

49
TIPS INSIDE

"Name That Box" Contest

DETAILS, PAGE 35

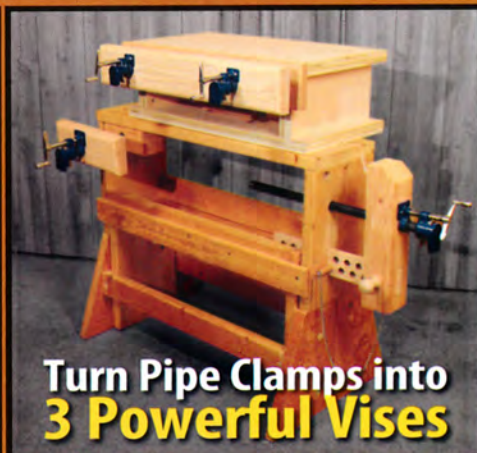
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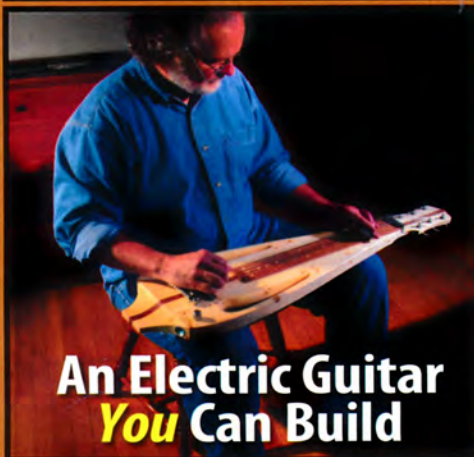
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AMERICAN WOODWORKER

#167, August/September 2013

Features

34 Rotary Box

Learn how to make gears while building a fascinating project.

42 Laptop Electric Slide Guitar

If you want to try your hand at guitar making, this is the perfect place to start.

50 Workingman's Boot Bench

A pro blends new and old techniques to build a sturdy cabinet.

55 3 Classic Vises Made with Pipe Clamps

Increase your bench's versatility on a budget.

60 Make a Butcher-Block Top

Create a thick top without using thick boards.

64 Food-Safe Finishes

You are what you eat.

67 Precision Circle-Cutting Jig

One of our favorite bandsaw accessories.

68 Indoor Planter

Tricks for using dimensional lumber make this project easy to build.

Departments

10 Workshop Tips

16 Well-Equipped Shop

22 A Great American Woodworker

26 Turning Wood

30 My Shop

74 Oops!



74



34



42



50



55



60



64



67



68



10



16



22



26



30

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MORE INFO

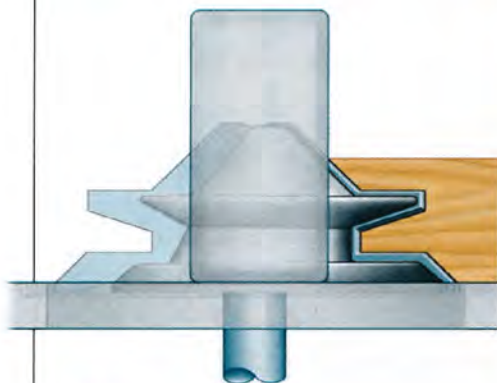


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Making Squaring Blocks

Watch how easy it is to make these essential aids for gluing cases (p. 72) at
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Joint with a Planer

See how you can flatten extra-wide boards and glue-ups (p. 62) at
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Precision Circle-Cutting Jig

Watch all the steps in making one of our favorite bandsaw jigs (p. 39) at
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AMERICAN WOODWORKER

#167, August/September 2013

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Item 68523 shown

LOT NO. 68523/60415

Cutting disc sold separately.

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580 LB. CAPACITY FOUR DRAWER TOOL CART

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LOT NO. 95659

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2000 LB. ELECTRIC WINCH WITH REMOTE CONTROL AND AUTOMATIC BRAKE

Item 68146 shown

LOT NO. 68146/61258/61297

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LOT NO. 91214

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6.5 HP OHV HORIZONTAL SHAFT GAS ENGINES (212 CC)

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PREDATOR ENGINES

LOT NO. 68120/69730/60363

LOT NO. 68121/69727, CALIFORNIA ONLY

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45 WATT SOLAR PANEL KIT

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LOT NO. 68751/90599

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LOT NO. 877/69121/69129/69137/69249

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Tablesaw Shooting Board

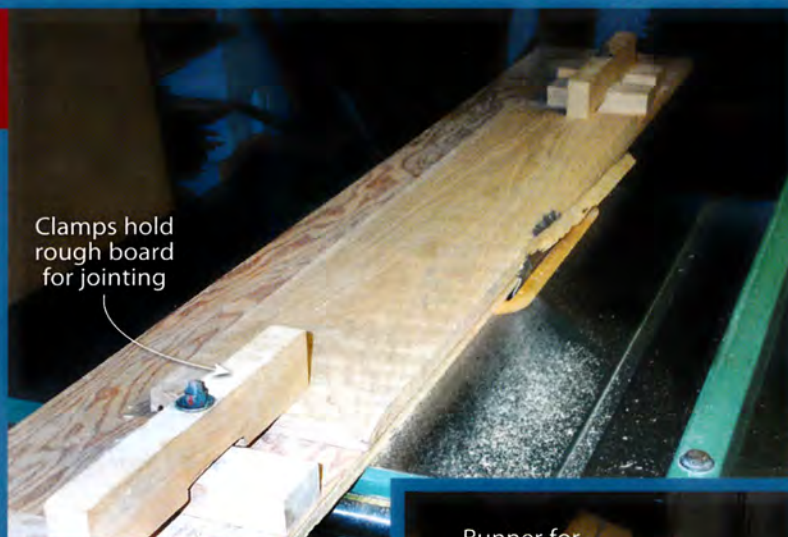
I USE THIS TABLESAW FIXTURE for straightening and squaring the edges of my lumber. It's just a long plywood base with a runner that slides in my saw's miter slot.

To make one, you'll need a piece of 3/4" x 12" x 96" plywood. You'll also need clamps on top to hold your rough boards. My clamps are just maple blocks with bolts running through them. The front clamp is stationary; the rear clamp is adjustable to accommodate boards from 3' to 7' long. To adjust the rear clamp, I added threaded inserts to the base at 6" intervals. Adjustable toggle clamps would work just as well.

To make the runner, cut a 3/4" wide x 1/8" deep groove in the base and glue in a strip of 3/4" x 1/2" hardwood. Position the runner so that the base's edge will be trimmed about 1/8" the first time you run it through the saw. After the runner is fastened in place, engage the runner in the miter slot and trim the base.

To use, clamp your board so that its full length overhangs the base's edge.

Fred Burne



COURTESY OF CONTRIBUTOR

Card Scraper Organizer

A SCRAPER'S EDGE is very delicate. I used to keep my card scrapers loose in a drawer, but to avoid nicking their edges, I made a simple stand. I cut a few slots in a 2" thick piece of hardwood using a backsaw; the scrapers fit perfectly in the saw's kerf. There's extra space on the stand for more kerfs. I love scrapers—I'm sure I'll buy more!

Alejandro Balbis



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COURTESY OF CONTRIBUTOR

Mobile Suction

MY DUST COLLECTOR, though pieced-together, is the perfect solution for my one-car garage shop. I use a cyclone separator and 5-gallon bucket in conjunction with my shop vacuum. For easy mobility, I combined the two units on one 1/2" thick plywood platform.

To fasten the platform, I removed one of the vacuum's casters and ran screws through the bottom of the vacuum. Part of the base extends to support the 5 gallon bucket and cyclone separator.

I found a ball caster that was the right height and fastened it to the underside of the platform's extension. I also made a wooden block for the end of the hose to make it easier to slip the hose onto my tool's dustport.

Marvin Peterson

SOURCE

Oneida Air Systems, oneida-air.com, 800-732-4065, The Dust Deputy DIY – Cyclone Only, #AXD001004, \$39.

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Wedged Sanding Block

A **CURVED SANDING BLOCK** can really save the day for sanding concave parts. Over the years, I've made several to accommodate different radii.

I use a wedge to secure the sandpaper to the block. This design stretches the paper tightly around the block and allows me to quickly change grits. It also works for flat sanding blocks.

I make my sanding blocks to match the width of commonly found sandpaper rolls. If you cut strips from sandpaper sheets or belts, the block can be virtually any width.

To make a block, use a compass to draw its shape on a piece of hardwood. Cut the block on the bandsaw, then fair the curve using sandpaper taped to a flat surface.

Next, make the hardwood wedge. Its angle should be about 15° and its length should be less than half the thickness of the block. Place the wedge on the block in its "in-use" position and trace around it. Cut into the block with the bandsaw.

To use, cut a strip of sandpaper to length and wrap it around the block. Place both ends of the paper in the cutout. Insert the wedge to stretch and secure the sandpaper.

Yoav Liberman



COURTESY OF CONTRIBUTOR

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Marking Gauge Replacement Pins

A GOOD MARKING GAUGE is essential for accurate handwork. I like refurbishing old tools, so I picked up this gauge from a flea market. As with any used tool, it was in need of a little TLC. Its face wasn't flat and its pins needed to be replaced.

The single pin was worn down to a nub and the double pins were two different lengths of finish nails. Regular wire nails don't work very well for a marking gauge; hardened nails are best, because they'll hold an edge. But where do you get hardened nails that are small enough? Well, it turns out that most hardware stores carry them. They're made for hanging pictures on plaster or masonry walls. I bought some that were exactly the right diameter for my "new" gauge.

Here's how to install them: First, remove the old pins by grabbing them with a pair of pliers. Use a side cutter to trim the hardened nails long enough to protrude about 3/16" after they're inserted into the gauge. Hardened nails are more difficult to cut than a typical finish nail. A lineman's pliers works best—its long handles give extra leverage. To keep the nails from flying across the room when you cut them, wrap a rag around the business end of the tool, including the nail, to catch the pieces.

Push the new pins into place using pliers, or carefully tap them in with a hammer. After they're in place, sharpen them with a small grinding wheel in a rotary tool or use diamond paddle-style sharpeners.

Brad Holden

THE RESAW KING RIPS UP THE COMPETITION

Over the weekend, I set up the bandsaw and did some re-sawing of highly flamed maple. I am very happy with the saw and the Resaw King blade. This equipment will certainly meet my objectives of reducing waste and improving quality of my products. Thanks for the guidance in selecting the saw and blade. I will soon be ordering a second Resaw King blade so that when I need to have one sharpened I will have no down time. I'm now spoiled!

- John P., Milton, West Virginia

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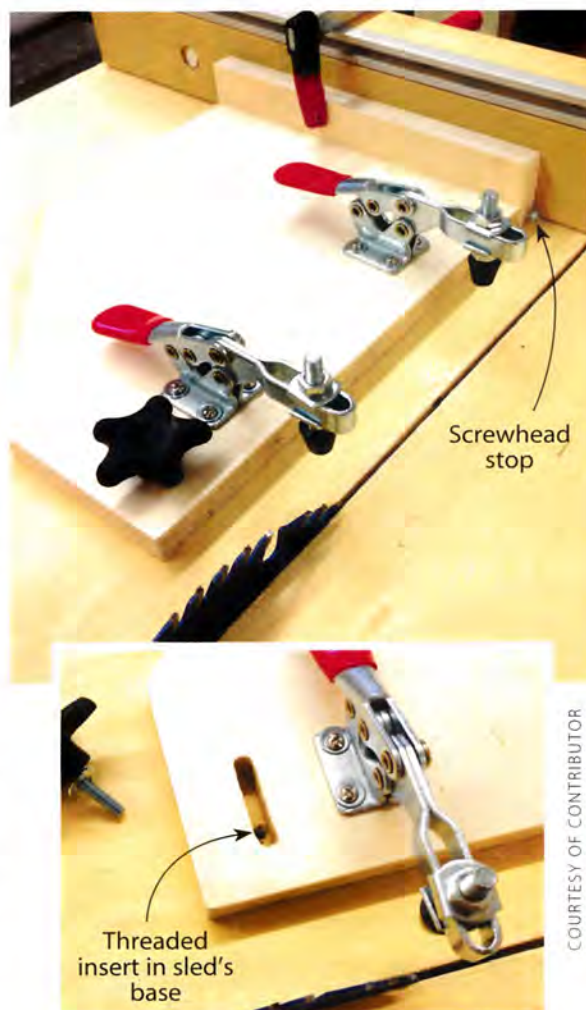
I USE MY TABLESAW'S CROSSCUT SLED to slice narrow strips for cutting boards. (The boards are too wide for my miter saw.) Each strip must be exactly the same length, but when I tried using a standard stop block, I realized that the parts were creeping ever so slightly during the cut. Their sides weren't parallel.

I needed a new stop—one that would hold the offcuts in place. To solve the problem, I made a fixture that acts as both a stop block and a hold-down. It clamps to my sled's fence.

The fixture is made from two pieces of 3/4" plywood and two toggle clamps. An F-style clamp holds the fixture's back square against the sled's fence. The front end is secured by a jig-knob and a threaded insert installed in the sled. A slot for the jig-knob's stud allows me to adjust the fixture side to side.

I did run into one problem. Because of the fixture's size, the edge in contact with the workpiece is quite long. This created a trap for dust, so I had to blow the dust away after each cut in order to butt the workpiece directly against the fixture. To avoid this, I installed a screw in the fixture's corner, near the fence. My workpiece butts up to the screw, creating a generous gap for dust to gather in. If and when the stock gets less than 3" long, I install a second, similar screw on the jig to keep the workpiece square.

Cory Hoehn



COURTESY OF CONTRIBUTOR



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Dust Bin Window

MONITORING THE LEVEL OF DUST in a cyclone's bin is a pain. You have to remove the lid and look, which isn't easy. If you forget or put it off, dust will back up into the collector's main unit, clogging up the filter, which, once discovered, is a huge mess to clean up.

Some dust collectors have a flashing light telling you when the bin is full. Others have a window, so you can see when it's full; mine had neither, so I added my own window. Each time I turn the collector off, I check the window to see if the bin needs emptying.

I cut a rectangular hole in my dust collector's cardboard canister, and then cut a piece of 1/8" thick acrylic to cover the opening. The acrylic was 1" wider and taller than the hole to make room for fasteners.

To make the acrylic fit the curve of the bin, I carefully heated it using a heat gun. A large coffee can served as my bending form. The curve is very slight, and 1/8" acrylic heats up quickly; it was ready to bend in less than a minute. Make sure you wear gloves for this.

I fastened the window on the inside of the bin using weather stripping tape and pop rivets.

Tom Rosga



1/4" plywood workpiece

COURTESY OF CONTRIBUTOR



Screw

Thin Stock Push Block

A LARGE, HANDLED PUSH BLOCK is a perfect safety device for sliding large, thin pieces over a router bit. I found that out when I needed to cut a slot in a piece of 1/4" thick plywood.

I used double-faced tape to fasten the plywood to the push block. To make the cut, I just rocked the jig both onto and off of the bit. Masking tape on the fence indicates start/stop points.

For operations like this, the push block's bottom surface will get gouged up over time and will need to be replaced, so don't glue the handles on; just fasten them using screws. Make sure the screws don't run so deep that you risk hitting them with a router bit.

Joe Scharle



Mirror

COURTESY OF CONTRIBUTOR

Mirror, Mirror on the Bench

SEEING THE BACK SIDE of a glued and clamped joint can be tricky. Clamping pressure can skew a joint, as can moving an assembly to see its back side. If all your cuts are square, the joint should be tight—theoretically—but I like to know for certain.

To make sure everything is spot on, I slide a small mirror under the joint and have a look. This way I don't have to lift the assembly and risk tweaking it out of adjustment.

Richard Helgeson

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Digitally-Precise Marking

A DIGITAL MARKING GAUGE? Really? Well, why not, right? The iGaging Digital Marking Gauge still does everything a traditional marking gauge does. In fact, you don't even have to use the digital readout, but it's there if you want it.

So first let's imagine it didn't have a digital readout. This is a quality marking gauge even without it. It has a generous fence, smooth operation and a very substantial feel. You can choose either a pin gauge or a wheel gauge. The price isn't bad either, relative to other high-end marking gauges.

The wheel gauge is great for marking across the grain, as it cuts the wood's fibers, making a very crisp, clean line. If you opt for the pin gauge—for marking with the grain—you get two auxiliary pins. One pin attaches to the beam for use as a mortising gauge. The other pin attaches in place of the fence, so you can use the gauge as a divider or compass. The pins are a hardened alloy; they'll mark on steel as well as wood.

You can read the gauge in fractions or millimeters. The wheel gauge moves in 64ths, and the pin gauge moves in 128ths of an inch. If you go metric, you'll read in 100ths of a millimeter, which is splitting hairs for woodworking. The readout shuts itself off after five minutes of inactivity to preserve the battery.

I think you'll find that the digital readout is quite handy, once you get used to it. One of the big benefits of the digital readout is repeatability. Provided you know a previous setting, you can get back to it in a snap. You can also zero the readout at any point, which is nice for marking mortises. Say you want a 3/8" mortise. Mark one side of the mortise, zero the gauge, move its arm 3/8" and mark the mortise's other side from the same face.



Wheel gauge



Pin gauge

Another use for the digital readout is as a depth gauge, using the beam as a probe.

There are a couple items on my wish list for this tool. First, the knob for locking the head in place is tiny. Other than the possibility of a larger knob putting too much torque on a small setscrew, there's no obvious reason for it to be that small.

Second, if you're not careful you can push the buttons on the readout while you're using the gauge. At best, it's annoying; at worst, you could accidentally zero the gauge and lose your setting.

SOURCE

iGaging, igaging.com, 949-366-5708, Digital Marking Gauge with wheel-style cutter, #35-780, \$40; Digital Marking Gauge with pin-style cutters, #35-777, \$45.

Super-Size Disc Sander

A 15" DISC SANDER, like the new 15-205 from General International, is a great addition to any shop if you've got room on the floor and in your budget. There was a time when every patternmaker's shop had a large sander like this for precision work on large pieces. Most of those shops are history, but the need for fine-tuning angles and edges by sanding hasn't gone away.

Besides general shaping of parts, one of the other tasks for such a machine is fine-tuning miters. Even with a good miter saw, joints will often need some tweaking. Making those micro-adjustments using a miter saw can be an exercise in frustration, but it's relatively simple using a disc sander's large, flat surface.

The 15-205 is equipped with "x" and "y"



axis miter slots, allowing you to set the miter gauge at any angle to the disc. The 12" x 22" cast-iron table tilts from 0° to 45°. This beefy tool can handle shaping or making precise adjustments on large or small parts.

The 15-205 is equipped with a 2 hp, 220 volt motor, a 4" dust port and an enclosed steel stand with a built-in storage shelf. The table height is 38-3/8", and the machine weighs 212 pounds.

Safety features include a lockout key for the "on" switch, an oversize stop switch and a mechanical brake.

