your first fungus bowl, consider a relatively soft wood such as poplar or Eastern red cedar. Both species take texturing details well. Poplar looks good with trunk texturing and cedar provides more natural variations in the wood of the trunk-textured bowl.

Crossgrain blanks, as I would use for a typical bowl, will offer more grain support for the carved fungi. The blank has to be large enough to accommodate both your finished bowl and the fungi that will be protruding from its side. For example, I used a 10" X 6" (25cm X 15cm) blank to produce a 6" X 4" (10cm) bowl with one of its fungi extending out 1-3/4" (4cm). Knots, holes and other defects can add to the natural look of the finished piece.

Shape the exterior

Mount your blank between centers. The base of the bowl should be oriented toward the tailstock. Shape the overall form of your bowl and put a tenon at the base. Then remount your bowl in a scroll chuck using the tenon. The bowl will remain in the chuck until you are ready to add detail to the fungi.

Shape the fungi rings

Delineate the top and bottom of both rings with a parting tool (**Photo 1**).

1. *Use a parting tool to define the rings and pare away the adjacent waste. This process also defines the exterior shape of the bowl behind the rings.*

On the underside of the fungus, a gentle curve from the side of the bowl into the ring looks best, rather than having the ring attached to the bowl with a sharp 90 degree angle. Continuing with the parting tool, remove the rest of the wood on either side of the rings. You want to maintain a continuous, flowing curve along the bowl's exterior through the base of the fungi rings. If you want a fungus that curves up or down, cut your ring approximately 1/2"-thick. Then use your spindle gouge to gently shape the top or bottom to form a curve (**Photo 2**).

Remove the ring waste

I cut out the fungus shapes before hollowing the bowl (**Photo 3**). Begin by marking off which parts of each ring will be a fungus and which parts will be waste wood. Also, decide how you

2. *Take gentle cuts with a spindle gouge to form a curved surface on the fungi rings.*

3. *After drawing the location of your fungi, begin cutting away excess ring material with a handsaw. Cut close, but not into the vessel's surface.*

Fungi design

There are several design factors to think about before making shavings.

- *Where to place the fungi*. The shape of your bowl will help you think about this. If the bowl is fairly straight-sided or even slightly enclosed, a fungus close to the rim should probably be relatively small so it does not hide a fungus closer to the base.

- *The shape of your fungi*. Search the Internet for images of tree fungus and you will see that there are an array of forms; some stick straight out from the tree, some turn upwards, some turn downwards, etc. You will want to shape your rings the way you want your finished fungi to bend.

- *How far out to protrude*. You will turn away the sides of the bowl leaving only the rings that will become the fungi. The depth of those rings will determine how far out your fungi will protrude.

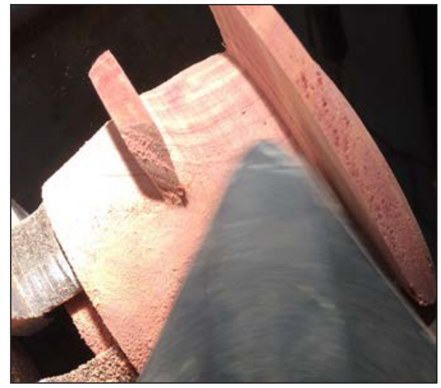
- *How far apart your rings need to be* in order to get between them with a carver, sandpaper, your fingers, and other tools you may be using. Farther apart, obviously, makes it easier. Closer together and you must love a challenge! I find that 3/4" – 1" (19mm - 25mm) is the minimum spacing.

- *Ring thickness*. The rings need to be strong enough to allow for shaping and carving. My rings are a minimum of 1/4"- (6mm-) thick, if they are going to stick straight out from the bowl. For those that will curve up or down the rings need to be up to 1/2"- (12mm-) thick to allow for undercutting the top or bottom for a curve. The size of your bowl will also influence the thickness of your rings.

For the sake of simplicity on your first bowl, I suggest starting with just two fungi rings. But, if you have a tall bowl or vessel, you might consider more rings.

4. *Use a coping saw to trim out waste in tight spots.*

5. *A rasp can remove a lot of waste quickly and can be used to add texture.*



6. *The pointed tip of a detail sander will reach into tight spaces and reduce hand sanding.*

want the base of each fungus to join the bowl. Many fungi grow in a gentle fan shape out from the tree, so I often follow that design.

Use the spindle lock to hold the form steady as you work through the next steps.

Beginning with a straight hand saw, such as a razor saw, cut away the bulk of the waste material from the rings.

As you continue to define the fungi, a coping saw lets the blade lay on its side and get between the top and bottom rings. It's often possible to get into tight spots while encircling another already-cut fungus (**Photo 4**).

