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American Woodworker

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#141, APRIL/MAY 2009

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- Ice Cream Scoop
- Travel Humidor
- Solitaire Game
- Rustic Chair

A Pro's Guide:
30 Essential
Finishing
Supplies

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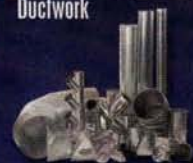
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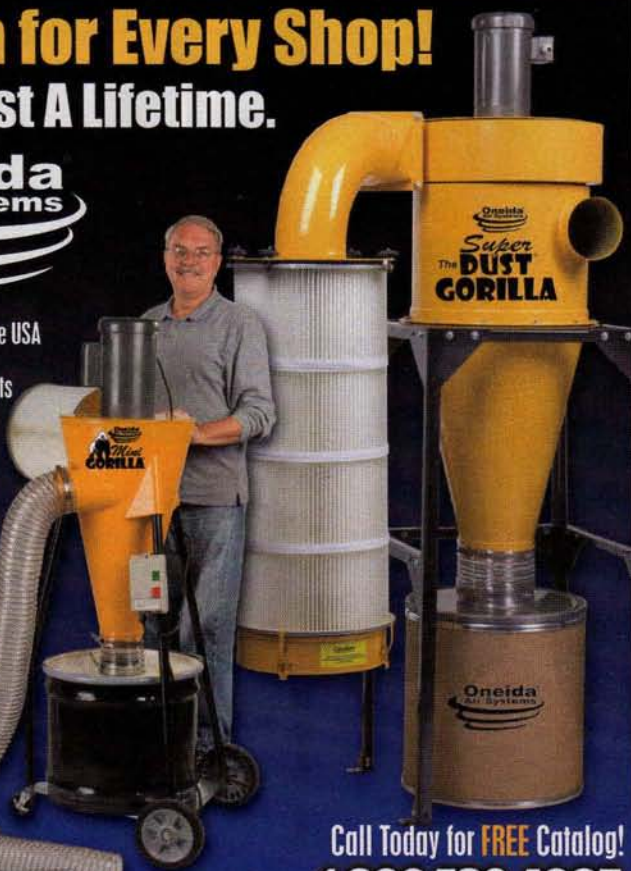
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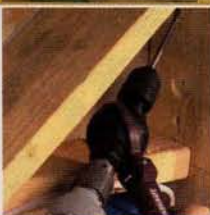
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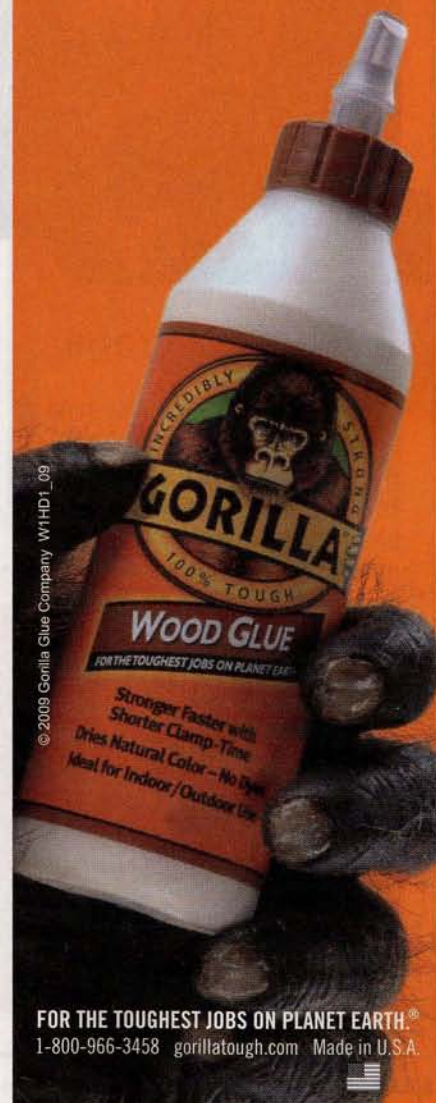
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Terrific Tip!

Swingin' Storage

I LIKE TO STORE hardware in its original package on a Peg-Board wall in my shop. I've devised some swinging panels for the wall that give me a lot more usable space. To make the panels, you'll need 1/8" Peg-Board, a 3/4" dia. dowel rod and Peg-Board tool holders.

Make the panels by cutting 12"x 12" pieces from the Peg-Board. For each panel, cut one dowel 2-1/2" long and one 5" long. Cut a 1/8" wide groove in one end of both dowels and slide the dowels onto the panels. Fasten the dowels with screws (see insert, above).

To install a panel, insert the longer dowel in the top tool holder until the bottom dowel slips into the bottom tool holder. The long top dowel must

extend through both rings of the tool holder to keep the panel from falling out. Each pair of tool holders holds up to six panels.

I also cut a 1/8" wide slot in a 12" length of 2x4 to use as a base for the panels so I can remove a panel from the tool rack and set it on my workbench.

—Mark Thiel



Simple Dowel Drilling

I NEEDED A WAY to hold dowels steady so that I could drill pilot holes in them. After a little head scratching, I cut a V-notch in a small piece of 2x4. I clamped a second piece of 2x4 against the piece of dowel as a brace.

—Larry Peters

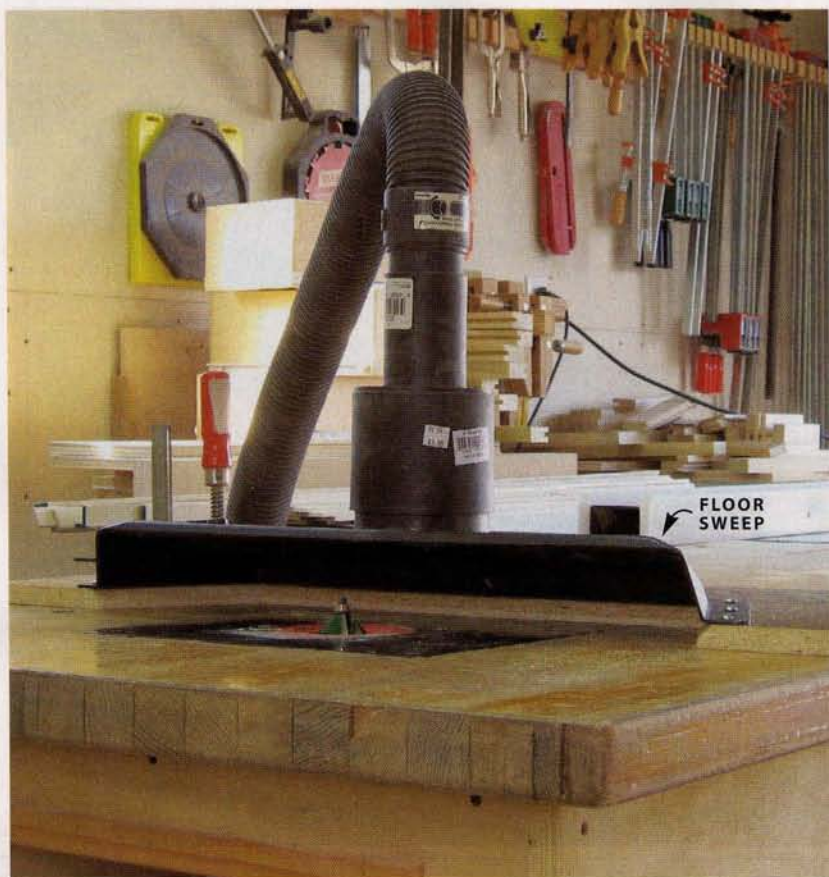


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Floor Sweep Dust Port

MY ROUTER TABLE is probably the most used tool in my shop. Its fence has a dust port, but it's not very effective when routing with a bearing-guided bit. I went to my local woodworking store one day looking for a better dust port, but got inspired and purchased a floor sweep instead.

When I got home, I traced the floor sweep's profile on a piece of particleboard and cut it out on the bandsaw. I screwed the floor sweep to the particle board, and clamped the whole thing to my router table. The floor sweep's gaping mouth gobbles up all the dust I can produce.

—Mitch Palmer

Re-Usable Tack Cloth

MICROFIBER CLOTH PICKS up tiny dust particles as well as, if not better than, a tack cloth. Unlike a tack cloth, micro fiber cloths are washable and reusable. Rockler sells Norton's microfiber finishing cloth for \$5-7, but any microfiber cloth will work as long as it has hemmed edges.

—Kevin Southwick



Marking Dark Wood

I OFTEN USE DARK, exotic wood for turning pens. It's difficult to see center marks on these species, so I paint the ends of my pen blanks with liquid paper. After it dries in a few seconds, I can easily mark the center with a pencil.

—John Woods

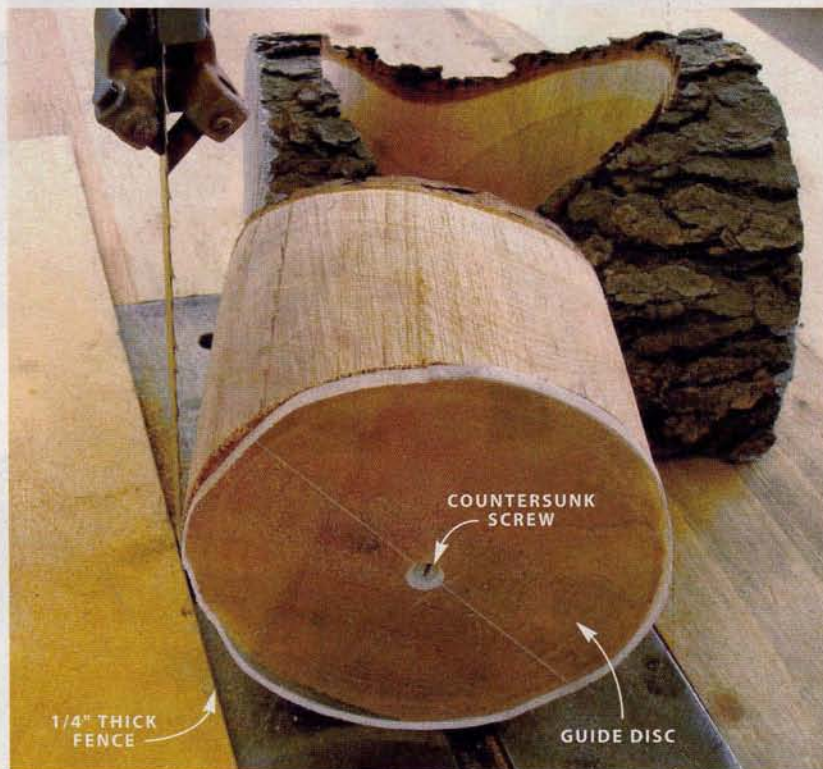


Bowl Blank Guide Disc

HERE'S AN EASY WAY to cut bowl blanks from half log sections. Cut a round guide disc from 1/4" thick material the size you want your blank to be, then countersink a hole in the center. Saw the log in half down its length on your bandsaw, then screw the guide disc to the flat side of the log, making sure the screw's head does not stand proud of the surface.

Next, make a 1/4" thick fence as long as your saw's table. Clamp the fence so that it just touches the left side of the blade and is parallel to the table's slot. Saw into the log using the disc as a guide against the fence.

—Dick Ayers



Ball Valve Blast Gate

STANDARD BLAST GATES BUG ME. After a while, the gate no longer closes all the way because dust gets stuck in the gate's track. Since I've never been able to get all the dust cleaned out, I decided to try a plumbing ball valve instead. It's just a fitting with a ball inside that's turned by a T-handle. There is absolutely nowhere for dust to get caught in this valve. It costs a little more than a blast gate, but you never have to clean it out, or lose

dust collection power because it won't close.

Home centers carry 2" diameter valves for about \$8. Reducer fittings, also available in the plumbing department, make it easy to adapt the valves to fit your dust collector hose. If you want to go all-out, you can buy 3" or 4" diameters from www.flexpvc.com, but they cost \$42 and \$110 respectively.

—Perham Rogers



Handy Handscrews

IT'S FAR EASIER TO edgeband a panel if it's standing up rather than lying flat. Since I don't have a workbench with a face vise, I clamp a handscrew on the end of the panel and use another handscrew to clamp the first one to a sturdy worktable.

—Ken Dembny



Convex Sander Pad

IN THE PROCESS of refinishing an old chair, I found that my random orbit sander's flat surface didn't work for sanding the concave hollow of the seat. My sander uses hook-and-loop paper, so I purchased some adhesive-backed hook-and-loop material at the hardware store. After sticking the material together with the hooks on one side and loops on the other, I cut out a disc shape that was small enough to fit in the center of my sander without blocking the dust collection holes. I then applied the paper over the pad. It worked perfectly to create a slight convex bottom on my sander that conformed to the chair's curve, and held the sandpaper firmly in place.

—Steve Laber



Giant Caliper

HERE'S AN EASY WAY to measure the exact diameter of a large part. This method uses two framing squares and doesn't require any math. Place the squares in opposite directions and slide them together, keeping their blades (wide part) flush, until the tongues (narrow part) are tight against the sides of the object. Read its diameter from the inside edge of a square's blade.

—Larry Lundholm

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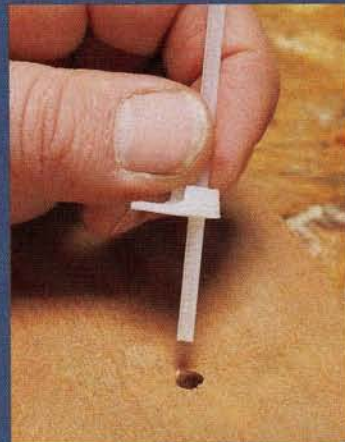


Garden Variety Wrap

HOOK AND LOOP tie wrap is nothing new, but you may not be aware that it comes in two different varieties. The two-piece kind sells for about a dollar per foot. One piece has hooks; the other has loops. The one-piece "garden variety" kind, which has hooks on one side and loops on

the other side, comes in a 1/2" wide by 45' roll that only costs about 3 bucks! It really is made for gardeners, but I've found dozens of uses for it around the shop, such as binding cords, securing box lids, and bundling wood scraps or dowels.

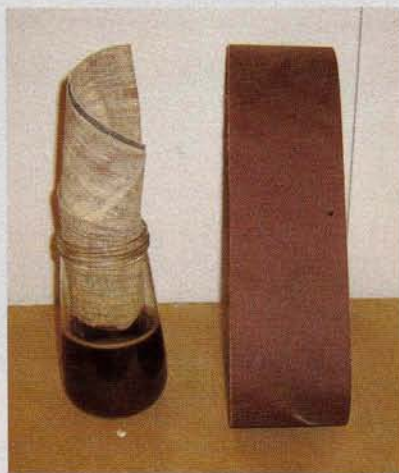
—Peter N. Williams



Zip Tie Depth Gauge

I FIRST USED THIS TECHNIQUE to measure tire tread depth, but found it to be quite useful in the shop to find depths of holes or to transfer measurements. Just cut off the "zipper" end of a zip tie, insert the straight end into the hole, and zip the tab to the proper position. You can measure the zip tie with a ruler or just transfer the measurement directly. 100 plastic ties cost about five bucks.

—Ed Waali



Launder Your Sanding Belts

WHEN I'M SANDING wood with lots of pitch or removing old finish, my sandpaper gums up so much that I can't get it clean with a rubber eraser-type cleaner. I used to throw away the sandpaper and buy more. Now, I pour some resin cleaner (for cleaning saw blades) in a glass jar and soak the sandpaper overnight. You can get a quart of Pitch and Resin Remover from Rockler for \$10 (item #64956). Add water and it makes a gallon. After soaking the sandpaper, I clamp it to a board and rinse it off with a garden hose or, if needed, a pressure washer. After the belt dries, it's ready to use again. I've washed about ten belts with the same jar of cleaner, and it's got plenty of life left.

—Chuck Rudkin

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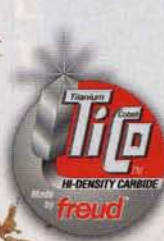
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Pocket Joints Plus

KREG'S VISE CLAMPS are perfectly suited for clamping pocket hole joints because their large, flat faces hold the parts flush without marring the wood. I like to get extra mileage out of everything, so instead of storing my Kreg clamps in the case for use only when making pocket hole joints, I keep them with the rest of my clamps, ready for use at all times. They're faster than C-clamps, and thanks to their large, round faces, they don't leave their signature on my work.

—Serge Duclos



Shop-Made Wing Nuts

WOODEN WING NUTS are easier on your hands than metal ones. Making them is a great way to use up shop scraps and leftover hex nuts. When you need a wing nut, you won't have to go to the hardware store.

Start with a strip of wood that's about 3/4" thick, at least 1/4" wider than the hex nuts, and long enough to work with safely. Using a Forstner bit, drill holes the exact depth of the hex nuts. Size the holes so that the nuts fit snug. Drill a hole sized for a bolt the rest of the way through. Dab some petroleum jelly on the nuts'

threads with a Q-tip, then apply epoxy around the holes' shoulders and insert the nuts. The petroleum jelly keeps the epoxy from sticking to the threads. To make sure each nut is level, thread in a bolt. It should stand straight up. When the epoxy has cured, cut and shape the wing nuts for a comfortable grip.

—Mark Young

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Double Duty Peg-Blocks

I NEEDED A WAY to lift pieces off the surface of my bench for finishing, so I made some small blocks and inserted short dowels into them. Here's the bonus: I discovered that if I fastened a piece of Peg-Board on top of my bench, I could tap the blocks' pegs into the holes and use the blocks as stops or bench dogs. Add a couple wedges and you can secure boards for planing or sanding. Two or three pegs in the same block add stability for heavier work. Hmm... maybe a workbench with a Peg-Board top is next!

—Bill Kurek

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Small Cyclonic Collectors

ONEIDA'S NEW Dust Cobra is designed to work with portable woodworking tools, especially those with 2-1/2" and smaller dust ports. Half dust collector and half shop vacuum, the Cobra features high-efficiency cyclonic separation and three times the air performance of most shop vacuums (260 cfm vs. 70 cfm, according to Oneida). Oneida also says that the Cobra's HEPA filtration media collects 99.97% of test material from 0.3 microns. The Cobra requires no filter bag and its 12-gal collection barrel is easy to remove and reinstall. It occupies only 2 sq. ft. of floor space, stands only 62" tall and comes with built-in mobility and 10' of 2-1/2" dia. industrial-grade flexible hose.

Oneida's Mini Gorilla is designed for dust collection in small shops where you can hook up dust collection to one machine at a time. Like the Dust Cobra, the Mini Gorilla features cyclonic separation, stands just under 62" high and features built-in mobility. The Gorilla provides 600 cfm and comes with high efficiency filtration that captures 99.97% of test material from 0.2 to 2.0 microns. It's equipped with a 5" dia. inlet, a Baldor industrial quality dual voltage 1-1/2 hp motor, and a 17-gal collection barrel. A remote starter and true HEPA filter media (99.97% capture @ 0.3 microns) are available as options.

Source: Oneida Air Systems, www.oneida-air.com, (800) 732-4065, Dust Cobra, #XCK110010, Call for price; Mini Gorilla, #XPP010100, \$890; Remote Starter for Mini Gorilla, \$77; True HEPA Filter Media upgrade for Mini Gorilla, \$129.



Adjustable Spring Clamp

FOR THOSE of you who like simple glue-ups or work alone in your shop, Bessey has added another handy spring clamp to its line. The VarioClippix XV5-170 is a variation on the XV5-100, with two rapid-action jaws instead of just one. The sliding top and bottom jaws are adjustable up to 6-1/2" wide and have a throat depth of 2". The soft-touch swivel pads give a firm, non-marring grip so your work stays put and undamaged. The clamp is lightweight and stable, and best of all—can be operated with one hand.

Source: Bessey Tools, www.besseytools.com, (800) 828-1004, VarioClippix (XV5-170) Double Jaw Variable Spring Clamp, \$7.49.





Resaw Bandsaws

LAGUNA TOOLS' new 3000 Series 16" and 18" bandsaws incorporate new features designed to enhance performance and ease of use. With resaw capability in mind, the frames, flywheel tilt and blade tensioning systems on both saws are designed to properly tension blades up to 1" wide for maximum performance. Resaw capacities are 12" for the 16" saw and 16" for the 18" saw. Throat capacities are 15" and 17", respectively.

Both saws are equipped with quick-release blade tensioning, gas-sprung rack-and-pinion table-tilt mechanisms, rack-and-pinion blade guide adjustment and ceramic Laguna blade guides. Replace the ceramic guides with Cool Blocks, and both saws can take blades down to 1/16" wide.

For safety and convenience, each saw also has a work light and a foot brake with a micro switch for emergency shut-off. You can also use the brake to save time, by stopping the blade more quickly for repositioning or removing work. A mobility kit is also available.

Source: Laguna Tools, www.lagunatools.com, (800) 234-1976, Laguna 3000 Series Bandsaws, 16", \$1795; 18", \$1995; Mobility Kit, #AB00002, \$205.



Lightest in its Class

HITACHI WAS the first company to introduce the sliding compound miter saw in 1988, twenty years ago. Two new 8-1/2" saws continue a great tradition. The C8FSE weighs only 31 lbs., the lightest in its class, perfect for carrying to and from a job site.

The C8FSHE adds an LED work-light and laser

(photo above). Both saws are equally at home in a woodworking shop. They're equipped with stops at 15°, 22.5°, 31.6°, and 45°, both left and right, as well as bevel ranges up to 48° to the left and 5° to the right for compound cuts. You can cut material up to 2-9/16" high and 12" deep in a 90° crosscut. Both saws feature a pivoting fence extension, table-mounted hold-down clamp, and dust collection.

Source: Hitachi Power Tools, www.hitachipowertools.com, (800) 706-7337, C8FSE 8-1/2" Sliding Compound Miter Saw, \$350; C8FSHE, \$375.

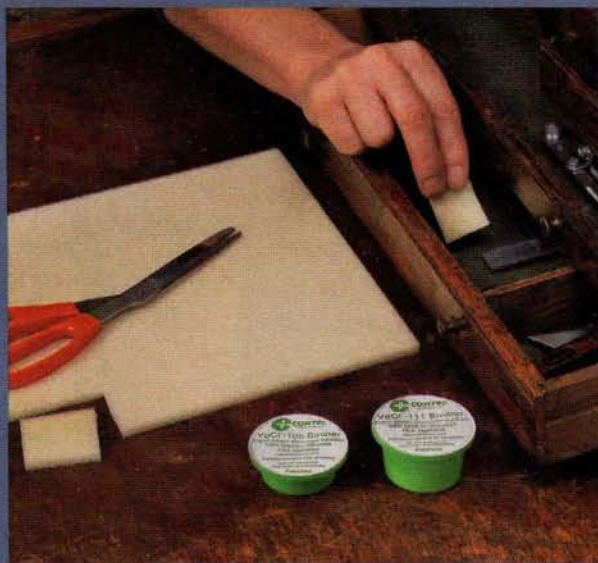
Hand-Soothing Sander

ALTHOUGH RANDOM ORBIT sanders are mainstay tools that have been around workshops for a long time, they are constantly being improved. Makita's new BO5030 random orbit sander has a rubberized palm grip for better control and a pad control system that minimizes hand jolting upon start-up. It features 12,000 orbits per minute with a 1/8" random orbit action for fast, smooth sanding and uses 5" eight-hole hook-and-loop abrasive paper. A 3 amp motor and oversized sealed ball-bearing construction promise long service life. This sander comes with abrasive paper and a dust bag. The kit also includes a tool case. A variety of hoses and adapters are available from Makita to attach this sander to your vacuum system.

Source: Makita USA, www.makitatools.com, (800) 462-5482, BO5030 Random Orbit Sander, \$69.95, BO5030K, \$72.95.



The Well-Equipped Shop



Ban Toolbox Corrosion

PLACED IN ANY ENCLOSED SPACE, these anti-corrosion emitters provide continuous protection for up to two years, even on odd-shaped parts or difficult-to-reach areas. They give off a harmless corrosion-inhibiting vapor that forms an invisible crystal barrier on both ferrous and non-ferrous metals. The 10" by 10" foam sheet protects a total of 8 cu. ft. Or, cut it to fit—1 sq. in. of foam shields 138 cu. in. of volume). The round emitters have self-adhesive backings. The small size is suitable for areas up to 5 cu. ft. and the large size for up to 11 cu. ft.

Source: Lee Valley & Veritas, www.leevalley.com, (800) 871-8158, 10" x 10" Foam Sheet Emitter, 56Z61.25, \$6.50; Small Emitter, 56Z61.20, \$6.90; Large Emitter, 56Z61.22, \$9.50.

Triangular Columns

THE TRIANGULAR columns on Jet Tools' new 16", 18", and 20" bandsaws are designed to provide strength and rigidity. Jet claims this new column style reduces frame twist by 65%. Woodworkers will also appreciate the increased resaw capacity: 10" on the 16" model and 12-1/4" on the 18" and 20" models.

All models include computer balanced band wheels, a miter gauge and a precision T-style rip fence, complete with a resaw post. The 18" and 20" models feature micro-adjustable ball-bearing guides, three-position, quick-release blade tensioning and a tension scale.

The 16" saw is powered by a 1-1/2 hp motor and comes with a 17" by 17" cast iron table. The 18" model comes with a 19" x 19" cast iron table and either a 1-3/4 hp or a 3 hp motor. The 20" model boasts a 21" x 21" table and can be outfitted with either a 3 hp or a 5 hp motor.

Source: WMH Tool Group,



www.jettools.com, (800) 274-6848, Jet JWBS-16 16" 1-1/2 hp Bandsaw, #708749B, \$1239; JWBS-18 18" 1-3/4 hp Bandsaw, #710750B, \$1629; JWBS-18-3 18" 3 hp Bandsaw, #710751B, \$1829; JWBS-20-1 20-in. 3 hp Bandsaw, #708754B, \$2449; JWBS-20-3 20" 5 hp Bandsaw, #710755B, \$2699.