SOURCE

General International, general.ca, 888-949-1161, 15" Disc Sander, #15-205, \$1,460.

Go-Anywhere Toggle Mounting Plate

A HOLD-DOWN for a bench top or fixture can get you out of a tight spot. Sometimes an odd-shaped or small part doesn't lend itself to being held by a typical clamp or vise. These new Toggle Clamp Plates from Lee Valley are a really cool idea.

Mount the clamp to the plate and insert it into a 3/4" dog hole—or drill a 3/4" hole anywhere you need it. The 3/4" x 5" long post is actually slightly undersize and barbed; when clamping pressure is applied, there's no slippage.

The plates are drilled and tapped to accept Bessey Auto-Adjust clamps. It would be nice if they'd accept a variety of clamps, but the Bessey Auto-Adjust clamps are the cream of the crop, in my opinion. Mounting bolts are included. You could use other toggle clamps, but you'd have to drill and tap the plate to accept them.

The actual plate is 3/8" thick, so it adds 3/8" to the maximum height capacity of the clamps, but doesn't take anything away from the minimum capacity. According to the manufacturer, you can still clamp a piece of paper to your bench. If you're using the In-Line Auto-Adjust clamp, which applies horizontal pressure, its center height is raised from 7/8" to 1-1/4".



Toggle Clamp Plates are sold separately or as a set that includes a Bessey clamp. The clamp adds \$15 to \$17 to the price.

SOURCE

Lee Valley & Veritas, leevalley.com, 800-871-8158, Toggle Clamp Plate with 3/4" Post, #50F01.01, \$21.50.

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Auto-adjust toggle clamp

Features

- 1 Auto-Adjust:** The BESSEY® Auto-Adjust Toggle Clamp automatically adjusts to variations in work piece height while maintaining clamping force.
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- 3 Adaptable Base Plate:** Holes are sized and spaced for easy mounting and flexibility in metric and imperial.
- 4 Large Handle:** Soft insets for maximum comfort.

Benefits

One BESSEY® Auto-Adjust Toggle Clamp offers a range of clamping force and clamping height. It can replace a range of competitive clamps for quicker set-ups, smaller tool cribs and consolidated inventories.



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Dual-Drum Sander Plus

WANT TO CUT SANDING TIME IN HALF? If you do any kind of production work, the SuperMax 25 x 2 Dual Drum Sander is worth a serious look.

If you're in the market for a dual-drum sander, chances are you're well aware of the benefits of any drum sander: no tearout, finish-sanding large pieces without picking up a random orbit sander, etc. The SuperMax 25 x 2 adds a couple nice features to that list.

For efficiency, two drums are better than one. A finer grit is used on the rear drum, so compared to a single-drum sander, it's like taking two passes at once. With a different grit on each drum, the drums need to be set at slightly different heights. The rear drum sits lower than the front, so it raises and lowers independently. The 25 x 2 has two digital readouts. The top one tells you the sanding height, while the bottom one shows the differential between the front and rear drum.

Second, the 25 x 2 has an edge-sanding feature. This is nice for raised panel doors, face frames, or any stile-and-rail work. You can quickly flush the ends of the stiles with the rails and then finish-sand them; all without moving to a different machine.



Here's how it works. Remove a section of the rear drum's guard and re-fasten it to the top of the machine, creating a 90° fence above the rear drum. There are two possible positions for the fence, so you don't wear out just one spot. The fence is small—only 4-1/2" tall x 7-3/4" wide—so I'd recommend an auxiliary shop-made fence attached to the factory fence for large parts.

While the fence is handy to store and install, I wish that the two mounting positions angled across the drum, to spread out the wear. Also, since the rear drum will typically have a finer grit than

the front drum, you can't get too aggressive with material removal.

While you're adjusting the rear drum for edge-sanding, you're at the back of the machine, unable to see the digital readouts. So the folks at SuperMax installed a simple mechanical dial on the back, so you can see how much

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you're moving the rear drum. When you're done edge-sanding, a preset stop allows you to quickly return the rear drum into position for normal operation.

The edge-sanding feature on this machine works pretty well, although it's not on a par with a stand-alone edge sander. The good news is that you can get by without the extra cost and space requirements of an edge sander.

The 25 x 2 will sand parts as wide as 25", with a maximum thickness of 6". On the other end of the spectrum, it'll sand parts as short as 2-1/4" and as thin as 1/32".

The 3 hp motor runs on a 220 volt circuit. The conveyor is powered by a separate motor, allowing an infinitely adjustable feed rate from 0 to 20 feet per minute. Also, the 25 x 2 has SandSmart technology, which optimizes feed rate by automatically slowing the conveyor if it senses the motor is being overloaded.

As with all SuperMax sanders, the head—not the conveyor or bed—moves up and down. That's nice if you're using an infeed or outfeed table for long parts.

It comes with a cast-iron stand, and a mobile base is optional. You can also purchase infeed/outfeed tables (pictured).

SOURCE

SuperMax Tools, supermaxtools.com, 888-454-3401, 25 x 2 Dual Drum Sander, #913003, \$3,095; Mobile Base, #98-0120, \$170; Infeed/Outfeed Tables, #98-2551, \$270.

Dust-Collection Booster

EFFICIENT DUST-COLLECTION is paramount to a healthy shop environment. If you currently have a single-stage or two-stage dust collector, the new Super Dust Deputy will boost their efficiency.

The Super Dust Deputy can be retrofitted to any 1/2 hp to 3 hp dust collector, with no loss of cfm. According to the manufacturer, it'll separate up to 99% of wood waste before it gets to your dust collector's filter. That prevents filter clogging, which helps maintain your system's airflow.

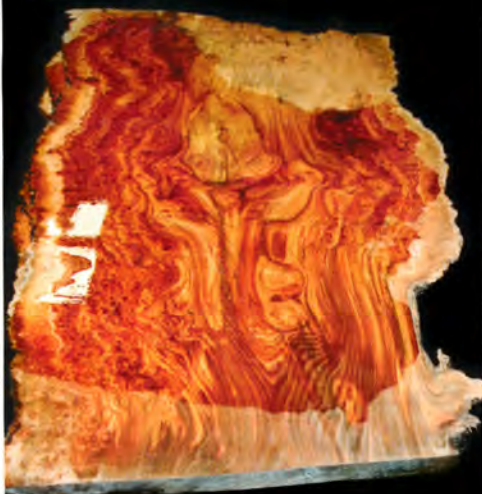
The gasket and all hardware are included. You'll need to either provide your own drum or purchase a 17-gallon Drum Kit from Oneida. You'll also need to furnish your own hoses; inlet diameter is 5", and outlet is 6". The cyclone unit is 27" tall. Drum included, the unit's footprint is 15" x 17". Hoses, reducers, and heavy duty plastic bags for the drum are also available from Oneida.

SOURCE

Oneida Air Systems, oneida-air.com, 800-732-4065, The Super Dust Deputy, #AXD002030A, \$169; 17 Gallon Steel Drum Kit, #SEK170601, \$89.



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The 1221 is heavy and solid; the bed, headstock and tailstock are all cast iron. It weighs in at more than 120 lbs., and the stand adds another 73 lbs. Mass is a big deal for turning, as it increases stability and cuts down on vibration. Also, the 1221 has three speed ranges—60 to 900 rpm, 110 to 1800 rpm, and 220 to 3600 rpm—to suit whatever turning task you have. A ratcheting belt system makes it easy to change between speed ranges, delivering more torque at the slower speeds.

Within each range, the speed is infinitely adjustable; use the knob to dial in just the right speed for the job. A digital readout eliminates guessing the lathe's rpm.

The 1221 has a 21-1/2" working distance between centers and a 12-1/2" swing. You can also purchase a 22" bed extension as well as an extension for the stand to accommodate longer turnings. Spindle thread is 1" / 8 tpi, and quill travel is 2-1/4".

At 200 rpm, the 1221's 1 hp, single-phase motor



allowed me to round off a rough oak bowl blank without stalling or bogging down. It also features "soft-start" and smooth transition from forward to reverse.

There are, however, a few things on my wish list. First, there's a pinch point between the headstock's handwheel and the lathe's housing. Let's say the lathe is turned off but still spinning. Common practice is to reach for the handwheel to stop it the rest of the way. You could get your finger squeezed much harder than you'd like, or worse. Granted, you're not supposed to use the wheel to stop the machine, but people do.

Second, a 5/8" post is probably fine for the 6" tool rest, but it'd be nice to have a 3/4" post—particularly for a 10" tool rest. As you slide a tool further from the post, you're creating more leverage. With a sturdier connection, a more massive post helps prevent vibration.

SOURCE

JET, jettools.com, 800-274-6848, 1221VS Woodworking Lathe, #719200, \$800; Lathe Stand, #719202, \$348, 22" Bed Extension, #719201, \$200, 22" Stand Extension, #719203, \$107.

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Brian Lorentzen

**Most woodworkers love big boards.
This guy makes them.**
by Spike Carlsen

THE FIRST THING I notice as I walk into Brian Lorentzen's cutting shed is a just-opened 26" dia. walnut log sitting on a Wood-Mizer bandsaw mill. Then I notice Brian shaking his head at the shiny ends of the 3/4" lag bolts he's just sawn through. "I love what I do," he explains in waggish dismay, "because every time I saw into a log I feel like a little kid at Christmas—I never know what I'll find inside." And while the first cut on this particular log hit a pair of old hammock hooks, Brian soldiers on (after digging the hooks out of the log and replacing the saw's blade), because the next cut just might hit the jackpot.

Addicted to wood

In 1990, the notion of sawing lumber was nowhere on Brian's radar. As a machinist and machine designer, he was more interested in metal, motors and computers. But while clearing land for the house he was about to build, Brian began thinking that the massive fallen oaks must be good for something other than firewood. "I thought, 'Hmm, I wonder if I could get boards out of these things?'"

That's how naive I was," he jokes.

Brian hired a sawyer to mill some of the logs on site, and as the sawyer worked, Brian saw magic unfolding before his eyes. In 1998, he bought his own sawmill, took a kiln-drying course at the University of Minnesota and took a lumber-grading class through the National Hardwood Association.

Eventually, Brian cut and dried the lumber for the doors, staircases and cabinets that went in the house. He also built most of the furniture and crafted all the stained glass windows. Of course, that was after he'd completed all the carpentry and masonry work on the structure.

Fifteen years later I encounter a 54-year-old man with such passion for turning logs into lumber that he has 100,000 board feet of it tucked in every nook and cranny of his garage, basement, shed, kiln and house. In addition to boards showing spectacular grain, Brian's inventory includes burls and slabs showing more of the same. He has quartersawn shedua stacked in the kitchen pantry and a minivan-size stack of padauk in his office. He hauled out

three bobcat loads of bird's-eye maple through the bedroom window last year. "When woodworkers walk through the house," he says, "they always pose the same question: 'You're not married are you?'"

Brian loves wood of every race, color and creed. Given the opportunity to purchase 15,000 board feet of tigerwood, leopardwood, padauk and other exotic woods a few years ago, he sold his DeLorean to create the room to store more wood.

Over the course of a long morning, Brian points out so many "once in a lifetime" boards that I figure he must have as many lives as Samantha, his omnipresent shop cat. Brian moves from pile to pile, sliding out quartersawn oak, flamed maple and crotch walnut boards. He pauses before a 20" wide x 3" thick slab of elm and waxes, "This is the most perfect log I ever sawed." When asked if he has a personal stash of wood he'll never sell, Brian grins like a Cheshire cat and unflinchingly responds, "Oh yeah." At this point, I realize I'm in the presence of a man who knows every flame and fleck of every board he's ever cut.

Focused on "fun" logs

Located just outside St. Paul, Minnesota, Brian finds a plentiful supply of oak, elm, maple and other boulevard trees. For clear, straight-grained lumber he seeks out canopy trees—ones that shed their lower limbs early in life—that can yield a 15' to 20' log with nearly zero knots. Many of his logs are veneer grade. As his storehouse of woods has increased, so has his selectivity in the logs he saws. He now prefers logs that are at least 3' in diameter, along with crotch woods and other logs "that are fun."

Though Brian occasionally fells a tree on his own, he prefers trees "with the gravity already taken out of them." He gets most of his logs through word of mouth and a handful of tree services he's built relationships with over the years. "People say there are no big trees left, but that's not true," he



PHOTO COURTESY OF BRIAN LORENTZEN

Walnut book-match 2" x 28" x 72"

Boards that would be difficult to use independently often create spectacular book-matches.



Stacks of stored lumber turn Brian's three-stall garage into a labyrinth of woodworkerly delights. A car seems out of place.



Walnut crotch book-match 2" x 60" x 60"

Freshly cut walnut has a distinctively greenish tone that oxidizes within a few days to dark brown. Here the oxidized color appears at the ends.



Like most woodworkers, Brian stores treasure boards in his shop. In Brian's case, about 50,000 board feet of treasure.

explains. "Some of the best logs come from people's front yards. There are amazing trees in the inner city and in farmer's fields. Ironically, many sawyers won't touch these trees for fear of hitting metal and ruining a blade. I hate hitting metal, but some logs are so extraordinary, I'm willing to take the risk."

In addition to bolts, bullets, chains and other forms of "tramp metal," Brian has even hit glass telephone insulators while sawing. He recalls one walnut log where he cut through three generations of bolts and screws—and went through three blades. "Sometimes you start on a log thinking you'll spend three hours and get 600 board feet of beautiful lumber, but you wind up spending three days and getting a bunch of firewood."

The art of making boards

As passionate about turning logs into boards as most woodworkers are about turning boards into furniture, Brian studies each log carefully in order to produce the most attractive and valuable boards. "The way a log is turned and cut can make the difference between an ordinary flat-grained board and a flamed or quartersawn beauty," he explains. "Commercial mills are concerned only with speed and yield. They'll take three minutes to saw a log that I'll study for an entire afternoon." Brian studied one triple-crotch walnut log for six months before he fired up

the saw. "I'm a treasure hunter for amazing wood grain," he claims. "I'm glad there's not a tape recorder running in my cutting shed," he says, "because all day long you'd hear me shouting to myself, 'Wow, look at that flake! Look at that figure!'"

Brian has made a science of cutting and drying wood. "Cut and dry boards the right way and 100% of them will be flat and crack-free," he explains. "Do it wrong and they'll be warping and twisting within hours." "Doing it right" is a long journey that takes three years or more.

Brian only cuts logs in cooler weather (under 70°), "to avoid mold and checking." When the logs first arrive, he coats the ends with wax. "Then I think about each log for awhile and how I'll saw it." He cuts logs up to 42" in diameter on his Wood-Mizer. A few times a year—when it's time to cut a monster log—he'll break out the massive center-pivot slabber that he designed and built. Powered electrically, it swings an 8' chainsaw bar in a horizontal arc and can saw logs up to 6' in diameter.

Once the boards have been sawn, Brian stands them vertically for several days to allow surface moisture to dissipate. He applies a coat of Pentacryl (a wood stabilizer used to keep green wood from checking) to the surfaces of thick wide boards and crotch pieces. Next, he carefully sticks the boards in the order they were cut from the log and uses ratcheting straps to hold the piles perfectly flat.

Then he shed-dries each pile for a minimum of one year for each inch of thickness of the boards it contains: A pile of 12/4 boards will be assigned a three-year wait, or longer. Brian disdains open-air drying because it exposes lumber to sun, rain and weather that's sure to cause degradation.

This first stage of the drying process is the most critical, according to Brian. "Checks and mold occur in this stage while the green boards dry down to 50% moisture content," he explains. "Once you get wood below 50% moisture content, such defects are much less likely to develop."

After shed-drying, Brian kiln-dries the wood at a low temperature for a month or more, ending at 130° to kill bugs and larva. (Yes, he designed and built the kiln.) The goal is 5% to 8% MC. At the end of this drying process, Brian conditions the boards by flash-steaming them for about 30 minutes. Flash-steaming relieves case hardening created during the drying process. "It's like a sauna for wood," Brian says. After this spa treatment, Brian moves the finished boards into a conditioned space, where they're carefully stacked, like wooden treasure waiting to be discovered.

Why go to such trouble and expense? "You build something out of a bunch of narrow boards and it looks okay," Brian explains. "Build it with wider boards and it looks better. Build it with wide boards that are flamed or quartersawn and book-matched, and it's the first thing someone sees when they walk into the room. They're awed by it. That's what woodworking is all about." 🐿️

Find out more about Brian (and browse through 600 web pages-worth of lumber) by visiting logs-to-lumber.com.

Spike Carlsen is the author of *Woodworking FAQ*, *A Splintered History of Wood* and *Ridiculously Simple Furniture Projects*. For more information visit spikecarlsen.com or facebook.com/spikecarlsenbooks.



Brian's Wood-Mizer handles logs up to 42" in diameter.

Red elm book-match 1-1/2" x 24" x 96"

According to Brian, the best figure and color in a log is typically in the first few boards, right under the bark.

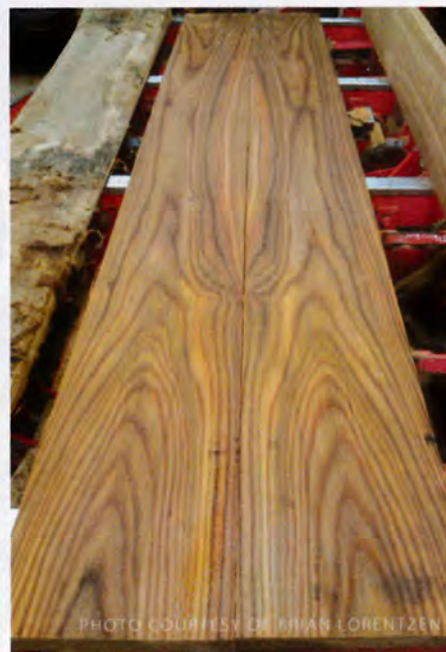


PHOTO COURTESY OF BRIAN LORENTZEN



PHOTO COURTESY OF BRIAN LORENTZEN

For cutting logs up to 6' in diameter, Brian designed and built this pivoting log slabber.

Spalted maple book-match 2" x 30" x 120"

Harvesting spalted boards takes a bit of luck, Brian says, because spalting is a by-product of the decay process. That means the log has to be cut at just the right time, while spalting is actively occurring, but before the log's cellular structure deteriorates and the wood becomes soft and punky.