Try to cut the waste wood as close to the bowl as possible without cutting into or marring the surface. This will reduce the amount of carving and sanding you will need to do later. A wood rasp also helps to smooth off waste wood, and may be the one carving tool you want to brush the outside of the bowl—it can give an interesting texture to the outer surface (**Photo 5**).

Once all of the waste wood is removed, I use an electric detail sander to continue to smooth the wood. This tool's pointed tip allows me to do detail sanding close to the fungi (**Photo 6**).

Hollowing

With the outside shaped and sanded, hollow the bowl's interior. A bowl gouge is the go-to tool for this step, but a scraper or one of its variations—a carbide tool or Oland tool—will also perform the task. Drilling a depth hole in the center of the blank helps clear chips and prevents me from turning through the bottom. Establish the thickness of the sides at the rim of the bowl and then maintain that thickness as you continue hollowing.

Sand the inside of the bowl.

Texturing

If the bowl is to have texture, now is the time. For a bark-like appearance I've used a Foredom tool with a reciprocating hand piece. This makes for a deeper, more textured bark appearance.

For more delicate bark I use a wire wheel in a hand drill, as was done for the opening image. However, the distance between fungi, particularly if they are stacked, sometimes will not allow a texturing tool to reach all areas. I have experimented with a wire brush or scratching with a nail, but with limited success.

The Foredom tool with a variety of carving bits is then used to put detail on the fungi, such as an undulating form, grooves, or uneven edges

7. *A powered carver efficiently adds realistic textures to the vessel's exterior.*

8. *A woodburning tool is another good option for adding realism to your fungi.*

(**Photo 7**). I have also used pyrography to put texture and detail on a fungus (**Photo 8**).

Coloring

In addition to widely varying forms, fungi also occur in an array of colors; and because tree fungi have an element of mystery, this is an opportunity to go beyond reality with your colors and designs. Using simple acrylic paints, I layer and blend paints until a satisfactory result is achieved.

Finishing

For finishing the outside, I like Krylon spray-on matte finish to give the bowl and fungi a more natural appearance. I also use this on the inside of the bowl, or sometimes opt for a glossier spray lacquer. On cedar, I first use a sanding sealer and then matte or glossy spray lacquers.

Head out for a walk in the woods and find your fungal inspiration.

After retiring in Asheville, NC, Pat Thobe joined the Carolina Mountain Woodturners and has been turning steadily for 10 years. She loves challenging herself to see how an idea will work on the lathe, and notes that with all the talent in the CMW, there is always someone to offer help.

Joining spindle techniques with a facegrain bowl project

It may seem odd to apply a parting tool or a spindle gouge to the outside of a facegrain vessel, but both tools have a place here.

Spindle gouges *are excellent for detail work on vessels. Their open form (in contrast to a deep bowl gouge) won't clog with shavings. Their shallow profiles and longer noses facilitate reaching into awkward spots where bowl gouges refuse to tread. And sometimes a sharp spindle gouge will be the only tool that will leave a good surface on confused grain.*

Use caution, however, as spindle gouges are lighter than their bowl gouge relatives. You won't be able to hang the tool as far over the tool rest without risking loss of control.

A ***parting tool*** *can be used in facegrain work for the same primary purpose it has in spindle turning--wasting lots of wood, quickly. Because of the way the grain orientation meets the cutting edge of this tool in the facegrain presentation, a fresh, sharp edge is critical. Still, a smooth surface may be hard to achieve, and a bowl or spindle gouge or scraper may be needed for clean-up duties.*

❐

Finishing hack: oil-based options

by Mark F. Palma

Finish management -- *Palma applies homemade oil-wax finish to an ambrosia maple bowl. Finishing is messy -- wear eye protection, an apron, and chemical resistant gloves, and cover the bench with butcher paper.*

Looking at the overwhelming number of commercially available wood finishes will most likely give you a headache, leaving you confused and empty-handed. Each claims to be the best, have miracle properties, and of course, rely on some secret formula. And they can be expensive. Search online and it's the same: postings and videos claim to know the perfect finish but you must follow their formula exactly, or face certain failure.

The truth is you can create a credible finish with ingredients you likely already have. We may not know exactly what is in those cans of miracle finish, but we can replicate their properties in the home workshop.

Why hybrid finishes

A hybrid finish blends the desirable characteristics of its ingredients. Oil makes the wood's figure pop and come alive, plus it's easy to manage in the home workshop, so it's the basis of most shopmade hybrid finishes. But rather than applying the oil, waiting 30 days for it to cure, and then top-coating with a surface finish (polyurethane, varnish, or wax), a hybrid finish might combine the oil and the surface finish into one application. For manufacturers, the goal is to create a one-step finish with properties that fuel your desire to buy. Reality often falls short.