Portable Dowelling Machine

HERE'S A TOOL that combines a plate joiner's ease of use with the strength and precision of dowels. Freud's Doweling Joiner features two bits set 32mm (1-1/4") from center to center, adjustable indexing pins for even spacing of repetitive holes, and an adjustable-depth fence to accommodate various stock thicknesses. The joiner accepts standard 10 mm. shank boring bits ranging from 3/16" to 1/2" dia. (5mm to 12 mm). It works much like a plate joiner, with an adjustable rack-and-pinion fence allowing for any angle necessary. But what sets the doweling joiner apart from a plate joiner is its capacity to

drill shelf pin holes. The 32mm spacing was certainly not happenstance. Any woodworker who has had to suffer through drilling dozens of holes with a drill press or who has used a jig and a handheld drill will be happy to use this tool for the task, especially on a jobsite.

Source: Freud, www.freudtools.com, (800) 472-7307, FDW710 Doweling Joiner, \$329.



Granite Top Hybrid

RIDGID HAS joined the granite-top tablesaw jamboree with a new 10" hybrid saw. Hybrid saws position the motor underneath the table, like a cabinet saw, for a smaller footprint than a contractor-style saw, and better dust collection. According to Ridgid, this 452 lb saw's 1-3/4" thick granite table and extensions provide a no-rust, no-warp vibration-reducing surface.

This saw features a left-tilt blade, a T-square-style rip fence with 30" right and 20" left rip capacity and a Herc-U-Lift mobile base. The quick-release spreader and blade guard assembly travels up and down with the blade. A 1-1/2 hp motor supplies the power. Cut depth is 3-1/8" at 90° and 2-1/4" at 45°. A carbide-tipped blade and T-slot miter gauge are included. This saw is covered by Ridgid's lifetime service agreement.

Source: Ridgid, www.ridgid.com, (866) 539-1710, 10" Granite Top Tablesaw, #R4511, \$599.



The Well-Equipped Shop



Finger-Saving Contractor Saw

SAWSTOP'S NEW 10" contractor saw features the same award-winning blade contact detection and brake system that has made their cabinet saw one of the hottest tools available. This is great news for woodworkers who don't have room for the cabinet saw and for contractors who want a job site saw.

Weighing in at 280 lbs, SawStop's contractor saw comes with a massive 62 mm (approx. 2-1/2") diameter main bearing, a heavy-duty arbor shaft, cast iron trunnions and arbor block, a solid cast iron table with removable extension wings, a large paddle switch for hands-free shut off, a dust-collecting blade shroud, and a 1-3/4 hp motor. The left-tilt blade is equipped with a true riving knife and has a maximum cutting height of 3-1/8".

Models with 30", 36" and 52" rails are available. Cast iron wings, a 30" outfeed table, a mobile base and a job site cart are available as accessories.

Source: SawStop, www.sawstop.com, (866) 729-7867, 10" Contractor's Saw, CNS175-SFA30 (includes aluminum extrusion fence & 30" rails), \$1599; CNS175-TGP36 (includes Professional Series T-glide fence & 36" rails), \$1779; CNS175-TGP52 (includes Professional Series T-glide fence & 52" rails), \$1839; Cast Iron Wing Assembly, #CNS-CIWA, \$189 for 2 wings; Sigle Cast Iron Wing, #CNS-07-017, \$100; 30" Outfeed Table, #OFT30-CNS-000, \$99 (not compatible with CNS175-SFA30 saw); Contractor Saw Mobile Base, #MB-CNS-000, \$160; Job Site Cart, #CNS-JSC, \$199.



Plenty of Power in a Small Package

POCKET-SIZED, lithium-ion powered tools are handy for drilling small holes and driving small screws. Here are two updated 12 volt drill/drivers from Bosch. Weighing less than 2 lbs., the PS20 driver delivers 100 in-lbs of torque at 500 rpm, a 25% increase over the original tool.

Bosch says that the PS20 is the only driver in its class sporting a 1/4" locking and magnetized collet-style bit holder. The PS30 has a 3/8", 3-jawed chuck, 220 in-lbs of torque, variable speed from 400 – 1100 rpm, and weighs 2.4 lbs. Both tools are equipped with an LED work light, and include two 12 volt batteries, a 30-minute charger, and a canvas carrying bag.

Source: Bosch Tools, www.boschtools.com, (877) BOSCH-99, PS20 12V Max Pocket Driver, \$129; PS30 Drill Driver, \$155.

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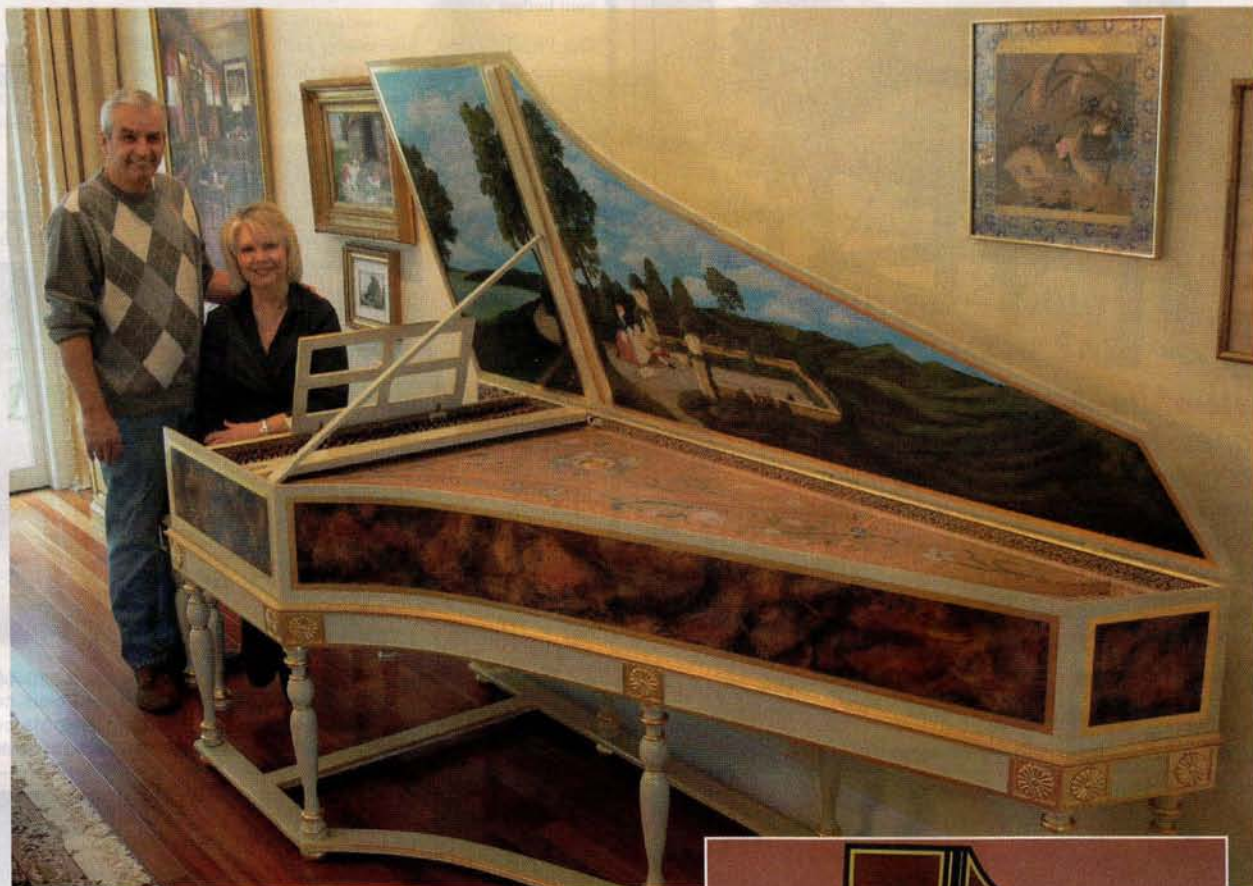
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Ernie Miller

Harpsichord builder extraordinaire

By Spike Carlsen

WHEN MOST WOODWORKERS tackle a project, they cut, fit and glue a few dozen pieces of wood together over the course of a week or two. Not Ernie Miller. Each of his projects requires up to 500 pieces of wood and 1,200 hours of painstaking work. How does one approach an enterprise of such daunting proportions? "I look at it as building twenty smaller projects that all wind up getting

assembled into one big project," he explains, nonchalantly.

Despite his casualness, Ernie has mastered instrument making, one of woodworking's most demanding pursuits. The harpsichords he builds are as wondrous to see as they are to hear.

"Most woodworkers have patience and pay attention to detail," says Ernie. "I think what sets me apart is that I have extreme patience and I pay extreme attention to detail." Repeating the same task 183 times—as Ernie does when he's building a double manual harpsichord—makes extreme focus a necessity.



An instrument such as this double manual (two keyboard) harpsichord can take Ernie up to six months to create. The woods he uses range from Sitka spruce to ebony; accents include bone, faux painting and gold leaf.

A life dedicated to music

Ernie has been building harpsichords for nearly a quarter of a century, but he's been involved in the world of music much longer. He became interested in piano technology as a teen. In college, he earned a music degree,

and went on to teach choral music for 35 years. In his spare time, he studied to become a Registered Piano Craftsman. He tuned and repaired pianos for a few years, and then began rebuilding grand pianos—a trade which eventually

put him in contact with the instrument that became his passion.

"The problem with restoring pianos is that someone needs to bring you a piano to work on," chuckles Ernie. "But if you want to build a harpsichord, you can build one from the ground up." By coincidence, one of the country's finest harpsichord builders, Paul Kennedy, lived less than a mile from Ernie's home. While Ernie never apprenticed under Kennedy, he was at his shop nearly every day for five years. "Paul was so generous in sharing his time and talents that I'll feel forever in his debt," explains Ernie. "I learned by asking, and Paul taught by showing. It led

to a wonderful friendship."

Ernie completed his first harpsichord in the mid 1980's, but destroyed it a few years later. "To hide the evidence," he admits. Ernie isn't the only one to annihilate a harpsichord. When the piano surged onto the scene in the 1700s, harpsichords fell so far out of favor that during the exceedingly cold French winters of 1802 and 1803, people burned them to keep warm. "Because of that," Ernie says, "it's very difficult to find an original French harpsichord to obtain measurements from."

The instrument maker

Miller completes every step, from turning the legs to gluing the soundboards. Each of the woods he works with is well suited to its purpose: resonant Sitka spruce for the soundboard, versatile poplar for the curved case, and durable ebony and rosewood for parts of the keyboard. Ernie doesn't stray far from the old masters' materials and techniques, but he does make exceptions. For the plectrums—the part that plucks the string—he uses Delron plastic; it's more durable than the traditionally used crow feather. And for creating the registers—a part that must be accurate within 1/1,000th of an inch for the keys to strike properly—he relies on computer-generated templates as guides.

Ernie's wife Sandy paints the lids, soundboards and other elements. "When I started building harpsichords, I threatened to paint them," Ernie says. "The problem is, I can't paint." So Sandy became involved in the business. The end result is an object that's part musical instrument, part work of art—and worth every penny of the \$10,000 to \$25,000 cost.

Music boxes

Ernie likes intricate work so much, that part of his business has evolved into creating music box versions of his harpsichords. "I've always had an interest in miniatures," explains Ernie, "so twenty years ago I built my first harpsichord model." The model was-



Beneath the skin of each exquisitely decorated harpsichord lies an instrument exquisitely crafted of poplar.



Miller's wife, Sandy, paints the scenes and ornamentation that embellish the cases, lids and soundboards. Most of her designs are based on those of vintage instruments. The lid of this harpsichord declares "Music is the gift from God which makes one flourish."



Ernie crafts small scale "childproof" instruments featuring rounded corners for safety and lidless construction to avoid pinched fingers. "One is never too young to enjoy music," he quips.

n't very convincing, according to Ernie—and that's when his stubborn streak kicked in. His goal became to craft a music box so realistic that someone looking at a photo wouldn't be able to tell whether it was full-sized or miniature (**bottom, right**).

Clearly, though, there are differences. Ernie explains, "In a harpsichord, what you don't see is most important. But in a music box, it's just the opposite." Crafting the music boxes' intricate mini-keyboards and turning their diminutive legs are perhaps the most challenging aspects.

When it comes to decorating, Miller turns to his computer. He photographs full-size painted harpsi-



This rose wreath is an example of the intricate painting and pride in craftsmanship that goes into each instrument.

chord components, reduces them, prints them out, and adheres the printout to the music boxes. As many vintage harpsichords were originally decorated by applying painted papers, Ernie's approach holds true to traditional methods.

Rigorous quality control

Though keeping the business a two-person affair limits output to two harpsichords plus a few related instruments and music boxes a year, Ernie prefers the hands on part of building to managing employees. "I always try to make the next harpsichord better than the last. There are so many new techniques I want to try—I love to keep learning. Plus, I'm running out of years to learn," explains the 63 year old craftsman. He's dabbled in other forms of woodworking. "I've built furniture and I can make a drawer that opens and closes. But after a week or two, my mind wanders," Ernie muses. "There's nothing else I'm burning to do except make instruments."

For more information, visit www.ernestmillerharpsichords.com.



Ernie builds other instruments, such as this ottavino, styled after a 17th century Flemish example. Diminutively sized (this one is only 16" high), ottavinos are placed on a table and played while standing.

To experience building a harpsichord from start to finish, check out Ernie's online postings on the North Carolina woodworker Website:

<http://www.ncwoodworker.net/forums/f101/harpsichord-project-part-1-keyboard-17851/>

Spike Carlsen is author of A Splintered History of Wood: Belt Sander Races, Blind Woodworkers and Baseball Bats published by HarperCollins.



As a diversion from building full size harpsichords, Ernie builds 1/4-scale music box replicas that are difficult to differentiate from their full-scale counterparts.

Building a Keyboard

SOME HARPSICHORD BUILDERS begin by building the curvilinear case, but Miller prefers starting with the keyboard. "I love building keyboards; it gets my juices flowing," he explains. And once those juices start flowing, they need to continue flowing for a long time; it takes up to two weeks to craft a single keyboard.

The keyboard starts out as one large slab of wood, glued up from 1/2" poplar (**Photo 1**). The entire

keyboard is drawn onto this slab, with each key numbered so it can eventually be reassembled in that exact order. A decorative key tip section is applied (**Photo 2**) before the blank is cut into sections. Each section is then meticulously cut into individual keys, using a bandsaw and a scroll saw (**Photo 3**). Each individual key is then shaped, drilled, fine tuned, fitted and positioned on the keyframe (**Photo 4**). The work is

exacting—the slots and holes in each key must be a mere 1/1,000" to 2/1,000" wider than the guide pins they encompass. "This takes a lot of time and patience," Miller explains, "also food and a television set!"

Finally, the entire assembly is fitted into the harpsichord case (**Photo 5**). As the harpsichord nears completion, thin strips of ebony and bone are glued to the keys (**Photo 6**).



1 The keyboard building process begins by gluing up a poplar panel large enough to accommodate an entire keyboard.



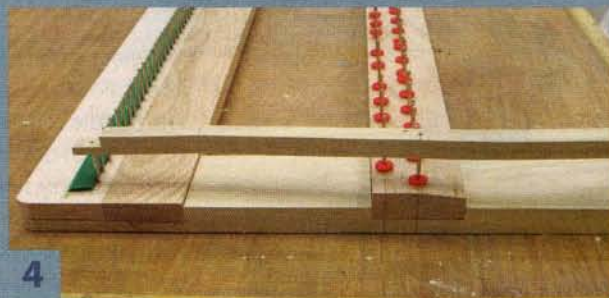
3 A bandsaw and scrollsaw are used to cut the blank into individual keys. Straight "sharp" keys lie between pairs of square-shouldered "natural" keys. The scroll saw cuts the square shoulders.



5 Once the keyboard has been completed, the entire assembly is fitted into the case



2 The decorative key tips (called arcades) are applied as a single strip to the keyboard blank before the blank is sawn, first into sections, and then into individual keys.



4 Each key is positioned on the keyframe. Then, using mini-files and infinite patience, Ernie enlarges the key's pre-drilled holes into slots that fit the guide pins with extremely close tolerances.



6 Walnut, ebony and bone are laminated to the tops of keys for durability and appearance.

Ice Cream Scoop

by Alan Lacer

IN SIMPLER DAYS, soda jerks quickly and efficiently dished perfect servings of ice cream with sturdy wooden-handled scoops. Today, if you have a little turning skill, a small block of wood, and the metal parts (see Sources,

page 28), you can create a classic ice cream scoop that will make you the envy of jerks everywhere.

How-To

Select a block of dried hardwood about 1-3/4" square and 6" in length. The handle must be strong enough, so stay with domestic hardwoods, such as cherry, hard maple, walnut or yellow birch. Exotic woods such as purpleheart, black palm (used here), bubinga, rosewood and gonzalo alves are also good choices.

Drill a 3/8" dia. by 1-1/4" deep hole for the scoop's stem. If the end of the blank is properly squared, this operation is easily performed on a drill press (**Photo 1**). Another option is to mount the blank on the lathe and turn it to a cylinder, using a spindle roughing gouge. Then replace the tailstock center with a drill chuck to drill the hole (**Photo 2**).

Mount the drilled blank on the lathe with the drilled hole facing the tailstock. If you have a cone-type live center (**Photo 3**), simply run the cone

into the drilled hole. Another option is to turn a tapered wooden plug that fills the hole and provides a surface to engage the tailstock center. The plug should protrude about 1/2", so you can remove it when you've finished turning the handle.

If the blank you've mounted is still square, turn it to a cylinder, using a spindle roughing gouge.

Fit the brass ferrule to the blank. The ferrule is 1" long, so mark that length on the blank with a pencil. Turning the correct diameter is a bit trickier. Start by turning the tenon to match the outside diameter of the ferrule (**Photo 4**). Before you use the outside calipers for any lathe work, be sure to round the ends.





1

Use dense hardwood for the scoop's handle. Start by drilling a hole for the scoop's stem in the end of the handle blank.



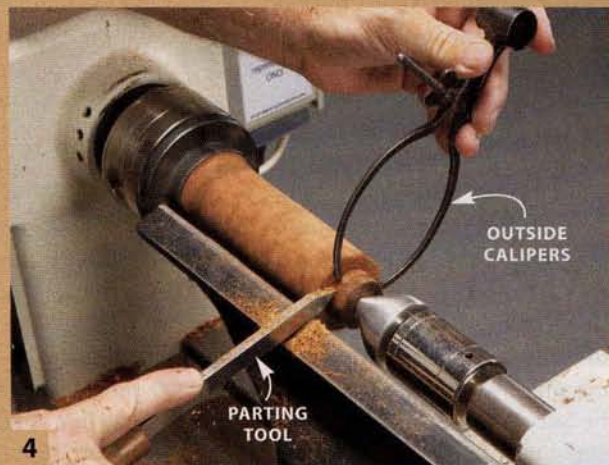
2

Another option is to drill the hole on the lathe. This method requires turning the blank to a cylinder and then replacing the tailstock center with a drill chuck. The mark left by the tailstock center locates the bit.



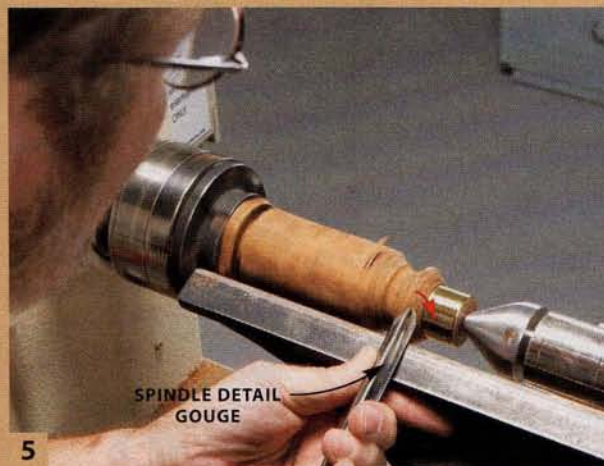
3

Once the hole is drilled, you have two options for re-mounting the blank: A cone-shaped live center or a small tapered plug. The cone centers itself; the plug fills the hole, so you can mount a standard live center.



4

Turn a tenon to house the scoop's ferrule. First, match the ferrule's outside diameter. Then carefully reduce the diameter until you can drive on the ferrule.



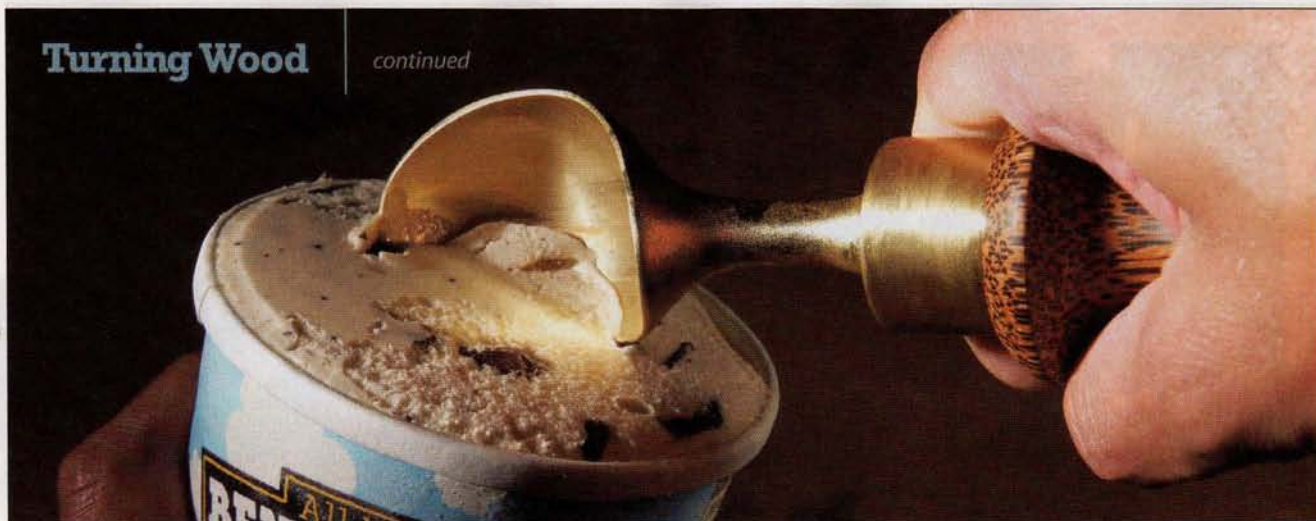
5

Shape the area behind the ferrule with the spindle detail gouge, working from large to small diameters. I like to start with a wide, tapered flange.



6

Reduce the diameter behind the flange to create the neck. From this point on, remove the handle often to check how it feels in your hand.



Next, create a short taper on the end of the tenon. Keep checking with the ferrule until it just starts to go on. Turn the ferrule a few times around the tenon to create a burnished surface. Then, when you start the lathe you should be able to "see" the diameter you are targeting. I try to achieve a very tight driven-on fit. If the tenon is longer than the ferrule, you may need another ferrule to drive the first one home. Another option is to turn the tenon to a slightly loose fit and glue on the ferrule with epoxy. If you use epoxy, wait for several hours before completing the turning.

Shape the handle with a spindle detail gouge (**Photos 5, 6 and 7**). This is an organic process: Remove the handle frequently, to see how it feels in your hands—the perfect shape is the one that feels right. Most of my handles end up about 5-1/2" long, with maximum diameters near 1-5/8". Switch to the skew chisel to finish shaping the rounded areas (**Photo 8**). For information about using this versatile tool, see "Rockin' and Rollin' with the Skew" (AW #137, September 2008).

If the ferrule's tenon protrudes, use either a skew chisel (long point down) or a thin-kerf parting tool to turn the end flush with the brass (**Photo 9**).

When you're satisfied with the handle's feel and appearance, sand it—and the ferrule, too—to at least

220 grit (**Photo 10**).

Cut the handle from the waste. I usually remove the blank from the lathe and separate the handle by sawing with a coping or Japanese saw. Then I finish sanding the end of the handle by hand.

Apply the finish (**Photo 11**). For the best protection against water and washing, use a film-forming finish such as a gel varnish or polyurethane. Wipe on at least three coats, lightly sanding between coats with 320 or 400 grit sandpaper, 0000 steel wool, or a very fine abrasive pad, such as white Scotch Brite. For a more natural look, use pure tung oil or even boiled linseed oil as the finish. Again, apply at least three coats and wait until the finish is completely dry before using the scoop.

Glue the metal scoop into the handle with epoxy (**Photo 12**). Use a rag dampened with lacquer thinner or acetone to remove any epoxy that squeezes out. Prop the scoop upright for about one hour for the glue to set, and allow at least one day before use.

Tips for Using

Before you attack that frozen ice cream, immerse the scoop's business end in a cup of hot water for a couple minutes. Use the side of the scoop to dish the ice cream—don't dig in with the front, like a shovel. If you're serving a gang of kids, or a gaggle of soda enthusiasts, dip the metal in the hot water periodically, to keep it warm.

When you wash the scoop after your ice cream social, don't submerge the wood handle for more than a couple seconds, and don't ever run the scoop through a dishwasher. Following washing, towel the scoop dry and then leave it out to air-dry, so any remaining moisture quickly evaporates. 

SOURCES

- ◆ Rockler Woodworking and Hardware, www.rockler.com, (800) 279-4441, Brass Ice Cream Scoop Hardware Kit (includes scoop and ferrule), #29848, \$10.99.
- ◆ Oneway Mfg., www.oneway.ca, (800) 565-7288, #2MT Live Center with Cones, #2064, \$120; #1MT Live Center with Cones, #1100, \$120; Talon Chuck, #2985, \$231. Packard Woodworks, www.packardwoodworks.com, (800) 683-8876, #2MT 12" Keyless Chuck, #111022, \$37.95; #1MT Keyless Chuck, #111021, \$37.95.