PHOTO COURTESY OF BRIAN LORENTZEN

Game Call

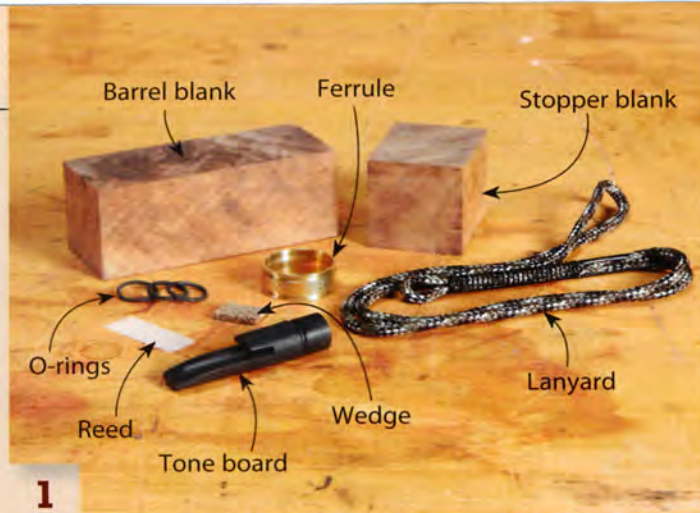
Turn an essential
duck-hunting accessory.

A TRUE AMERICAN folk object, the game call gained enormous popularity in the late 19th century, when it became part and parcel of hunting. Poke around a bit and you'll find game calls for geese, turkeys, doves, crows, squirrels and even coyotes. But in all its many forms, the classic game call is the duck call.

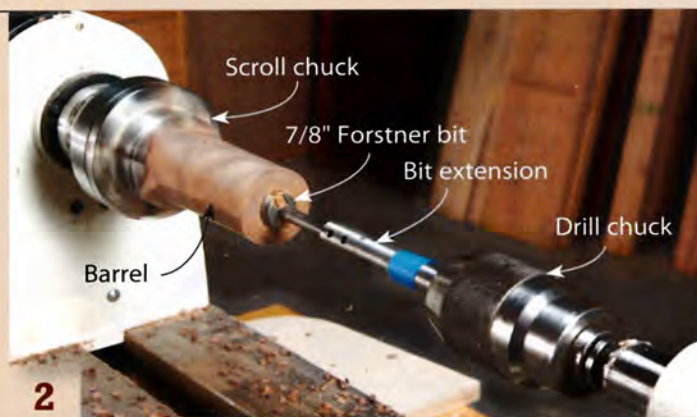
Whether you hunt with a gun or a camera, a game call is a wonderful turning project. The parts that make the sound (called the "guts") are available in kit form or as separate parts (see Sources, page 29), so once you're set up for drilling and turning, it's easy to produce a number of calls in a short time. Play with different shapes or explore your own theories about dimensions and sound—I guarantee you'll have fun. But before you commit to a valuable piece of wood for that heirloom call, it's a good idea to work out the basic drilling, chucking, shaping and fitting, using blanks of common wood such as poplar.



Sportsmen: Turn a wooden fishing lure at AmericanWoodworker.com/WebExtras



1 **Cut** blanks for the call's wooden parts. You'll also need three O-rings and the "guts"—the parts that create the sound. A ferrule and lanyard are optional.



2 **Drill** a hole through the blank that will be the call's barrel. This requires a scroll chuck to hold the blank and a drill chuck to hold the Forstner bit and its extension.



3 **Reduce** the diameter at the end of the barrel and add details after installing a tapered plug in the hole and engaging the tailstock. This end will be the mouthpiece.



4 **Flip** the blank end-for-end and mount it on a jam chuck so you can work the other end. The hole in the barrel snugly fits a tenon turned on the jam chuck.

Stuff you'll need

In addition to the guts, you'll need two blanks of wood (**Photo 1**; see Sources). You can use contrasting woods or cut both blanks from one long piece. Any good, dry wood will do. Walnut is a popular choice (historically and with contemporary makers), and it's usually readily available. The recent development of resin-injected woods commonly used in pen-making has created a material not so prone to dimensional changes due to exposure to moisture—an unavoidable occurrence with mouth-blown calls.

You'll also need a 2" x 2" x 4" blank of poplar or other soft wood to create two jam chucks, and basic spindle-turning tools, including a spindle roughing gouge, a skew chisel, 1/4" and 3/8" detail/spindle gouges and standard and thinner parting tools. Next on the list are a four-jaw scroll chuck and a drill chuck (a keyed chuck that mounts in the lathe's tailstock), 5/8" and 7/8" Forstner-style drill bits and E-6000 adhesive (see Sources). A lanyard and a ferrule are optional, but you'll definitely need O-rings if they don't come with the guts parts that you order (see Sources).

The guts rule

The guts play an important role in determining a call's diameter, because they mount in a hole drilled through one part

(the stopper). As the guts come in different styles and sizes, this hole must be sized to fit. A larger hole drilled through the other part (the barrel) houses a tenon turned on the stopper. The call has to be long enough to house the guts; beyond that, its length can vary.

The call shown here is sized to house Arkansas-style single-reed guts, which require a 5/8" bore. I used a pair of 1-3/4" x 1-3/4" blanks to make this call: one 2" long with a 5/8" bore (for the stopper) and one 4" long with a 7/8" bore (for the barrel).

Turn the barrel

The first step is to drill a centered 7/8" dia. hole all the way through the barrel blank, using the lathe or a drill press. To drill the hole on the lathe, mount the blank in a scroll chuck (**Photo 2**). The blank can be mounted square (as shown) or on a shouldered tenon. (This tenon has to be turned first, of course, after mounting the blank between centers.)

Drill the hole with a Forstner bit and a drill chuck. To keep from building up excessive heat, it's best to use a high-speed steel (HSS) or carbide-edged bit. Most of these bits are short, so you'll probably need a bit extension. Drill slowly and frequently back the bit out of the cut to clear the chips.

Next, shape the barrel's mouthpiece (**Photo 3**). Reduce the diameter to about 1-1/4". Flatten the end to facilitate mount-



5

Turn a tenon for the ferrule, a metal band used to reinforce the joint between the call's two wooden parts. Ferrules commonly appear on older calls, but including one is optional.



6

Complete the barrel by connecting the two ends. If you decide not to add a ferrule, leave extra thickness at the joint to keep the wood from splitting.



7

Cut a cove to house the lanyard. First, cut a shallow groove with a thin-kerf parting tool. Then use a small detail/spindle gouge to form the cove.



8

Flare the end of the call's stopper after mounting it and drilling through it, as for the barrel. Leave the edge flat for mounting on the jam chuck. This end sounds the call.

ing it for the next step and sand everything smooth—don't leave any sharp edges where your mouth will contact the call.

Remove the barrel and mount a 2" long poplar waste block in the scroll chuck, with its grain running parallel to the lathe bed. Turn a tenon on the waste block that's slightly larger than the hole drilled through the barrel and about 1" long. Then carefully reduce its diameter to obtain a jam fit with the barrel (**Photo 4**). The fit should be tight enough to hold the barrel for turning but loose enough to allow it to be easily removed after it's been turned.

To support the barrel's free end, turn a short, tapered plug to fit inside its drilled hole and bring up the tailstock. (Another option is to install a live center with a cone-type point in the tailstock.)

The portion where the barrel fits onto the stopper requires special attention, because it may split if the parts swell or if the barrel takes too much force to install. The solutions are to leave this portion extra-thick or to install a metal ferrule to reinforce the joint (**Photo 5**). Size a tenon to fit the ferrule using outside calipers. Aim for a push-on fit and plan to glue on the ferrule using E-6000, a rubber-based adhesive that bonds permanently but stays flexible.

The barrel's final shape is up to you, but a curved form makes the call easy to hold (**Photo 6**). Although not essential,

a lanyard reduces the chance of losing the call and frees up both hands for those moments of truth (**Photo 7**). Complete the barrel by finish-sanding it to 220 grit (or 320 grit if the 220 grit scratches remain visible).

Turn the stopper

Drill a centered hole through the 2" blank as before, but use a 5/8" Forstner bit to match the hole to the Arkansas-style guts we've chosen. The tailstock end of this blank will be the exit for sound, so it's often flared like a horn for greater volume—in theory, anyway (**Photo 8**). Turn this end of the stopper about one-quarter of the way up the outside.

Remount the jam chuck you used for the barrel and resize its tenon to fit the smaller hole in the stopper. If the end of the stopper has been flared, you may have to lengthen the tenon to create a secure fit.

Install the stopper on the jam chuck and bring up the tailstock for additional support. Then turn a tenon to fit inside the barrel, with shallow grooves for two O-rings (**Photo 9**). Make the tenon about 1" long and size its diameter for a very slightly loose fit into the barrel. Space the grooves about 1/2" apart.

The O-rings may be slightly wider than the parting tool; if so, make a second cut to widen each groove. The depth of the grooves is also critical, as the O-rings must protrude slightly



9 Cut shallow grooves for the O-rings after flipping the stopper, mounting it on a jam chuck and turning a tenon that's slightly smaller than the hole in the barrel.



10 Install the O-rings to create an airtight fit with the barrel that's neither too tight nor too loose. This is a critical step! Adjust the fit by carefully increasing the depth of the O-ring grooves.



11 Shape the middle section to complete the stopper. The end of this stopper flares like a horn on the outside to match the flared shape cut on the inside.



12 Insert the assembled guts after applying finish to the stopper and barrel and allowing it to thoroughly dry. Then install the barrel, add the lanyard and start quacking!

above the tenon to achieve an airtight fit with the barrel—but not so tight that the pieces have to be forced hard together (**Photo 10**).

Shape the tenon's shoulder to fit nicely against the barrel. Then finish-turn the outside of the stopper (**Photo 11**). Complete the job by finish-sanding the stopper to the same grit as the barrel.

Fowl-weather finish

As moisture is a real enemy, whether from blowing the call or from the environment (cold and wet is often the norm for duck hunting), it's imperative to apply a moisture-resistant finish on both the inside and the outside of the call. Some makers soak their calls in linseed oil. I prefer to use a film-forming finish. Any high-quality varnish that's thin enough for wiping will work. I apply four coats of Waterlox Marine Finish, using a small brush to get inside the barrel. Allow the parts to dry for several days before assembling the call.

Get quacking

Assemble the guts (the third O-ring fits in a groove on the tone board) and install them in the stopper (**Photo 12**). Use a bit of E-6000 adhesive, if necessary. Install the barrel and give the call a couple blasts. Does it sound like a duck? You can

alter the sound by adjusting the reed and wedge on the tone board, but my advice is to ask someone familiar with duck calling to assist you with the call's initial "tuning" and to teach you some basic calls. That's much more fun than purchasing an instructional duck call CD.

SOURCES

- Web Foot Custom Calls, webfootcustomcalls.com, Duck Call Guts, #DS01, \$4.10 ea.
- Hut Products, hutproducts.com, 800-547-5461, Deluxe Single Lanyard, #3002, \$0.89 each, Duck Call Blank Kit, claro walnut, #3113, \$8.29 ea.; O-rings, 10-pack, #3003, \$0.99.
- Tho Game Calls, thogamecallsstore.com, 603-867-1018, Stippled Brass Band (Ferrule), 1-1/4" OD x 1/2" wide, \$5.99 each.
- Woodcraft Supply, woodcraft.com, 800-225-1153, HSS Forstner Bits, 5/8", #12E34, \$14.99, 7/8", #12E41, \$18.99; 5" Bit Extension, #144512, \$23.09; E-6000 Adhesive, 3.7 oz. tube, #147109A, \$5.99; Waterlox Marine Finish, 1 quart, #85W54, \$39.99.
- Packard Woodworks, packardwoodworks.com, 800-683-8876, Oneway Talon Scroll Chuck, #112670, \$231.90, 1/2" Key Drill Chuck, #2MT, #111012, \$36.99.

Alan Lacer is a turner, writer, demonstrator and instructor living near River Falls, Wis. For more information, visit alanlacer.com.

Shop Therapy



**Woodworking is always satisfying—
even when plans don't work out.**

MY WIFE AND I BOUGHT a 100-year-old farmhouse near Bristol, Ind. that came with a decrepit 30' x 40' barn. I planned to save the barn after we finished restoring the house. However, plans don't always work out. A couple years later I was facing my second knee replacement and knew I wouldn't be able to return to my job as a pattern maker.

While recovering from the surgery, I decided to start my own woodworking business and turn the barn into a woodshop. (This would be my second woodworking shop. I lost my first in a fire 25 years ago. At that time, I

couldn't afford to rebuild.)

I read every woodworking magazine I could find to get up to date on all the advances in machinery that had occurred since my first shop and used this information to create a list of the machines I'd need for my new shop. I intended to use the barn's lower level to conduct craft classes. That left the 20' tall upper level for the shop. In the layout I planned, there'd be room for all the new machinery, but no space for a dust-free finish area. So the 20' ceiling became two 10' ceilings, with a finishing room and a storage area located above the main shop.



Now, how to get pieces up to the finishing room? Stairs were out of the question, so an elevator became part of my plan: I'd cut a hole in the ceiling and use an electric hoist to raise and lower an open-framed box.

By this time I was ready for therapy on my new knee—and restoring the barn served the purpose. First I had to address its walls, which had listed under the sagging roof. I strung cables around the perimeter and slowly pulled in the walls a little each day. It took weeks but eventually they were straight and the roof—what was left of it, anyway—was lifted back to its intended position.

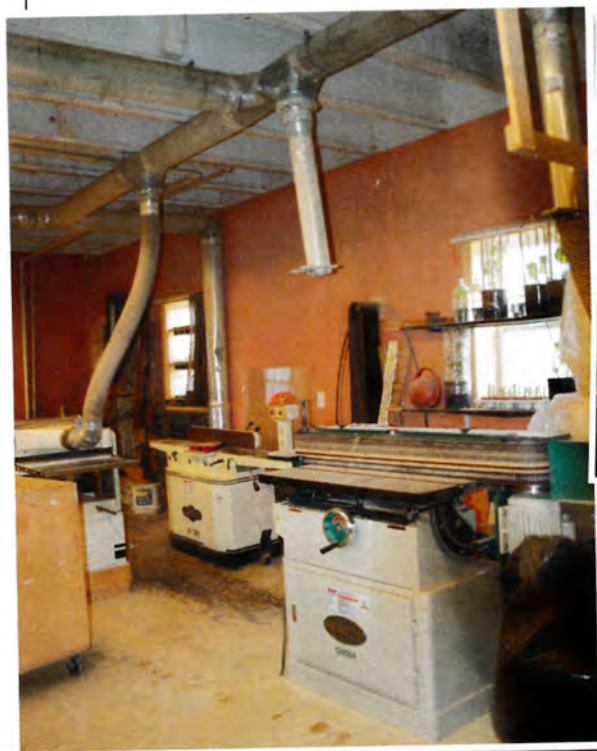
Rebuilding the floor was next. Knowing it would have to support a great deal of weight, I sistered 2x12s to every joist, using carriage bolts every 16", and installed new support beams in the basement. Then I triple-decked the floor, staggering every joint. To leave a clear span in the main shop area, I installed 30' wooden I-joists and a single-deck floor to create the upper finishing room/storage area.

The barn's exterior required a great deal of work, as I

added windows, a walk-in door and a large double door, not to mention the 57 gallons of paint it took to refresh the thirsty weathered siding. To provide additional support and space for insulation, I built sister walls inside all the exterior walls. The roof received the same treatment, with I-joists sistered to the old rafters.

I installed a furnace in the basement with ductwork to the main level and added a new panel box, with conduit runs in the floor joists to all the machinery and to outlets around the shop's perimeter. I installed phone and computer connections and industrial fluorescent lights. I ran water lines and installed laundry sinks on both levels. Except for the new metal roof, the concrete basement floor and a little help from friends and family at critical times, I did all the work myself.

Then, while helping unload my new machinery, my new 800 lb. compressor fell on me. The accident resulted in permanent nerve damage that has caused me to lose partial use of my legs. Still, I've managed to set up the shop and continue to work as I can on a daily basis.



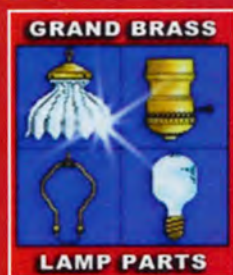
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Send us photos of your shop, a layout drawing and a description of what makes your shop interesting. Tell us what you make in it and what makes your shop important to you. If "My Shop" features your shop, you'll receive \$100.

Email your entry to myshop@americanwoodworker.com with digital photos attached. Or mail your description with digital photos on a disk to My Shop, American Woodworker, 1285 Corporate Center Drive, Suite 180, Eagan, MN 55121. Please include your phone number. Submissions cannot be returned and become our property upon acceptance and payment. We may edit submissions and use them in all print and electronic media.

I've installed heavy-duty casters on a chair that I use to scoot around from machine to machine. My dream of a profitable woodworking business is gone, as I can no longer work fast enough to do any better than breaking even. But I do what I can. I happily build items for friends and family members, and I've created a growing line of doll furniture—mostly solid oak—that I market online. As I said at the beginning, plans don't always work out. You just gotta go with the flow.

*Deni Madlem
Bristol, Ind.*



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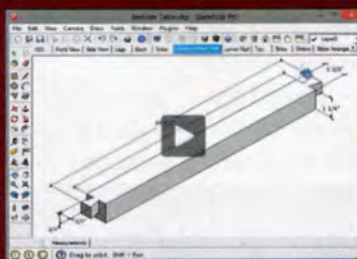
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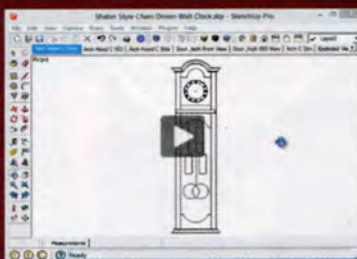
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Rotary Box

Learn how to
make gears
while building
a fascinating
project.

by John and Pete
Hutchinson

MY ROTARY BOX started out as a solution to a specific problem. Back when I was playing poker with my buddies, someone suggested that we needed a fitting storage container for our boys-night-out cigars. The box came to me in a flurry of CAD calculations and sketching and was an instant hit.

Turn the gear-shaped knob on top of the box and all six doors open at the same time.



Quick Start: Deconstructing the Box



Step 1

Remove the gear-shaped knob on top of the box.



Step 2

Turn over the box and unscrew the bottom plate.



Step 3

Remove all of the small follower gears and the doors.



Step 4

Pull out the large driver gear.



Step 5

Unscrew the middle plate from the columns below.

Not for everybody, however. When doctors and spouses pointed out that cigars are not necessarily the path to true happiness, I reluctantly retired the box. It became nothing more than a conversation piece. As if the loss of a mission statement wasn't bad enough, my fallen star slowly began to bind, warp and tear itself apart.

But hope springs eternal. One day a pen collector and turner suggested that I revisit the project as a home for his most-valued specimens. Eureka! My box had a new reason for being. Redesigned, it could hold transpar-

ent pen tubes. I enlisted the help of my brother, Pete, who is a stickler for accuracy. Learning from my mistakes, he built a new box that still works fine.

As you can see at left, all the doors of the box open and close at the same time. One large gear turns six smaller gears—one for each door. Making the gears and drilling the holes for their axles is exacting work, but you really don't have to be ultra-precise. It's not like you're making a watch!