Hybrid finish components

A hybrid finish usually combines a solvent, also called a reducer, with a surface finish such as varnish, an oil, or both. The solvent or reducer thins the finish to improve its working properties. The three most common reducers for oil finishes are mineral spirits (white spirits), paint thinner (a form of mineral spirits), and turpentine. Mineral spirits are an inexpensive petroleum derivative that are also available in a low odor formula. Paint thinner is a less refined petroleum-based product with a strong odor. Turpentine is derived from pine trees and has a distinct smell that people either like or want to avoid. All reducers must evaporate (or volatilize) before the finish cures. As they volatilize, reducers emit odors and some create a health risk in an inadequately vented shop.

Line up the usual suspects- *-mineral spirits, turpentine, and paint thinner are the go-to solvents (reducers) for hybrid oil-based finishes.*

The oils in commercially available hybrid finishes will be either hardening or non-hardening. Tung oil, boiled linseed oil, and heat treated walnut oil harden and will work as a base component in a hybrid finish. Mineral oil, orange or lemon oil, and anything labeled butcher block oil is non-hardening; they're temporary coatings, not finishes. Although they instantly enhance the grain and figure, they wear quickly, offer little protection, and may prevent other finishes from adhering to the wood, so avoid them.

What turners need

Most hybrid finishes are created for furniture, not woodturning. What works well on a flat tabletop may misbehave on a curvy bowl. Some commercially available hybrid finishes are too thick or too thin for turning; only a few are just right. Some cure quickly when exposed to oxygen and can harden in the container, wasting most of it.

For most turners, the eight desirable qualities of a hybrid finish would include:

- easy application in the home shop,
- pops the wood grain,
- manageable degree of gloss,
- flows well without being runny,
- manageable curing time
- will protect the work,
- easy to renew and repair,
- doesn't cost too much.

Ease of use in the home shop

All finishes have specific environmental conditions in which they will behave correctly. Temperature, humidity, and cleanliness are the key variables. Although all finish manufacturers will tell you an optimal range of conditions, the practical range for your finish can be learned only through experience. For example, applying a surface finish in a room where the temperature dips below 70F (21C) will extend the time before the finish hardens, increasing the likelihood of dust contamination and drips. Oils are more forgiving of drips and dust, although they do not cure quickly if the temperature is below 65F (18C).

Popping the grain and curing

All finishes enhance grain to some degree, but highly figured wood comes alive with oil. Oil has its greatest aesthetic impact in the first coat. That's why an oil-varnish hybrid makes a great first coat. Subsequent coats can skip the oil, reducing the risk of trapping oil and gumming up the curing finish.

That first coat of oil/varnish blend can take a week to cure. An oil/wax finish is more forgiving because the two components do not interfere with each other's curing process, but never try to combine an oil/wax and an oil/varnish finish or you will have a terrible mess.

Gloss

Oil by itself gives the wood a warm sheen but you would have to build up many coats to achieve any degree of gloss. An oil-wax hybrid finish builds up some gloss quite quickly without offering much protection. Instead, add a small amount of varnish to your drying oil to bring out some luster. The higher the degree of shine, the more prone to scratches and dust. To control the degree of shine, don't use semi-gloss or satin varnish. Instead, stick to gloss varnish and after it has cured, cut back the shine with fine abrasives.

No-dust finishing booth -- *A cardboard box on its side makes a quick and handy finishing booth, shielding the curing finish from at least some air-borne dust.*

Flowing but not dripping

Any hybrid finish benefits from multiple light coats, rather than a few heavy coats. Most premixed finishes were not designed for turned work. Turned curves encourage finishes to sag, run, and pool, before they cure. With light coats this isn't readily noticeable, but the finish may not be uniformly thick across the piece.

Any hybrid finish with a varnish component could run before it solidifies. The more oil or solvent in your blend, the more care you'll need to take to catch finish defects. So, add as little solvent or oil as is necessary to get the finish to flow well without running. Apply sparingly and let the finish build through multiple coats.

Curing time

Provide enough curing time and do not rush subsequent coats. The varnish component will trap oil against the wood, block oxygen exchange, and make it harder for oil to cure. The top may seem dry to the touch, but this can be deceiving because surface finishes cure from the outside-in. Support your work in a way that promotes air circulation and consider using a box on its side to prevent dust from falling onto the work as it cures.