Alan Author is a woodturner, writer and instructor living near River Falls, WI. You can find out more about Alan and his work at www.alanlacer.com.





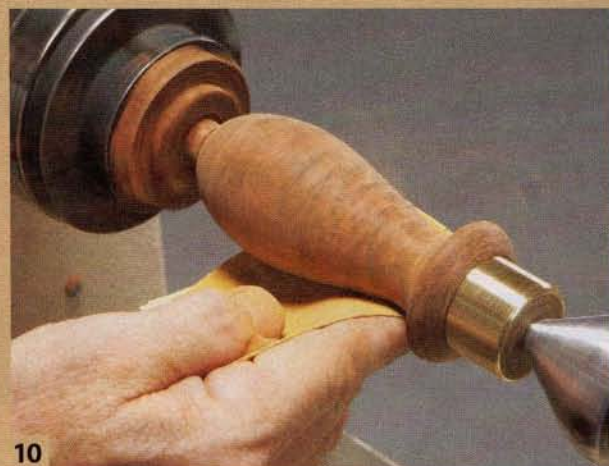
7 **Start to shape** the end of the handle. Be sure to leave sufficient waste, so you don't whack into the chuck.



8 **If you are comfortable** with a skew chisel, use it to finish shaping the handle's rounded areas. You can shape the entire handle with the spindle detail gouge, but the skew leaves a smoother surface.



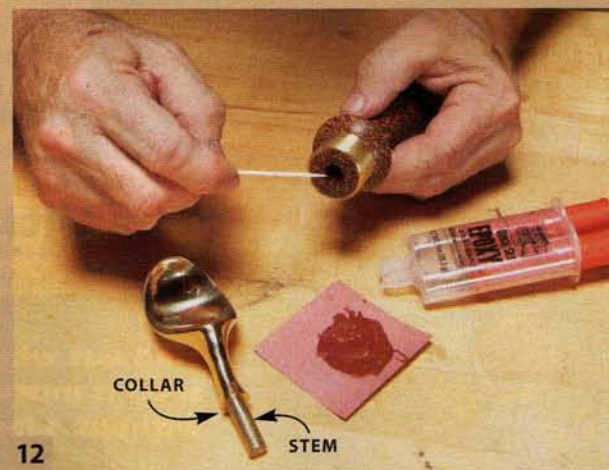
9 **Trim the end** of the tenon flush with the ferrule. Use the skew chisel long-end-down or a thin-kerf parting tool.



10 **Finish-sand** the handle. Start with 120 grit; if turning marks remain, drop back to 100 grit. Sand to 220 grit, or further if you still see sanding scratches. Sand the brass ferrule to the same grit.



11 **For a finish**, I wipe on polyurethane or pure tung oil. I think tung oil looks better, but polyurethane provides somewhat better protection.



12 **Install the scoop.** Work a generous amount of epoxy into the hole. Insert the scoop's stem and bed its collar against the end of the handle.



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Effective alternatives to wearing a sanding mask

By Dave Munkittrick

NO DOUBT ABOUT IT, long-term exposure to wood dust can be a health hazard. Experts agree that collecting dust at the source should be the first line of defense. Next comes personal protection, afforded by wearing dust masks and respirators. In order to be effective, however, most of these products rely on a good seal to your face, which poses a problem if you have a beard, as I have, or sensitive skin. Fortunately, we don't have to shave or put up with a rash in order to reduce our exposure to dust. Here are five respirators that don't require an airtight seal.

Four of them are powered respirators that pump filtered air into a mask. This creates an area of positive pressure inside the mask and prevents any dust-laden outside air from leaking inside. The stream of filtered air flows down the inside of the visor and across your face, which keeps you cool and prevents the visor from fogging up. The fifth respirator is a unique low-tech design that does the job without a separate power source.

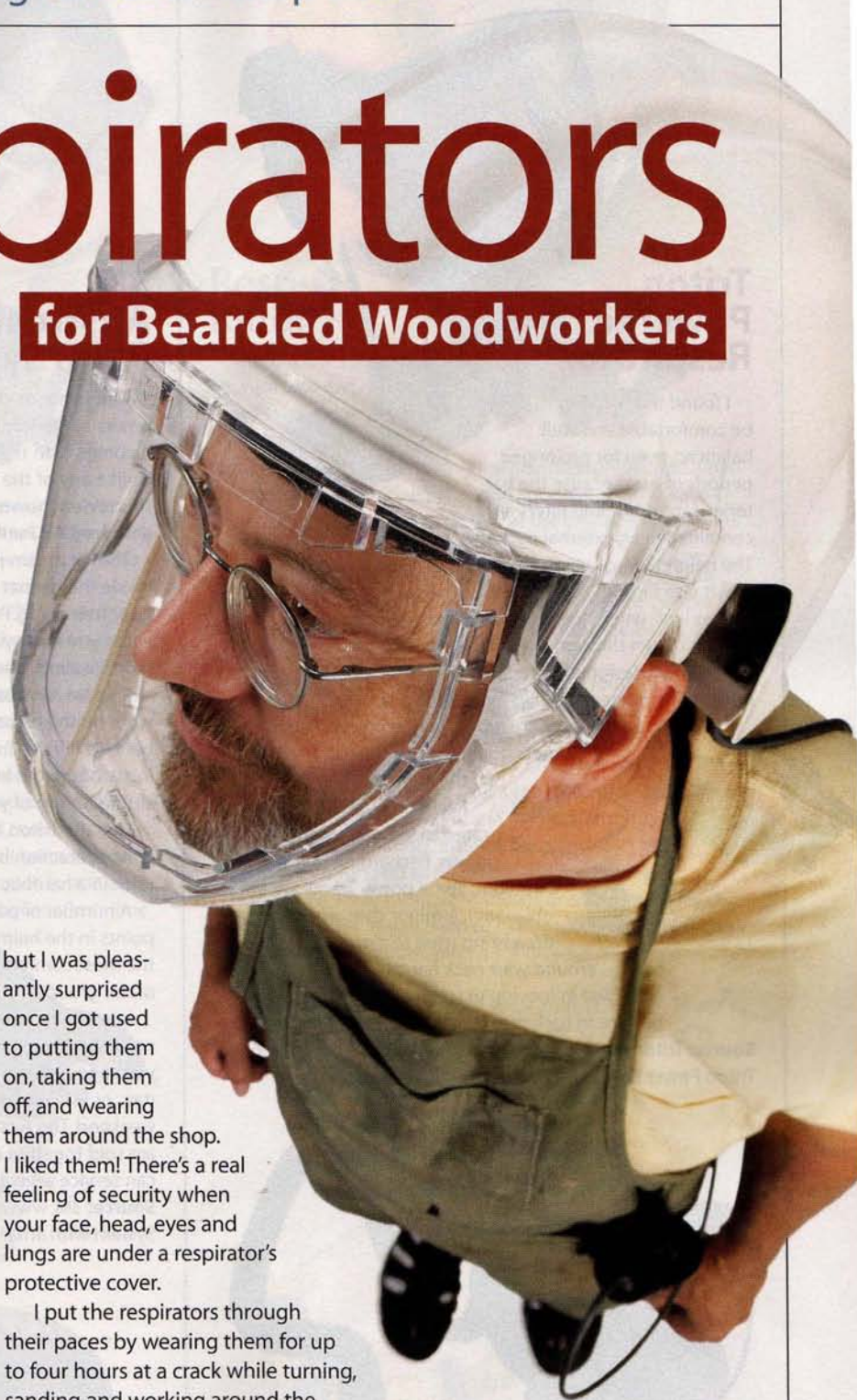
When I tried out these particular models, I expected the big, bulky helmets to be quite cumbersome and annoying to wear. They were at first;

but I was pleasantly surprised once I got used to putting them on, taking them off, and wearing them around the shop. I liked them! There's a real feeling of security when your face, head, eyes and lungs are under a respirator's protective cover.

I put the respirators through their paces by wearing them for up to four hours at a crack while turning, sanding and working around the shop. The respirators didn't interfere in any significant way with most of my work, but when the job required me to look down for a prolonged period, they caused a minor amount of neck and shoulder fatigue. The exception

was the non-powered Resp-O-Rator; it was so light it never bothered my neck or shoulders.

It's important to note that none of these respirators can be used for fume protection from finishing products.



Triton Powered Respirator

I found the Triton to be comfortable and well balanced, even for prolonged periods of use, because the batteries, fan, motor and filters are contained in an external pack that's worn around the waist. The helmet's visor never fogged up unless the batteries got low. It also flips up out of the way. The earmuffs pull out of the way, as well, when hearing protection isn't needed.

Air is drawn through a washable pre-filter and a pair of cartridge filters designed to remove 95% of dust particles under 1 micron. The filtered air flows over your forehead and down along the visor, creating a gentle breeze. The helmet gets hot in a hurry, though, if you turn off the airflow.

Rechargeable NiCad batteries rated to last eight hours supply power. Recharging takes overnight. Spare power packs are available (\$80). A minor concern is that the drawstring used to close the shroud around your neck hangs loose and could get tangled in moving machinery. To avoid this risk, be sure to tuck the string inside your shirt collar.

Source: Triton, www.tritonwoodworking.com, (888) 874-8661, Triton Power Respirator, \$209.

3M Airstream PAPR System

This is hands-down the best power respirator of the group, and it comes with the highest price. Unlike any of the other respirators in this review, however, the Airstream PAPR (Powered Air Purifying Respirator) System is NIOSH approved.

The Airstream provided the most CFM of airflow. The breeze inside the helmet did the best job of keeping me cool and the visor free of fog. Powered respirators can get a little warm when you exert yourself and breathe harder or faster, so the more cooling breeze there is, the better.

The 3M Airstream has a separate NiCad battery pack that's worn on the waist, like the Triton, but the fan is located in the helmet, like the Trend. That means no breathing tubes to get in the way and no battery sitting on top of your head.

Like the Triton, the Airstream provides head protection by mounting the respirator in a hardhat.

A number of padded adjustment points in the helmet made the Airstream the most comfortable power respirator of the group.

In addition to recharging the battery pack, the Airstream's smart charger allows you to top off the battery at the end of the day, or leave it on the charger over the weekend. The Airstream and smart charger are sold together or separately, so businesses can service several helmets with a single charger.

Source: 3M, www.3m.com, (888) 364-3577, Airstream PAPR System with Smart Charger, \$870; Airstream PAPR System, \$692; Smart Charger, \$185.



Trend Airshield and AIR/PRO

Trend offers two powered respirators. The Airshield (above) has been available for some time, while the AIR/PRO (bottom) is new. Both units are self-contained, with battery, motor, fan and filters all located in the headgear. That makes them easy to put on and take off, but a little top-heavy.

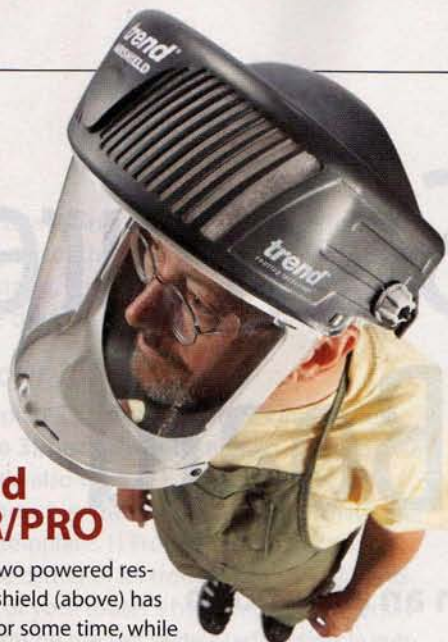
The AIR/PRO model has moved the heavier components to the back of the headpiece for better balance and greater comfort (left). Both models use rechargeable NiMh batteries. The Airshield comes with a single small battery rated

for four hours. There's space to add a second battery in the visor to give you eight hours of run time.

The AIR/PRO comes with a much larger battery that's rated for eight hours. Spare batteries can be purchased for either model.

The visor on both models lifts out of the way for convenience. Ear muffs cannot be worn with these respirators, but foam plugs work fine.

Source: Trend Routing Technology, www.trend-uk.com/en/US/, (270) 872-4674, Airshield Face Shield, \$320; AIR/PRO Face Shield, \$400.



AIRSHIELD



AIR/PRO

Resp-O-Rator

This is a low-tech respirator for woodworkers with beards and a small budget. I have to admit I laughed when I first saw the Resp-O-Rator, and my granddaughter cried when she first saw me wearing it. Despite appearances, the Resp-O-Rator does a great job at a fraction of the cost of the powered respirators featured in this story.

Wearing a nose clip and having something stuck in your mouth takes some getting used to, though—some people may never get used to it. It helps if you've done some diving or snorkeling in your past.

The Resp-O-Rator is very light in weight. I found it to be the most comfortable of the respirators in this story, as its weight rests largely on your shoulders. The HEPA filters are in back, away from the dust clouds. The only time I felt some discomfort was when I was leaning over a task for a prolonged period of time. The discomfort was not in my neck and shoulders, as with the other respirators. Instead, the muscles in my lips got tired as they struggled to hold onto the mouthpiece.

You can wear ear muffs, face shields or safety glasses with the Resp-O-Rator. If you need to talk or take a drink of water, it drops out of your mouth and hangs on your neck until you're ready to get back to work.

Source: Duxterity, www.Resp-O-Rator.com, (336) 227-7168, Resp-O-Rator, \$49.95; Replacement Filters, \$7.95 (pkg. of 2); Replacement Mouthpiece, \$3.95 (pkg. of 2).



Marble Solitaire Game Board

Create a classic in an afternoon



by Jim Church

WHEN I VISITED my grandmother, I always enjoyed playing a game with marbles on a round wooden board. My grandmother called it "Marble Solitaire." You may know it on your PC as "Hi-Q." My grandmother's wooden board disappeared long ago, but I've kept the game alive by making wooden boards for my own grandchildren, as well as for other relatives and friends. The game's appeal is universal—young and old alike enjoy its vexing simplicity.

I make these game boards in two sizes, 9-1/2" dia. and 14" dia. (see Figure A, page 36). The small board is similar in size to my grandmother's original board. It's made to work with 5/8" marbles. The large board has wider spacing that makes it easier for adult-size fingers to move marbles without jarring the ones next door. This board works with 1" marbles. Both marble sizes are available in bags or as singles in most toy stores or online (see Sources, page 36).

You can make one of these game boards in less than a day, following these simple steps: Saw the round shape, rout the trough, plunge-rout the marble pockets, round the edges and apply the finish.

You'll need a tablesaw, a bandsaw, a plunge router and three ordinary router bits (see Sources).

Create the Round Board

Whether you glue up several pieces of wood or use a wide board, the project starts with a 3/4" thick rectangular blank with a minimum diameter slightly larger than the final game board (**Photo 1**). I make my blanks from wide boards, so they showcase continuous grain patterns without any glue lines.

Using the bandsaw, cut the circular shape freehand or with a circle-cutting jig (**Photo 2**). If you cut freehand, use a compass to draw a circle of the desired diameter. Mark the centerpoint the compass leaves (you'll use this point in a later step). Saw oversize and then sand to the line.

I usually make boards in multiples, so I use a circle-cutting jig. Set the jig to cut the board about 1/8" oversize in diameter. After cutting, sand the edge to remove the saw marks and reduce the board to its final diameter.

Rout the Trough

I use a round template to guide the router when I rout the trough (**Photo 3**), but a circle-cutting jig made for use with a router would also work.

You need to know two measurements to calculate the size of the round template: 1) From the center of your game board to the center of its trough (see T, Fig. A); and 2) From the edge of your router's baseplate to the center of the bit. To determine the template's radius, simply subtract measurement 2 from measurement 1. Create the template the same way you created the round game board. Center the template on the board and secure it with double faced tape.

Install the core box bit and set the plunge depth (Fig. A). It's easiest to rout the trough by making four or five arcs to complete the circle (**Photo 4**). Making two or three passes to reach the final depth minimizes bogging down the router and burning the wood. Sand the trough by hand or with a detail sander to ease the sharp edges left by routing (**Photo 5**).

Rout the Marble Pockets

Create pockets for the marbles by making plunge cuts with a V-groove router bit. The pockets are arranged in a simple grid pattern (Fig. B). Their diameter, depth and pitch (distance between adjacent centers) depends on the game board you're making (Fig. A). Use a photocopier to enlarge the pattern and attach it to your game board (**Photo 6**). You'll need a separate pattern for each board you make. For a small board, the pattern's grid should measure 1" square; for the large board, it should measure 1-1/2" square. For the best accuracy, measure your enlargements across all 6 boxes (the target measurements are 6" or 9"). The enlarged pattern for the large board requires oversize paper. If your copier is limited to 8-1/2" by 11" paper, enlarge one half of the grid and tape two copies together.

Before you rout the pockets, remove the nail used to center the pattern on the board. Install the V-groove bit and set the plunge depth. To avoid burning the wood, I set the router's plunge stop to the final depth, but complete the pocket by making two or three plunges.

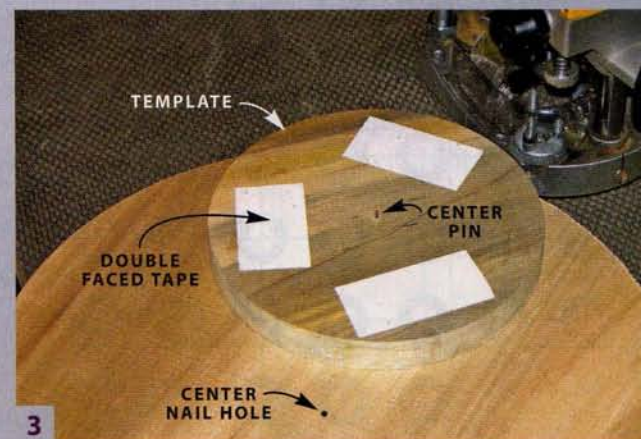
Position the router so the bit's point is centered over the first target. Hold the router steady and plunge-rout the pocket. Repeat the process to create the other 32 pockets (**Photo 7**). Then remove what's left of the pattern.



1 Start by cutting a square blank slightly larger than the game board's diameter. Install a nail or pin at the center for use with a circle-cutting jig. The nail hole will disappear when you rout the center marble pocket.



2 Saw the round board on the bandsaw, using the circle-cutting jig. I usually make two passes around to make sure no high spots remain. Sand the edge to remove the saw marks.



3 To rout the board's trough, use a template and a plunge router equipped with a core box bit. Center the template on the board by installing its center pin in the nail hole at the board's center. Tape holds the template in place.

FIG. A: DIMENSIONS

	9-1/2" Board	14" Board
A	3/4"	3/4"
B	11/16" *	15/16" *
C	1/4"	5/16"
D	1/4"	3/8"
E	1/2"	3/4"
F	1"	1-1/2"
T	4"	6"
R	4-3/4"	7"
CB	3/4" dia. core box bit	1" dia. core box bit
VG	1/2" 90° V-groove bit	3/4" 90° V-groove bit
RO	1/4" round over bit	1/4" round over bit

* approximate width after sanding

Fig. A
Layout

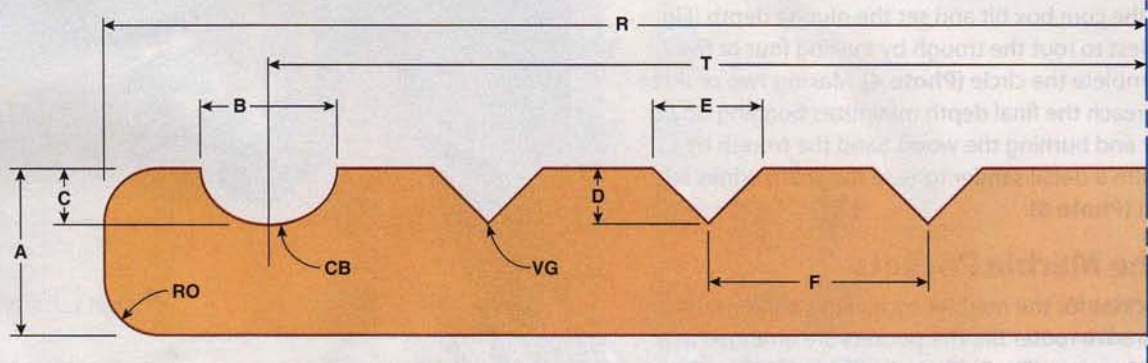
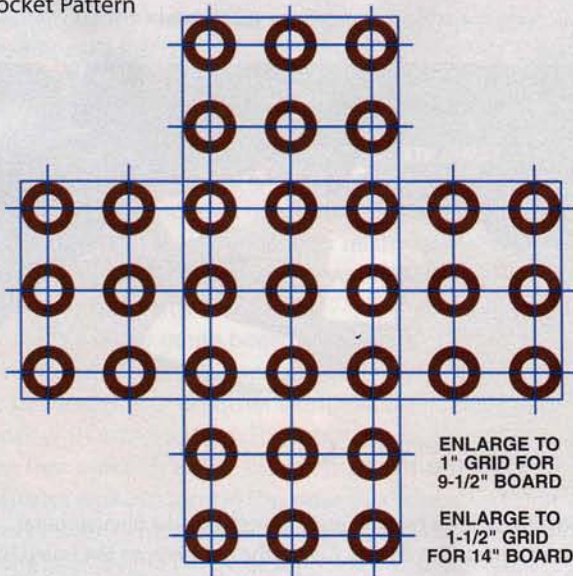


Fig. B
Pocket Pattern



ENLARGE TO
1" GRID FOR
9-1/2" BOARD

ENLARGE TO
1-1/2" GRID
FOR 14" BOARD

Finish the Board

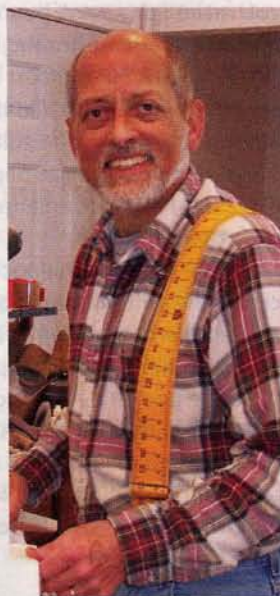
Finish-sand the board after rounding over its outside edges. I use a two-step finishing process. First I apply a pre-stain wood conditioner. Then I spray on three light coats of semi-gloss polyurethane.

SOURCES

- ◆ Little Works of Art, www.emarbles.com, "Jupiter" machine-made marbles by Mega Marbles, 5/8" dia., \$.50 for 5 marbles; 1" dia., \$.50 for 2 marbles; Bag of 24 5/8" dia. player marbles and 1 1" dia. shooter marble, \$3.
- ◆ Rockler Woodworking and Hardware, www.rockler.com, (800) 279-4441, Core Box Bits, 3/4" dia., #91001, \$27.99, 1" dia., #23822, \$32.99; 90° V-Groove Bits, 1/2" dia., #90869, \$19.99, 3/4" dia., #90880, \$23.99; 1/4" Round Over Bit, #26078, \$24.49.

JIM CHURCH

Watching *The New Yankee Workshop* while recuperating from spinal surgery rekindled Jim's interest in woodworking. Jim has since built a small shop on the back of his house in West Simsbury, Connecticut. To see samples of Jim's game boards, visit www.angelscreations.com.





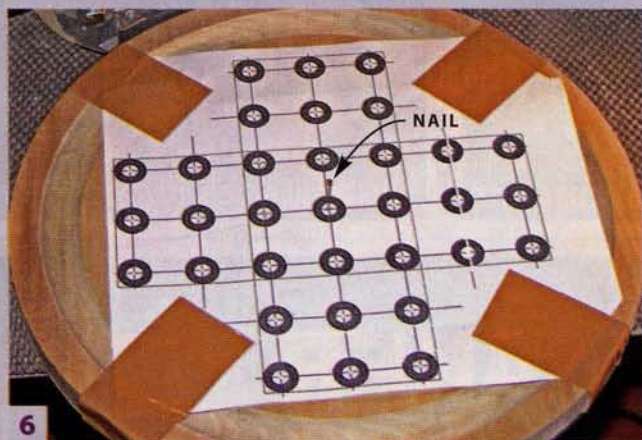
4

When you rout the trough, always bear against the template from the same point on the router's edge. To help keep the router oriented correctly, complete the trough by routing several arc-shaped segments.



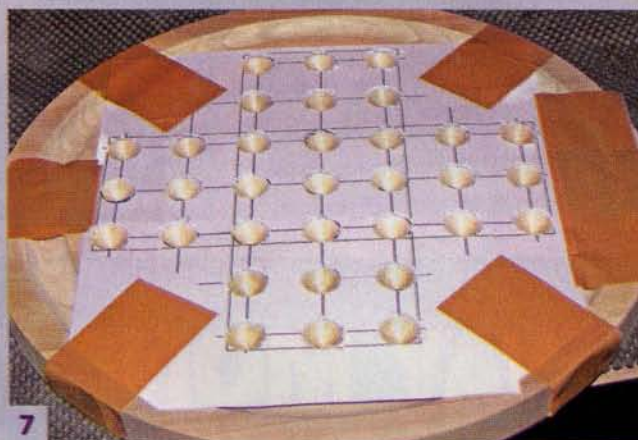
5

Sand the trough and soften its sharp edges. To reach the trough's bottom, I fold an oversized sheet of hook and loop paper around the edges of my detail sander's pad.



6

Center the marble pocket pattern. Poke a nail through the pattern's center and into the game board's center hole. Arrange the pattern to complement the grain and then tape it to the board.