Pete figured out the trick to synchronizing the doors: Don't glue the gear's axles into the doors—just make

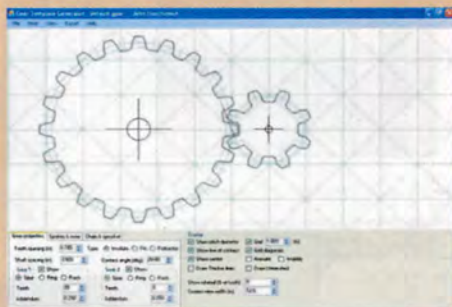
them a tight fit. This way, if one or two doors happen to lag behind the others, you just rotate them a bit by hand. Once the box is tuned, it should stay in tune.

If you get the bug to build this project, you could start with the gears, the octagonal plates or the doors. It really doesn't matter. We'll start with the doors, just to get them out of the way, and then move on to the more esoteric, fun stuff. A word of warning: Once you start making things with gears, you may get hooked. I sure am!

"Name That Box!" Contest

What's this box for? It's a solution in search of a problem! Take a crack at suggesting what could be stored inside by visiting AmericanWoodworker.com.

We'll choose the winner on Sept. 1, 2013. The best entry will receive software for designing gears of any size plus a set of the Woodpeckers Setup Blocks featured in this story. Good luck!



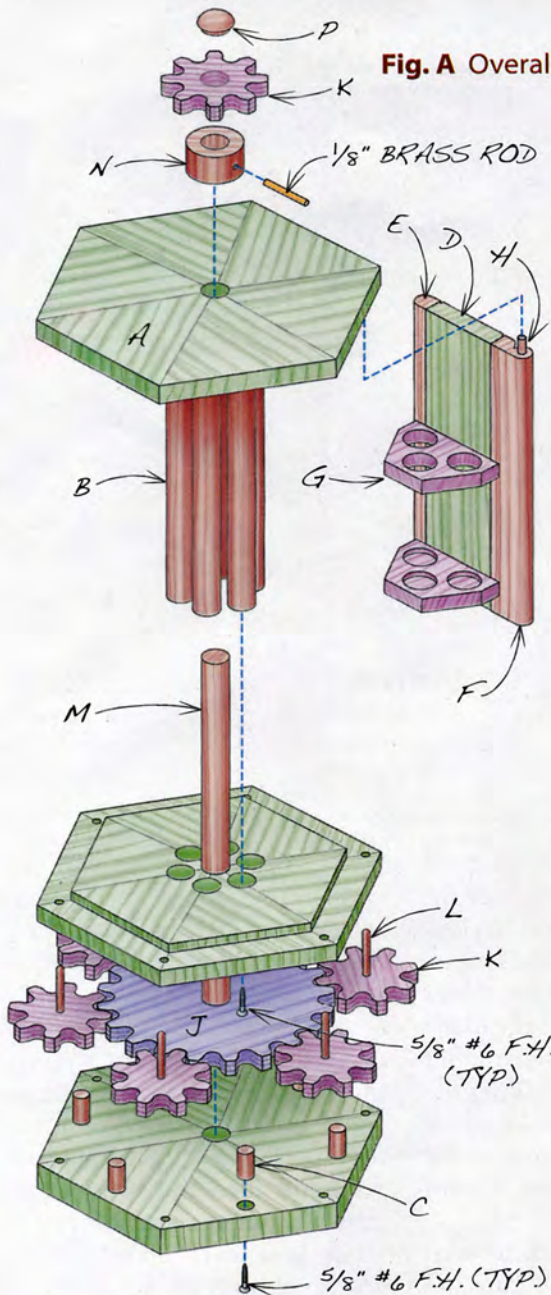
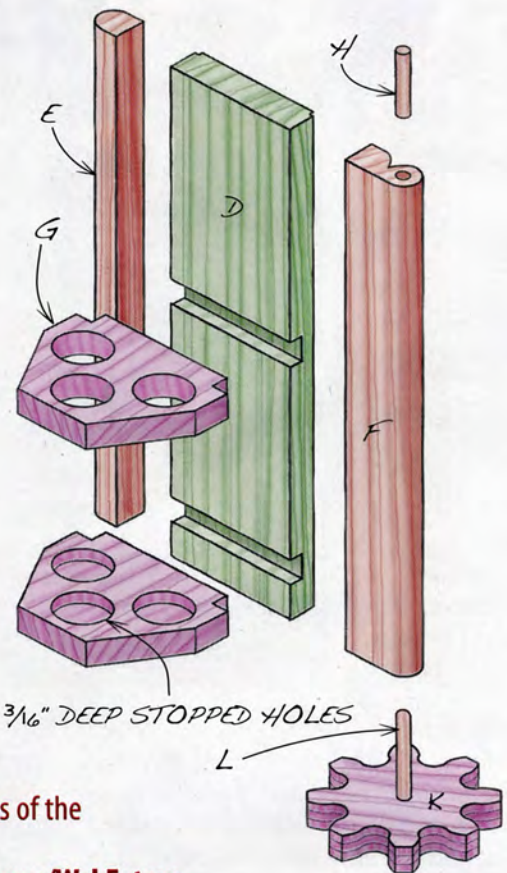


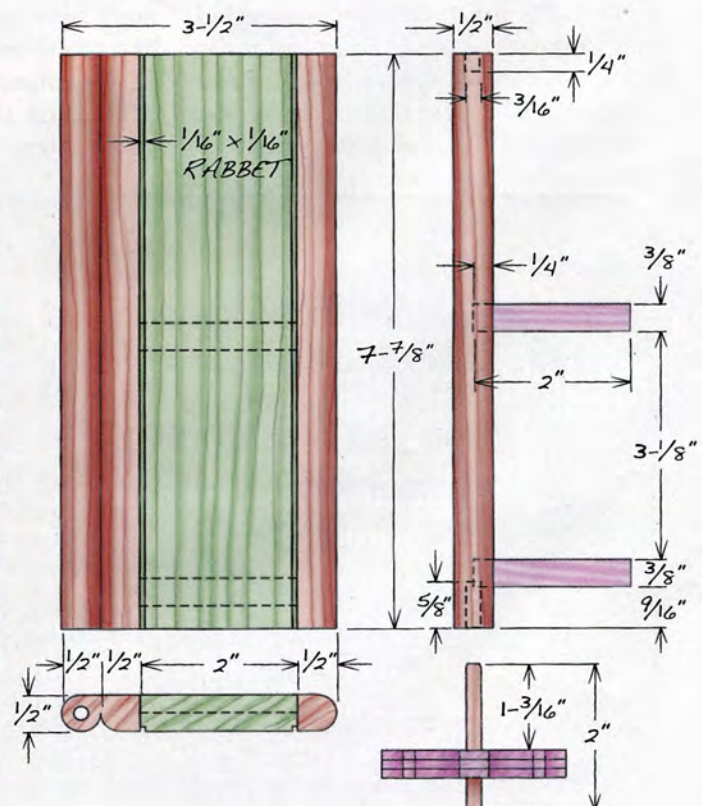
Fig. A Overall Exploded View

Fig. B Exploded View of Door



Download full-size plans of the gears and plates at
AmericanWoodworker.com/WebExtras

Fig. C Door Details



Cutting List

Overall Dimensions: 11-1/4" H x 9-1/4" x 9-1/4"

Section	Part	Name	Qty.	Material	Th x W x L
Case	A	Plate	3	Red oak	3/4" x 6-15/16" x 8" (a)
	B	Column	6	Hardwood dowel	5/8" dia. x 8-1/2"
	C	Spacer	6	Hardwood dowel	3/8" dia. x 1-1/2"
Doors	D	Panel	6	Cherry	1/2" x 2" x 7-7/8"
	E	Outer stile	6	Walnut	1/2" x 1/2" x 7-7/8"
	F	Inner stile	6	Walnut	1/2" x 1" x 7-7/8"
	G	Shelf	12	Cherry	1/2" x 2-1/2" x 2"
Gearing	H	Door axle	6	Hardwood dowel	3/16" dia. x 5/8"
	J	Driver gear	1	Baltic birch plywood	3/8" x 5-3/8" dia. (b)
	K	Follower gear	7	Cherry	3/8" x 2-3/8" dia. (c)
	L	Follower gear axle	6	Hardwood dowel	3/16" dia. x 2"
	M	Drive shaft	1	Hardwood dowel	5/8" dia. x 11"
	N	Washer	1	Hardwood dowel	1" dia. x 3/8"
	P	Button	1	1/2" Screw plug	5/8" o.d. x 1/4" (d)

Notes: **a)** Each plate is made from three blanks, cut in half. Each blank is 3/4" x 3-5/8" x 9". See Fig. H. **b)** Make from 6" square blank. **c)** Make each gear from three 1/8" x 2-5/8" x 2-5/8" blanks. **d)** Cut standard plug so its shaft is 1/16" long.

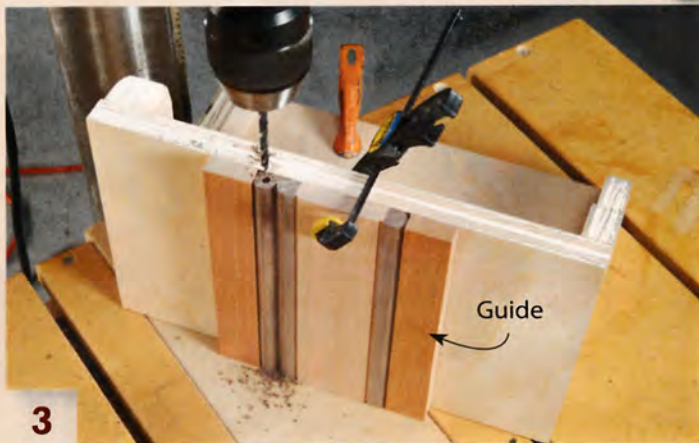
Making the Doors



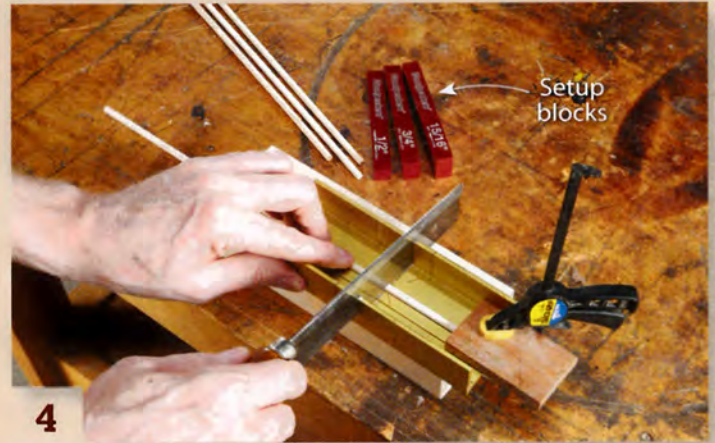
1 Rout a board's edges to make the door's stiles. All stiles have a bullnose molding; the inner stiles have an additional bead.



2 Rip the stiles from the board. Glue the stiles to a center panel and trim each door to final length.



3 Drill holes into both ends of the doors for the axles that the doors will pivot on.



4 Cut 3/16" dowel rod to make the axles. Use a group of setup blocks to position a stop block in a small miter box (see Sources).

The doors consist of three parts: center panels (D), stiles (E and F) and shelves (G). All of these parts are 1/2" thick; you can buy pre-planed wood or mill it yourself. All of the pieces will be quite short when cut to final length. For safety, do all your preliminary machining on three sets of pieces that are 15" long.

Rip and joint the panel stock to width, then rout 1/16" x 1/16" rabbets along its edges (Fig. C). Trim the panels 1/8" extra-long, then cut dados for the shelves.

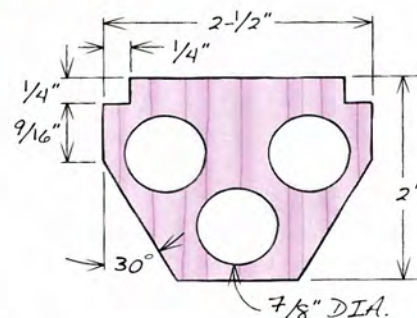
Make the stiles from a piece that's at least 3" wide (Photo 1). Rout both sides with a bullnose bit or roundover bit (see Sources, right). Rout one side with a beading bit making multiple shallow passes. Rip both sides to final width (Photo 2). Trim the pieces 1/8" extra-long and glue them to the panels. Trim each door to final length.

Build a right-angle stand for drilling axle holes in the doors (Photo 3). Carefully lay out the holes and drill. Make the axles (H and L) from 3/16" dowel rod. (It's available at craft stores and home centers.) Cut the axles to length (Photo 4 and Sources), but don't glue them in the door. Make the shelves (Fig. D) and glue them in place.

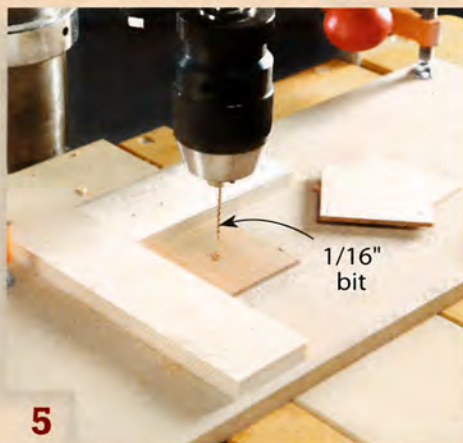
SOURCES

- Eagle America, eagleamerica.com, 800-872-2511, Bull Nose Bit, 3/8" Radius, #160-0302, \$28.95; Point Cutting Plunge Roundover Bit (for the bead), #139-0202, \$17.95; Hinge Mortising Bit, #114-1205, \$17.95.
- Woodcraft, woodcraft.com, 800-225-1153, Mini Miter Box and Saw, #140347, \$21.99
- Woodpeckers, woodpeck.com, 800-752-0725, Setup Blocks, 13 pc. set, SUB13-2012, \$119.99.

Fig. D Shelf Details



How to Make a Follower Gear



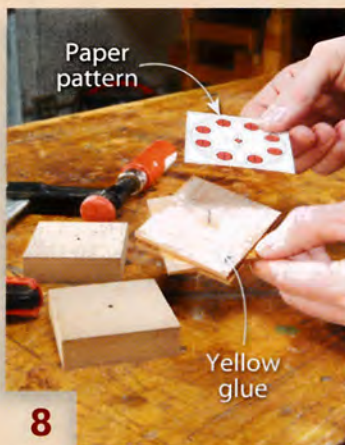
5 Drill alignment holes in the center of three 1/8" thick squares.



6 Insert a 3d nail through the top piece. Apply glue and rotate each piece 45°.



7 Clamp the stack between cauls. The nail keeps each piece centered.



8 Glue on a paper pattern of the gear. Later, add a backer piece below.



9 Enlarge the center hole to 3/16"—the size of the gear's axle.



10 Set up a drilling jig with a group of setup blocks or a single shop-made block.



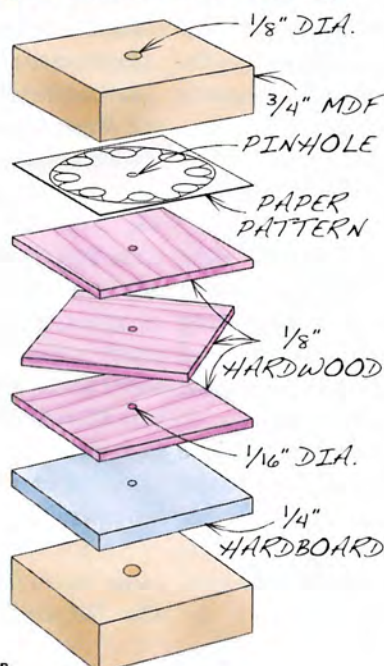
11 Rotate the blank on the jig and drill. Align the bit in each hole's center by eye.

The procedures for making the large driver gear (J) and the smaller follower gears (K) are pretty much the same. The driver is made from plywood, however, while the followers are laminated. I'll only show you how to make a follower, since it's more complicated.

Start by making 1/8" thick blanks (see Cutting List, page 36). Drill 1/16" holes through the blanks and glue them together (Photos 5–7). For strength and stability, the grain of each piece must run in a different direction (Fig. E).

It's possible to lay out each gear individually with a compass (Figs. F and G), but it's much easier to work from a paper pattern. (Download these at AmericanWoodworker.com/WebExtras.)

Fig. E Follower Gear Glue-up



Use a caul to glue the pattern to the top of the stack (Photo 8), then use a temporary-bond spray adhesive to add a backer board to the bottom. Enlarge the hole in the stack (Photo 9), then drill the gear's "dedendums" (see Fig. G) using a jig (Photos 10 and 11). I used a "metal dowel" as a pivot pin, but a wooden dowel would work, too. Metal dowels are available at hardware stores.

Cut out the gear (the "addendum circle") freehand or use a circle-cutting jig (Photos 12–14; see "Precision Circle-Cutting Jig," page 67). Remove the backer board (Photo 15). Make a mandrel from hardware store parts. (Saw off the head of a 10-24 bolt to make its shaft.) Sand the gear with coarse, medium and fine sandpaper



12

Set up a circle-cutting jig on the bandsaw. Use a 1/8" blade.



13

Position the jig's pivot pin with setup blocks or a shop-made block.



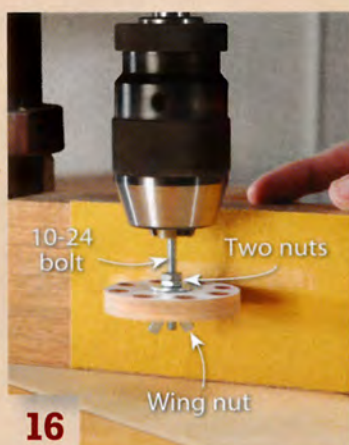
14

Place the gear on the pivot pin and push the jig into the blade. Rotate the gear.



15

Pry off the backer piece. It prevented the gear's bottom from tearing out.



16

Sand away the saw marks. Mount the gear on a shop-made mandrel.



17

Saw out the teeth following the pattern. Again, use a 1/8" blade.



18

Wet the pattern and scrape it off.



19

Sand both sides. Smooth the faces of the teeth with a file or sandpaper.

adhered to a tall, wide block (Photo 16).

Saw the faces of the gear's teeth (Photo 17). After cutting, use the side of the blade to lightly shave away any irregularities. Remove the pattern and clean up the gear (Photos 18 and 19). Glue the axles into the gears (Fig. C).