Level of protection

Finishes offer protection, but they do not protect equally well against everything. Surface finishes provide some scratch resistance to the underlying work by getting themselves scratched. Polyurethane is tough, but any moisture that gets below the surface encourages the finish to separate and come off in pieces. Oils add luster, but do not protect from scratches. Few finishes offer UV protection, which degrades varnish and fades the wood color.

Rejuvenate or repair

I get lots of calls involving failed finishes. A consistent theme is that the finish looked good when it was applied, but a few years later it is coming off, getting cloudy, or is scratched.

Oil and wax finishes are the easiest to renew or repair, which is why they are well suited to treen. Varnishes are the worst, usually requiring the old surface to be completely removed—a time consuming, tedious, and expensive process. And the higher the degree of gloss, the more conspicuous scratches and dust will be.

Cost and false economies

I estimate that over half of the finish removed from the can is thrown out on the walls of

The food safe myth

Missing from the list of desirable finish qualities is "food safe." All currently available finishes are food safe after the finish has cured. Finishes cure at different rates, but it is safe to assume that after 30 days any finish will have cured. Click the blue box (or scan the QR code) to read Bob Flexner's Spring 2008 article on this topic in American Woodturner.

the application cup, or on the brush or rag applicator. A typical bowl actually needs only an ounce of finish for two coats, if that. When you take into account the likelihood of having finish spoil in the can rather than being used on a project, the actual cost of the applied finish is low and of the thrown-out finish, high.

Unless you are a production turner, buying large containers of finish is a false economy. Exposure to air, even in a storage container, is what drives oil and varnish to cure. Commercial products such as Bloxygen displace the air in a can of finish, delaying but not preventing the inevitable curing process. Bloxygen and its competitors are just a heavier-than-air inert gas, and if you are a home brewer you may have a bottle of CO2, which works just as well.

Alternatively, consider ways to make your finishing process more material-efficient. Finishing in batches will leave you with a higher percentage of finish on the work and less in the trash. Make hybrid finishes in small batches -- a four-ounce jelly jar lasts me about 30 days.

Where to start?

Once you identify the look and application properties you want to achieve, you can choose ingredients and adjust the percentage of each to reach your goal. Commercial or shopmade, there is no perfect finish. If there was, we would all be using it. Every finish is a compromise.

Consider what matters to you, combine ingredients that might get you closest to those traits, and experiment.

If the wood changes color dramatically when exposed to light (cherry or padauk, for example), or has dyed sections that may fade, then UV protection may be the most important quality. Mix an oil with a varnish that includes UV protection for your finish.

With daily wear items, such as a salad bowl or a plate, an oil-based finish is usually the best choice. A small amount of varnish can be added to bring out some luster.

With items that will sit on shelves and be admired, look to an oil/varnish or oil/wax finish. You can build up some gloss and pop the finish with this combination.

Maybe it's you

The largest variable in finishing is often not the finish, but the person applying it and the care they put into the process. Are you patient? Will you follow instructions? Will you stir or shake a finish (or not) depending on what is needed to mix it properly? Will you store your finishes appropriately? Properly dispose of old finishes? Allow adequate curing time between coats? Will you clean your shop before applying finish?

Slow down, take your time, and learn to enjoy finishing!

Mark Palma, from Cameron, WI, will be one of the demonstrators at the 2020 AAW Symposium in Louisville, KY,

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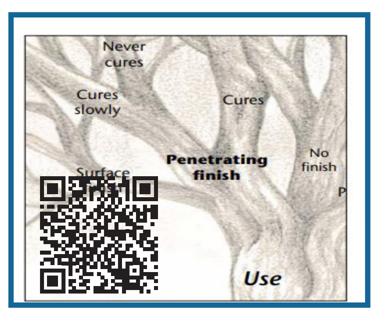

Oil-and-wax mix consists of shaved beeswax, left, gently heated in a water bath with a drying oil. The mix gives this spalted birch bowl a soft, gentle sheen that is reasonably durable and easily renewed.

Shopmade oil-and-wax finish

An oil-and-wax finish is simply a combination of oil and wax in appropriate ratios. Oil-and-wax finishes are forgiving to apply and the easiest to renew or repair, which is why they are well suited to treen. Oil adds luster, but offers negligible protection from scratches or UV damage. However, oils make a practical finish for daily living. The bumps and bruises a piece develops become part of its history and charm.

Making your own oil-wax mixture requires controlled heat to melt wax, followed by the addition of a combustible oil, so consider your safety and your property. Do not make the finish in your living space or use containers that would also be used for food preparation. Make sure your work surface is clean, that all combustible materials are moved out of harm's way, and that the area is well-ventilated. Wear heavy gloves and a face shield, and have a fire extinguisher at the ready.