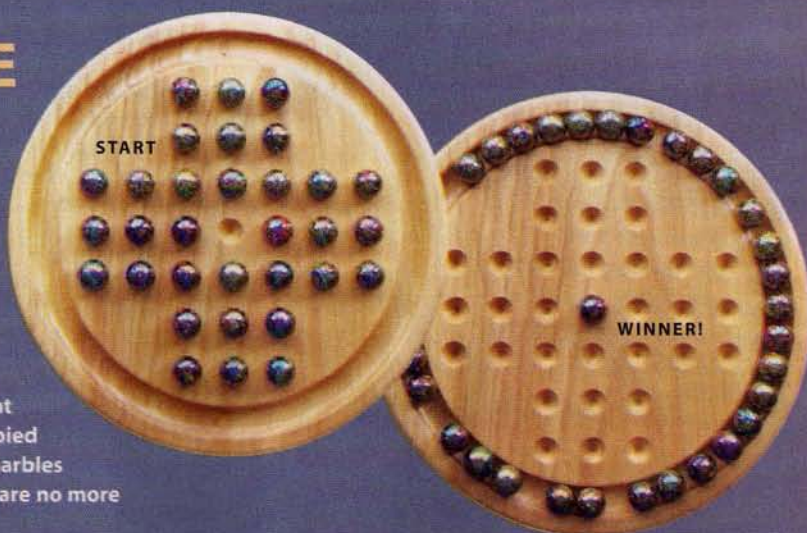


7

Create the marble pockets by making plunge cuts with a 90° V-groove bit, centered on each target. To complete the board, remove the pattern and round over the outside edges.

PLAYING THE GAME

Marbles come in a wild assortment of colors and designs. My favorites, named "Jupiter," are made by Mega Marbles. These marbles have a textured surface that I find easier to grip. You may have a bag of cat's eye marbles from your youth. In any event, you'll need 32 marbles to play the game. Start with the marbles in all the pockets except the center. The goal is to remove all the marbles by jumping, until only one marble remains, preferably in the center pocket. Jumps are allowed over adjacent marbles, left, right, and up and down, to any unoccupied position. Diagonal jumps are not allowed. Jumped marbles are stored in the trough. The game ends when there are no more allowable jumps.



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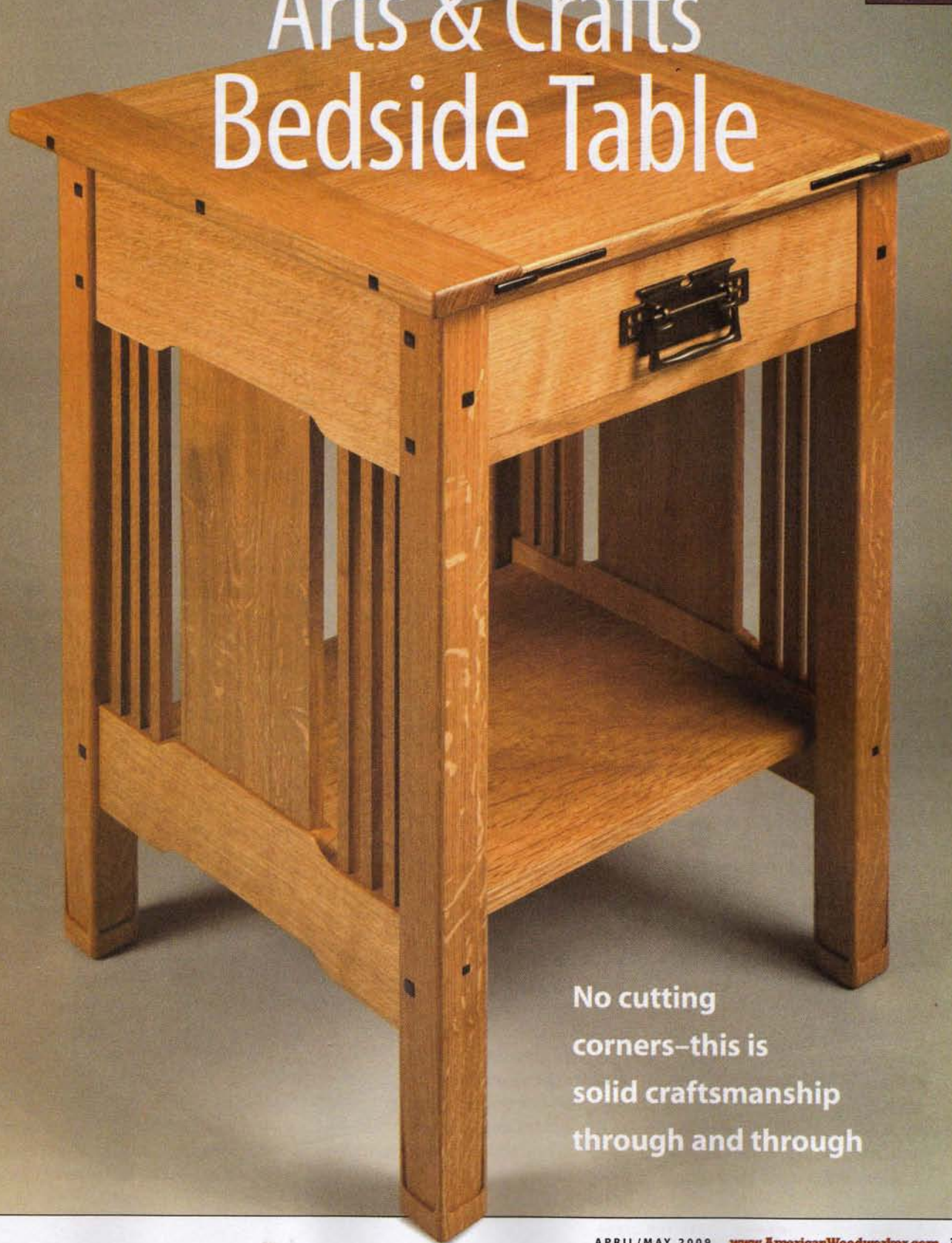


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Fig. A Exploded View

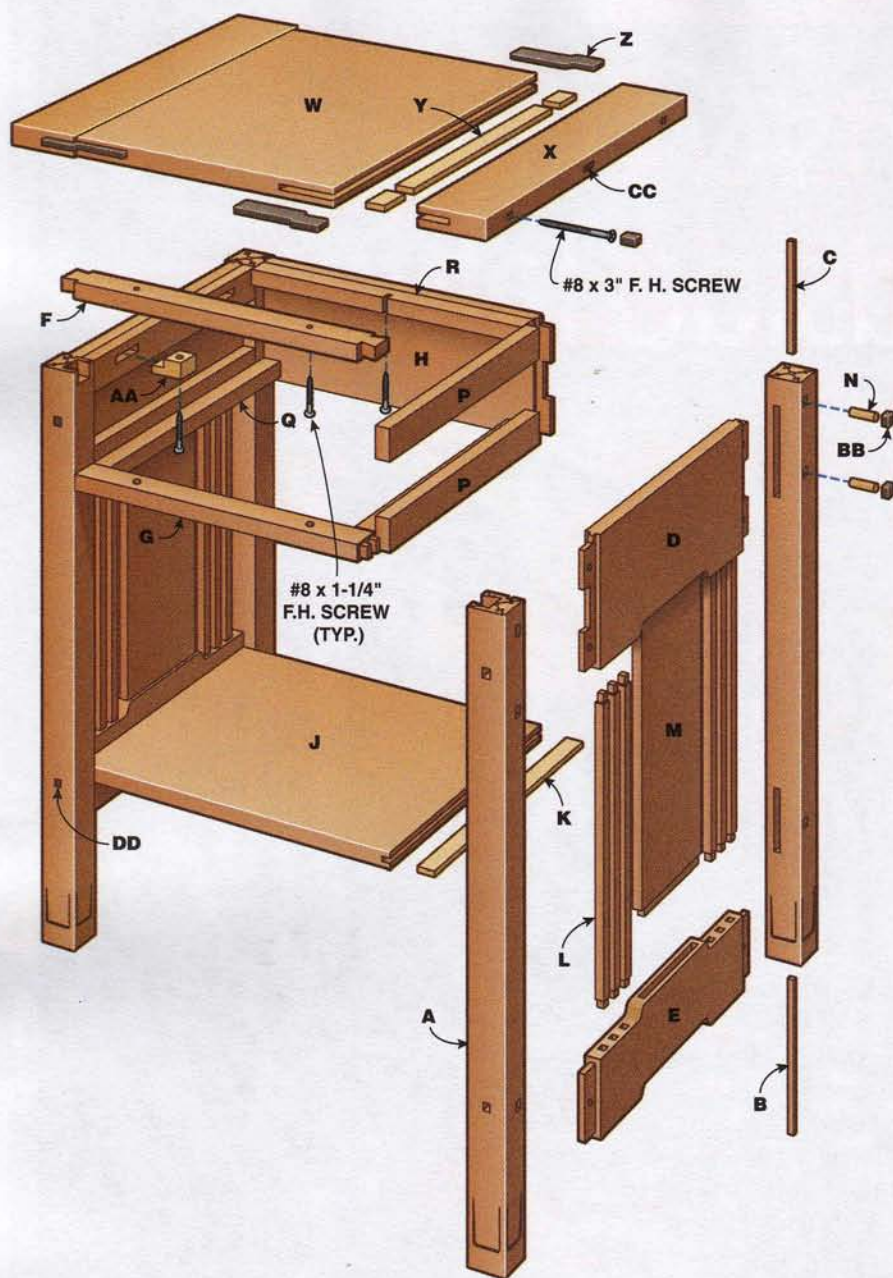


Fig. B Leg Indent Jig

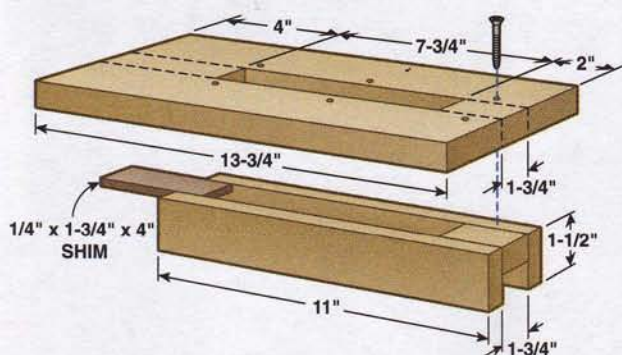
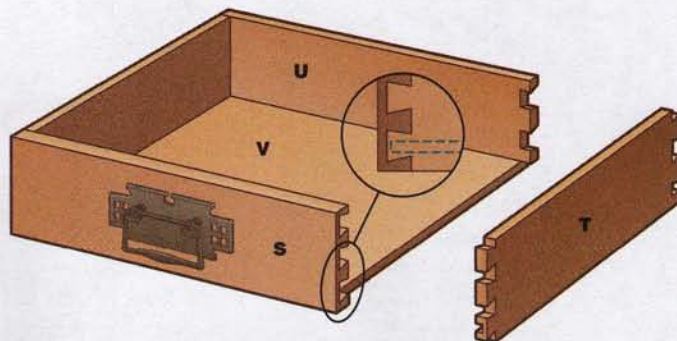


Fig. C Drawer Details



ARTS AND CRAFTS is both a style of furniture and a philosophy about craftsmanship. It calls for honest, functional design and a harmonious effort between designer and craftsman.

The design of this bedside table borrows elements from three Arts and Crafts sources (see Arts and Crafts Details, page 43). I've combined them to create my own style, and built this table using the best construction techniques of that period.

Make the Legs

1. Glue up each leg from four separate extra-long pieces (A, **Photo 1**) (see Four-Sided Quartersawn Table Legs, page 47). Alternatively, you can make the legs from one piece of 8/4 wood. Once the legs are glued, make plugs (B and C) to fit into the legs' hollow ends. Mill the plugs so they're easy to slide into the ends, then glue them with epoxy. Trim the legs to final length.

2. Cut mortises in the legs (**Photo 2**) for the upper and lower side rails (D and E), rear rail (H), and lower divider (G) (see Figs. D and E).

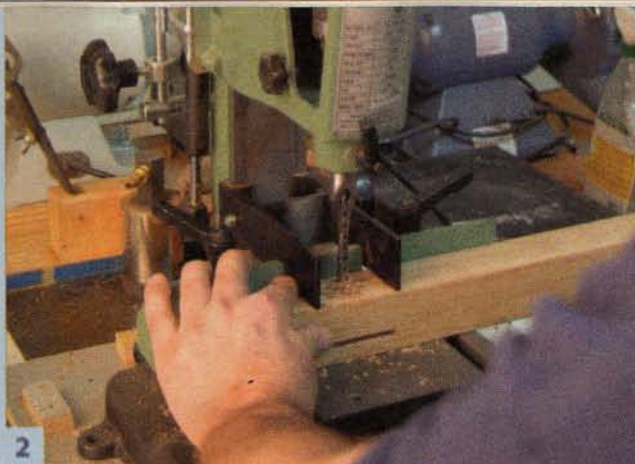
3. Layout and drill 1/4" holes for the pins (N) that will go through the joint's tenons (**Photo 3**). Cut mortises for the ebony plugs that cover the pins (**Photo 4**).

4. Rout a 1/8" roundover on all of the legs' long edges and bottom edges.

5. Rout leg indents using a jig (Fig. B) and a plunge router equipped with a 1/2" straight bit and a 1" O.D. template guide (**Photo 5**). A 1/4" spacer tilts the jig to create the indent's taper. (This jig was designed by Darrel Peart, an expert in building Greene and Greene-style furniture. See his book in Sources, page 46). To use the jig, draw a pencil line across



1 Begin by gluing up the legs. Each leg is composed of four pieces of quartersawn oak, joined by lock miters. (For more on this technique, see Four-Sided Quartersawn Table Legs, page 47).



2 Cut mortises in the legs using a mortising machine.



3 Drill holes for 1/4" dia. pins in the adjacent sides of the legs. Insert a loose tenon into the mortise to prevent splintering.



4 Make the holes square using a mortising-machine's hollow chisel. Tap the end of the chisel with a soft mallet until the square portion of the hole is about 1/4" deep (see inset).

the leg at the indent's top starting point; then place the jig on the leg and the assembly in your vise. Next, place your router on the jig and plunge the bit until it touches the leg on the pencil line. Lock the bit at this depth. Push the router up the jig so the bit is no longer touching the leg, start the router, and rout the indent (**Photo 6**). Sand the bottom and edges of the indents with 150-grit sandpaper. Feather the top of the indents into the leg.

Build the Sides

6. Mill the upper and lower rails, then cut tenons on their ends (**Photo 7**). Note that the upper tenon on the upper rail is 1/8" narrower than its mortise; this space allows the rail to shrink and swell without cracking. The lower tenon on this rail, and the tenon on the lower rail, are cut for a snug fit with their mortises. Cut grooves in the lower

side rails for the shelf support spline (K).

7. Make 1/4" hardboard templates for the upper and lower rails (Fig. F). Trace the templates' outlines on the rails and bandsaw the profiles. Attach the templates to the rails with carpet tape and rout the profiles with a flush trim bit (**Photo 8**).

8. Lay out and cut mortises for the spindles (L) and panel (M) (**Photo 9** and Fig. D).

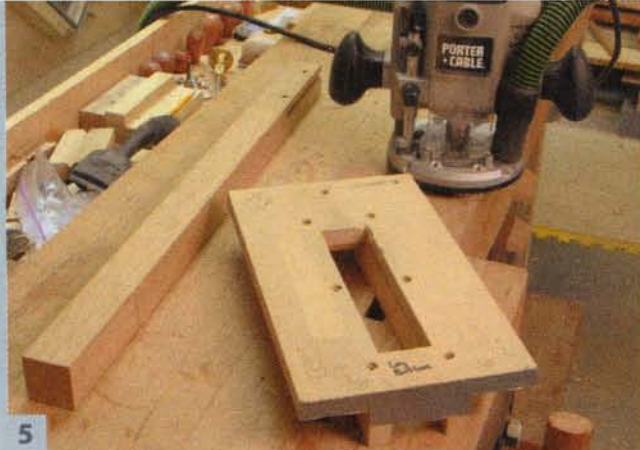
9. Make the spindles and cut tenons on their ends. Ensure a snug fit into the mortises, because the spindles will not be glued in place. Dry fit the rails, legs and spindles. Measure the distance between the rails to determine the panel's exact length. Make the panels and cut tenons on their ends. Dry clamp the entire side assembly and mark the location of the pin holes in the upper rail. Disassemble the side and drill elongated holes through the upper tenons,

so the rail is free to shrink and swell. Clamp the rails, spindles and panel together, without glue, then glue the legs to the rails (**Photo 10**).

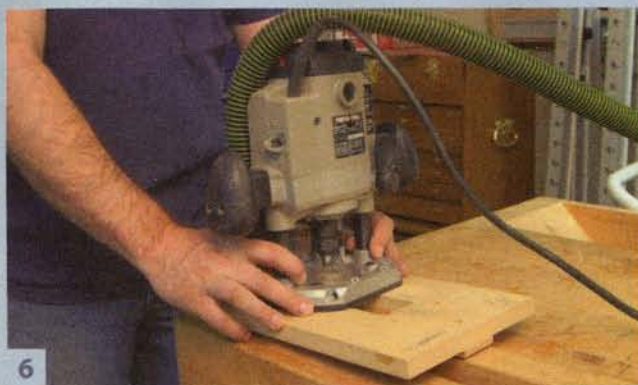
10. Once the glue has set, complete the pin holes by drilling through the tenons. The final holes should be 1" deep. Glue the pins in the joints, but don't install the ebony plugs (BB). They'll interfere with clamping in the steps ahead.

Assemble the Base

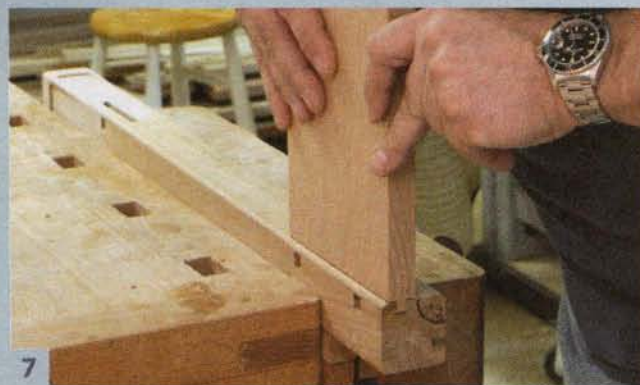
11. Mill the dividers (F and G) and rear rail (H). Using a dado set, cut a 1/16" shoulder on all four sides of the lower divider and the rear rail, and the bottom face of the upper divider. This cut establishes a consistent length between the shoulders of all three pieces. Raise the dado set to the appropriate height and finish cutting the tenons on the rear rail. Readjust the



Build a router jig for making Greene and Greene-style indents at the bottom of the table's legs.



Route the indents. The indents are shallow ramps that are flush at the top and about 1/8" deep at the bottom. This jig fits tight around the leg and tilts the router.



Mill the rails, cut tenons on their ends, and test their fit. The tenon on the upper rail is split in two in order to avoid weakening the leg.



Make hardboard templates for the rails, then shape the rails using a flush-trim bit. You can see that my router table is very simple!

dado set's height to cut the outside cheeks of the lower divider. Remove the material between the double tenons of the lower divider, staying 1/32" below the shoulder (**Photo 11**). Pare to the shoulder with a chisel.

12. Cut the dovetails on the upper divider. Scribe around the dovetails to lay out the sockets in the legs. Drill, saw, and pare the sockets.

13. Drill holes in the upper divider for screws to fasten the top. Drill holes in the lower divider large enough for a screwdriver to pass through.

14. Assemble the sides, dividers and rear rail without glue. Measure the distance between the lower rails to determine the exact length of the shelf (J). Make the shelf and cut a groove at each end to receive the shelf support spline (K) (**Photo 12**).

15. Disassemble the base and glue the spline in the side rails. Glue and

assemble the sides, dividers, rear rail and bottom shelf (**Photo 13**). Once the glue has set, drill holes through the tenons, as you did in step 10. Install pins in the joints. Mill the doublers (P). Measure the distance between the inside face of the upper rails and the legs to determine the doublers' exact thickness. Cut mortises in each upper doubler for table top buttons (AA). Glue the doublers in place. Mill the runners (Q) and cleat (R). Cut a slot in the cleat for a screw. Glue the cleat to the rear rail. Glue the runners to the lower doublers (**Photo 14**).

Build the Drawer

16. I've built the drawer for this table in a traditional manner with half blind dovetails in front and through dovetails in back (**Photo 15** and Fig. C). I lay out and cut these joints by hand, so I haven't drawn their precise dimensions for you. For more on cutting drawer dovetails by

hand, see "Precise Hand-Cut Dovetails," AW#119, January 2006, p. 62. There are many other ways to make the drawer, however—just pick the method you're comfortable with. Add the pull (see Sources) when you're done.

Make the Top

17. Select the wood for the top's core (W). I like to book-match my tops by re-sawing a piece of 8/4 stock, and use other parts of the same board for the breadboard ends (X). I wait a few days for the re-sawn stock to stabilize, then glue up the top, ensuring that it's flat, and cut it to final size.

18. Cut a groove in each end of the core. Reference the groove's location from the core's bottom. Using the same setup, and also referencing from the bottom, cut a groove in the breadboard ends.

19. Drill stepped holes in each



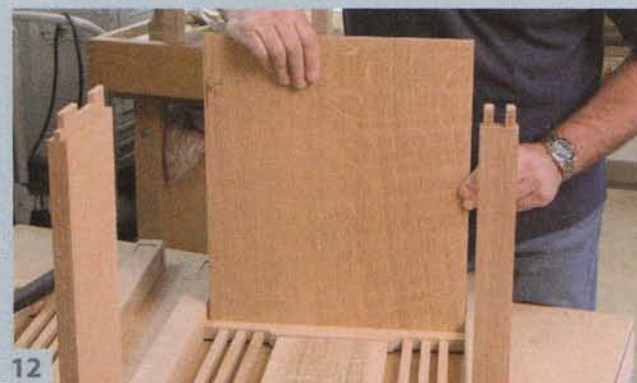
9 Clamp a pair of upper and lower rails together, then lay out mortises for the spindles and panel that go between the rails.



10 Clamp the rails, spindles and panel together without glue. Then glue the legs to this assembly.



11 Saw two tenons side by side on the ends of the divider that goes below the drawer. One large tenon would weaken the legs too much.

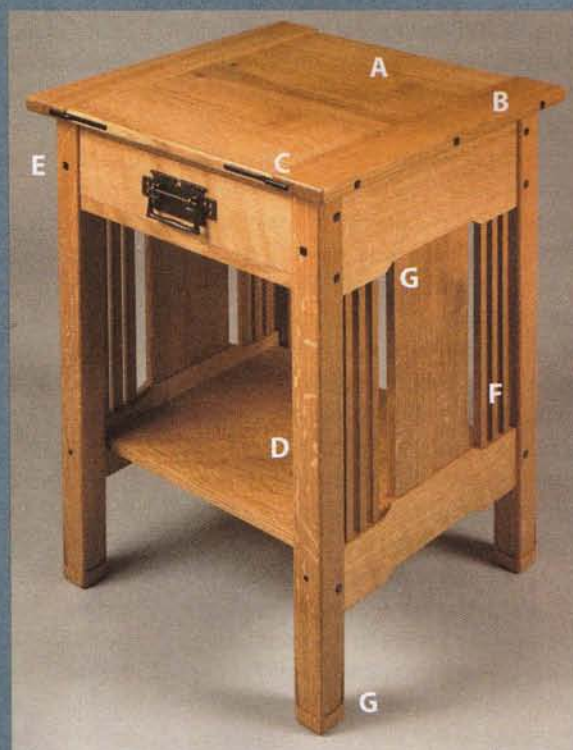


12 Fit the shelf. It sits on a spline that runs the length of the lower rail. The shelf won't be glued, so it's free to expand and contract.

ARTS AND CRAFTS DETAILS

Most of my work is influenced by the look and feel of Arts and Crafts furniture. In this bedside table, I've added details created almost one hundred years ago by Charles and Henry Greene, Frank Lloyd Wright, Gustav Stickley and L. & J. G. Stickley. Arts and Crafts designers borrowed ideas from many sources, and I have, too. I've used the following elements to create my own signature style:

- A. Quartersawn oak** was widely used by many Arts and Crafts designers.
- B. Breadboard ends**, slightly raised above the main top, are common on furniture by Greene and Greene.
- C. Ebony spline** often bridged joints in Greene and Greene pieces.
- D. Four-sided quartersawn legs** show oak's ray fleck figure all the way around. They were a trademark of L. & J. G. Stickley's Mission furniture.
- E. Ebony plugs** were a distinctive touch of Greene and Greene furniture. Some plugs covered screws, some covered pins that go through mortise and tenon joints, and others didn't cover anything—they were placed to please the eye.
- F. Square spindles** are reminiscent of several Frank Lloyd Wright designs.
- G. Leg indents and cloud lift profiles**, inspired by Chinese furniture, were adopted by the Greenes.





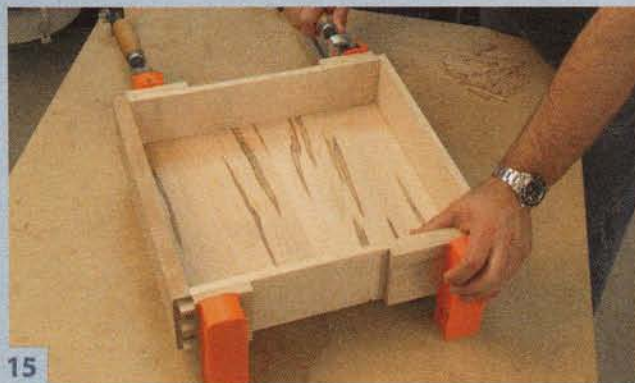
13

Assemble the table in a trial run. Tap the top rail into dovetailed sockets in the ends of both legs. When you're sure everything fits, glue the base.



14

Add runners for the drawer. Make sure that they are flush with the front rail and square to the case, front to back.



15

Glue the drawer, using blocks with fingers to put pressure directly on the dovetails.