Fig. F Follower Gear Pattern

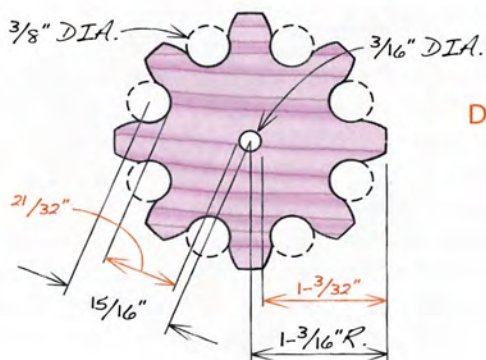
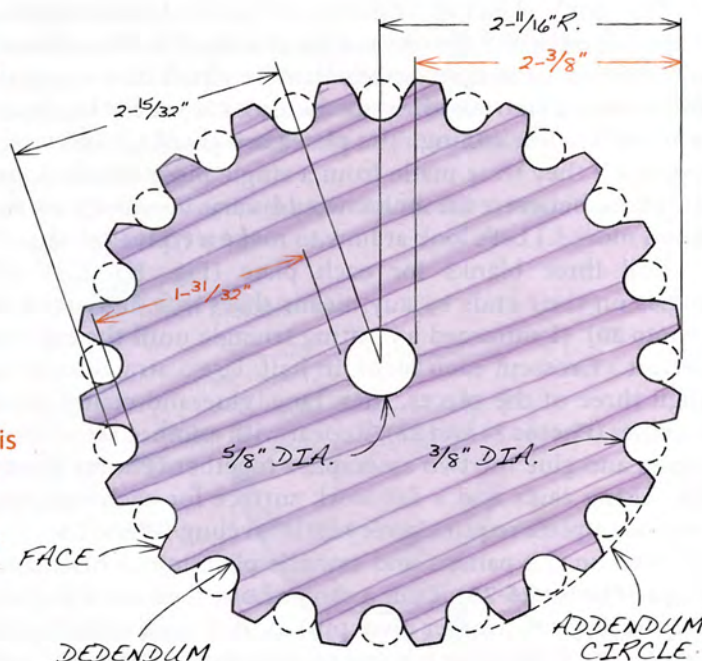


Fig. G
Driver Gear
Pattern



Dimensions in this color indicate setup block measurements

How to Make a Plate



20

Saw 60° angles on both ends of three blanks. Crosscut the blanks in half.



21

Tape three half-pieces together. Flip open the joints and apply glue.



22

Clamp lightly across the joints, then clamp the assembly flat using a caul.



23

Joint the glue-up on 80-grit sandpaper, if necessary.



24

Tape two assemblies together and glue. Apply clamp pressure across and down.



25

Sand both surfaces flat and even.

The box's skeleton consists of three almost-identical plates (A), six columns (B) and six spacers (C). The columns and spacers are simply dowels that are glued into one plate and screwed into another, so the box can easily be disassembled for fine tuning. The plates are glued up from segments. (If they were made from a single piece of wood, the distances between the holes would vary unequally as the wood moved.) Let's look at how to make a typical plate.

Mill three blanks for each plate (Fig. H). Cut 60° angles on their ends by any means that's safe and accurate (Photo 20). (I shimmed a drafting triangle until the cut was perfect.) Crosscut each blank in half. Use a straightedge to align three of the pieces, then tape, glue and clamp them together (Photos 21 and 22). Repeat with another set of three pieces and glue the two assemblies together (Photos 23 and 24). Using cauls and a flat work surface for each step will produce a plate requiring very little leveling (Photo 25).

Glue on the pattern and saw the plate into a hexagonal shape (Photos 26-28). Drill a center hole, then use the gear-drilling jig (with a larger pivot pin) for drilling all other holes (Photo 29). Rabbet the top and middle plates (Photo 30).

Fig. H
Plate
Segment
Blank

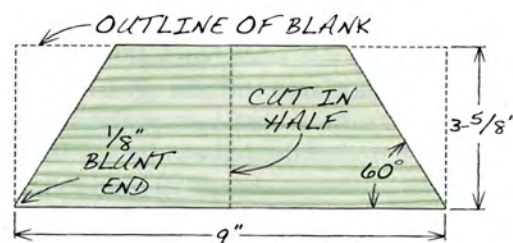


Fig. J
Plate
Glue-Up

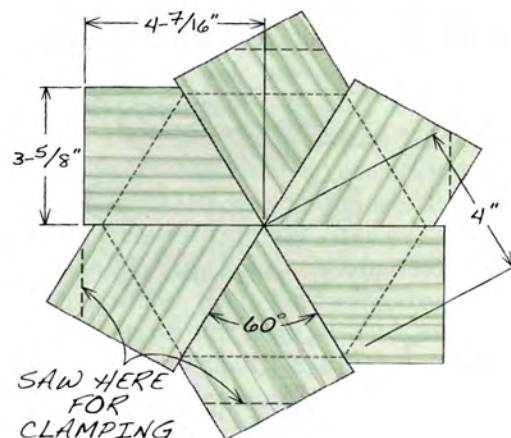
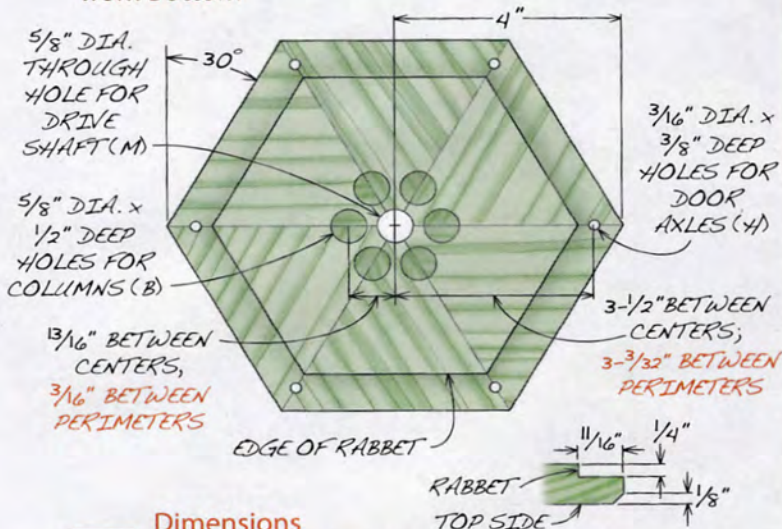


Fig. K Top Plate Drilling Diagram, Viewed from Bottom



Dimensions in this color indicate setup block measurements

Fig. L Middle Plate Drilling Diagram, Viewed from Bottom

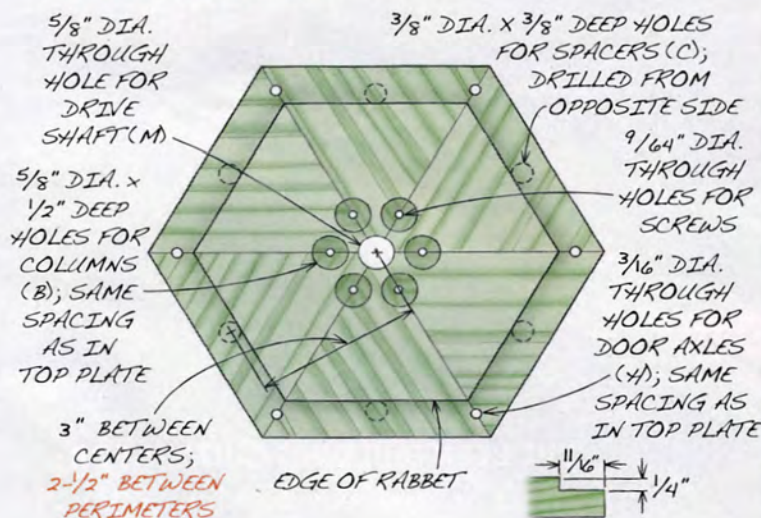
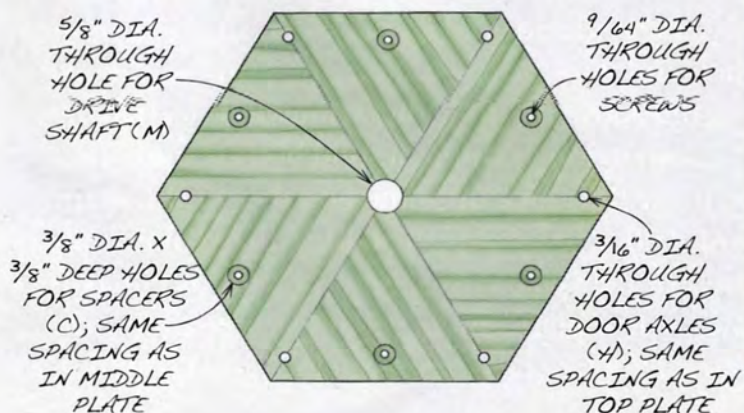


Fig. M Bottom Plate Drilling Diagram, Viewed from Top



26 Glue on the plate's pattern. Lay paper and a plywood caul on top, then clamp.



27 Follow the edges of the pattern to saw the plate into an octagon.



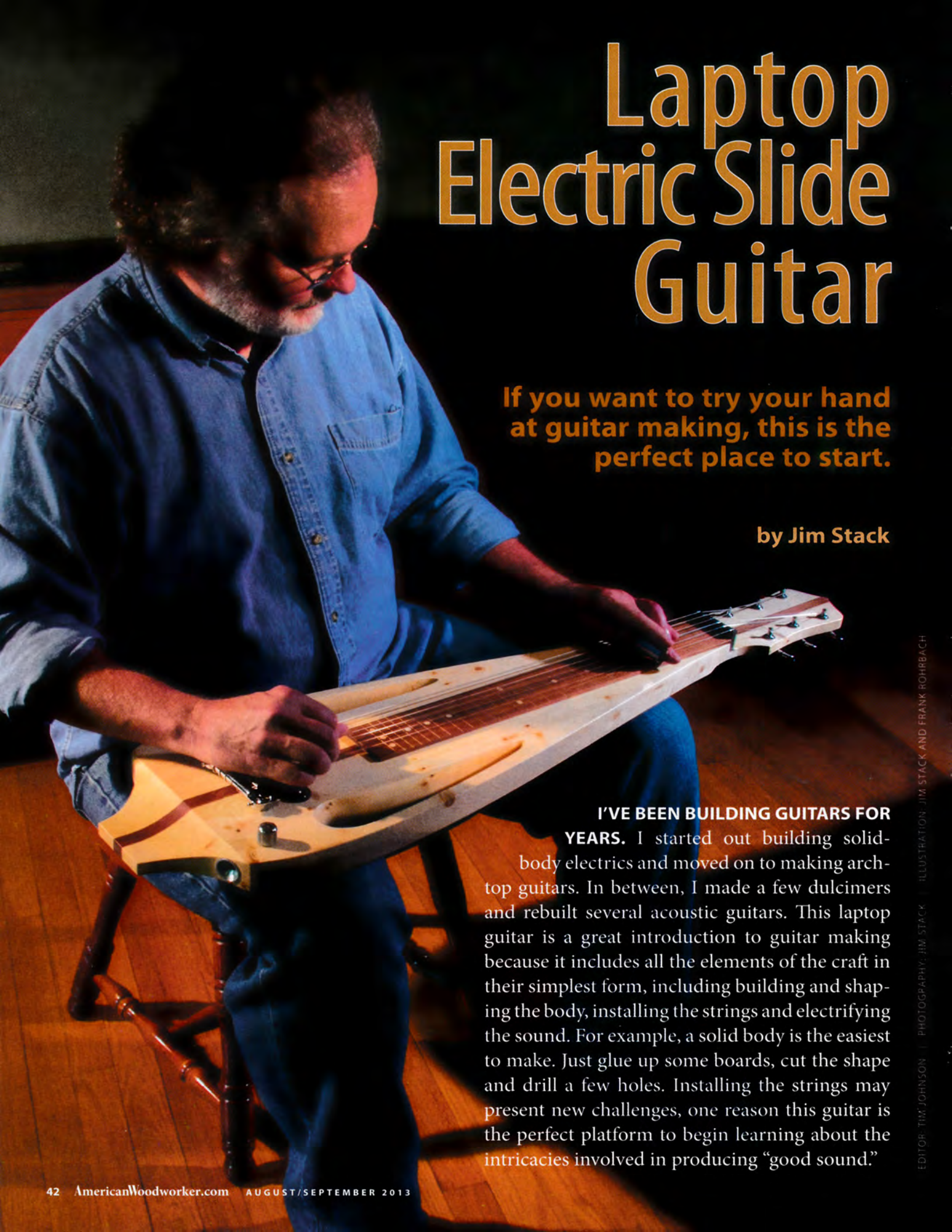
28 Straighten and smooth the edges by sanding.



29 Drill the plate's holes using the pivot-pin method employed for the gears.



30 Rout a rabbet around two plates using a large-diameter hinge-mortising bit.

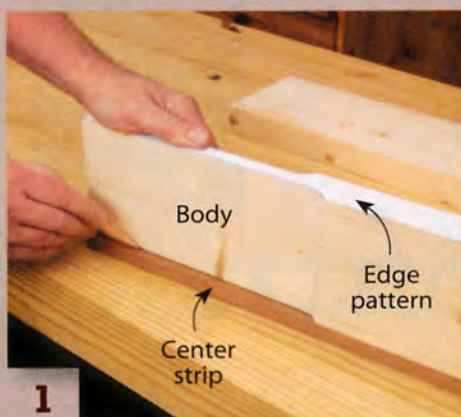


Laptop Electric Slide Guitar

**If you want to try your hand
at guitar making, this is the
perfect place to start.**

by Jim Stack

I'VE BEEN BUILDING GUITARS FOR YEARS. I started out building solid-body electrics and moved on to making arch-top guitars. In between, I made a few dulcimers and rebuilt several acoustic guitars. This laptop guitar is a great introduction to guitar making because it includes all the elements of the craft in their simplest form, including building and shaping the body, installing the strings and electrifying the sound. For example, a solid body is the easiest to make. Just glue up some boards, cut the shape and drill a few holes. Installing the strings may present new challenges, one reason this guitar is the perfect platform to begin learning about the intricacies involved in producing “good sound.”



1 **Mark** the edge profiles on the blanks for the guitar's body. Use a pattern to cut the first profile. Then trace it on the other blanks.



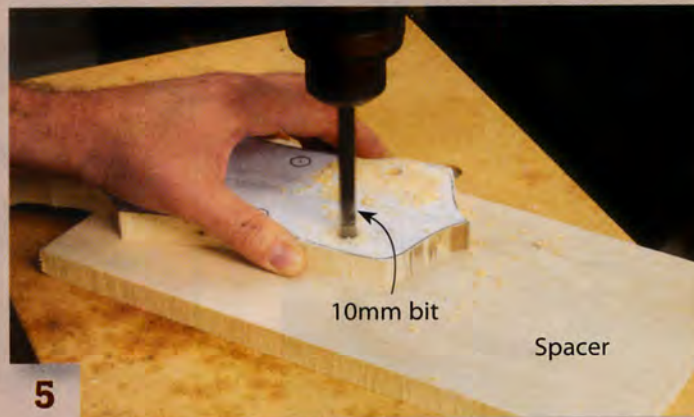
2 **Cut** out the body after gluing together the blanks and attaching another pattern.



3 **Drill** overlapping stopped holes to create a mortise for the pickup after drilling and sawing the decorative cutouts.



4 **Drill** a stepped hole through the back of the body for the volume control pot. Another hole drilled in the edge of the body will connect this hole with the pickup mortise.



5 **Drill** holes for the tuners in the headstock, using a spacer and additional support under the opposite end of the body to ensure that the holes are drilled squarely.

The wiring is easy because there are only three electrical components: the pickup, the volume control potentiometer (called the “pot”) and the output jack assembly (see Sources, page 49). The wiring carries only 100mA of voltage, so there’s virtually no chance of a dangerous electrical shock. Handling a hot soldering iron is the only part of the job that requires extra care.

This guitar is easy to play because it uses “open tuning.” To sound a pleasing harmonic chord, all you have to do is strum the strings; no special fingering is required. To create different chords and notes, you slide a bar (called a “steel”; see Sources) along the strings with your left hand while strumming or picking with your right hand.

Shape the body

While it’s true that wood vibrates when the strings of a guitar are strummed, the choice of wood doesn’t affect the sound of an electric guitar nearly as significantly as it does with an acoustic guitar. That means almost any wood will do.

Machine two 8/4 blanks and one 4/4 blank of contrasting wood for the guitar’s body (A and B, Fig. A and Cutting List, page 44).

Print out the full-size patterns for the top and edge (Fig. E, page 49). Attach the edge pattern to one of the blanks, using

spray adhesive. Spray only the pattern and attach it while the adhesive is still wet. Let the adhesive dry for two or three minutes before cutting.

Stand the blank on edge on your bandsaw and follow the pattern to make the cuts that define the headstock and the tail end of the body. Stack this freshly cut blank on the other blanks and trace the profiles (**Photo 1**). Then cut the remaining blanks.

Carefully align the surfaces when you glue up the blanks and remove any glue that squeezes out. After the glue has dried, remove the clamps and attach the top pattern to the glued-up blank. Then cut the body’s profile (**Photo 2**). Install a 1-1/2" Forstner bit in your drill press and drill a hole at the large ends of the body’s teardrop-shaped cutouts. Then use a jigsaw to cut them out.

Drill mortises

Create a mortise to house the electric pickup (**Photo 3**; Fig. E). Drill 3/4" dia. x 1" deep holes to establish the ends of the mortise. Then drill overlapping holes to complete it.

Drill a 1/16" dia. pilot hole through the body to establish the location of the stepped mortise for the volume control pot on the back (Fig. E). Then turn over the body to drill the mortise (**Photo 4**). First, drill a 1-1/2" dia. x 1/4" deep hole.