The ingredients and supplies are as follows:
· a craft stick or two for stirring
· two clean jelly jars, about 4oz (120ml) capacity
· Boiled linseed oil, walnut oil, or tung oil
· 1-2oz (30-60g) shaved beeswax.

Place a flat-bottomed saucepan containing 1-1/2" (4cm) depth of water on a hot plate. Leave the burner off for now.

The more oil, the thinner the finish will be. Experiment with the ratio, adjusting from 10% up to 50% wax, beyond which the result will harden into a solid, unusable block.

Mix the shaved beeswax with the oil and divide it into the two jelly jars. Place the two jars into your pan of cold water. Turn the hot plate on low and slowly bring the water towards a simmer. Beeswax melts at about 145°F (63°C), so you do not need or want boiling water. Stir the finish when you see a little steam coming off the water, and keep the temperature below boiling. Keep stirring until all the wax has liquefied, then turn off the burner. Stir in the solvent.

Remove the pan from the heat and let everything cool for an hour. Remove and cover the jars and you now have an oil and wax finish. You could even pour the finish into small bottles and give it as a maintenance kit for your bowls and woodenware.

The amount of gloss varnish in a wipe-on oil-varnish mixture will determine the degree of gloss. If it's too glossy, cut back the shine with fine abrasive such as a grey (600-grit equivalent) non-woven pad. These two bowls have the same oil-varnish finish, but the blond bowl has been cut back to a matte surface.

Shopmade wipe-on poly finish

Wipe-on polyurethane varnish makes a durable finish that can be given any desired degree of gloss according to how much varnish it contains. You can also include UV protection in your finish by choosing a varnish that boasts UV resistance as one of its qualities.

A commercial wiping varnish or salad bowl finish is usually polyurethane varnish thinned with mineral spirits to improve flow. Many turners complain about poor finish build with wipe-on polyurethane; no mystery when as much as 70% of the can is solvent. Making your own lets you control the ratio of ingredients.

I am not a fan of polyurethane, but I see so many turners using wipe-on poly or salad bowl finish that it makes sense to make your own. The ingredients are:

- one small bathroom paper cup of gloss polyurethane
- 1/2 paper cup of mineral spirits or turpentine.

To make a "salad bowl finish," add one small paper cup of boiled linseed oil to these ingredients.

Either formula will build faster than the store-bought version and cost less than half as much. To achieve the properties that suit your needs, adjust the ratio of solvent-to-ingredients or oil-to-polyurethane after you use a batch or two.

Use gloss varnish, not semi-gloss or satin, as the latter contain flatting agents. You can always control gloss by applying fewer coats or cutting back the sheen with fine abrasives.

Any hybrid finish with a varnish component could run before it solidifies. The more oil or solvent in your blend, the more care you'll need to catch finish defects. So, add as little solvent or oil as is necessary to get the finish to flow well without running. Apply sparingly and let the finish build through multiple coats.

Any finish with a varnish component will need a light sanding between coats with 400 grit abrasive.

Other variables such as shop temperature, humidity, and cleanliness may encourage you to adjust the ratio of ingredients to alter the working properties. Give the finish adequate time to cure, as surface finishes cure from the outside-in. Err on the side of more drying time.


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Protecting your lungs

By Steve Forrest

It's a rare woodturner who doesn't protect their eyes, but too few turners take lung protection as seriously. Maybe it's the immediacy of an eye injury in contrast to the long-term risk of lung disease that influences our decisions? There are significant health risks associated with the invisible dust particles that stay suspended in the shop air for hours; here are some of the options for protecting yourself from those risks. The discussion moves from the least- to most-complex alternatives. Brand names are noted only to provide examples of the types of lung protection products available commercially—not to imply endorsement or criticism.

The problem

Recent investigations have shown that standard shop dust extractors do not adequately reduce the volume of dust entering our air and lungs. The fact that personal protective equipment (PPE) is too often poorly designed or too poorly fitted to provide protection compounds the issue.

When it comes to health risks, we are not concerned about those big, wet, curly shavings shooting from a green blank. Nor should we be overly concerned about those little motes that float around in the glancing light. The real hazard lies in the dust that is too small to see, because that is what lodges deep in our lungs, potentially leading to debilitating allergies, chronic respiratory diseases, or cancer.

Dust protection comes in three flavors – stuff you wear to protect yourself (PPE), stuff you use at the source (dust collection/extraction), and stuff that works on the air in the environment (air filters, exhaust fans). Source collectors and whole-shop air cleaners play important roles, but effective PPE is the critical link.