16

Move on to making the top. Drill deep holes all the way through the breadboard ends in order to fasten them to the top with screws.

breadboard end for the screws that will fasten it to the core (Fig. H). Start by drilling 1/8" holes all the way through the breadboards. Use a 3/8" Forstner bit to counterbore the holes from the outside edge (**Photo 16**). Drill elongated 3/16" holes from the inside edge to allow the screws to move with the core. Layout and cut plug mortises on the breadboard ends. Use a 1/8" roundover bit to rout all the edges of the breadboard ends, except the bottom.

20. Plane a hollow no more than 1/32" deep on the grooved side of each breadboard end (**Photo 17**). This is an optional step, but I do it to ensure that the joint stays tight.

21. Make the breadboard spline (Y). Cut each spline into three pieces (Fig. A) and glue the pieces to the core. Leave a gap between the spline pieces for the screws. Let the glue dry and scrape off any squeeze-out. Glue on the bread-

board ends, making sure that they're centered on the core (**Photo 18**). Don't put glue all the way across the joints—just in the center, about 4" wide. Let the assembly dry overnight, then drill pilot holes into the core using an extra-long 3/16" drill bit. Add the screws.

22. Turn the top over, so the flat side is up, to cut slots for the decorative ebony spline. Mark the top to indicate where to begin and end the slots. Rout the slots with a 1/4" slot cutter set up for a 1/2" deep cut (**Photo 19**). Square the ends of the slots with a chisel.

23. Mill the stock for the ebony spline (Z). Cut the inside profile of each spline using a jigsaw or bandsaw. Trim each spline to fit. Install the spline, without glue, and trace the outer profile so that it protrudes 1/8" proud of the top. Remove the spline and round over all its edges and ends. Sand the spline up to 400 grit. Glue the spline,

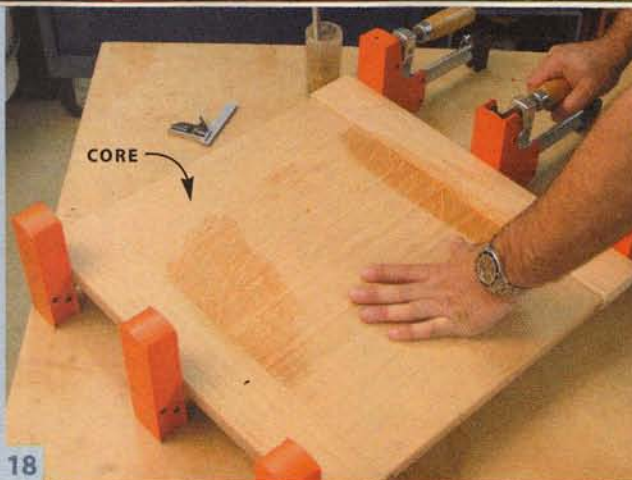
but only apply glue in the core portion of the slots. The spline should be free to float in the breadboard end, allowing the core to expand and contract.

24. Make the ebony plugs from a couple of blanks. Round the ends of each blank to create a pillow shape using a sanding jig (**Photo 20**), or by hand with a file and sandpaper. (For more information on this jig, and detailed instructions on shaping and polishing plugs, see Darrel Peart's book.) The jig has holes for various size plugs and is clamped to the disc sander's table. Rotating a blank into one of the holes quickly creates a pillow shape on the end of the blank. After this coarse rounding, sand the ends as you did the spline pieces. Cut the plugs to length on the bandsaw, to avoid kickback, and install them with a dab of glue.



17

Plane a slight hollow on the breadboard ends in order to create a spring joint. The hollow helps ensure that the joint comes tight at the ends and stays tight in the future.



18

Glue the top. Only the center portion is glued, so the core is free to move. Screws at both ends of the joint pass through elongated holes, also allowing the top to move.



19

Route slots in the top's edges to receive ebony spline. Use a slotting bit with a bearing and an oversize base plate, which helps prevent the router from tipping.



20

Round the ends of ebony blanks into a pillow shape for making plugs. I use a jig that accommodates various sizes of square stock—ready for my next Arts and Crafts project!

Fig. D Side Elevation

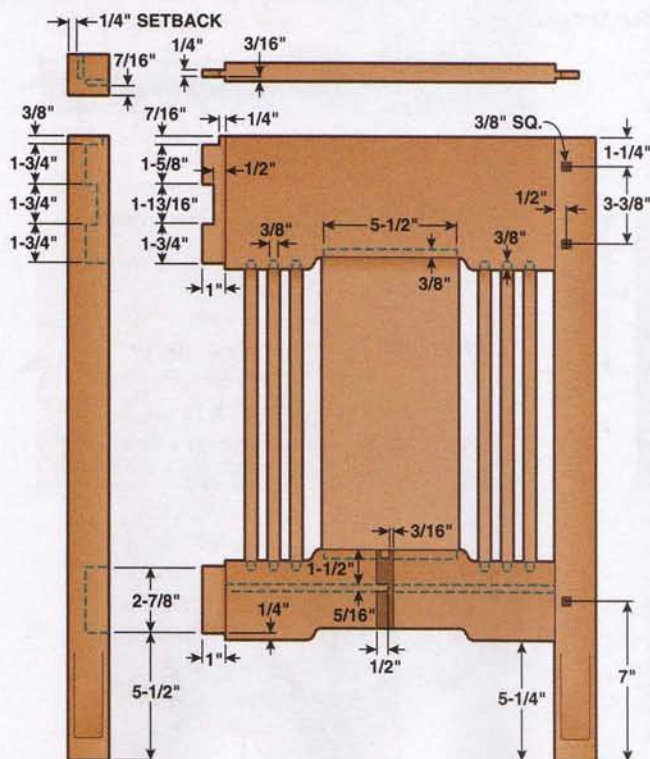
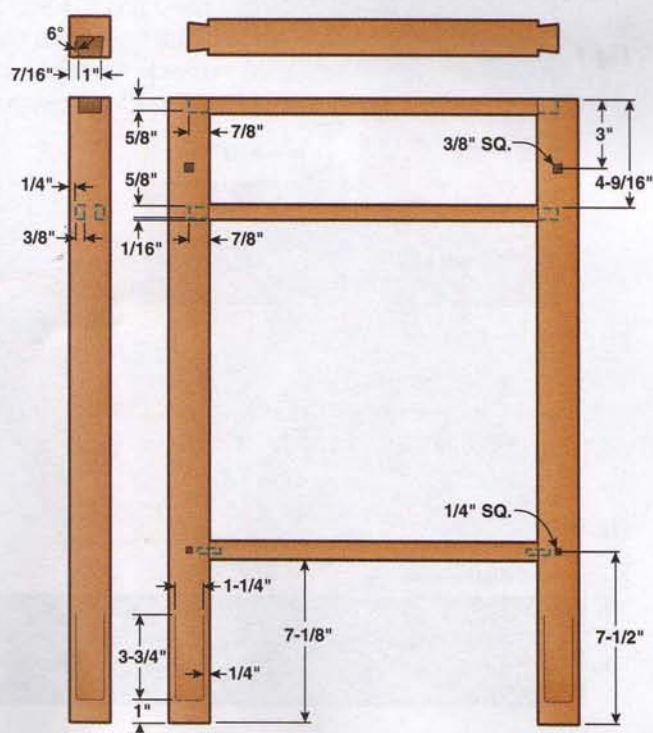


Fig. E Front Elevation



CUTTING LIST BEDSIDE TABLE Dimensions: 28-1/8" H x 20" W x 20" D

PART	NAME	QTY.	MATERIAL	TH X W X L
Base				
A	Leg part	16	QS White Oak*	3/4" x 1-3/4" x 27-1/4" (a)
B	Lower leg plug	4	QS White Oak	1/4" x 1/4" x 9"
C	Upper leg plug	4	QS White Oak	1/4" x 1/4" x 6"
D	Upper side rail	2	QS White Oak	3/4" x 5-3/4" x 16-1/2" (b)
E	Lower side rail	2	QS White Oak	3/4" x 4" x 16-1/2" (b)
F	Upper divider	1	QS White Oak	3/4" x 1-1/2" x 16-1/4" (c)
G	Lower divider	1	QS White Oak	3/4" x 1-1/2" x 16-1/4" (c)
H	Rear rail	1	QS White Oak	3/4" x 5-3/4" x 16-1/4" (c)
J	Shelf	1	QS White Oak	5/8" x 14-1/2" x 16-7/32"
K	Shelf support spline	2	QS White Oak	5/16" x 15/16" x 14-1/2"
L	Spindle	12	QS White Oak	1/2" x 1/2" x 13-1/4"
M	Side panel	2	QS White Oak	1/2" x 6" x 13-1/4"
N	Pin	12	Oak dowel	1/4" x 3/4"
P	Doubler	4	QS White Oak	3/4" x 1-1/2" x 14-3/4"
Q	Runner	2	QS White Oak	3/4" x 1" x 15-1/2"
R	Cleat	1	QS White Oak	3/4" x 1-1/4" x 14-1/2"
Drawer				
S	Drawer front	1	QS White Oak	7/8" x 3-3/4" x 14-1/2"
T	Drawer side	2	Maple	1/2" x 3-3/4" x 16"
U	Drawer back	1	Maple	1/2" x 3-1/4" x 14-1/2"
V	Drawer bottom	1	Maple	1/2" x 15-3/4" x 14"
Top				
W	Core	1	QS White Oak	3/4" x 19-3/4" x 14"
X	Breadboard end	2	QS White Oak	7/8" x 3-1/2" x 20"
Y	Breadboard spline	2	QS White Oak	1/4" x 15/16" x 20" (d)
Z	Spline	4	Ebony	1/4" x 3/4" x 4-1/4"
AA	Button	4	QS White Oak	3/4" x 1" x 1-5/8"
BB	Plug	26	Ebony	3/8" x 3/8" x 1/4" (e)
CC	Plug	2	Ebony	3/8" x 3/4" x 1/4"
DD	Plug	2	Ebony	1/4" x 1/4" x 1/4"

* QS White Oak=Quartersawn White Oak

(a) Rough cut these pieces at 32" L. Completed legs are 1-3/4" x 1-3/4" x 27-1/4"

(b) Length includes two 1" L tenons.

(c) Length includes two 7/8" L tenons.

(d) Cut each spline into three pieces.

(e) Make from two blanks 3/8" x 3/8" x 12".

Fig. F Side Rail Templates

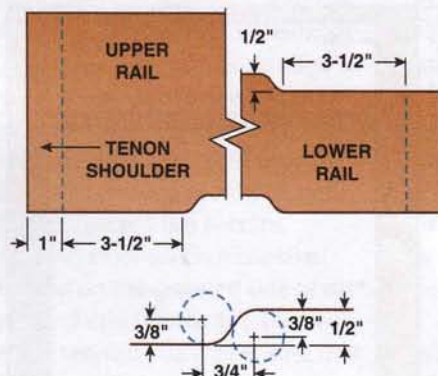


Fig. G Spline Detail



Fig. H Top Details

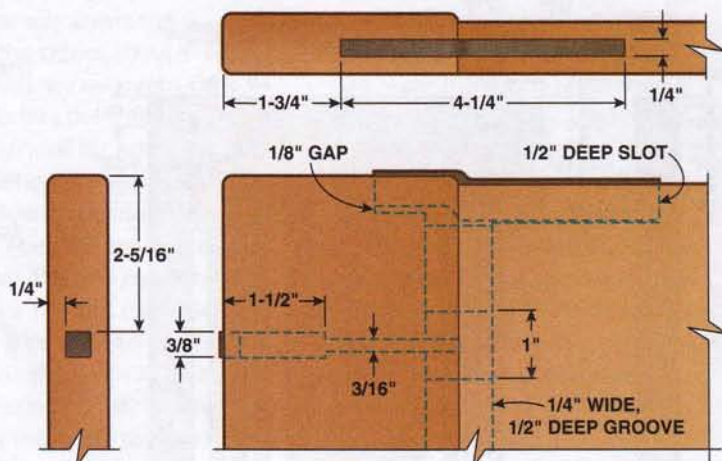
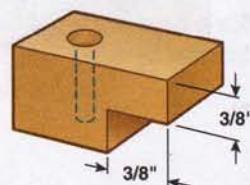


Fig. J
Table Top
Button



Apply the Finish

25. I prefer to protect white oak with a simple oil finish, not adding any dyes or stains. Left natural, it's a beautiful wood which ages to a golden color.

26. Make four tabletop buttons. Cut lips on the buttons to fit loosely into the mortises on the upper doubler (Fig. J). Center the top on the base and fasten screws through the top divider. Install the buttons, centered in their mortises.

SOURCES

◆ Darrell Peart, *Greene & Greene: Design Elements for the Workshop*, Linden Publishing, www.woodworkerslibrary.com.

◆ Horton Brasses, www.horton-brasses.com, (800) 754-9127, Mackintosh Pull, AD-4064, \$18.50.



Stewart Crick

A lifelong woodworker, Stu writes, teaches, and builds Arts and Crafts furniture from his Manassas, Virginia workshop. He also

serves as President of the Washington Woodworkers Guild. Visit his website at www.stuswoodworks.com.



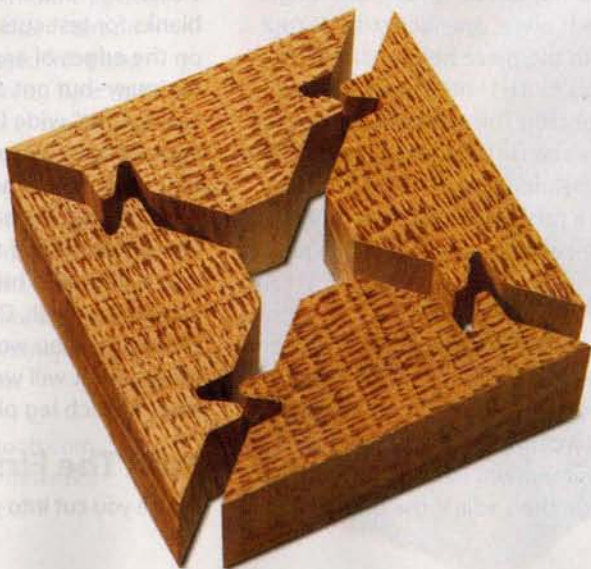
Four-Sided Quartersawn Table Legs

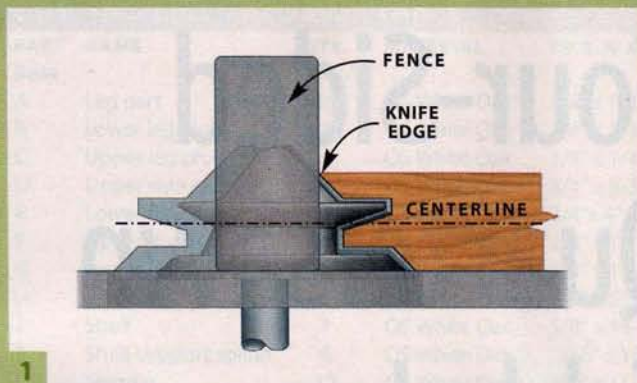
**How to rout lock miters
on narrow pieces**

By Tom Caspar and Stewart Crick

IF YOU SPOTTED an oak leg with quartersawn figure on all four sides, your first reaction might be: That's neat! But if you know wood, your second reaction ought to be: Now, how did they do that?

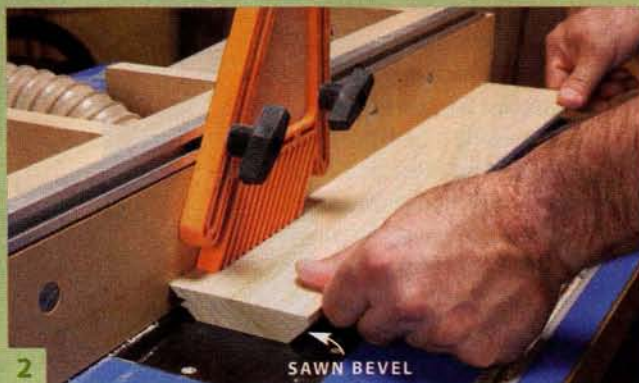
Well, there's more than one way. You could make a solid, plainsawn leg and glue quartersawn veneer on all four sides. Or you could make a leg from quartersawn wood and veneer just two sides. Or you can do what L. & J. G. Stickley did over one hundred years ago, in the heyday of the Arts and Crafts era, and make the leg from four interlocking pieces of solid wood (see Arts and Crafts Bedside Table, page 39). This method is the most durable type of construction because there's no chance of veneer flaking off. Using a modern lock miter router bit, it works well for any size leg, big or small.





1

Set up a lock miter bit in your router table by aligning the center of the bit with the center of your material. Set the fence to produce a knife edge.



2

Test the setup by routing similar lock miters on two scrap pieces. Pre-cutting some of the bevel on the tablesaw produces a smoother profile.



3

Fit the pieces together. If the top surfaces are flush, the setup is OK. If not, adjust the fence's position or the bit's height.



4

Route the first bevel by standing each leg piece on edge, in a vertical position. Make a large push block, with a stop on the end, to hold the workpiece tight against the fence.

Figuring out how to make these lock miters safely and accurately on a narrow leg can be quite a challenge. On each piece, one lock miter is routed with the piece held vertically; the other is routed with the piece held horizontally. The problem, as you can readily see, is that the pieces have very small bearing surfaces. The solution: make a push block and a jig to hold the pieces rock steady for each pass.

Test The Set Up

You'll need a lock miter bit that can handle 3/4" thick stock (See Source, page 49) and a router with variable speed mounted in a router table. Dial the router down to one of its lowest settings, then adjust the bit's height

and the fence as shown (**Photo 1**).

Chances are that the setting will be close, but not perfect, so prepare two blanks for test cuts. First, cut a bevel on the edges of each piece using your tablesaw—but not a complete bevel. Leave a 1/4" wide flat area. Rout one edge of both pieces (**Photo 2**) and fit them together (**Photo 3**). Be picky here. The top surfaces must be absolutely flush. If they aren't flush, adjust your bit's height, the fence's position, or both. Once you've got the setup right, you won't have to change it because it will work for cutting both sides of each leg piece.

Route The First Bevel

Before you cut into your good wood,

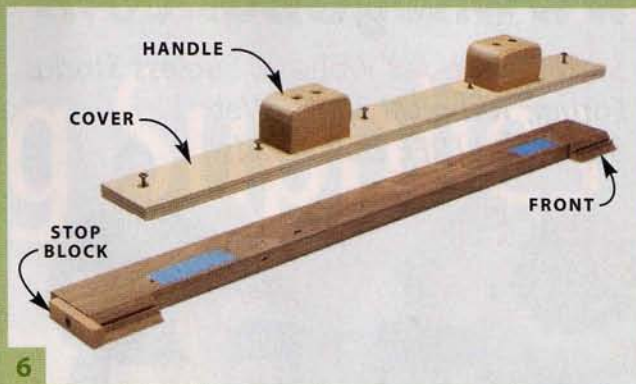
you'll probably want to go through the whole procedure with scrap stock. Prepare your blanks by selecting wood with strong quartersawn figure. Rip them to the final width of the leg and crosscut them a few inches extra long. When you're done, the blanks must be absolutely flat and straight—this is essential for making precise lock miter joints.

Next, make a push block that's as long as the blanks. It should be as thick as the blanks are wide. Fasten two push pads to the top of the block and add a stop to the block's end to help push the blanks through the cut.

Attach a featherboard to your router table's fence. This is a must—the pressure it applies is essential to making a smooth cut.



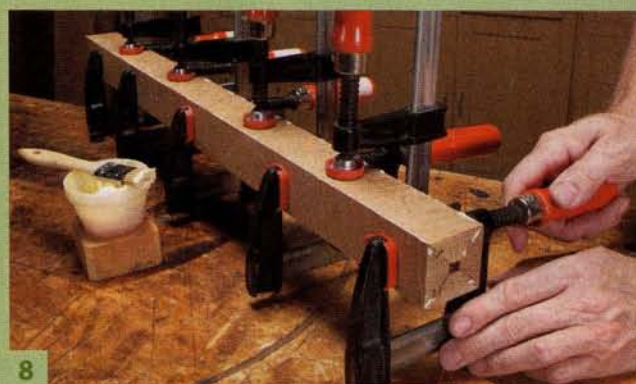
5 Build a jig for routing the second bevel. Rout a lock miter on this piece by standing it on edge, as in the last step. Remove the center portion of the lock miter profile using a bandsaw.



6 Fasten a cover piece to the jig and attach a stop block. Slide the workpiece into the jig from the front, with its lock miter engaged with the jig's profile.



7 Rout the second bevel with the workpiece held horizontally. The jig provides a wide bearing surface in order to cut a perfect joint on this narrow piece.



8 Glue four identical pieces to make the leg. The interlocking miters prevent the pieces from slipping side to side.

Stand the workpieces on edge and rout the first bevel on each one (**Photo 4**).

Rout the Second Bevel

Make a jig for cutting the second bevel. Start with a piece that's about the same length as the workpieces. Stand the piece on edge and cut a lock miter along its length. Next, remove most of the profile using a bandsaw (**Photo 5**). Leave about 3" of the lock miter at each end. This huge notch ensures that the workpiece will nest securely in the jig.

Next, fasten a stop block to the end of this piece, plus a cover piece that hangs over the lock miter by about 1" (**Photo 6**). Fasten some

blocks to the cover piece to make the jig easier to push.

Slide a workpiece into the jig from the front end, so the lock miters on both pieces are engaged front and back. It should be a pretty tight fit. If it's too tight, place masking-tape shims under the cover. Rout the second bevel (**Photo 7**). Slide the piece out of the jig and rout the remaining pieces. When you're done, glue-up is fairly simple, but use lots of clamps all around to make sure the joints are tight (**Photo 8**). Let the glue dry overnight and cut the legs to final length.

SOURCE

◆ Freud, www.freudtools.com, (800) 472-7307, Lock Miter Bit, #99-035, \$79.99.



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A Pro's Guide

30 Finishing Supplies

30 must-have tools for finishing all types of woodworking projects

by Kevin Southwick

COLLECTING WOODWORKING TOOLS is undeniably fun. As a professional finisher, I meet a lot of woodworkers on the job and in the classes that I teach. So I know that spending hundreds of dollars on a new router or a fine hand plane is thought of as a reasonable expense for an essential tool. On the other hand, having to buy sandpaper or a new can of finish is usually likened to throwing money away.

Why is that? I think of finishing supplies as good investments—essential woodworking tools on a par with those that cut and shape wood. Good finishing tools make it easier to apply good finishes, which both improves my enjoyment of woodworking and produces a superior result. In my opinion, a well-equipped woodworking shop includes a well-equipped finishing cabinet. Here's a collection of finishing tools and supplies that I think are worthy of your hard-earned cash.



Finishes You Can Wipe, Brush or Spray

It makes sense to keep different kinds of finish on hand, because each project presents unique finishing challenges. A **wipe-on/wipe-off finish**, such as General Finishes Gel Topcoat urethane, looks great, applies easily and eliminates worries about bubbles, drips, runs, sags, dust nibs, hair, or brush marks. Any finishing oil, oil/varnish blend, or gel varnish will do, as long as you prepare the surface well and buff the finish thoroughly dry, to avoid streaks. Wipe-on/wipe-off finishes leave an attractive low sheen, but they provide limited water resistance and numerous applications may be required.

Film-building finish, such as Varathane oil-based polyurethane, is the best choice if you want a higher sheen or better moisture protection. Building a film finish requires a brush or pad, sanding between coats, and a little practice. Most oil-based polyurethanes can be thinned to make wipe-on/wipe-off finishes.

Shellac is a must-have. A beautiful finish on its own, shellac can also be a big time-saver, because it dries super-fast. Zinnser SealCoat is liquid shellac that's light in color and free of wax, so it's compatible with virtually any other finish.

Spray-on finish in aerosol cans is excellent for finishing smaller projects. Many different finishes are available as aerosols, including lacquer, shellac, acrylic and polyurethane. Apply thin coats for the best results.



Touch-Up Tools

Knowing how to hide mistakes makes you a better woodworker. Touch-up tools allow you to disguise defects such as glue spots, sanded through edges, light-colored scratches, and fill-

ins that don't quite match. **Wood touch up pens** are handy to have, as are **colored pencils** and wood-tone **colored markers** from an art materials or office supply store.



4 Types of Brushes

When you choose a finishing brush, consider the task you want to perform. For example, when you are applying varnish, you'll get the best results by using a varnish brush, rather than a paint brush. **A varnish brush** is designed and constructed to be used with thin finishes such as oil-based polyurethane, shellac and lacquer; paint brushes are designed to apply much thicker material. The best varnish brushes have very fine natural bristles that are relatively short and densely packed. A 2" wide brush is the most versatile size.

Redtree and Grammercy natural bristle varnish brushes are my favorites. Redtree 2" brushes cost less than \$20, about the same as a paint brush of comparable size and quality. Grammercy brushes cost twice as much, but they're made by hand and are worth every penny.

A sash brush is a round, tapered natural bristle brush that is uniquely suited for evenly applying finishes to uneven surfaces such as shaped moldings or carvings. I keep a range of sizes ready for use. Sash brushes are available at art materials stores.

A synthetic bristle brush, made with Taklon nylon bristles, is an excellent choice for water based materials.

Disposable brushes are indispensable: No cleaning required! Chip brushes (natural bristle) are useful for applying both stains and finishes (although they do shed bristles). Foam brushes work well on flat surfaces. However, shellac and lacquer will dissolve them.



Rags and Cloths

Scott brand shop rags are my top choice for general use. These lint free, heavy duty paper towels are economical and available in rolls or boxes—I prefer the boxes, because they keep the towels clean.

Knit 100% cotton rags are more absorbent than towels. They're good for staining and for wipe-on/wipe-off finishes. Buy them ready for use or cut them from 100% cotton T-shirts—just avoid the seams, collars and armbands.

Super absorbent, **100% cotton cheesecloth** makes an excellent applicator pad that affords precise control for padding or wiping on film-building finishes. Wrap a pad of cheesecloth in nylon stocking fabric for an extra-nice applicator.