Fig. A
Plan and Side Views

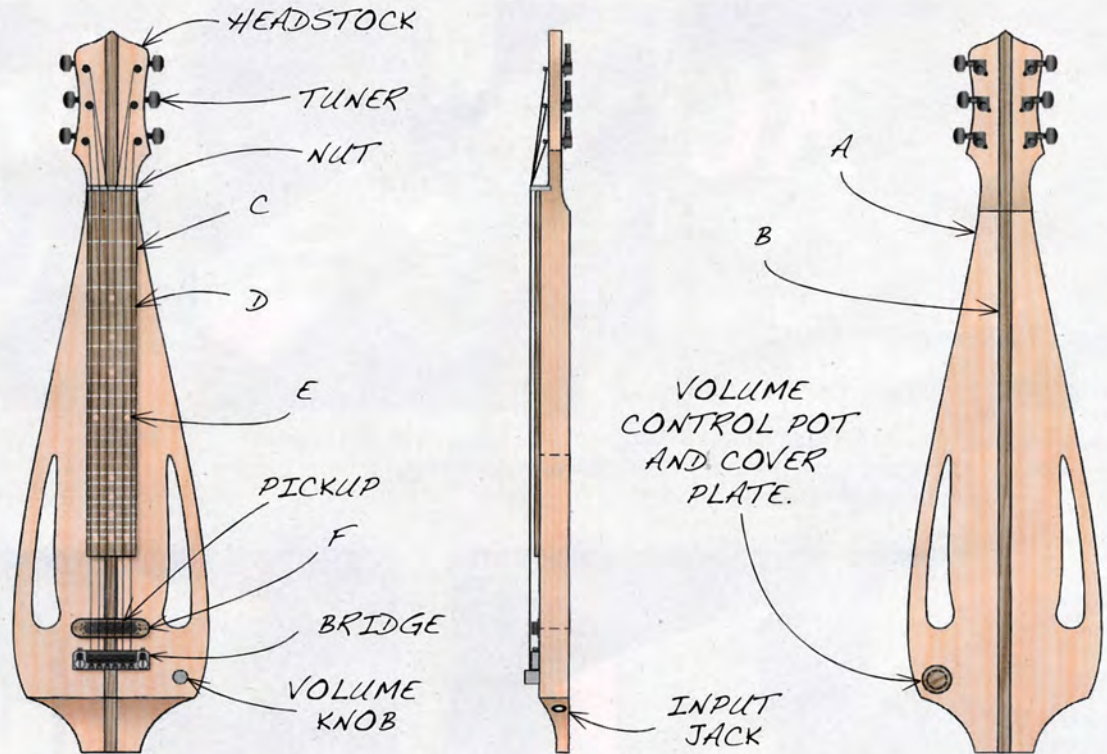


Fig. B Nut Details

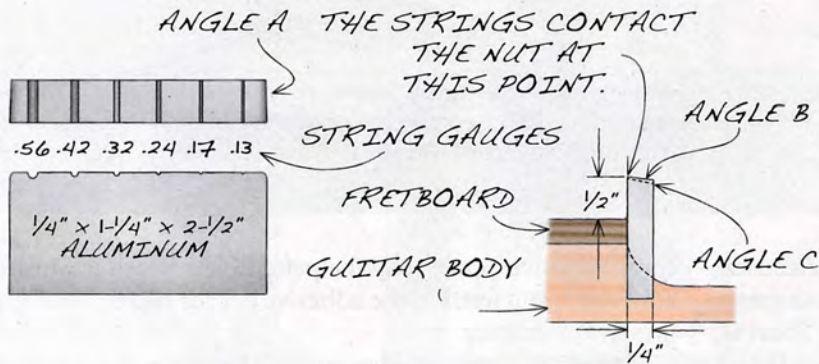


Fig. D Pickup Details

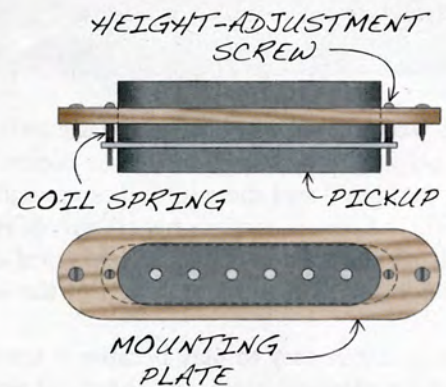
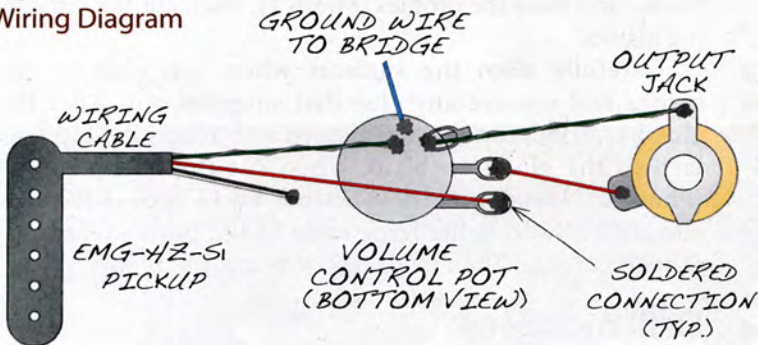


Fig. C
Wiring Diagram



Cutting List Overall Dimensions: 2-1/4" Th x 10" W x 39-1/2" L

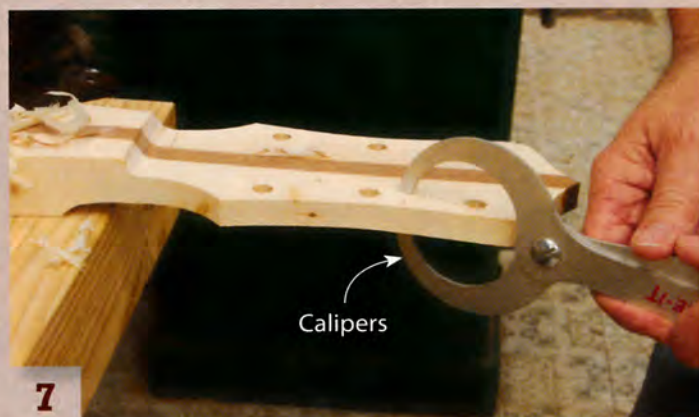
Part	Name	Material	Qty.	Th x W x L
A	Body	Pine	2	1-1/2" x 5" x 40"
B	Center strip	Mahogany	1	5/8" x 1-1/2" x 40"
C	Fretboard	Mahogany	1	1/4" x 2-1/2" x 20"
D	Faux fret	Maple veneer	24	1/32" x 1/2" x 3-1/4"
E	Fret marker	Maple	11	1/4" dia. x 1/4"
F	Mounting plate	Mahogany	1	1/8" x 1" x 4-1/2"



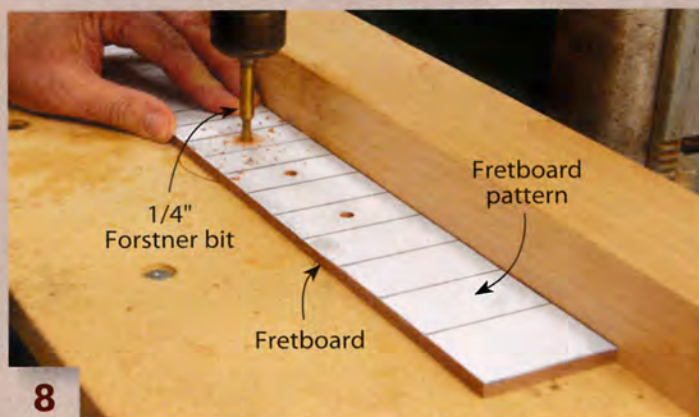
Learn how to build an acoustic guitar from a kit at
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6 **Smooth** the saw cuts and refine the body's shape using a spindle sander.



7 **Make** sure the headstock is a consistent thickness.



8 **Drill** shallow holes for the fret markers after attaching the pattern to the fretboard.



9 **Cut** slots in the fretboard for the faux frets using a shop-made miter box. Attach a stop to the saw in order to cut the kerfs to a consistent depth.

Then drill a 1" dia. x 1-5/16" deep hole centered in this larger hole. Finally, drill a 5/16" hole through the top, centered in the 1" hole.

Next, drill a counterbored hole in the side of the body for the output jack assembly and the wires that connect the jack with the pickup and the pot (Fig. E). First, use a Forstner bit to drill a 7/8" dia. x 1-3/4" deep hole that intersects the pot mortise. Then use a 1/4" bit to drill a channel through to the pickup mortise. To create ample room for the wiring, plan to make adjustments as necessary, using a small chisel.

Drill holes for the tuners

Use the pattern on the body and a brad point bit to locate and drill 10mm holes in the headstock for the tuners (Photo 5). A 25/64" or 13/32" bit will also work. These holes must be drilled squarely, so place a 1" x 5" x 10" piece of scrap on the drill press table and press the headstock against it while you drill. It helps to have a friend support the tail end of the body. Drill through the headstock and into the scrap wood.

Refine the body

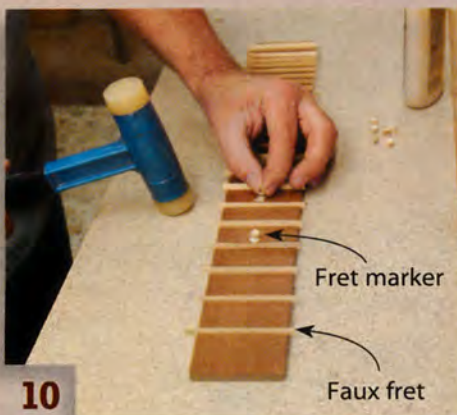
Use a spindle sander to smooth the body's profile (Photo 6). A sanding drum mounted in a drill press will also do the trick. Wet the pattern with a damp rag, let it soak for a minute or

two and then peel it off. Then smooth the body's top and bottom faces by sanding. Use rasps and files, if necessary, to level the contours at the headstock and tail end. Note that the headstock must be a consistent thickness for the tuners to mount properly (Photo 7). Use chisels, rasps, files and sandpaper to smooth the teardrop cutouts and ease their edges.

Make the fretboard

The strings on this guitar aren't fingered or pushed against frets like those on a standard guitar. That means the fretboard (C) doesn't need real frets. Lines indicating where the frets would be located are all that's necessary. Stick-on fretboard appliques are available, but I'd rather start with real wood, saw slots and insert strips of veneer (D) to simulate real frets.

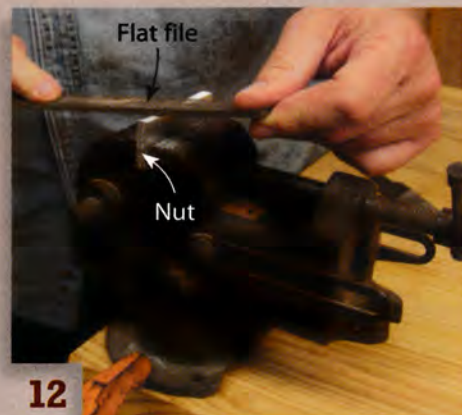
Mill a blank of wood to 1/4" x 2-1/2" x 20". Then print out the full-size fretboard pattern and attach it to the blank using spray adhesive. The frets on the pattern are spaced properly for the guitar's 650mm scale length (see "Fret Spacing," page 49). Drill shallow 1/4" dia. holes for the fret markers (E; Photo 8). Then use a shop-made miter box and a dovetail saw to cut slots for the veneer faux frets (Photo 9). To build the miter box, make a U-shaped jig and clamp it to your bench. Lay a square across the jig, hold the dovetail saw against the square and cut a shallow kerf across both edges of the U. Insert the fretboard, line up



10 Glue in the fret markers and faux frets after removing the pattern. Then trim and sand them flush.



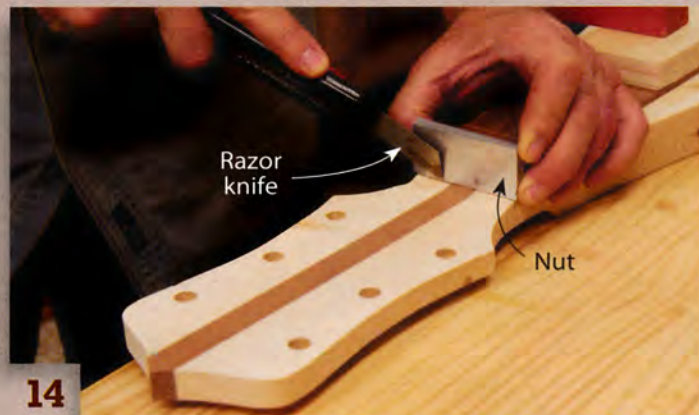
11 Glue the fretboard on the body, making sure it's perfectly centered and flush with the base of the headstock.



12 Shape the nut, an aluminum bar that registers the strings at the base of the headstock.



13 Cut a groove for the nut at the end of the fretboard. Register the saw against the fretboard to cut the groove's inside shoulder.



14 Mark the groove's outside shoulder, using the nut as a guide.

each fret mark with the kerfs and saw a slot. Saw these slots to a consistent depth, about one-third the thickness of the fretboard.

Dampen the fretboard pattern and peel it off. Then glue veneer faux frets in the slots and fret markers in the holes (Photo 10). Slightly mound the glue on both sides of the faux frets to stiffen them. Use a 1/4" plug cutter to create the wooden fret markers. When the glue is thoroughly dry, trim the markers and faux frets nearly flush. (The dried glue helps to keep the veneer from splitting.) Complete the job by sanding by hand, using a block, until the fretboard's face is smooth.

Mark the centers of the fretboard and the body. Then spread a thin coat of glue on the back of the fretboard. Let the glue tack for a couple of minutes and then carefully locate the fretboard, centered on the body and flush with the edge of the cove at the base of the headstock (Photo 11). The tacky glue makes it easier to keep the fretboard in place when you tighten clamps or add weight. Let the glue dry.

Shape the nut

The nut is a block that registers the strings at the headstock end of the guitar (Fig. B). The nut shown here is made of aluminum, but bone, rosewood, ebony or even man-made materials such as Corian can also be used. An aluminum nut produces a bright and strong sound, which is just fine for a laptop slide

guitar. Because 1/4" thick aluminum stock can be difficult to find, I glued together two pieces of 1/8" thick aluminum, using two-part epoxy.

Use a file to shape the nut (Photo 12). Slope its ends to match the body's profile at the headstock (Angle A, Fig. B) and slope its top to closely match the angle of the strings from the headstock to the tuners (Angle B).

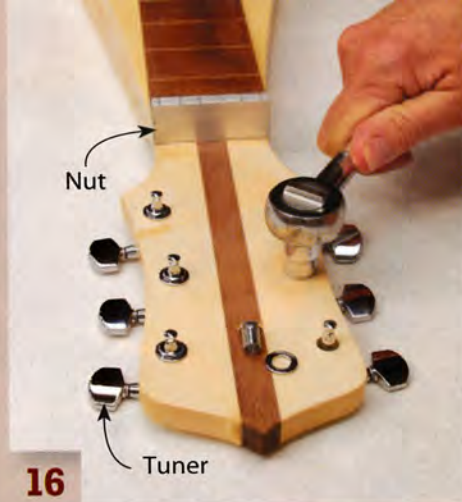
The nut sits against the fretboard at the base of the headstock and is housed in a 1/4" wide groove. Cut one edge of this groove against the end of the fretboard (Photo 13). Use the nut to locate the other edge (Photo 14). Then chisel out the waste (Photo 15). Take your time: This groove must be square on the sides and flat on the bottom. The nut must fit snugly and its top edge must stand 1/2" above the fretboard.

Apply the finish

Cover the groove you've just cut for the nut with tape. Then apply the finish. Any film-forming finish will work, but for a classic guitar finish, spray nitrocellulose lacquer. Apply three or four wet coats and sand between each coat using 400 grit sandpaper. Sand the final coat using either 400 grit or 600 grit. Let the finish dry thoroughly and then rub it out using #0000 steel wool and apply a coat of wax. The wax keeps off fingerprints and adds a nice sheen.



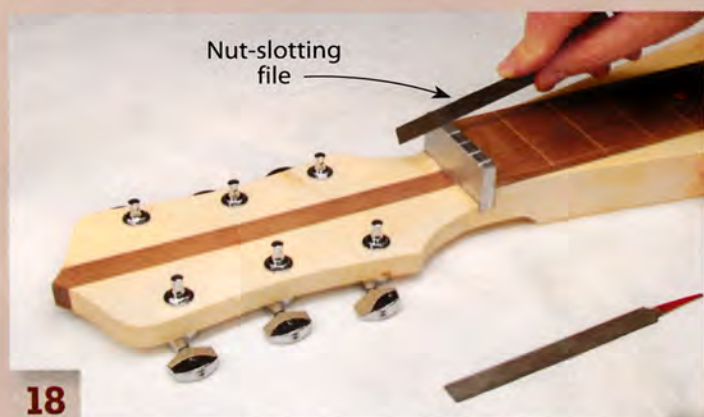
15 Pare the groove to a consistent depth. The nut must fit snugly, so test its fit often as you work.



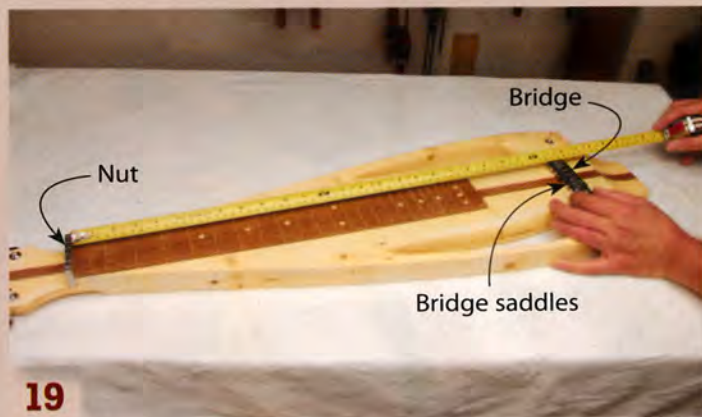
16 Install the tuners and the nut after applying the finish. Position the tuners to follow the headstock's curved edges.



17 Cut a slot for each string in the nut. Angle the slots so the strings will only contact the nut at its highest point.



18 Round the bottoms of the slots using special files, so the strings will slide easily while they're being tuned.



19 Locate the bridge at the "scale length" (650 mm) between the nut and the bridge saddles. Then drill holes for the bridge's mounting posts and ground wire.

Install tuners and cut slots

After the guitar is finished, install the tuners (see Sources) and the nut (**Photo 16**). Glue the nut in its groove using two-part epoxy. Attach the tuners using the supplied hardware and setscrews.

Cut slots in the nut to register the strings (**Photo 17**; Fig. B). On a standard guitar, the spacing between the strings decreases between the saddles on the bridge and the nut (the two points between which the strings are suspended). However, on a slide guitar such as this one, the spacing remains the same. That means you can simply center the bridge (see Sources) on the nut and use its saddles to transfer the slot locations.

Each string is a different diameter (see Sources), so each slot must be sized to fit. In a nutshell, the slots will get incrementally wider and deeper as the string diameters increase. The goal at this point is to get close. You'll dial in the perfect fit later, when you install the strings.

To keep the strings from buzzing when the guitar is played, they must contact the nut only at its highest point. That means the slots have to be sawn at a steeper angle (Angle C) than the angle you've filed on the top of the nut. Use a hacksaw to cut the slots. Rock the saw from side to side to widen each slot to accommodate its string and use a nut-slotting file to round and smooth the bottom (**Photo 18**; see Sources). The strings must

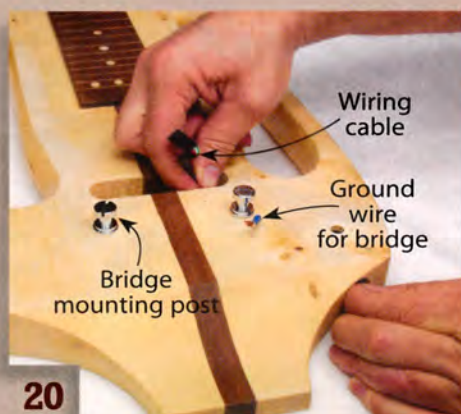
be level with the fretboard in order for the steel (the bar you slide) to work properly, so cut each slot to a depth that makes the top of its string flush with the top of the nut. Test-fit a loose string in each slot as you work. Don't cut too wide or deep.