Paper dust masks

As noted in Lauren Zenreich's excellent overview in the May 2018 *Woodturning FUNdamentals*, PPE for dust protection exists on a spectrum. At one end are the widely available paper dust masks with a single (or sometimes double) headband, commonly known as nuisance dust masks. These are certainly cheap and easy to don, but virtually ineffective against hazardous microscopic wood dust.

A significant improvement are dust masks that are explicitly rated by NIOSH to a given standard of protection. These can properly be referred to as "particulate respirators," available with ratings of 95, 99, and 100. All require a proper fit to achieve their designated effectiveness.

Nuisance dust masks are so light that their weight is negligible, but some people find masks

D. E. McIvor

Paper dust masks are readily available and inexpensive, but are often compromised by a poor fit or a low NIOSH rating.

to be uncomfortable – too close, too closed, too hot. Another problem for turners who wear glasses (safety or corrective) is that masks tend to fog up the lenses, either because of a leaky fit, or because the design permits exhaust air to exit behind the glasses. Some masks come equipped with one-way exhalation valves, and this can certainly help with fogging and overall comfort.

Paper filter masks are relatively inexpensive. But depending on your level of exposure, you may find yourself burning through a lot of dust masks. Factor in issues such as your total exposure (the quantity of dust and the time you are in it), your baseline health, and your acceptance of risk, and even the choice of a basic dust mask becomes more involved than you might have thought.

Understanding NIOSH ratings

The National Institute for Occupational Safety and Health ratings offer a letter and a number. The letters N, R, or P refer to the mask's effectiveness against oil. N means Non-resistant, which is acceptable if our goal is to block wood dust.

Dust particle size is expressed in microns, (thousandths of an inch). Particles smaller than 10 microns are invisible to the naked eye and are small and light enough to float around in the air for hours.

A NIOSH rating of 95 means that the filter removes 95% of all particles greater than 0.3 microns in diameter. A 99 rating reflects 99% particle capture, and a 100 rating is 10 times more effective than that: 99.97%. NIOSH 100 is the same level of filtration that HEPA filters achieve. For more information, see the CDC's Respirator Fact Sheet.

Reusable masks

These masks perform essentially the same function as dust masks, but with the potential for greater protection through better design. The mask itself is made of a flexible material and is wider than a paper dust mask, so it is more likely to seal properly. Many have adjustable straps that can provide a more secure and comfortable fit. Reusable masks generally have exhalation valves, often positioned down and away to minimize lens fogging. And they all have replaceable filters, sometimes combined with cartridges for vapors, sometimes solely for dust.

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The RZ mask has a cloth housing over a replaceable paper cartridge. A proprietary filter attachment system exhausts air away from the eyes.

However, they are not a panacea. The filters may protrude enough to impair your sight lines, or interfere with a faceshield, and the weight, although modest, can become tiring. Because the mask is moisture-proof, sweat and condensation build up inside. The mask may make wearing glasses difficult. Because they are not disposable, they need to be properly cleaned and maintained. As with disposable masks, the cost of filters can add up, and you are limited to the manufacturer's offerings because they are not interchangeable across brands. A wide range of sizes, fits, materials, and filter profiles are available, so finding one that fits you well is likely, with a search.

There are also full-face respirators that combine a faceshield with a flexible mask and cartridge filters (not pictured). The advantage provided by these units is the integrated protection for the turner's face. However, users report the same concerns with these units as the half masks, including discomfort, problems attaining a good fit, weight, visibility, and

D. E. McIvor (left & middle images)

Reuseable silicone rubber masks by 3M, Trend, and Ellipse fitted with dust filters. Multiple straps and flexible sides encourage a good fit, and replaceable cartridges promote good protection.

cost of filter cartridges. With the integrated faceshield and respiratory protection, these units are something of a hybrid between half masks and Powered Air Purifying Respirators (PAPR) systems (see below).

There are also fabric-based half-mask respirators that lie between paper and rubberized masks in fit and function; the RZ mask is a recent popular entry in this market. This mask style features a lower profile and softer feel while still using directional exhaust valves and replaceable filters. The basic requirement for a tight seal is the same as other respirators.

Snorkeling in the woodshop

The Resp-O-Rator (not pictured) is a unique snorkel-like breathing apparatus that positions the intake filters behind your head. This approach eliminates issues of fit or seal – it's absolutely airtight because your mouth is closed around the unit. The filters are positioned away from your face, and the whole unit is light. The drawback is adjusting to the feel of the mouthpiece and managing your saliva.

The PAPR promise

Significantly more expensive by orders of magnitude, but also providing definitive protection, are the PAPR. These include offerings such as the 3-M Versaflow and Airmate lines, Sundstrom SR-500, Trend Airshield, and JSP Power Cap.