Micro-fiber tack cloths make traditional tack cloths obsolete. They grab and hold dust amazingly well, and they're infinitely reusable. I use two—one that's dry, for initial dusting, and one that's barely damp, for use immediately before applying finish.



Dust Mask and Respirator

A reusable dust mask is worth the initial investment, because it can last for years. Just wash it by hand and it's ready to reuse. Dust Bee Gone brand reusable masks are comfortable and much more effective than any paper disposable masks I have ever used.

A respirator mask with organic vapor cartridges is a must-have to limit your exposure to toxic fumes found in finishing products. Lay in a supply of cartridges and replace them regularly.



Surface Preparation Tools

Any tool that makes sanding faster or easier is welcome in my shop. Machine sanders are obviously important, but even the best leave marks that must be removed for a top-quality finish. That's why hand sanding blocks are the most frequently used tools in my shop.

Shop-made sanding blocks of 3/4" wood with 1/4" cork or neoprene glued on the business end are my favorites for use on bare wood. Cork's firmness works best for flattening; neoprene works best for subtle curves or easing an edge. I keep several different sizes and shapes to meet needs such as reaching into tight corners.

The Preppin' Weapon is a good choice for sanding large flat surfaces; **solid cork blocks** work well for general sanding.

Hard felt or dense neoprene blocks work best for sanding film finishes between coats. These materials have flexible, cushioned working surfaces that provide consistent and delicate control.

Top Quality Abrasives

High tech sandpaper is made with durable backing paper, no-load coatings, and abrasive particles that stay sharp and are consistently sized. This sandpaper cuts quickly, leaves a uniform scratch pattern and lasts a long time. Stock ample supplies of sandpaper in every grit that you commonly use. Buy only the best quality paper, such as Norton 3X or 3M Sandblaster.

Steel wool ranges in quality, too. For example, the steel wool you find at hardware stores can be quite oily as a result of the manufacturing process. Top brands, such as Liberon, have very consistent, long, fine strands of steel that last longer, and don't shred as easily, so they are less messy.

Nylon abrasive pads (also called synthetic steel wool) are an alternative to using fine sandpaper or 0000 steel wool between coats of finish. Abrasive pads don't leave steel fibers behind, but they also don't cut as consistently as good quality steel wool.



Task Lighting

A movable light source, such as this inexpensive clamp light, is especially helpful to have during sanding and finishing operations. Highlighting surfaces with light from raking angles reveals defects and problems much more clearly than overhead light.

Good overhead lighting is also important. Be aware that colors look different under different types of lighting. Incandescent light makes colors appear "warmer" than natural light and fluorescent light makes colors appear "cooler." For this reason, color matching should always be done under the same type of lighting in which the final results will be viewed.

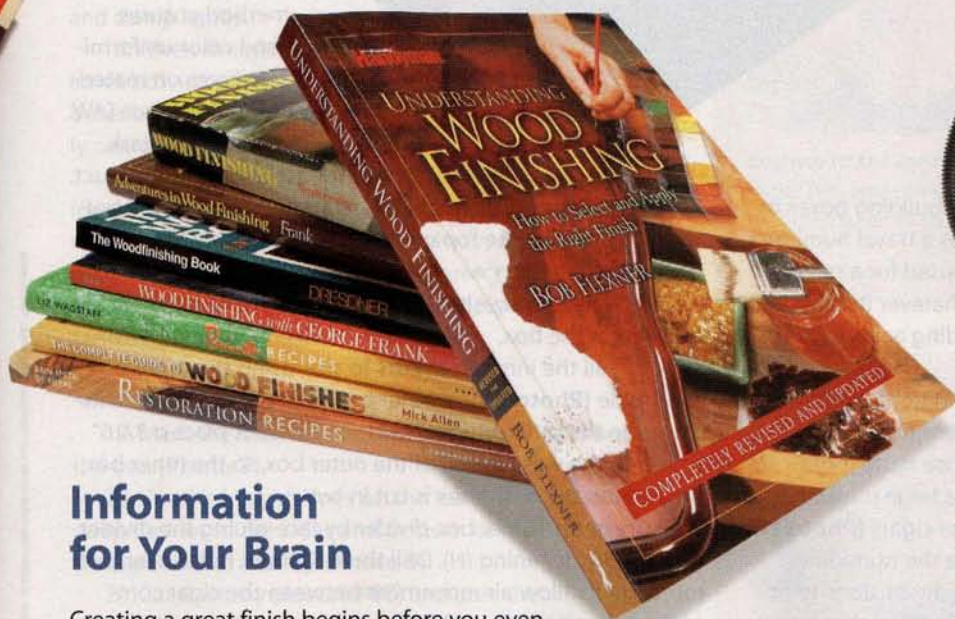


Wood Coloring Materials

Changing the natural color of wood is optional; if you want to do it, you should be familiar with two types of stains.

Pigmented oil stains in liquid or gel form are usually the easiest wood colorants to use. Gel stains are especially good for color matching, because they can be used like a glaze for layering color. Stains and glazes made using artist's oil colors offer the widest choice of colors. To make your own liquid stain, mix the oil colors in a 2 to 1 solution of mineral spirits and boiled linseed oil. To make a glaze, mix the oil colors with glazing medium. Artist's oil colors and glazing medium are available at art materials stores.

Dye stains are unique because they have both powerful and subtle coloring abilities. For example, they can turn maple jet black, gently tint it to an aged golden tone or amplify its curly figure. Water-soluble dyes are the easiest to use on bare wood and are usually the best choice for accentuating highly figured woods.



Information for Your Brain

Creating a great finish begins before you even open a can. **Books about finishing wood** are loaded with useful information, techniques and formulas, facts and honest opinions. I've learned something new from every finishing book that I've read. Bob Flexner's *Understanding Wood Finishing* is comprehensive and well organized. It also has an excellent in-depth index that's helpful whether you're seeking general information or trying to solve a specific problem.



Dust Collection

An effective shop vacuum traps dust without re-circulating small particles, which can ruin your finishes, back into the air. Fine vacuums come with cloth filters that remove dust particles down to 5 microns, and finer filters are available as upgrades.

A room air filtration system, usually installed to remove fine airborne dust for health reasons, will also clean the air before you apply finishes. Run the system for an hour or two and shut it off just before finishing begins.

Travel Humidor

A pull-apart box with a silky-smooth fit



by Suwat Phruksawan

I'VE HAD A LOT OF FUN over the years building boxes of all shapes and sizes. This one was made as a travel humidor for a friend. The box can just as easily be used for a travel jewelry box, eyeglasses—you name it. Whatever its use, the real crowd pleaser is the silky smooth sliding action as the box is opened: it always brings a smile.

I like working on small-scale projects. Materials are easy to find and afford. (I get my best wood from my scrap pile). Working on a small scale gives me a chance to do more handwork than time normally allows on a large project.

I sized this humidor to fit three Corona cigars (Photo 1). If you aren't a cigar person, just eliminate the humidifier and Spanish cedar. Then, modify the box dimensions to fit eyeglasses, pens and pencils, jewelry—anything that needs to be contained while bouncing around in a backpack, purse or suitcase.

Build the Boxes

1. Cut the parts for the outer box (A-D, Fig. A, page 58) to size. It's best to resaw the thin stock from thick boards. This

method ensures grain and color uniformity. It also conserves on material. My multi-purpose tall fence (AW #135) makes quick work of this task.

Size your humidor to fit the desired product.

2. Use water-resistant glue to attach the sides to the bottom. Do not glue the top on yet. Note: Make sure the box is perfectly square.

3. Epoxy a thin washer or other slim piece of metal inside one end of the box.

4. Cut all the inner box parts to size, using the outer box as a guide (Photo 2). The inner box (E, F, G and Q) should fit snugly in the outer box from side to side. But place a 3/16" spacer in the washer end of the outer box, so the inner box will fit after the outer box is cut in two.

5. Create the inner box divider by face-gluing the divider (M) and divider lining (N). Drill three 5/8" dia. holes near the top edge to allow air movement between the cigar compartment and the humidifier.

6. Glue the inner box together using the outer box as a form to insure a smooth, piston fit.

7. Cut the Spanish cedar linings (H-K) and install them inside the inner box (Photo 3).

8. Glue on the top piece (L) so its edge is flush with the edge of the divider.

9. Drill a shallow hole and install a magnet on the outside of the inner box end (G). Make sure the magnet aligns with the washer mounted in the outer box.

10. Drill some tiny holes at the opposite end of the inner box to allow for air movement when opening and closing the humidor (**Photo 4**).

Build the Humidifier

11. Cut the humidifier parts (R-T) and assemble with plastic adhesive (see Source, page 58, and **Photo 5**).

12. Cut some green floral foam (available at hobby stores) to fit tightly in the humidifier and install it. Cover the foam with cheesecloth or similar fabrics to allow the moisture to move freely.

13. Cover the cloth with sculpture wire mesh (available at hobby stores). Glue the wire mesh and the cloth on the rims of the Plexiglas box.

14. Build the humidifier frame (DD&EE) around the top edges of the humidifier. Make the frame a bit oversize so that you can trim it flush with the humidifier compartment.

Complete the Outer Box

15. Set the assembled inner box in the outer box. Cut the top lining (P) to size and position it on the inner box, so it covers the opening. Spread a thin layer of glue on the back of the lining. Then press the top in position on the outer box and clamp lightly.

16. When the glue has dried, remove the top and the inner box. Install a pair of temporary support blocks in the outer box (**Photo 6**). Locate the blocks so they are roughly centered where the inlay dados will be cut.

17. Mark the humidifier end of the box so you can identify it once the top is glued on. Note: If you forget to mark the humidifier end, you can always find it using a magnet. You'll feel the pull on the correct side.

18. Glue the top to the box. After the glue has dried, sand all the edges flush.

Create the Inlays

19. Mark the inlay and decorative button locations on the box (**Photo 7**).

20. Cut the inlay dados on the tablesaw. Cut 1/16" deep dados in the sides and bottom of the box and 1/4" deep dados in the top (**Photo 8**).

21. Cut the inlay pieces (U-BB) and glue them in place (**Photo 9**). Saw the ends flush and then remove the saw marks by sanding.

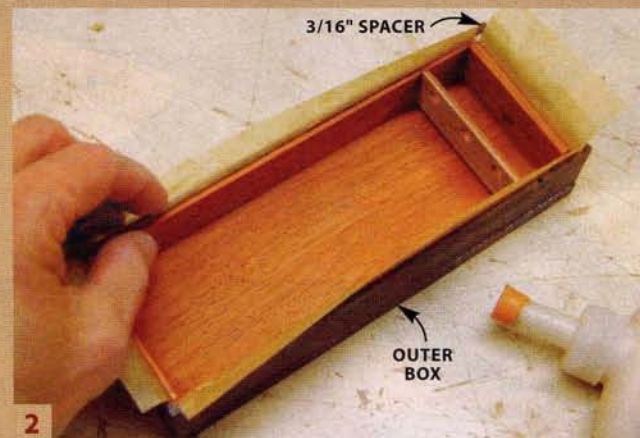
Shape the Top and Add the Buttons

22. Lay out the curve on the top (**Photo 10**). Plane the curve and sand it smooth (**Photo 11**).

23. Now cut open the box. Raise the blade above the



Build the outer box from a single piece of Brazilian rosewood that's been resawn into thin boards. Size the pieces to fit the objects you'll be carrying.

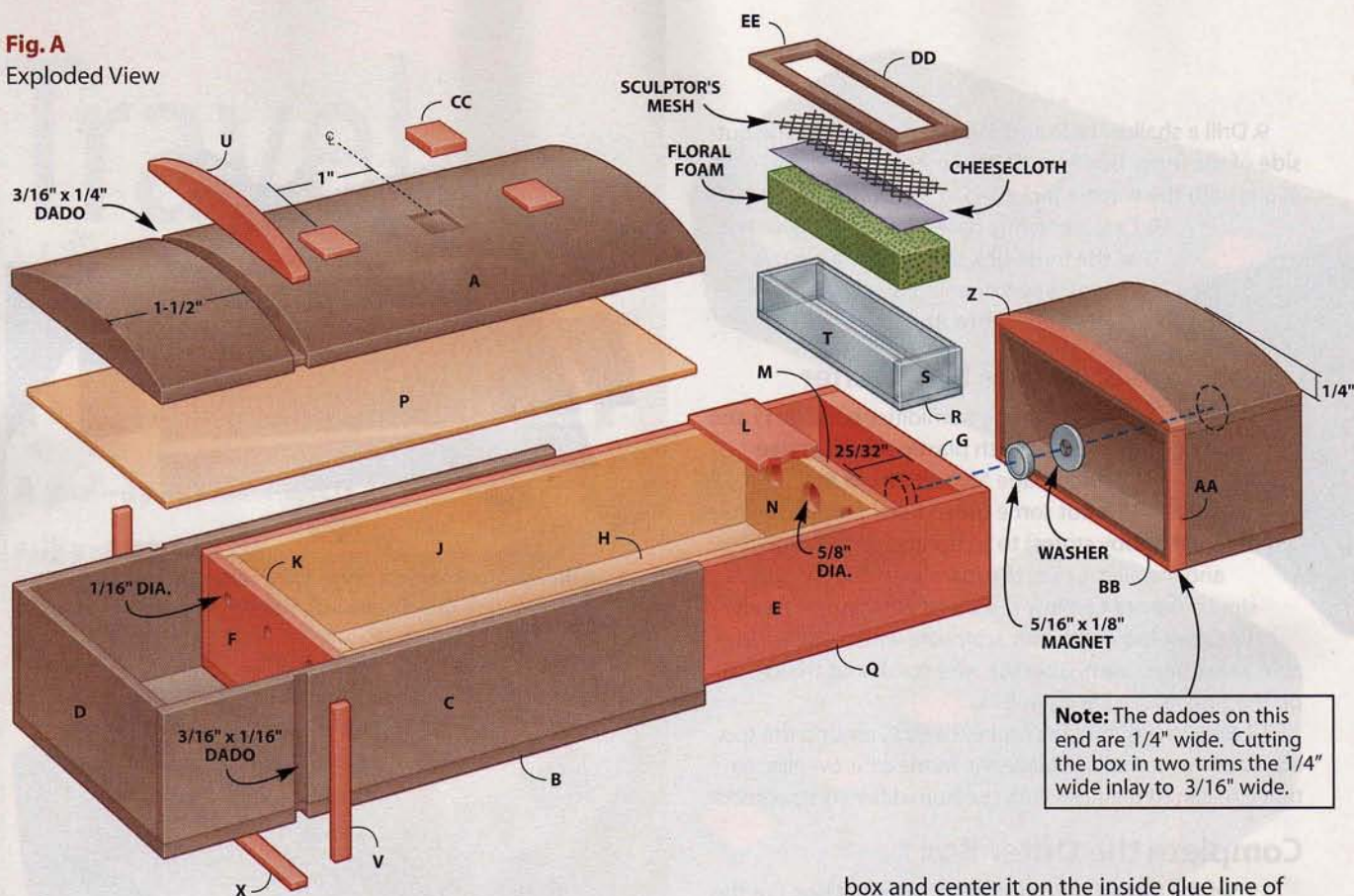


Custom-fit the inner box by using the outer box as a form. Wax paper prevents the boxes from sticking to each other and provides the side clearance for a piston fit.



Remove the inner box from the outer box and line it with Spanish cedar. Be sure to use water-resistant glue.

Fig. A
Exploded View



Note: The dados on this end are 1/4\"

box and center it on the inside glue line of the wider inlay.

24. Cut the box in two (**Photo 12**).

25. Pull out the support blocks from inside the box (**Photo 13**). Use a long auger bit to grab the support block that's deep inside.

26. Drill holes for the decorative buttons. Square the holes with a chisel (**Photo 14**).

27. Glue in the buttons (CC).

28. Finish-sand to 220 grit. Spray the outside of the box with gloss lacquer and rub it out to a satin finish.

29. Install the humidifier (**Photo 15**).

Source: Ridout Plastics, www.eplastics.com, (800) 474-3688, IPS Weld-On #16 Plastic Adhesive, 1.5 oz. Tube, \$3.81.

SUWAT PHRUKSAWAN

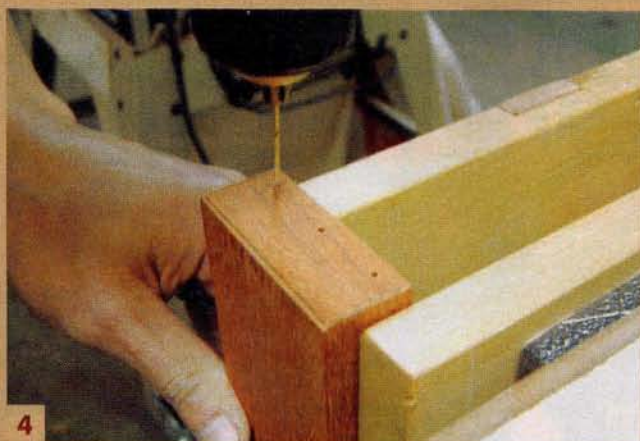
"I was born in Thailand and earned a degree in Architecture there. Although I have made a career change since I moved to the USA, I am still fascinated with design and always try to practice it in my woodworking. By day, I manage a software development team. In the evening, however, I can be found in my garage shop tinkering with all things woodworking."



CUTTING LIST		Overall Dimensions: 7-1/2" L x 3" W x 1-11/16" T			
PART	NAME	QTY.	MATERIAL	TH X W X L	
A	Box Top	1	Brazilian rosewood	3/8" x 3" x 7-5/8" (A)	
B	Box Bottom	1	Brazilian rosewood	1/8" x 3" x 7-5/8" (A)	
C	Box Side	2	Brazilian rosewood	1/8" x 1-3/16" x 7-5/8" (A)	
D	Box End	2	Brazilian rosewood	1/8" x 1-3/16" x 2-3/4"	
E	Inner Box Side	2	Padouk	3/32" x 1" x 7-3/16" (B)	
F	Inner Box End	1	Padouk	3/32" x 1" x 2-9/16"	
G	Inner Box Magnet End	1	Padouk	3/16" x 1" x 2-9/16" (C)	
H	Bottom Lining	1	Spanish Cedar	3/32" x 2-1/2" x 5-15/16"	
J	Side Lining	2	Spanish Cedar	3/32" x 29/32" x 5-15/16"	
K	End Lining	1	Spanish Cedar	3/32" x 29/32" x 2-3/8"	
L	Inner Box Top	1	Padouk	3/32" x 3/4" x 2-3/4"	
M	Inner Box Divider	1	Padouk	3/32" x 1" x 2-9/16"	
N	Divider Lining	1	Spanish Cedar	3/32" x 1" x 2-9/16"	
P	Top Lining	1	Spanish Cedar	3/32" x 2-11/16" x 5-7/16"	
Q	Inner Box Bottom	1	Padouk	3/32" x 2-3/4" x 7-3/16"	
R	Humidifier Box Bottom	1	Plexiglas	1/8" x 3/4" x 2-7/16"	
S	Humidifier Box End	2	Plexiglas	1/8" x 3/8" x 3/4"	
T	Humidifier Box Side	2	Plexiglas	1/8" x 3/8" x 2-3/16"	
U	Narrow Top Inlay	1	Padouk	1/4" x 3/16" x 3"	
V	Narrow Side Inlay	2	Padouk	1/16" x 3/16" x 1-7/16"	
X	Narrow Bottom Inlay	1	Padouk	1/16" x 3/16" x 2-7/8"	
Z	Wide Top Inlay	1	Padouk	1/4" x 1/4" x 3"	
AA	Wide Side Inlay	2	Padouk	1/16" x 1/4" x 1-7/16"	
BB	Wide Bottom Inlay	1	Padouk	1/16" x 1/4" x 2-7/8"	
CC	Buttons	3	Padouk	3/16" x 7/16" x 7/16"	
DD	Humidifier frame	2	Brazilian rosewood	3/32" x 1/8" x 2-9/16"	
EE	Humidifier frame	2	Brazilian rosewood	3/32" x 1/8" x 3/4"	

Notes:

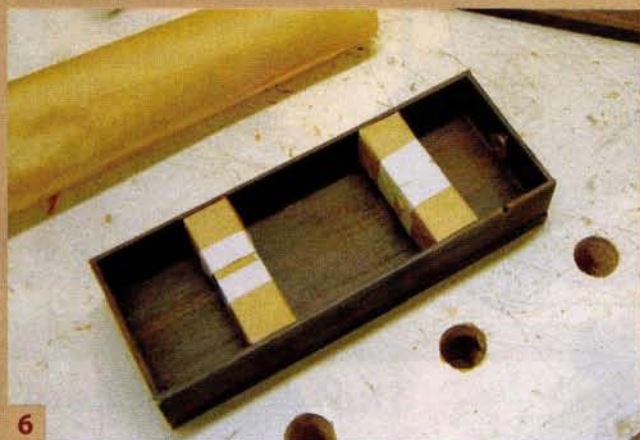
- These pieces are 1/8" longer than the finished project, to account for the saw kerf when the box is cut apart.
- Trim length to fit, if necessary.
- This end is thicker, to accommodate the inset magnet.



4 Drill air-escape holes in the end of the inner box. These holes allow the boxes to slide smoothly past one another.



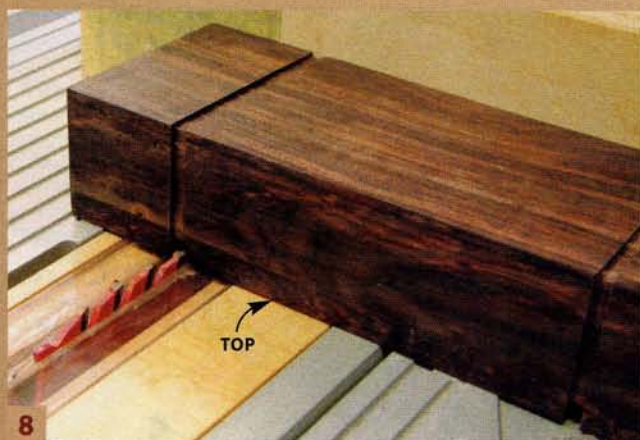
5 Build a Plexiglas humidifier to keep the cigars fresh. Assemble the box with plastic adhesive.



6 Place wood blocks wrapped in wax paper inside the box. The blocks support the walls when the inlay dadoes are cut and act as a backer when the box is cut in two.



7 Lay out the inlays on the box after the lid is glued on. The inlay on the humidifier end of the box (the end with the washer) is 1/16" wider. The extra width will be removed when the box is cut open.



8 Cut the grooves for the inlays. The groove in the top is extra deep to allow for shaping the lid.



9 Install the inlays. Start with the top piece, then add the side pieces. Fit the bottom inlay last, to minimize exposed end grain.



10 Lay out the curve on the top with a piece of flexible steel. Hold the steel at the center of the top and bend it to create the curve.



11 Plane and sand the gentle curve on the top.



12 Cut the box open with a single pass on the tablesaw. Position the box so the blade is centered on the inside glue line of the wider inlay.



13 Extract the support blocks by drilling a hole at a slight angle. Stop the drill and pull out the blocks.



14 Cut the recesses for the buttons with a brad point bit and then chisel them square.



15 To access the humidifier for recharging, pull the short end of the outer box off the inner box and lift the humidifier out of its compartment. The inner box has a rare earth magnet embedded in one end. The outer box has a washer glued to the inside of the short end.

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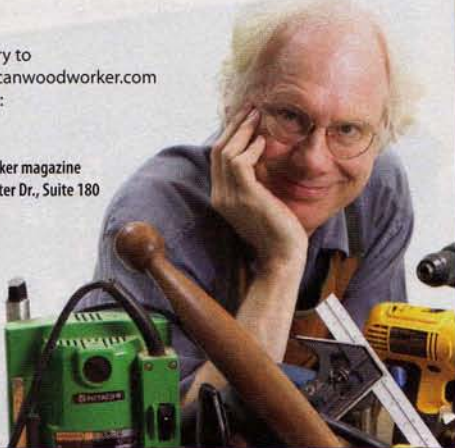
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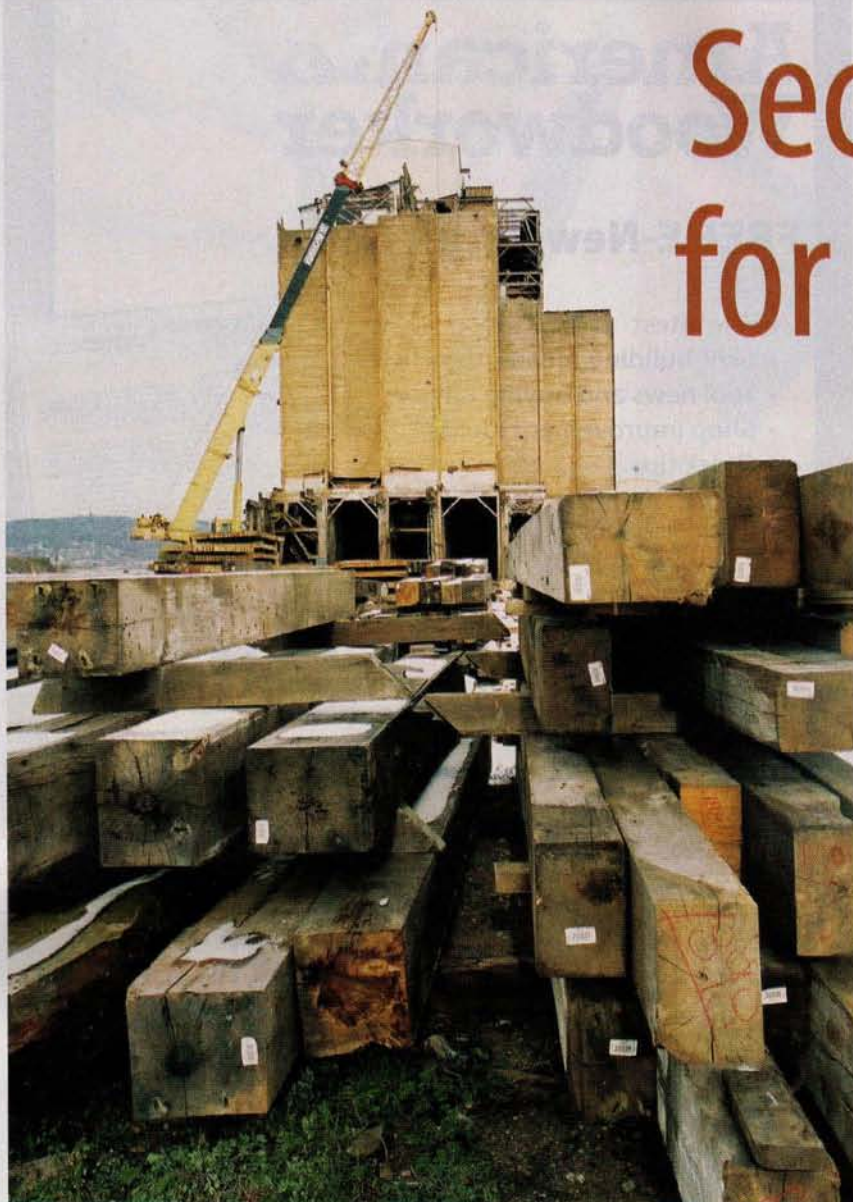
Code AW

Second Life for Old Pine

Antiquated grain elevators yield millions of feet of vintage lumber

by Glenn Gordon

THE THREE GLOBE GRAIN ELEVATORS, in Superior, Wisconsin, across the harbor from Duluth, Minnesota, are some of the largest grain elevators ever built of wood. The biggest of the three, fifteen stories high, is comprised of more than two million board feet of lumber that has essentially been curing in these structures for 125 years (**Photo 1**). Built in 1887, mostly of white pine from the once vast north woods of Minnesota and Wisconsin, the Globe elevators are relics of an era when timber was an economical and plentiful material, an era that built massive railroad trestles entirely of walnut. After the



1 Some of the largest grain elevators ever built of wood were erected in 1887 in Superior, Wisconsin, near Duluth. The structures were made from old growth timber from the vast forests of the North Woods.