The bridge mounts on posts that hold it slightly above the guitar's body. Center the bridge on the body, square it to the fretboard and locate its saddles (where the strings rest) 650mm from the leading edge of the nut (**Photo 19**). Mark and drill 15/32" dia. holes for the bridge's mounting posts at this location. Then drill a 1/8" dia. hole for the ground wire that connects the bridge to the volume control pot. Locate this hole underneath the bridge and drill through the body into the 1/4" channel from the pickup mortise. Then install the posts.

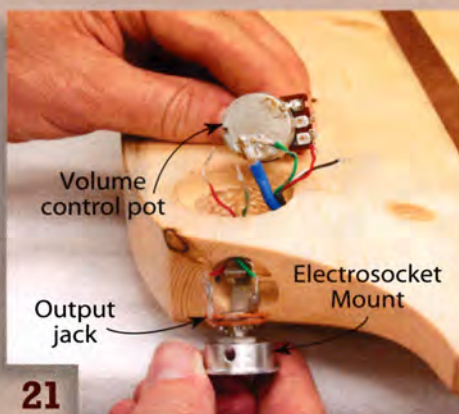
Wire and solder

The vibration of the strings activates the guitar's electric pickup. The pickup has magnets, and as you remember from your physics class, a wire that's vibrated in a magnetic field generates an electric current. That current travels from the pickup through the volume control pot to the output jack, where the guitar's cord picks up the signal and routes it to an amplifier, which processes it and sends it to the speakers. Voila! Electrified sound.

Feed the ground wire (use 18-24 ga. insulated copper) through the 1/4" channel and into the volume control pot's



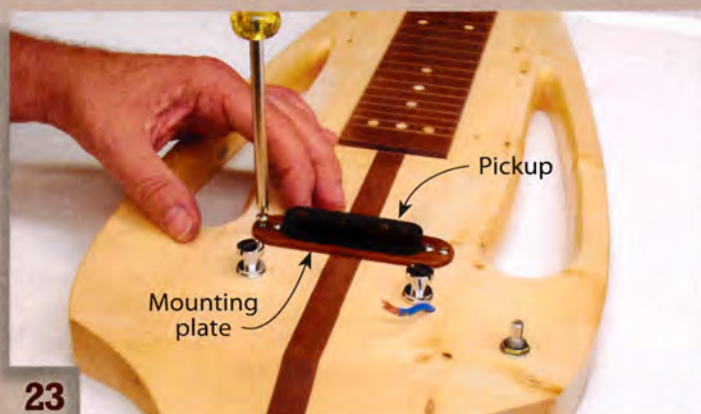
20 Feed the pickup's wiring cable through the channel and into the wiring cavity after feeding the ground wire through the same channel.



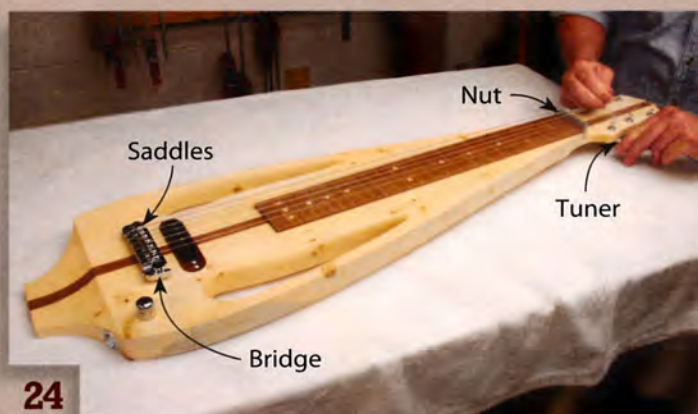
21 Solder the wiring from the pickup, the bridge and the output jack to the volume control pot (see Fig. C).



22 Install the output jack assembly and the volume control pot. Secure the pot by installing a washer and nut on its shaft.



23 Fasten the pickup assembly. Then solder the ground wire to the bottom of the bridge and install the bridge on its mounting posts.



24 Install the strings by fastening them to the bridge, threading them through the saddles and the grooves in the nut, and attaching them to the tuners.

wiring cavity. Then feed the pickup's wiring cable through the same channel (**Photo 20**). Cut the cable to length. Then solder its twisted green and bare wires to the base of the pot and its red wire to the proper lug (Fig. C). Its black and white wires aren't used; just make sure they're soldered together and bend them out of the way.

Solder the ground wire to the base of the pot. Then attach the output jack to its electrosocket mount and harvest wires from the pickup cable offcut to complete the wiring between the jack and the pot (**Photo 21**). Solder all the connections. Then insert the output jack assembly in its counterbored hole and fasten it with screws. Finish by installing the pot and the volume knob (**Photo 22**; see Sources).

Make a mounting plate with a hole sized for the pickup (F; Fig. D). Fasten the pickup to the mounting plate. Then plug in the cable and install the assembly on the guitar (**Photo 23**). Next, solder the ground wire to the bottom of the bridge. Then mount the bridge on its posts. This assembly is adjustable, so take the time to precisely dial in the 650mm scale length—this is important for proper intonation.

String it up

This guitar is set up for an open-D tuning. From lowest to highest pitch, the notes are D, A, D, F#, A and D. (The five lowest-

pitched strings are below middle C on a piano; the top string is above middle C.) Install the strings (**Photo 24**). Feed each string through the hole in the bottom of the bridge. Wrap it around the bridge, run it across the saddle and the groove in the nut, and attach it to the proper tuner. Bring the strings up to pitch gradually, to let them stretch and take a "set" at the proper pitch. This might require tightening them a few times, so it could take a day or so for the strings to stay in tune.

The strings should stand about 1/2" above the fretboard. For the steel to work properly, the tops of all the strings must be flush—adjust the depth of each groove in the nut as necessary, using the nut-slotting files. The pickup's height is adjustable. Position it about 1/8" below the strings—any farther away and the pickup won't work properly. Plug the guitar into an amplifier to see how it sounds. Adjust the pickup's height as you play to determine the position that works best for you.

Practice, practice, practice

Gently run the steel up and down the strings and see how much pressure is required to make that "slide guitar" sound. (Not much, you'll find.) Books and videos showing how to tune and play a laptop slide guitar are readily available. The key to playing? Practice, practice, practice. 

Fret Spacing

In order for the strings to vibrate and produce sound, they're suspended between two points—from where they contact the bridge saddle to where they contact the nut. The distance between these two points is called the "scale length." Placing the slide on a string between these two points shortens the string's length and changes its vibration, so it creates a different tone.

The spacing of the frets is calculated using the scale length and a logarithmic function called "The Rule of 18." (More accurately, it's "The Rule of 17.187.") If you want to learn more about this mathematical process you can look it up—the Internet is a good place to start.

The Rule of 18 locates each fret to indicate a change in pitch of one-half step (a semitone). It also locates the 12th fret at precisely one-half the scale length. Because halving the length of a vibrating string doubles its frequency, placing the steel on a string at the 12th fret sounds a note that's one octave higher than the note sounded by the full-length (or "open") string. Likewise, the 24th fret divides the string's length exactly in half from the 12th fret, so the note sounded is another octave higher (and two octaves higher than the note sounded by the open string). Because the distance required to raise the pitch by one-half step decreases as the string gets shorter, the frets get closer and closer together.

Fret markers provide points of reference. Traditionally, the 12th fret receives a double marker. I've added a triple marker at the 24th fret to indicate the second octave.

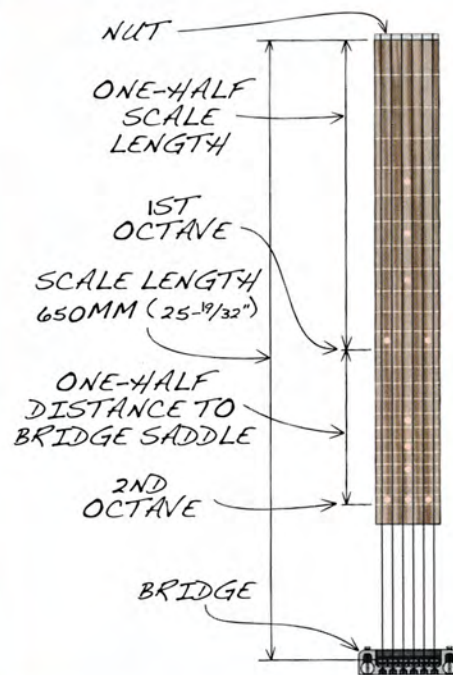
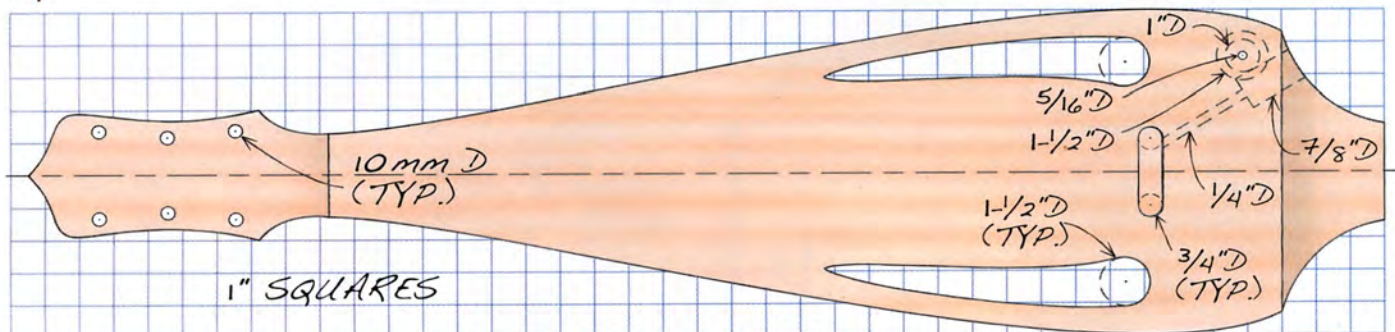


Fig. E Patterns

Top



Edge



Fretboard



Download full-size versions of these patterns at AmericanWoodworker.com/WebExtras

SOURCES

- EMG, emgpickups.com, 707-525-9941, EMG HZ-S1 Pickup, \$79.99.
- Stewart-MacDonald, stewmac.com, 800-848-2273, Electrosocket Jack Mount, silver, #4283, \$8.63; Gotoh Large Schaller-Style Knob Machines (Tuners), chrome, 3L/3R, #0903, \$36.26; 1/4" Output Jack, mono, #4652, \$3.64; Volume Control Potentiometer (CTS Control Pot), Split shaft, 500K-ohm (CTS #450S 3485-1133), #0116, \$5.95; Volume-Control (Dome) Knob, chrome, 1/4" shaft, #0157, \$3.52; Adjustable Wraparound Bridge, chrome, #0401, \$36.92; Shubb-Pearse Guitar Steel, #3954, \$29.26.

- Chicago Music Exchange, chicagomusicexchange.com, 888-686-7872, GHS Electric Hawaiian Lap Steel Dynamite Alloy Strings 13-56 (Gauges .013, .017, .024, .032, .042, .056.), #GHS Lap, \$5.99.

Jim Stack worked for 20 years in commercial cabinetmaking and furniture making shops. He has written 7 woodworking books and most recently was senior editor of Popular Woodworking books.

Workingman's Boot Bench

A pro blends new and old techniques to build a sturdy cabinet.

by Jeff Corns



I'M A BOOT GUY. I wear work boots every day in my shop—and as a hard-working professional cabinetmaker, that can often be six days a week.

I've got three pairs of well-worn Carharts to cycle through, plus a pair of hiking boots. They've been cluttering up my hallway for years, but no more. This boot bench provides plenty of storage space for them. It's also a convenient place to sit while tying up my laces.

How it's constructed

I've blended three different construction techniques in building this bench. The end panels and the drawer fronts are classic frame-and-panel assemblies, giving the bench an old-fashioned look (Fig. A, p. 52).

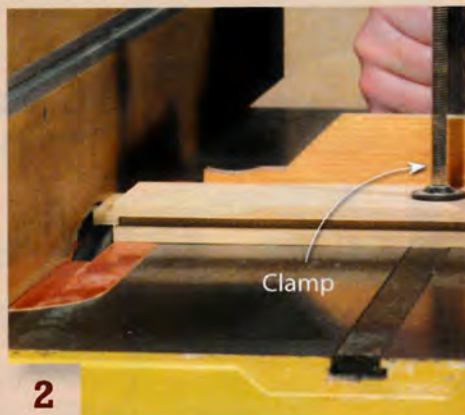
The front of the bench, however, is a face frame made with butt joints and pocket screws. The face frame is joined to the end panels with a lock miter, giving

the impression that the corners of the chest are made from thick pieces of wood. (In reality, all the framing pieces are only 3/4" thick.)

But those corners wouldn't fool anyone who knows wood well. Did you notice that they have ray flecks on both sides? If they were solid pieces, only one side would be quartersawn; the neighboring side would be plainsawn, which doesn't show ray-fleck figure. I prefer



1 **Begin** by building the frame-and-panel ends of the bench. First, cut grooves in all the rails and stiles with a dado blade.



2 **Cut** tenons on the ends of the rails. A clamping accessory for the miter gauge keeps the workpiece securely in place.



3 **Saw** rabbets all the way around the panels. Apply stain and finish to the panels, then glue the assemblies.



4 **Rout** a lock miter on the front stiles of each frame-and-panel assembly. When cutting lock miters, one piece is always held horizontally. The mating piece is routed vertically.



5 **Rout** a matching lock miter on the stiles of the cabinet's face frame. Assemble the face frame with pocket screws.

the “all-quartersawn” look, even though it's artificial.

The third construction method is quite simple: The bottom and the back of the bench are made of 3/4" plywood. Screwed together at a right angle, these pieces add the rigidity necessary for a large box with an open front.

Frame-and-panel work

The most efficient way to begin building the bench is to make the end panels and the drawer fronts at the same time. They're built exactly the same way, so you only have to set up your tablesaw once to cut the joints.

Begin by milling the end panels' stiles and rails (A1, A2 and A3) and the drawer fronts' stiles and rails (B1 and B2). Rip all of these pieces to final width and trim them to final length. Cut a groove along the inside edge of each piece (**Photo 1**). Cut mating tenons on the rails (**Photo 2**).

Glue up the panels (A4 and B3). You can start with material that's 5/8" thick, glue it together, then run the panels through the planer to the final thickness of 1/2". Assemble the frames, without glue, then measure the distance between the bottoms of opposite grooves to determine each panel's final dimensions (see Cutting List notes, p. 52). I place rubber “spaceballs” in the grooves to allow room for the panels to expand in high humidity (See Fig. C and Sources, page 54), so I subtract 3/8" from those groove-to-groove measurements to calculate each panel's dimensions. Cut a rabbet all the way around the panels to allow them to fit into the grooves (**Photo 3**).

If you'll be staining your piece, apply the stain now to the outside face of the panels. Add one or two topcoats of finish as well. Staining and finishing all the way to the edges of the panels guarantees that bare wood won't show when

the panels shrink, which they're sure to do at some point.

Glue the frame-and-panel assemblies. After the glue dries, sand all the joints even, front and back.

Build the case

Mill the parts for the face frame (C1 through C4). The openings for the drawers should be 1/8" larger—all the way around—than the drawer front frames you've made.

Cut mating lock miter joints on the end panels and the face frame's stiles (**Photos 4 and 5**). You'll need to make some test cuts in scrap wood first, of course, in order to correctly set the



Learn how to set up a lock miter bit at AmericanWoodworker.com/WebExtras

Fig. A Exploded View

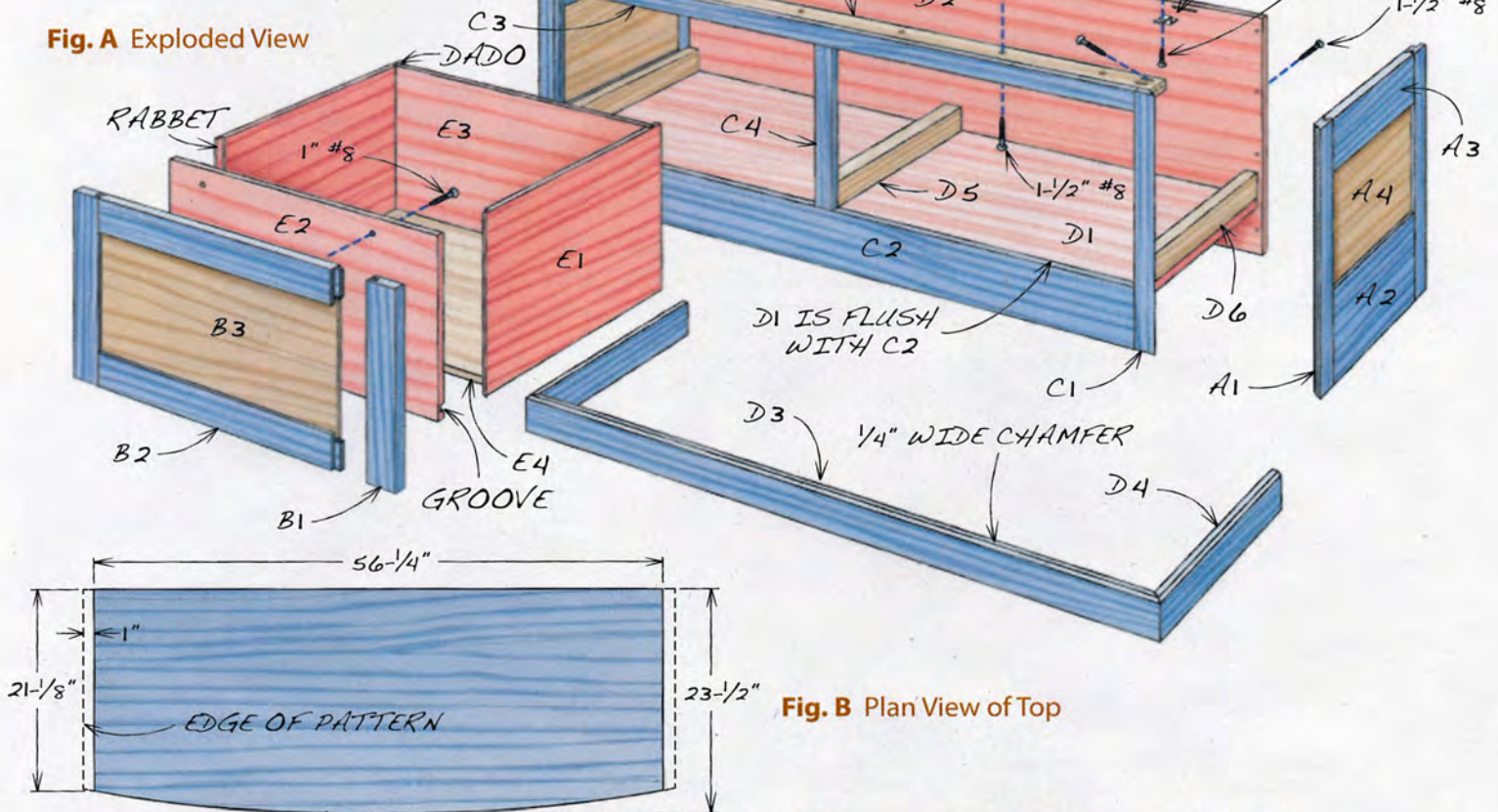
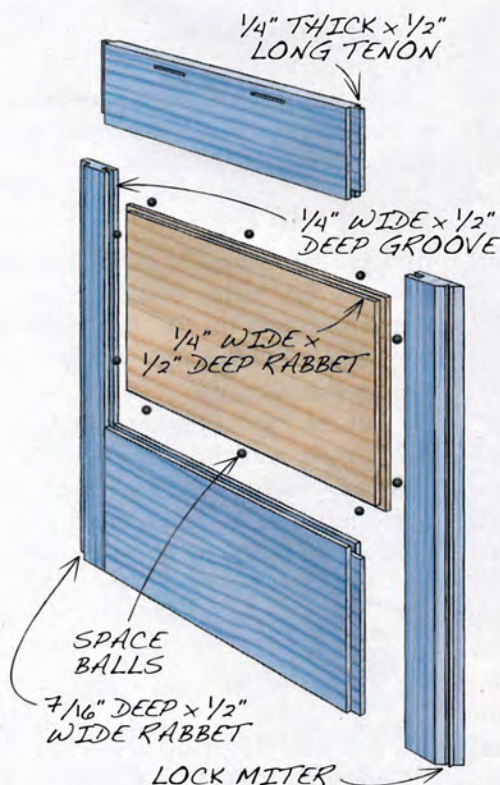