These PPE units rely on a fundamentally different approach from masks. Rather than filtering the air directly at the wearer's face, a helmet or other head covering is worn to supply pre-filtered air directly to the wearer. Along with a hose supplying the air, the helmet incorporates a faceshield and a flexible shroud that loosely seals around the wearer's face. The need for a perfect seal is eliminated because the air is supplied under positive pressure, and escapes out through provided vent holes and whatever leaks exist around the edge of the shroud. No fine wood dust makes its way into the pressurized zone of the helmet.

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A PAPR with motor, battery, and filters contained in the helmet. Whichever PPE you choose, prepare to embrace your inner Star Wars character.

Getting a good fit

A properly fitted mask does not leak, so that all the air entering your lungs passes through the filter. This ability to form a seal around your face is critical.

Masks come in different sizes, and many masks have a moldable nose piece or a flexible lining. These help conform the mask to the wearer's face, but these don't always work well. In addition, facial hair can break the seal and reduces effectiveness.

Most PAPRs include some combination of filters, battery pack, and motor. These may be worn on a belt or integrated into the helmet. Advantages include excellent filtration without risk of leaks. They easily accommodate glasses under the faceshield, visibility without fogging, and continuous airflow for comfort.

There are drawbacks. These units are expensive. Air hoses feature proprietary fittings. You still have to deal with replaceable filters, and batteries. PAPRs weigh more than a dust mask, especially if the battery, motor, and filters are all housed in the helmet, and some turners find this intolerable. The motors and blowers are not particularly loud, but some turners find the constant sound to be a nuisance. (Models with belt-mounted motors move the noise further from the turner's ears.) There is also an issue of convenience. You have to "suit up" with a PAPR, and it can feel like donning a space suit.

SCUBA in the workshop

Master turner Jerry Kermode devised an interesting variation on the PAPR. Rather than donning helmet, batteries, air pump, and filters, Kermode instead rigged up an ultra-lightweight 3M Airmate hood to an external source of air. There are high end units available commercially that employ an approach similar to Kermode's design. They involve pressurized air, essentially SCUBA for land, but a turner doesn't have to go to that extreme. A simple in-line air fan, some standard PVC tubing with the intake away from the workspace (outside, or piped in from the house, for example), and a custom-made linkage to the air hose (think duct tape) can offer the advantages of a PAPR with virtually weightless head covering and no battery limitations.

However, you are tethered to the air hose, and this does not offer any of the other protective benefits of a helmet or faceshield. Such a solution is best for sanding, and even then, you have to balance dust protection against impact protection. One possible hybrid solution that I am in the process of investigating is to use a PAPR helmet connected to an in-line, fixed air supply. This provides impact protection while minimizing the additional weight and expense of a full, self-contained PAPR. So far the results are positive.

Perfect protection

In a perfect scenario, great dust protection would be convenient, so that it could be easily incorporated into the daily routine. It would be comfortable, so that it could be worm whenever it was needed, and for extended periods of time. It would be effective, protecting us from any significant exposure to harmful dust particles. And it would be affordable.

Not surprisingly, getting all these features in one package is an elusive goal. Compromise and balance are necessary, particularly because our lungs are not the only organs and senses we need to protect. When we include eye, face, and hearing protection, the compromises multiply.

Ultimately, the best lung protection is the system you will consistently put on your face, rather than on a shelf.

Safe turning!

Steve Forrest is a recently retired teacher and former RN who has virtually taken up residence in his shop. He is a freelance writer and editor for American Woodturner *and* Woodturning FUNdamentals. *See his work at steveforrestwoodturning.com.*

A Shopmade Solution

These images illustrate the author's approach to implementing Jerry Kermode's PAPR system. While not without cost, this system is less expensive than an equivalent commercial system, but still provides significant face, head, and lung protection.

The 3M Versaflow comes in a range of styles. It offers relatively low weight, facial protection with a visor that can be raised, and all the advantages of a PAPR. As with the Airmate, the hose is proprietary. For those who choose to build their own in-line air supply, rather than rely on a self-contained PAPR with the attendant battery, motor, and filters, a generic CPAP hose mates acceptably with the hose inlet.

The author's shopmade air supply, with an inline motor and a 4" air hose to deliver the air supply. A fine screen over the inlet discourages spiders. The unit is located in an area that is isolated from the woodshop dust. The switch is by the lathe.

The tubing is stepped down from 4" to 2-1/2" before dropping behind the lathe. Linkages are cobbled together from duct or plumbing fixtures. Duct tape is the universal connector. A CPAP tube connects the air source to the hood.

Further reading

Managing wood dust is a long-standing concern for woodworkers. Both commercial interests and individuals have been seeking solutions in this ongoing battle, and the search has intensified with our expanding understanding of wood dust's health risks.