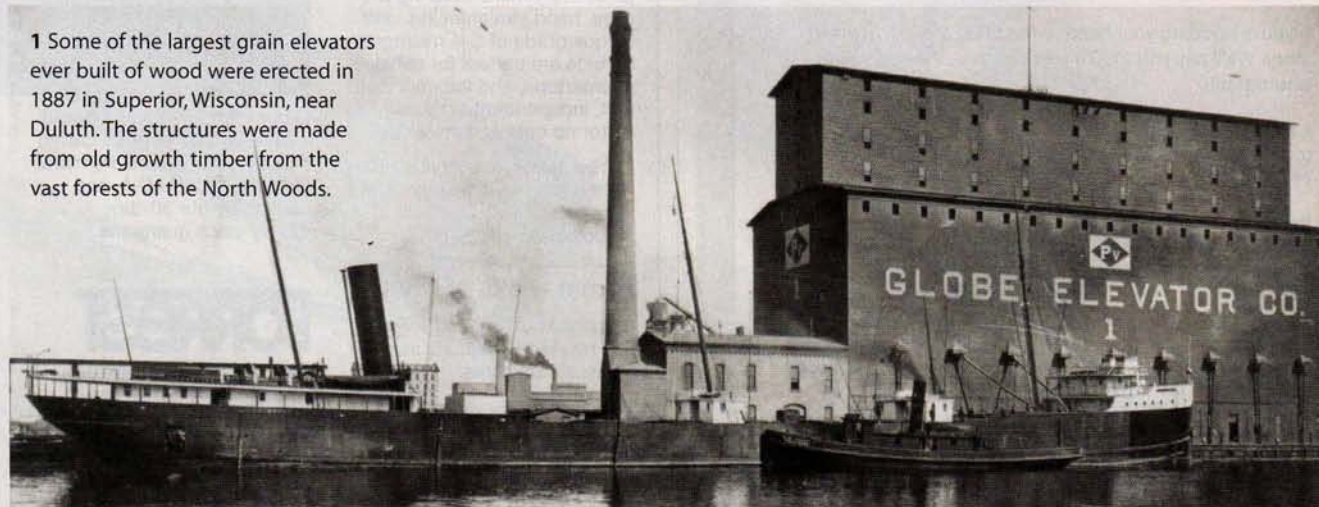


PHOTO COURTESY OF THUNDER BAY RESEARCH COLLECTION

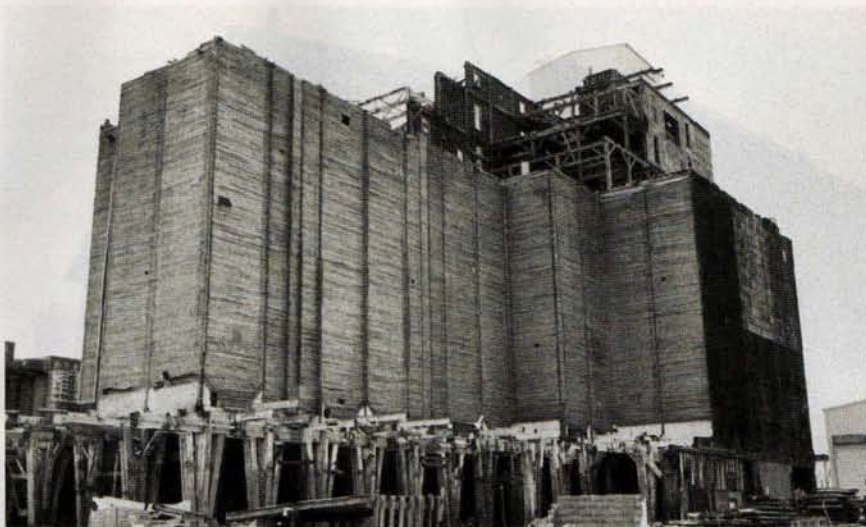
forests were depleted, it didn't take long for the wooden grain elevators and timber railway trestles of the 19th century to give way to cylindrical concrete grain elevators and bridges of steel.

The Globe's three wooden behemoths closed in 1997, but the weather-beaten buildings still stand, strung along a line a half a mile long next to an inlet of the Port of Duluth. Today, huge ships bound for ports all over the world come to load taconite from the Mesabi Iron Range and, at more modern grain elevators nearby, wheat, corn and soybeans from the plains of Minnesota and the Dakotas. Disused, the Globe complex was rescued from almost certain demolition and waste by the foresight of an entrepreneur named David Hozza, the founder and CEO of Wisconsin Woodchuck L.L.C., a company that salvages old-growth lumber.

What Hozza saw in these creaking old giants were not ramshackle dockside ruins but a resource worth preserving. Wisconsin Woodchuck is painstakingly dismantling the buildings (**Photos 2 through 4**). Its sister enterprise, The Old Globe Reclaimed Wood Company, directed by Tony Elvig, is selling the reclaimed lumber as certifiably antique material that tells a remarkable story. Most of the lumber is 2x6, 2x8, and 2x10 lengths of white pine that were spiked together face-to-face and staggered in such a way that the laminations formed continuous finger joints at the corners up and down the height of the elevators' hollow grain shafts (**Photo 5**).

The edges of the stacked planks that formed the interior surfaces of the shafts are beautifully eroded, like driftwood, from a century of flowing grain; the cataracts of corn, wheat, and barley acted abrasively on the wood like sandblasting (**Photo 6**). The bevel-ended 8x8's that you see in photo 4 are essentially giant washers for the iron tie rods that kept the walls of the hollow shafts from buckling outward under the pressure of tons and tons of grain.

During all the years they were in operation, the buildings were clad in corrugated iron, protecting the wood and its treasure of grain. The inside of the



2 Today, the Globe Grain elevators are slowly being dismantled to recover more than two million board feet of white pine lumber.



3 The ground and top floors of the elevator buildings were timber-framed with braced posts and beams.



4 This elevator has been stripped of the corrugated iron that sheathed the wood, protecting the wheat, corn, and barley from the fierce winters of Lake Superior.



5 A pair of crane-suspended "tuning forks" are used to grasp segments of the elevator walls so they can be cut with chain saws and lowered to the ground.

biggest building was an architectural wonder. The top floors housed ten enormous cast-iron pulley wheels, each weighing 4400 pounds. There were three huge grain distributors, each of which fed grain into an "octopus" that directed the grain into separate bins.

The job of dismantling the Globe Grain Elevators is expected to take several years (Photos 7 and 8). A small crew is working with a single crane to carefully cut, pry and lever manageable sections of

the shafts' walls apart before lowering them to the ground. Each member of the crew is rigged with a safety harness, as the gaping structures are pretty treacherous; a foot wrongly placed and someone could buy the farm.

The Old Globe Wood Reclaimed Wood Company is milling and resawing most of the 2" thick lumber into paneling and flooring for family cabins and lake homes in what Minnesotans call "Up North" (Photo 9). The faces of the planks are wire-brushed for texture. The lumber's black-oxidized holes left by the carpenters' old-fashioned square nails add even more to its character.

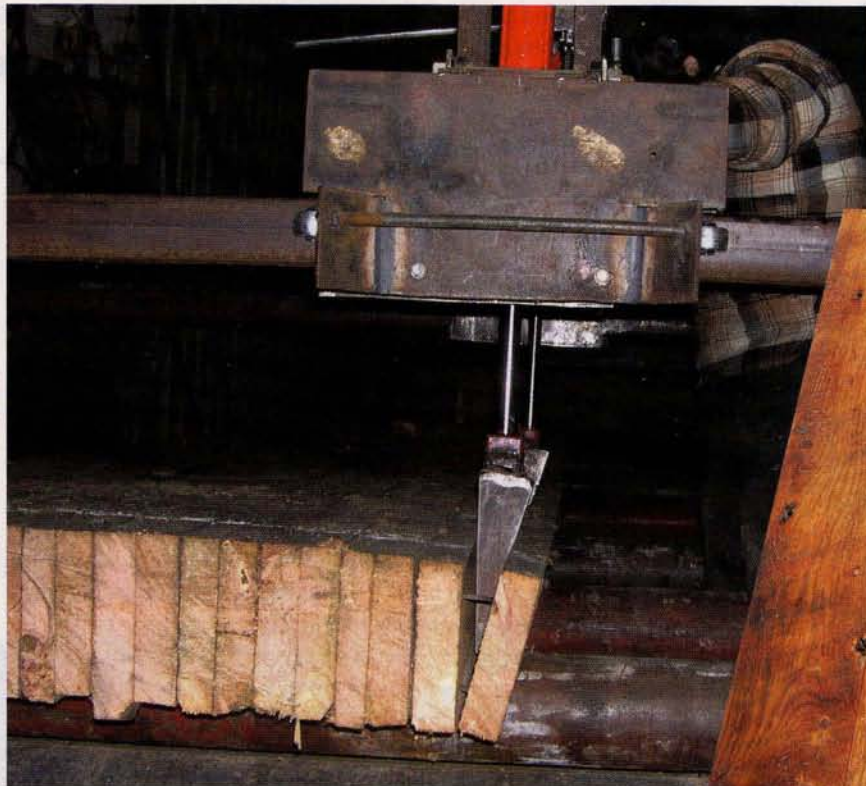
The heavy old-growth posts and beams that supported the Globe's elevators were mostly white pine, but oak and Douglas fir were also used. Old Globe sells lengths of these massive beams—mortises, tenons, holes and all—as material for fireplace mantles. Some of these fine old squared-up tree trunks were signed by the carpenters who built the elevators a hundred and twenty-five years ago, and a few were signed again by the sons of those carpenters working on the structures thirty years later. Their signatures dignify timbers the likes of which we'll never see again. ▲



6 The abrasive, sandblasting action of grain flowing through the elevators over 100 years sculpted the interior edges of the planks. These surfaces are being saved for their unusual character.



7 A small crew is working with a single crane to dismantle the three colossal elevators that made up the complex. The work is expected to take several years.



8 Segments are denailed using a custom-built set of hydraulic wedges to pry the planks apart.

SOURCES

- ◆ Wisconsin Woodchuck,
www.wisconsinwoodchuck.net, (800) 853-8623.
- ◆ Old Globe Reclaimed Wood Company,
www.oldglobewood.com, (218) 340-2056.



9 Cleared of nails, the wood is resawn and milled into boards for flooring and paneling.

The Magic of White Pine

by Tom Caspar

AAH, WHITE PINE. Just saying the name makes me smile. For a hand tool guy like me, it hardly gets any better; white pine is easy to plane, saw and pare. And the shavings smell so good, they transport me right back to the forest.

White pine (*Pinus strobus*) isn't your ordinary lumberyard pine. Construction lumber is usually a mixture of spruce, other types of pine, and fir (SPF, for short). These woods are denser and have a more uneven texture than white pine. SPF pieces are also likely to move a lot after they're sawn, for two reasons.

First, SPF is frequently sawn from small-diameter trees, so

boards often contain the pith. Second, construction lumber has a high moisture content (MC). It's only dried down to about 17 percent MC, so the wood has a ways to go before it stabilizes. White pine, on the other hand, is often cut from huge trees, far from the pith, and is usually available kiln-dried down to 7 to 9 percent MC, ready to be used in the woodshop.

Once dried, white pine is exceptionally stable and a pleasure to work. It shrinks and swells less than red oak or hard maple, for example, and is about on par with cherry. It has a uniform texture with inconspicuous growth rings, unlike construction lumber. You won't have the aggravation of catching an edge while planing or paring through alternating sections of soft earlywood and hard latewood. Your plane or chisel just glides right through the wood—except the knots, of course.

American woodworkers have always valued white pine. It was widely used in the colonial era for making everyday furniture because it was so plentiful and easy to work by hand. White pine's figure is fairly plain, so pieces were often stained or painted to brighten them up. White pine is pretty soft and easy to ding or scratch. It proudly bears its scars, though. All that old, humble furniture shows its history, and that's a big part of its charm. For fancier work, white pine was often used as a secondary wood. Many cabinetmakers used it for drawer sides and bottoms, cabinet backs, and as a ground for veneering.

White pine's appearance changes as it ages. Freshly cut, it's usually a pale straw color. Exposed to air and light, it turns a deeper yellow, like maple. But unlike maple, it keeps getting darker, eventually turning a warm brown. This patina extends down into the wood. If you plane an aged white pine board that's been recycled from an old building (left), you'll see a wide variety of colors reveal themselves with every pass. Eventually, you'll get to the wood's original pale color, but the wood that's just under that old surface still has a lot to say: I'm an American classic, and I'm proud of it.



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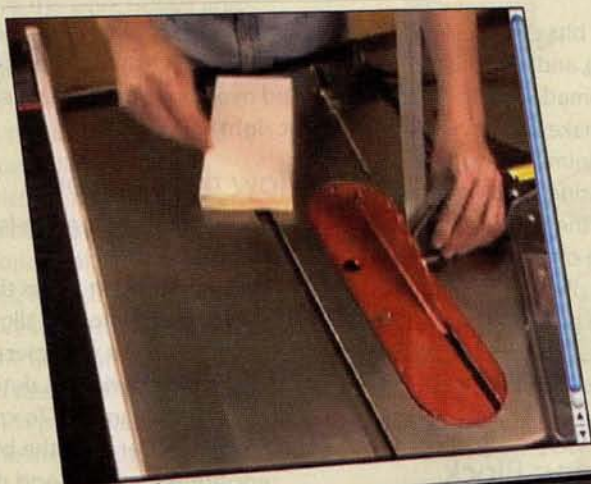
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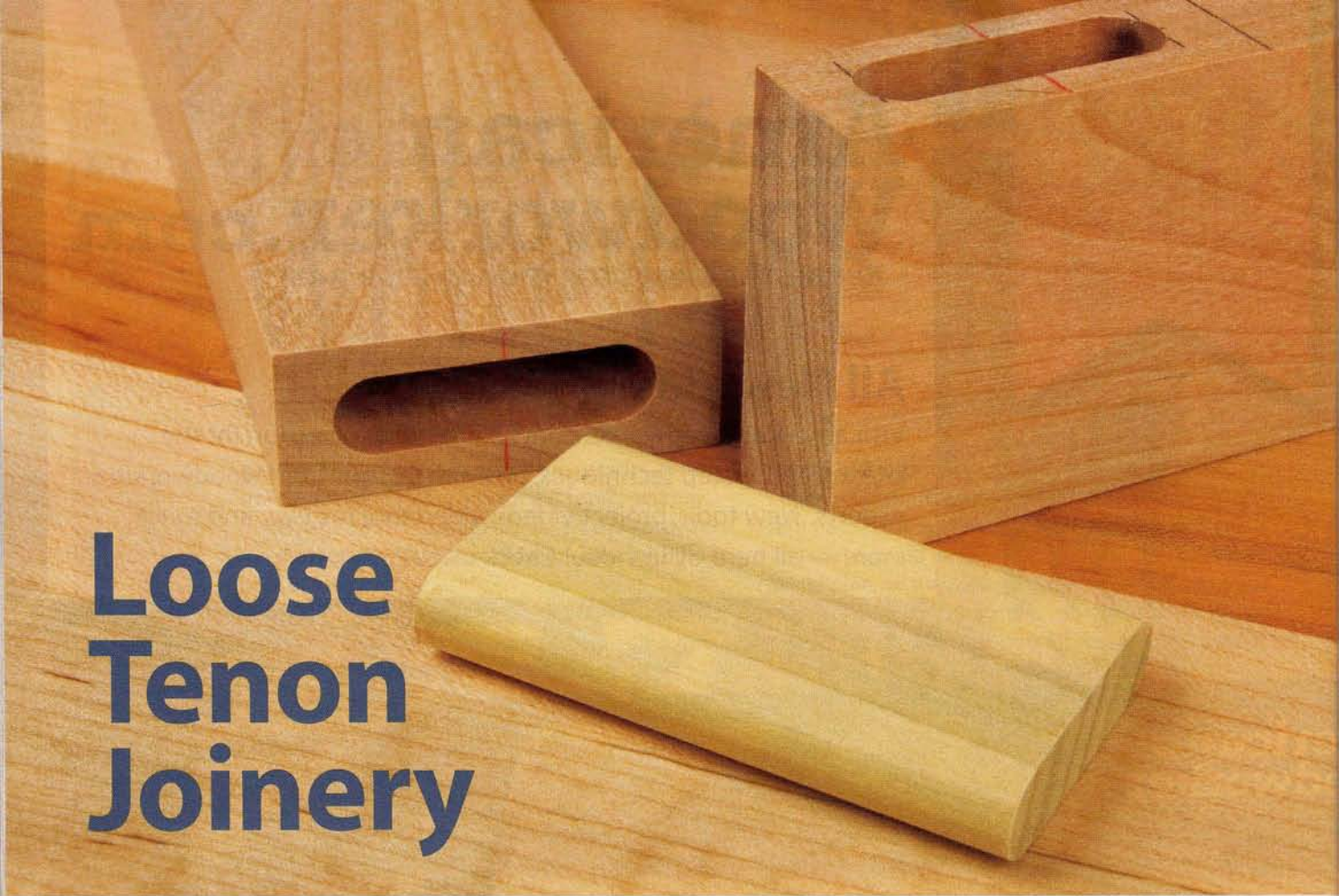
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Loose Tenon Joinery

Rout 4 variations of these super-strong joints with a versatile shop made jig

By Bill Hylton

I'VE USED A NUMBER of different methods to create mortise and tenon joints, but I keep coming back to loose tenons, because they're easy, strong and versatile. Instead of cutting a tenon on one part and a mortise in the other, I rout identical mortises in both parts, and connect them with a fitted strip of wood—a loose tenon. Loose tenon joinery is perfect for case-work, tables and doors of all sizes.

The only tools you need to start making loose tenon joints are a plunge router equipped with an edge

guide, straight bits designed for plunge cutting, and a mortising block—a shopmade jig I've designed that you can make in a day. The mortising block minimizes layout work and allows routing both edge and end mortises from the same router setup.

You can use off-the-shelf bits and just about any plunge router, but a precision edge guide is a must. I use the Micro-Fence edge guide, which I think is the best available (see Sources, page 72).

The Mortising Block

This jig holds the workpiece, supports the router and controls its movement (Fig. A, page 69). The jig consists of the mortising block itself, a top extension, an L-bracket and a clamp board for bench mounting.

The face of the block has dadoes and mounting-bolt holes for the two work holders—horizontal for edge

mortising and vertical for end mortising. The router sits on top of the block and overhangs the workpiece (**Photo, at right**).

How the Jig Works

- The jig's registration line locates the workpiece.
- The jig's L-bracket tracks the router and keeps the mortise aligned with the edges of the workpiece.
- The mortise's width is determined by the bit's diameter. To create mortises wider than the bit, you reposition the fence and make a second pass.
- The mortise's depth is controlled by the router's plunge mechanism.
- The mortise's length is governed by the jig's adjustable stop blocks.
- The mortise's lateral (side-to-side) positioning is controlled by the router's edge guide.

Build the Jig

1. Mill stock for the main parts and cut the pieces to final dimensions (Fig. B, page 73). The mortise block's body and the horizontal work holder must be exactly the same length, because you reference from the ends to rout vertical keyways in both pieces.

2. Rout the 1/4" deep vertical keyways in the mortising block and the horizontal work holder.

3. Rout single 1/4" deep horizontal keyways in the mortising block and the vertical work holder. The block's keyhole is stopped.

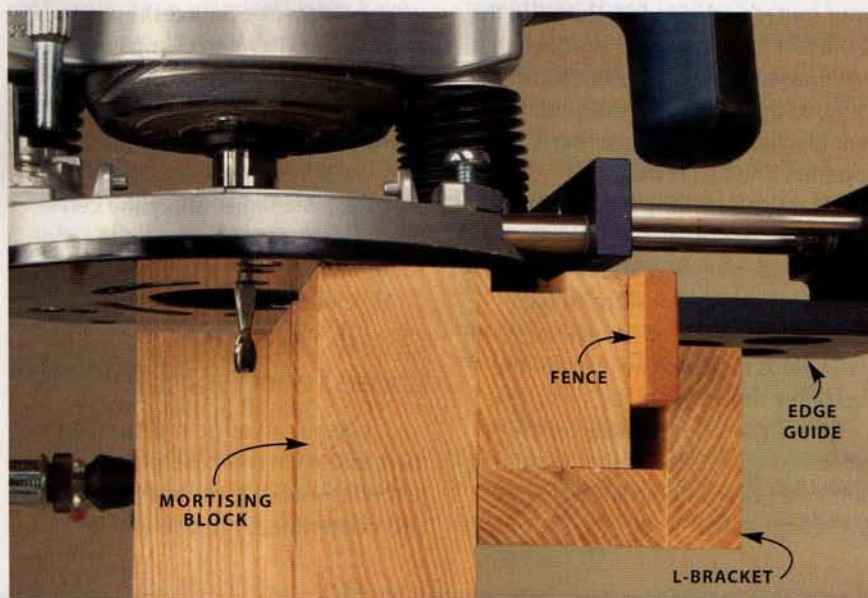
4. Rout mounting-bolt slots in each work holder, using a plunge router and an edge guide.

5. Plane 1/2" thick stock to fit the work holder keyways. Cut pieces to length to create the keys. Attach them.

6. Clamp the horizontal work holder to the mortising block. Tap a 1/2" brad point drill at both ends of each slot to transfer its location to the block. Remove the work holder and scribe a pair of vertical lines on the block through the four points you marked. Clamp on the vertical work holder, mark the slots and scribe a pair of horizontal lines.

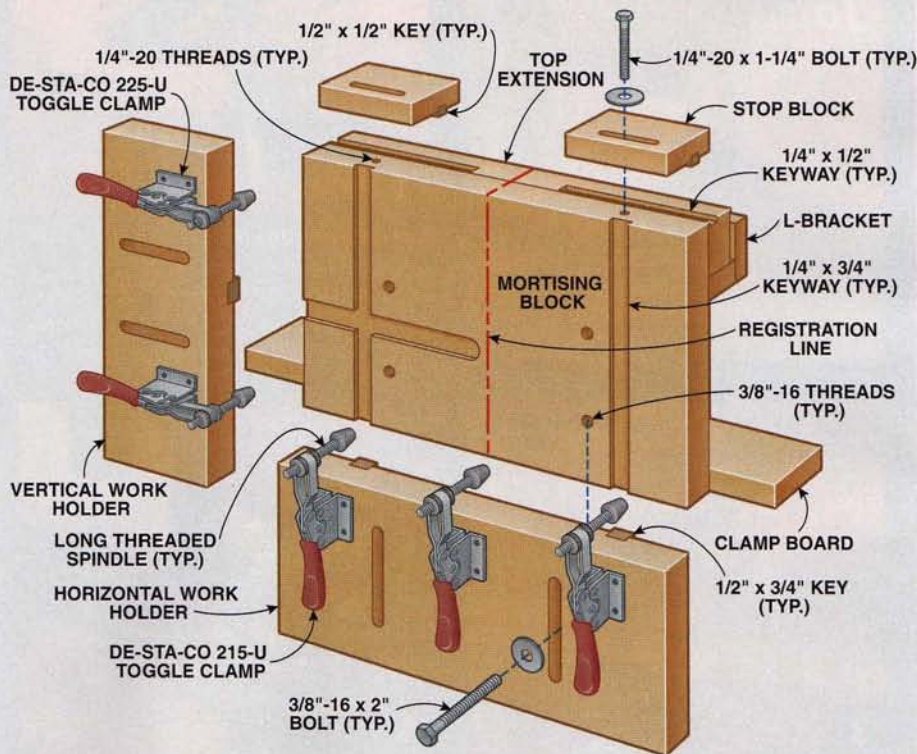
7. Drill holes for the work holder mounting bolts at the four points where the horizontal and vertical lines intersect. To secure the 3/8" bolts, I cut threads in the wood itself. To do this, drill the four holes with a 5/16" bit and use a 3/8"-16 tpi tap to cut the threads (see Sources). No cutting fluid is needed; just turn the tap into the hole, then back it out. Alternatively, you can use T-nuts or drive threaded inserts into the mortising block to secure the bolts.

8. Glue and clamp the top extension to the mortising block. Clean off any dried glue after removing the clamps. Then joint the assembly to ensure that its top surface is square to its face.



Adapt your router to the jig by installing a fence on the edge guide that fits the slot formed by the jig's L-bracket. This keeps the bit aligned as the router slides back and forth. To move the bit laterally, you simply adjust the edge guide.

Fig. A Loose Tenon Mortising Jig



This jig allows routing both edge and end mortises from a single setup. All you have to do is switch work holders.

9. Attach a 3/8" thick wood fence to your router's edge guide. Then size the L-bracket parts to create a groove that will house the fence. The fit should be snug, so the fence slides without any wobble. Glue the L-bracket parts together and install them.

10. Make both stop blocks from one long piece of 5/8" by 2-3/4" stock. Rout the 1/4" deep keyway and two mounting bolt slots. Cut the stops to final length. Make keys and attach them.

11. Rout matching keyways in the top of the mortising block.

12. Set the stops in place on the block and mark locations for mounting bolt holes. Drill and tap the holes for 1/4"-20 tpi bolts.

13. Install toggle clamps on the work holders (see Sources). I used stronger 500-lb. rated clamps on the vertical work holder and installed longer threaded spindles on all the clamps. Be sure to locate the clamps so they don't interfere with the router.

14. Draw a registration line centered on the face and top of the mortising block.

15. Glue on the clamp board.

Create the Basic Loose Tenon Joint

1. Lay out an edge mortise (**Photo 1**). It doesn't have to be elaborate, just lines marking the mortise ends and centerline. Only one line is

absolutely essential: a centerline across the mortise. This mark aligns with the jig's registration line.

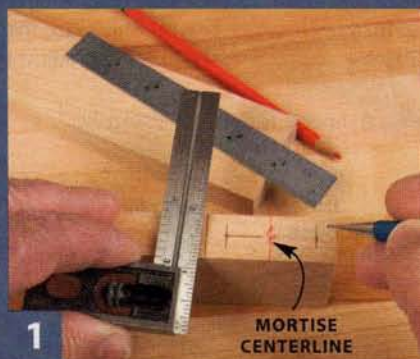
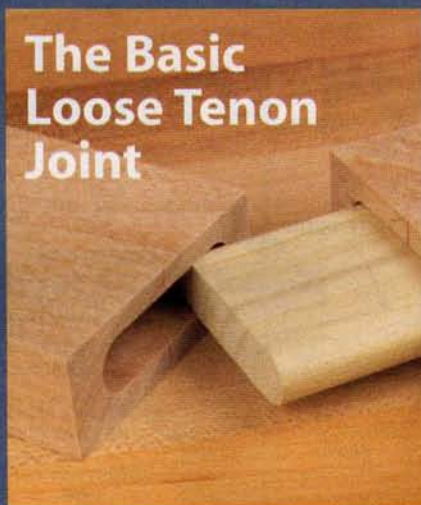
2. Position a test piece on the jig, using the horizontal work holder (**Photo 2**).

3. Adjust the work holder so the edge of the workpiece is flush with the jig's top. Line up the workpiece centerline with the block's registration line (**Photo 3**). Adjust the toggle clamps to hold the work securely.

4. Install a bit designed for mortising in the router. Up-spiral bits are popular for making these plunge cuts, but they're not essential.

5. Install the router on the jig and test-slide the edge guide's wood fence in the L-bracket groove. Apply

The Basic Loose Tenon Joint



1 Lay out one edge mortise on a test piece to set up the router and jig. The mortise centerline is used for positioning the workpiece on the mortising block—it's the only layout mark required for every mortise.



2 Set up the jig to rout the edge mortises. Install the horizontal work holder and position the test workpiece so its edge is flush with the top of the jig. Then tighten the bolts.



3 Align the mortise centerline with the jig's registration line. Then lock the test piece in position.



4 Install the router and adjust the edge guide to center the bit on the workpiece. Then adjust the router's plunge-depth stop to the desired mortise depth.



5 Install the stop blocks. Move the router to one end of the mortise and align the bit's edge with the layout mark. Slide the stop against the router and tighten the bolt. Set the second stop the same way.

wax, if necessary.

6. Bottom the bit onto the workpiece. Then move the router to center the bit on the mortise centerline (**Photo 4**). Lock down the edge guide and set the plunge depth.

8. Install the stop blocks to establish the length of the mortise (**Photo 5**).

9. Rout the mortise (**Photo 6**). That's all it takes. As long as the faces of the workpieces are oriented the same way on the jig, all the edge mortises routed with this setup will be the same, regardless of where they fall on the workpiece. Just scribe a centerline across each mortise and align it with the registration line on the block (**Photo 7**). If all of the mor-

tises are located in the same place on each workpiece, you don't even have to mark them. Instead, just fasten a stop on the jig against the end of your test piece and use it to register the workpieces.

10. The only change you have to make to rout the matching end mortises is to switch work holders (**Photos 8 and 9**).

11. Mill loose tenon stock to complete the joint (**Photos 10 and 11**).

Reinforce a Cope and Stick Joint

Routed cope and stick joints look great, but their stub tenon construction may not be suitable for large cab-

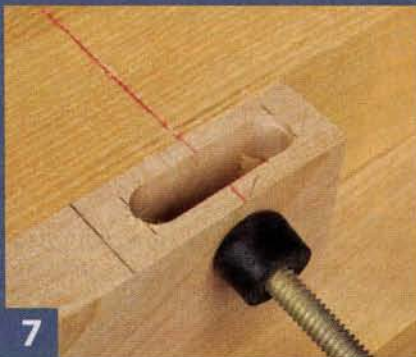
inet doors. Adding loose tenons strengthens these joints.

Rout the mortises before you rout the cope and stick profiles, so you don't have to work around stub tenons on the ends of the rails. (The mortises won't interfere when you rout the profiles.) Center the mortises across the thickness of the workpiece. The mortises probably won't align with the stub tenons produced by the cope cuts, but that doesn't matter, because everything will be hidden in the assembled joint.

Start with the end mortises. Offset them away from the rails' inner edges, so the panel groove won't cut into the mortises (**Photos 12, 13 and 14**). Use the rails' offset end mortises to locate



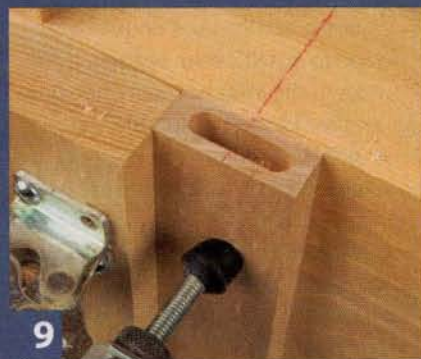
6 Rout the mortise with a series of shallow cuts. Plunge the bit about 1/8" and feed quickly to the far stop. Retract the bit, return to the starting position and go again.



7 Mark your stocks' outside faces and always orient the same face against the mortising block when you rout. Once all the edge mortises are routed, switch to the vertical work holder to rout the end mortises.



8 To mount the vertical holder, clamp a workpiece with its mortise centerline aligned with the jig's registration line. Slide the holder against the workpiece and tighten the bolts.



9 Install the router and rout the end mortise. The length, width, depth and placement of the mortise don't change when you switch work holders.

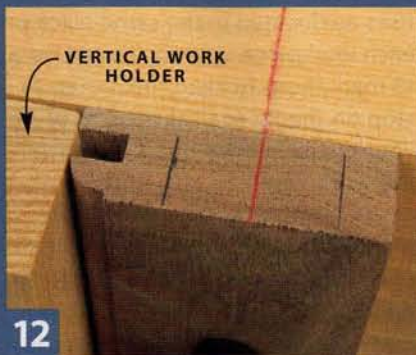


10 Size a loose tenon blank. Plane a length of stock to fit the mortises. It should slip in without wiggling or binding. Rip the blank to width, slightly less than the mortises' length.



11 Round the tenon blank's edges to match the mortises. Then cut individual loose tenons from the blank.

Reinforce a Cope and Stick Joint



12

This variation requires offsetting the rail mortises, so they don't interfere with the panel groove. Start by laying out the offset mortise on a pre-routed rail. Then use this rail to position the vertical work holder.



13 **Route the mortises** before you route the cope and stick profiles. Both ends of the rail must be routed with the same face against the block, so the initial set-up shown in Photo 12 positions the mortise in only one end.



14 **To position the mortise** in the other end of the rail, install a shim equal to the panel groove's depth between the work stop and the rail.

the stiles' edge mortises.

Be aware of the rails' offset mortises when you rout the profile and panel grooves—it's easy to rout the wrong edge.

Twin Mortise Joints

In post-and-rail constructions made using thick stock, you can make stronger joints by doubling the loose tenons. The rail mortises of these corner joints can all be the same depth, but the inside mortises on the posts will intersect, so they must be shorter, and their tenons must be mitered. The outside post mortises won't intersect, so they can be the same depth as the rail mortises.

Orient the workpieces with their outside faces against the mortising block. Set up and rout all the outside mortises. You'll have to change work holders when you switch from routing edge to end mortises. Reposition the bit and rout all the inside mortises (**Photo 15**). Reduce the final plunge depth when you rout these mortises in the posts.

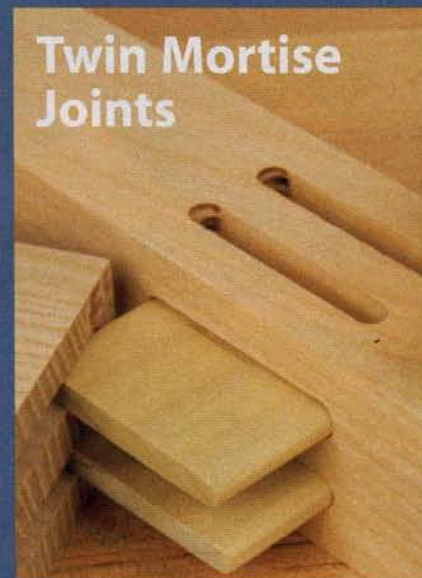
Loose Tenon Table Joint

In this construction, the apron usually is inset from the leg faces. My approach is to set up for the mortises in the legs (**Photos 16 and 17**). To rout the aprons, I use double-faced tape to install a shim equal in thickness to the inset between the apron and the block (**Photo 18**). Be sure to install the aprons outside-face in before routing their mortises. 

SOURCES

- ◆ Micro Fence, www.microfence.com, (800) 480-6427, Micro Fence Edge Guide, \$179.
- ◆ Buy Destaco, www.buydestaco.com, (800) 560-9292, De-Sta-Co Horizontal Toggle Clamps, #215U, \$9.69 ea.; #225U (500 lb. cap.), \$11.16 ea.
- ◆ Tap and Die sets are available at hardware stores and home centers.

Twin Mortise Joints



15

Route twin mortises in two steps. Lay out and rout the first mortises in both the edges and ends. Reposition the bit for the second mortises and go again. Always orient the same face against the fence.

Fig. B Dimensions

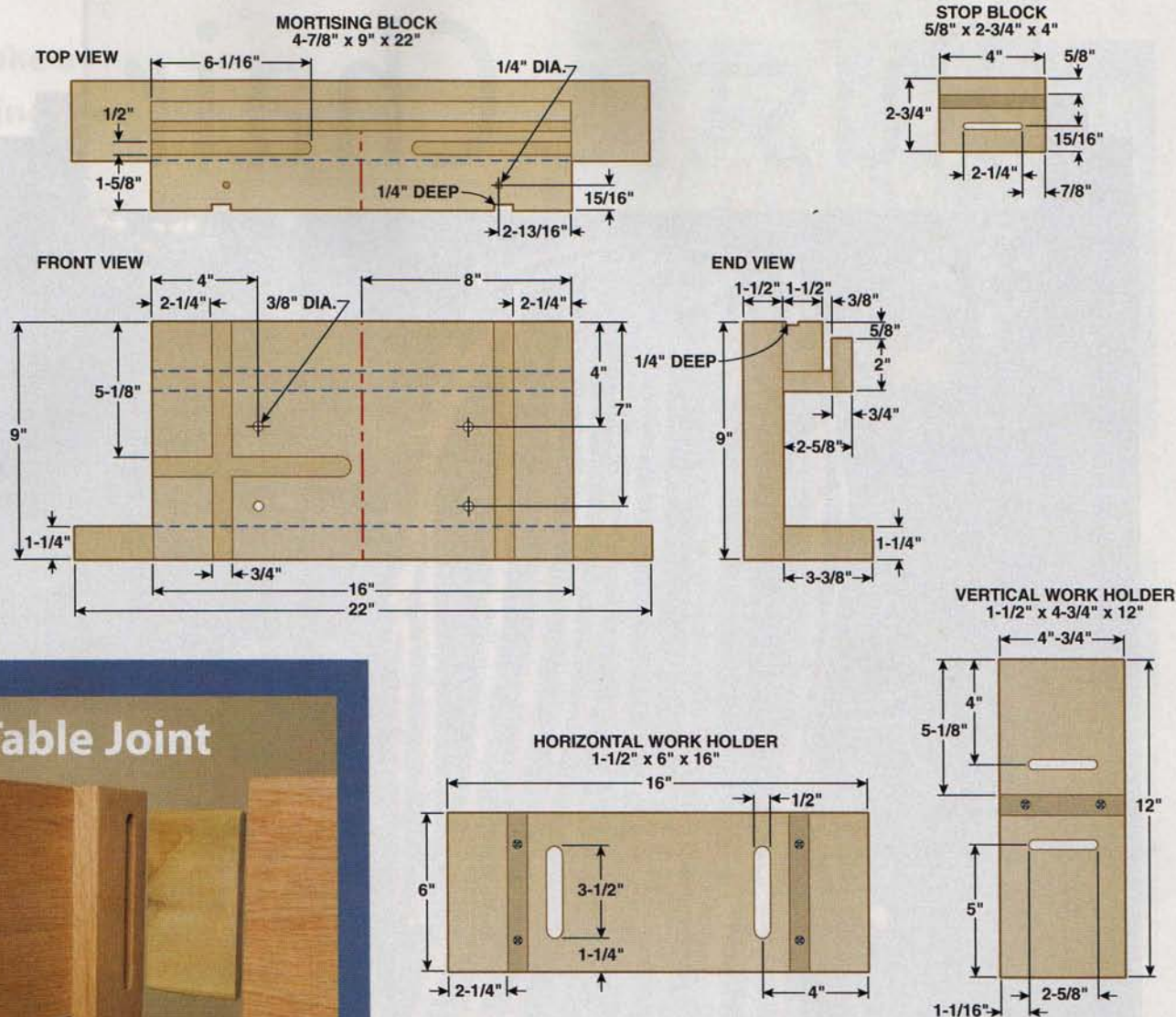


Table Joint



16

With table joints, the aprons are usually inset from the legs. Mortise the legs first. Clamp the leg with its outside faces against the mortising block and the work holder. Position the bit, set the stops and rout the mortise.



17

Flip and rotate the leg to rout the second mortise. It doesn't matter that the leg now extends in the opposite direction, because the mortises are centered on the jig's registration line.



18

To inset the aprons from the legs, you offset their mortises by the amount of the inset. Attaching a shim of the desired thickness to the jig automatically offsets the mortise correctly.

Rustic Chair



EDITOR: TIM JOHNSON • PHOTOS COURTESY OF FOX CHAPEL PUBLISHING

Make a chair in a day using green wood saplings

by Jonathan Benson

YOU CAN MAKE a pretty good case for bending and attaching green wood sticks as the second oldest wood-furniture making method—after coming upon a fallen log, and sitting. Today, this type of furniture is labeled "rustic," so exposed nails, screws and other hardware are acceptable for joining the individual pieces. Larger pieces can be joined using mortise-and-tenon joints cut by hand, a drill or a commercially available tenon cutter. Nails or leather straps also work well for joining the wood together.

Building this child's chair (see Fig. A, page 76) is a good introduction to rustic chairmaking. It's also a lesson in the great bending properties of willow. With rustic furniture, there are often no drawings or set plans. The shapes and sizes of the wood at hand and the maker's eye are often the determining factors when creating a design. A few basic dimensions are important, however. For rustic chairs, they include the height, width and depth of the seat. (see Fig. B, page 76). As this chair is designed for a child, it's smaller than an adult-size chair. But both chairs are made the same way.

Working with Green Wood

Green wood is either freshly sawn or has not undergone any formal drying process. It retains moisture and the wood's natural resins, which makes it easier to bend than wood that has been thoroughly dried. Alder, birch, beech, hickory, and willow are commonly used to make bentwood rustic furniture. Willow may have the best qualities of all because it bends easily, stays in place, and the bark usually doesn't come off when the wood dries. It can also be a reliable source of material—a good stand of willows near a creek or river will yield new saplings year after year.

Saplings work best for bending, because they are relatively straight and have few offshoots and leaves (**Photo 1**). That makes them easy to prepare. Use saplings and small branches to construct bent components, such as the arms and seat of this chair. Use thicker branches to construct the support structure.

When you cut live branches and saplings, it's best to use them right away, before they have a chance to dry out. The sticks can be wrapped in plastic and stored for a while, but they'll continue to dry. Mildew can also be a problem.



Willow saplings and branches about 1" in diameter make suitable bending material. Slightly larger branches are best for structural members.



Start by making a pair of frames. One frame supports the seat; the other frame supports the legs. Using a slightly curved branch for the front of the seat frame makes the seat more comfortable.



Nail each frame together after pre-drilling each hole, to avoid splitting the wood. Orient the pieces firmly against the bench, so the force of the hammer is directly transferred through the nail to the bench.

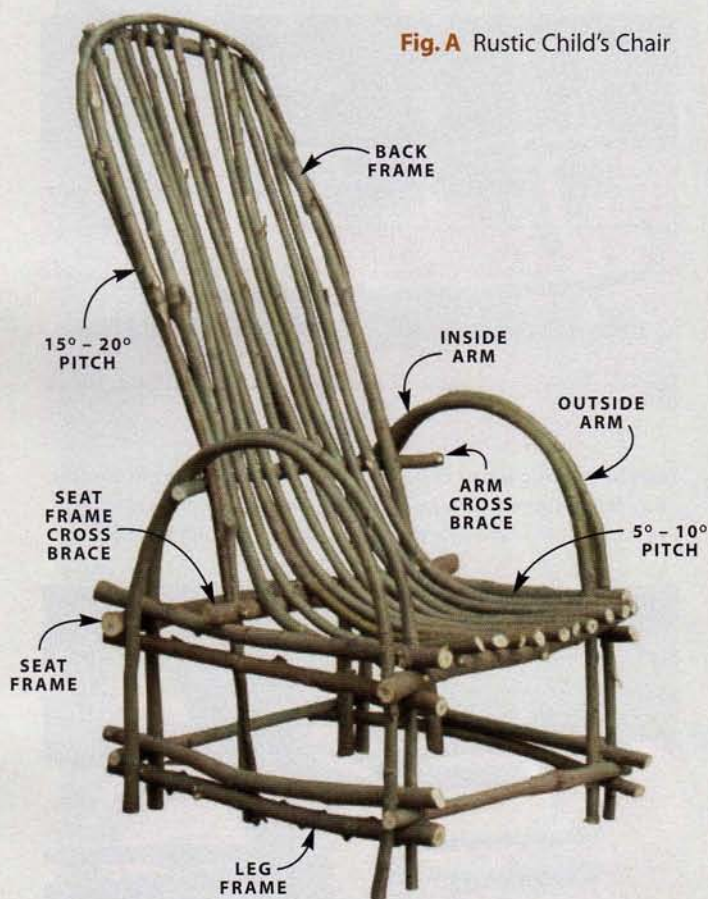


4 Nail the first arm inside the leg frame.



5 Bend the arm inside the opposite rail and nail it in place. Then trim the ends. This chair has a total of four bent arms. Pre-bending the branches before installation makes their curves more uniform.

Fig. A Rustic Child's Chair

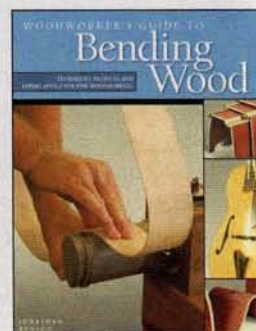


For the bent pieces in this chair, I cut willow and Osage-orange saplings that were about 1" in diameter at their thickest. The structural members were cut from branches of willow and Osage-orange and were slightly more than 1" in diameter. This chair's structural frames hold the bent elements in tension, which adds much strength to its overall structure. To create bent pieces that are uniformly shaped, you must pre-bend the thick end of each piece by hand or over the edge of a bench. Otherwise, the pieces will tend to bend more where they are thinner and less where they are thickest, resulting in uneven curves. Use galvanized nails (with heads) to fasten the pieces. Some joints could be wrapped with leather to add strength and detail. 

From the book *Woodworker's Guide to Bending Wood* by Jonathan Benson. Reprinted by permission of Fox Chapel Publishing. Jonathan Benson's work has been exhibited in over 40 galleries nationwide. He taught woodworking at the college level for over ten years and has held woodworking workshops and lectures across the country. In addition to *Bending Wood*, Jonathan is also the author of *Woodworker's Guide to Veneering and Inlay*. Both books are available directly from Fox Chapel at www.foxchapelpublishing.com.

FIG. B: COMMON CHAIR MEASUREMENTS

	BARSTOOL	CHILDS	DINING (SIDE)	DINING (ARM)	EASY	KITCHEN	STOOL	ROCKER
Seat Width	17"	18"	19"	24"	25"	19"	12"	20"
Seat Depth	17"	15"	19"	18"	26"	19"	12"	26"
Seat Height	30"	12"	18"	18"	17"	19"	27"	16"
Back Height	42"	40"	36"	36"	31"	34"		42"





6 Install the second inside arm. The remaining two arms are attached on the outside of the frame.



7 Install the seat frame by nailing it between the four arms. Angle the frame 5° to 10° to the back, to make the seat more comfortable. Here I've installed one of the outside arms to help with positioning.



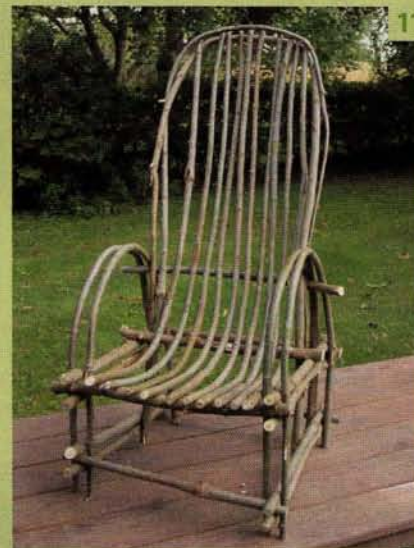
8 Construct the back frame by bending two long branches into a loop and threading them through a pair of nailed-on cross braces. The brace on the seat frame determines the seat's depth. The arm brace determines the pitch of the back—usually between 15° and 20°. Slightly bending this brace makes the back more comfortable.



9 Create the back's U-shaped frame by wiring together two long branches, so the thick end of one branch is attached to the thin end of the other. The wire helps the two branches bend uniformly. Nail the back frame in position. Then remove the wire.



10 Fill in the seat and back to complete the chair. Pre-bend the first branch to create a comfortable seat and back, after passing it between the two pieces that form the back's frame. Snug the branch against one of the inside arms. Make sure the branch is vertical and then nail it to the front rail, cross braces and back frame.



11 Install the remaining branches. Pre-bend the second branch and snug it against the opposite arm. Then work from both sides toward the center. Space the branches as far apart or as close together as you want, depending on your design and how many branches you have. These branches are spaced about 3/4" apart.

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Steam-Burnt Cherry

THE CHERRY SALAD

TONGS I'd made needed repairs. They were steam-bent, so they would "spring" when you squeezed them together. But the top portion where the two arms attached was messed up. Cutting off this section significantly shortened the tongs, so there wasn't much spring left. No problem: I could simply re-steam the pieces to increase the bend.

I'd made the tongs after reading an article about using a microwave oven to steam wood for bending. The wood was dampened, wrapped in moist paper towels and then heated in the microwave—the process had worked amazingly well.

Unfortunately, I couldn't remember how long to heat the wood. So, I tried 15 seconds, then 30, and then 60 seconds—nothing. Next, I tried 2 minutes. No soap. Irritated and fed up with the process, I set the timer

for 10 minutes and went outside to do a chore—I sure wasn't going to just stand there and wait.

When I returned nine minutes later, the smoke detector was screeching and smoke billowed out the door. I raced inside, opened a window and whipped a dishtowel lasso-style to silence the smoke detector. Coughing from the acrid smoke, I

opened the microwave to find a charred wad (formerly paper towels) that contained a pair of carbonized salad tongs.

A year and a half later, using the microwave still makes the kitchen smell like smoked cherry—or burnt paper towels, according to my spouse.

—Jayne Thorson



Sliding Dovetails

WHILE I WAS IN COLLEGE, I worked as a cabinetmaker to help defer expenses. After installing a custom made desk-workstation for one of my professors, he called to tell me how much he liked it, except that the drawer fronts came off in his hand if he pulled them too hard or too quickly. I was perplexed, because the drawers' dovetail joints fit so perfectly that I hadn't even bothered to glue them.

When I went to inspect my work, I discovered that I had oriented the dovetails incorrectly, so that instead of locking onto the sides, the drawer fronts slid on and off them. Thinking quickly, and hoping my professor didn't know a lot about dovetails, I told him, "I'm sorry, I forgot to glue the drawers."

My professor was happy with my solution. But I vowed to glue all of my dovetail joints in the future, and to pay closer attention when I cut them, so they wouldn't end up backwards. I might even have said, "Okay, no more dovetailing at 2:00 a.m.!"

—Don Busch



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