The links at right offer more reading on this topic from the pages of American Woodturner.

Wood Dust and the Woodturner, *by John English. (Includes Malcom Zander's piped-in air system, similar to Jerry Kermode's design).*
tiny.cc/JohnEnglish

Wood Dust, *by Pat Matranga.*
tiny.cc/PatMatranga

Improving CBN grinder safety

by John Kelsey

Maybe, like me, you saved a few bucks by choosing a bare grinder with no guards for your new CBN wheels? Maybe the vendor said, “They’re so safe you don’t need guards.” But one day while merrily reducing expensive steel to dust, leaning in close to see, I felt the breeze coming off the wheel kiss my forehead. Then I noticed a shiny cloud of metal particles glittering in the worklight. Hmmm.

Breathing fine metal dust is a known industrial hazard, same as fine wood dust: chronic irritation, maybe cancer--bah, let’s take a pass. Likewise, I’ll say no to wheel rash on my hand, arm, or forehead.

The grinder needed a guard, maybe the guard could also capture the swarf? I didn’t want to connect it to the shop’s dust system (hot sparks + sawdust + rapid air movement = disaster), so maybe a few high-strength magnets? Online dealers sell many shapes and sizes, including disks and blocks that will stick under toolrests, some with countersunk mounting holes.

The photos show my cobbled-together box guard. It’s just scraps cut to fit and screwed onto the grinder platform, with rails glued to the top surface to trap small tools. The fine metal powder clumps onto magnets on the underside of the toolrests, magnets mounted in the box behind the wheels, and magnets mounted on a bandsawn bracket in front of the wheels.

Okay, now what to do with those ferrous fuzzballs? I wear disposable finishing gloves to transfer them to larger magnets inside a cast-off bowl, and sweep up by dragging a magnet around. Then clean up with a shop vac that has a HEPA filter. Maybe I’ll try dissolving the accumulated dust in a glass jar of light oil, like an experiment at the science center.

Bar magnet mounted below the CBN wheel (left) captures metal particles (right).

Shopmade grinder stand holds tools and keeps forehead and CBN wheels safely separated.

Expensive turning tools converted to metal filings; better to collect them in a bowl than in your lungs.

John Kelsey is editor emeritus of Woodturning FUNdamentals and a member of the Lancaster Area Woodturners, an AAW chapter. ❐

Madrone

by Don McIvor

Madrone, a broad-leafed evergreen, grows primarily west of the Cascades and Sierras from Vancouver Island, B.C., to San Diego, CA.

Madrone readily forms burls. The wood ranges from pale yellow to pinkish-brown, sometimes with patches of dark red. The wood bears a passing resemblance to black cherry, though it tends to have a finer grain pattern.

The grain of madrone tends to be straight and very fine, with even texture. The wood is dense and easy to work. I find its working properties reminiscent of fruitwood, though the trees are not related taxonomically.

Madrone can lead to frustration or can be used to great artistic advantage. It is prone to significant and unpredictable movement in drying. The cell walls in burl grain tend to collapse, leaving the wood surface randomly pocked with divots. Treating madrone as any other species—rough turning wood and setting it aside to dry—usually produces firewood.

If a predictable outcome is your goal, then madrone needs to be processed to relieve the inherent stress before the wood dries. This is most commonly achieved by boiling green blanks, which can then be turned and dried with little movement. Commercially available blanks are often treated before marketing, although if not explicitly stated, it is worth asking so you know what you are in for.

The other option is to let the wood do what it wants to do. Turned thin and allowed to distort, madrone will create its own intriguing forms.

Madrone also accepts surface treatments well. It can be painted, dyed, or ebonized to good effect.

D. E. McIvor

Frank Ross Photos

From simple to sublime, all in madrone. Top: D. E. McIvor, 2006, Angela's bowl*, 4/1/2" X 3-1/2" (11cm X 9cm); middle (2007) & bottom (1991) by Helga Winter, (*both untitled*), fiber-reactive dye, 4-1/2" X 8" X 7-1/4" (11cm X 20cm X 18cm); root burl & rock, 10" X 8-1/2" X 7" (25cm X 22cm X 18cm).*

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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 *digitally, four times each year and free to members.*

Madrone, an evergreen hardwood, has large, leathery leaves that may blend with the surrounding forest, but its trunk and branches are distinct. Madrone often forms a multi-stemmed trunk that bends and curves sinuously as the tree reaches for light. The orange-red bark curls and peels off through the summer to reveal a polished trunk that varies from pale grey to red. ***See page 42 for more on this intriguing species.***

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