Fig. B Plan View of Top

Cutting List

Overall Dimensions: 20"H x 56-1/4"W x 23-1/2"D

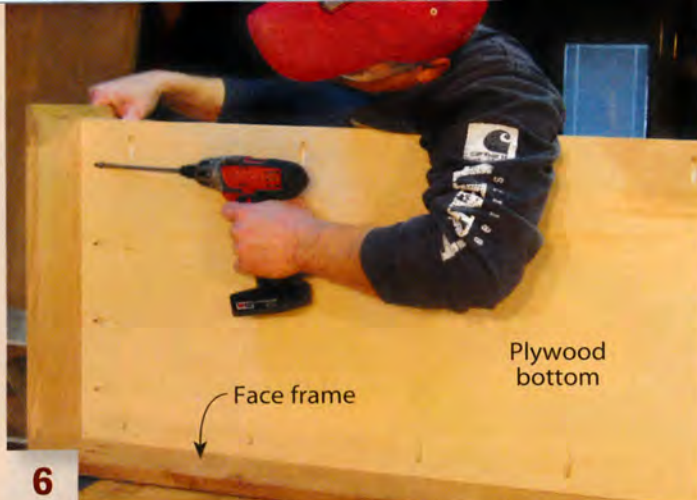
Fig. C End Panel Details



Section	Part	Name	Qty.	Material	Th x W x L
End panels	A1	Stile	4	Quartersawn white oak	3/4" x 2-1/4" x 18-3/4"
	A2	Bottom rail	2	Quartersawn white oak	3/4" x 6-3/4" x 16-1/4"
	A3	Top rail	2	Quartersawn white oak	3/4" x 3-3/4" x 16-1/4"
	A4	Panel	2	Quartersawn white oak	1/2" x 8-7/8" x 15-7/8" (a)
Drawer fronts	B1	Stile	4	Quartersawn white oak	3/4" x 2-1/4" x 18-3/4"
	B2	Rail	4	Quartersawn white oak	3/4" x 2-1/4" x 21"
	B3	Panel	2	Quartersawn white oak	1/2" x 8-7/8" x 20-5/8" (a)
Face frame	C1	Stile	2	Quartersawn white oak	3/4" x 1-9/16" x 18-3/4"
	C2	Bottom rail	1	Quartersawn white oak	3/4" x 4-1/2" x 51"
	C3	Top rail	1	Quartersawn white oak	3/4" x 1-1/2" x 51"
	C4	Center stile	1	Quartersawn white oak	3/4" x 1-1/2" x 12-3/4"
Cabinet parts	D1	Bottom	1	Birch plywood	3/4" x 18-1/4" x 52-5/8"
	D2	Back	1	Birch plywood	3/4" x 18-3/4" x 53-1/2"
	D3	Front molding	1	Quartersawn white oak	3/4" x 3" x 57"
	D4	Return molding	2	Quartersawn white oak	3/4" x 3" x 21"
	D5	Drawer blocking 1	1	Hardwood	1-1/2" x 2" x 18-1/8"
	D6	Drawer blocking 2	2	Hardwood	13/16" x 2" x 18-1/8"
	D7	Top-fastening rail	1	Birch plywood	3/4" x 2-1/2" x 52-5/8"
	D8	Top	1	Quartersawn white oak	1-1/4" x 23-1/2" x 56-1/4"
Drawer boxes	E1	Side	4	Baltic birch plywood	1/2" x 12" x 18"
	E2	Front	2	Baltic birch plywood	1/2" x 12" x 23-1/4"
	E3	Back	2	Baltic birch plywood	1/2" x 11-1/8" x 23-1/4"
	E4	Bottom	2	Baltic birch plywood	1/2" x 17-1/4" x 23-1/4"

Notes:

a) Panels are a total of 3/8" less in width and length than the distance between the bottoms of the grooves in the stiles and rails.



6 **Assemble** the case. Start by gluing one frame-and-panel end to the face frame. Next, use pocket screws to fasten a plywood bottom to both parts.



7 **Add** the second end. The lock miter joints are self-aligning. They won't slip when you clamp them—a big advantage over any other type of miter joint.



8 **Fit** molding around the base. Miter and glue the front piece to the case first. Cut a miter on one end of each return. Hold the return in place, mark its exact length, then cut and glue.



9 **Glue** the top. It's more than 1" thick, which gives the bench a sturdy, substantial look.

router bit's height and the fence's position (see Sources). These joints don't have to be lock miters—they could be splined, instead. I prefer lock miters because they're much easier to glue up. Assemble the face frame with pocket screws.

You've now made three sides of the case—the front and two ends. The next step is to assemble them, without glue, in order to make exact measurements for the bottom (D1) and back (D2). Before you do this, be sure to cut the rabbets on the end panels that receive the back (Fig. C). Clamp the assemblies together, then measure the distance between the end panels to determine the bottom's length. Measure the distance from the face frame to the rabbets to determine the bottom's width. Cut the bottom to size, then drill a number of pocket holes around its perimeter, on the underside.

Glue one of the end panels to the

face frame, making sure the two parts are square. After the glue dries, fasten the bottom to these pieces (**Photo 6**). (Note that the plywood is flush with the top edge of the face frame's lower rail.) Glue on the remaining end panel (**Photo 7**).

Cut a plywood back to fit the case. Glue and screw it to the end panels and to the plywood bottom. Cut the base molding (D3 and D4) and glue it to the case (**Photo 8**). Next, add "blocking" pieces (D5 and D6) for mounting the drawer slides—they can be glued and screwed in place. Lastly, add a rail (D7) behind the face frame for attaching the bench's top (D8). Before gluing and screwing the rail in place, drill and countersink holes through the rail for the screws that will go into the top.

Make the top

Mill boards to make a top that's about 1/4" extra-long and 1/8" extra-wide.

Glue the boards together (**Photo 9**).

Make a full-size pattern for the top from 1/4" thick MDF or plywood (Fig. B). You'll use the pattern to cut an arc on the top's front edge, using a router and a flush-trim bit (**Photo 10**). Make the pattern about 2" longer than the top. (This overhang will provide a surface for your router bit's bearing to get started on, before the bit cuts into the wood.) I used a bent stick to draw the arc on the pattern's front edge, then cut the arc with a jigsaw and filed and sanded the arc smooth.

Cutting the arc requires removing a lot of waste wood. You wouldn't want to do all of this with a router. Ideally, you'd cut 1/16" away from the line first, using a bandsaw, but the top is so heavy that this requires help. You could also use a jigsaw, but only a high-quality machine is capable of making a square cut in wood this thick and hard. The last option is to just use the router,



10

Rout an arc on the front of the top using a flush-trim bit and a 1/4" thick plywood pattern. A bowed front makes the cabinet look less boxy.



11

Make the drawer boxes and add slides. Draw a line indicating where the center of the slide goes using a simple two-board jig.



12

Fasten the drawer fronts to the drawer boxes from the inside. Use 1/8" spacing strips to position the fronts.



13

Attach the top. Fasten the front face frame directly to the top, but use tabletop fasteners around the sides and back. They'll allow the top to move without cracking.

moving the pattern on successive passes so you're only removing about 1/16" each time. When you rout, temporarily screw the pattern to the top's underside.

When you're done routing the arc, remove the pattern and draw lines on the top indicating the top's final length. Reposition the pattern on these lines and use the flush-trim bit to even up the glued-up boards. Rout a chamfer around the front and ends of the top.

Build the drawer boxes (E1 through E4). I glue them together and secure the joints with pin nails shot with a pneumatic gun.

Add top and drawers

At this point, I'm ready for sanding, staining and finishing. To get the color I wanted—which worked great on my floors years ago—I mixed two parts Minwax Dark Walnut and one part Minwax Provincial oil-based stains (see Sources). I then sprayed on three coats

of pre-catalyzed lacquer, but any clear and durable topcoat, such as a good polyurethane finish, would work.

After the finish has dried for a few days, install the drawer slides (**Photo 11**; see Sources). Slide the boxes into the cabinet. Prepare some 1/8" thick spacing strips and place them in the drawer opening (**Photo 12**). Position the drawer front in the opening and pull it tight to the vertical strip. Drill pilot holes, then fasten the drawer front to the drawer box. Add the drawer handles (see Sources), then remove the drawer boxes to attach the top (**Photo 13**). 🛠️



Find out how to make quick and easy drawer boxes at AmericanWoodworker.com/WebExtras

SOURCES

- Woodworkers Hardware, wwhardware.com, 800-383-0130, 18" Black Full Extension Slides, #FR5043 18 BLK, \$7/set.
- Rockler, rockler.com, 800-279-4441, Space Balls—Raised Panel Door Spacers, #12386, \$6.49/100.
- Lee Valley, leevalley.com, 800-871-8158, Tabletop Mounting Clamps (tabletop fasteners), #13K01.01, \$6.50/50; Rustic Mission handles, 320mm x 36mm, #01X19.34, \$11.20 ea.
- Freud, freudtools.com, 800-334-4107, Lock Miter Bit, #99-034, \$90.
- Minwax, minwax.com, 800-523-9299, Minwax Wood Finish, Dark Walnut #2716 and Provincial #211, \$9/qt.



Jeff Corns

is a self-employed finish carpenter who also makes custom furniture and cabinets. Jeff lives in Ohio.

3 Classic Vises Made with Pipe Clamps

Increase your bench's versatility on a budget.

AS A PROFESSIONAL woodworker, leaving the comfort of my shop to work on a jobsite is part of the routine. I always take along a portable bench that's equipped with three inexpensive vises made with pipe clamps. They're durable and simple to operate. To build them, all you need is some plywood and construction lumber. Almost any brand of pipe clamp will work. These vises can also be adapted to fit a larger, stationary bench, too.

by Chad Stanton



Face vise

The face vise is the workhorse of any bench. It's usually the first—and sometimes the only—vise woodworkers buy. Typically, it holds boards so their edges can be worked.



Tail vise

The tail vise, typically used in conjunction with bench dogs, is used for holding parts flat for face work. Mine has an adjustable guide board, similar to a leg vise. The guide board keeps the jaw from spinning and enables the vise to hold large workpieces.



Moxon vise

The Moxon vise is essentially a face vise with two screws. Because it clamps to your bench top, it brings your work closer to eye level—a dovetailer's dream. My design also features a quick-release handle.

Face Vise

Fig. A Exploded View

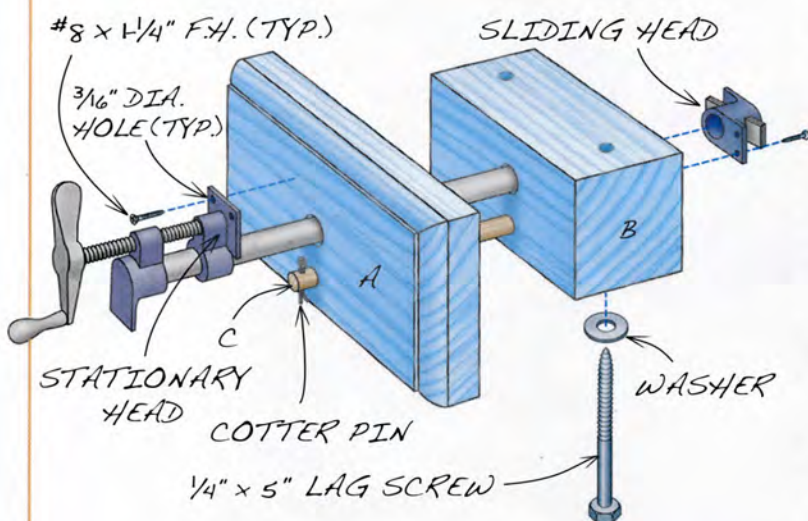
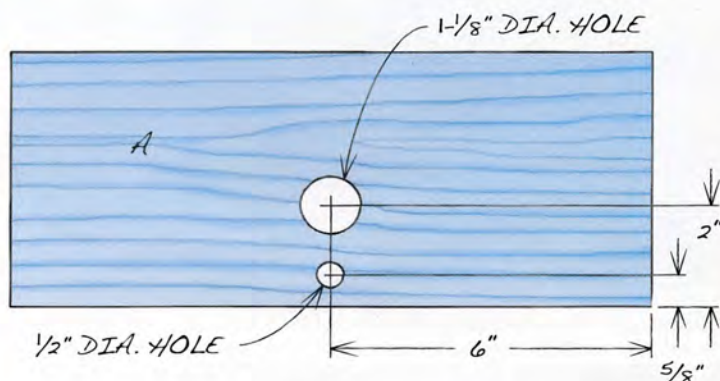


Fig. B Pipe and Guide Rod Locations



Cutting List

Overall Dimensions: 5" Th x 5" W x 12" L (a)

Part	Name	Qty.	Material	Th x W x L
A	Jaw	2	Oak	3/4" x 5" x 12" (b)
B	Mounting block	1	Pine	3-1/2" x 3-1/2" x 7-1/2"
C	Guide rod	1	Oak	1/2" x 12"

Notes:

a) Overall dimensions do not include pipe clamp.

b) Cut pieces slightly oversize and trim to final dimension after gluing.

THIS IS THE SIMPLEST and most-used vise of the three. You can use whatever length pipe you like, but I find that a pipe about 14" long is sufficient for most tasks (Fig. A).

Cut the jaw's pieces (A) slightly oversize, so you can true up the edges after gluing them together. Two pieces of hardwood, such as oak, make for a stiff, rugged jaw. I rounded over the jaw's outer edges, but that's optional.

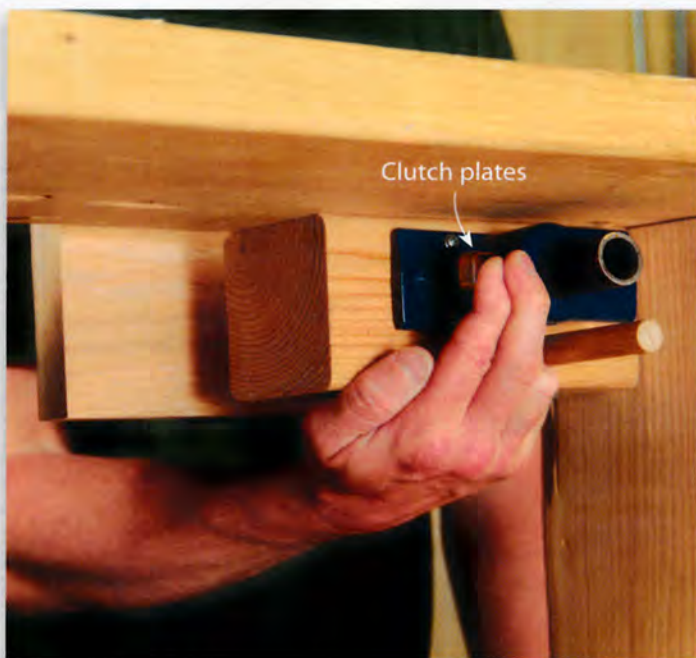
To drill the vise's holes, temporarily screw or nail the mounting block (B) to the jaw's back side. Make sure the mounting block is positioned so that when the vise is installed, the jaw's top edge will be flush with the bench's top.

Use a drill press to drill the holes for the pipe and guide rod (C) through both the jaw and the mounting block (Fig. B). The guide rod prevents the jaw from spinning. Next, separate the mounting block and jaw, and drill the lag screw holes in the mounting block. Using a metal-cutting bit, drill holes in your clamp's sliding head and the jaw of the stationary head.

To mount the vise to your bench, clamp the mounting block under your bench's top, flush with the bench's front edge, and then fasten it with lag screws.

With the clamp's sliding head removed, insert the pipe and guide rod through the jaw and mounting block. Reinstall the sliding head and then tighten the clamp on the two parts, with the stationary head positioned vertically and the sliding head positioned horizontally. Along with the mounting block's relatively short length, the sliding head's horizontal position makes the clutch plates easy to reach. Fasten the heads to the jaw and mounting block using screws, and secure the guide rod with a cotter pin.

To adjust the vise, reach to the back of the mounting block to squeeze the clutch plates. Slide the jaw into position and tighten using the clamp's handle.



Squeeze the pipe clamp's clutch plates to adjust the jaw in or out to suit the size of your workpiece.

Tail Vise

LIKE THE FACE VISE, first glue up the jaw (A) and faceplate (B) assembly. You could probably get by without the faceplate, but a stout wood like oak stands up to hard use much better than pine. Square up the assembly using a jointer and planer, if available. If not, a tablesaw or circular saw will do.

Mark and drill the jaw's pipe hole using a drill press. Also drill out the mortise for the guide board (C). A Forstner bit works best for this, because it lets you overlap the holes. Clean up the mortise's cheeks using a chisel.

Clamp the jaw in position to your bench's end. Using the pipe hole and mortise you just made as guides, mark the hole and mortise on the bench's leg.

Use a hand drill to make the pipe hole through the bench's leg and to excavate most of the leg's mortise. As before, clean up the mortise using a chisel. Make sure the pin board slides freely through the leg's mortise.

Drill the adjustment holes in the pin board (Fig. D). Insert the pin board in the jaw's mortise and, on the drill press, drill the hole for the knockdown pin (D). Assemble the two parts. The knockdown pin makes full disassembly easy for transport. I added a wooden knob to my pin to make it easier to remove.

Drill screw holes in the clamp heads. Insert the pipe into the jaw and slide the assembly into position on the bench. Reinstall the sliding head, tighten the clamp and install the clamp head mounting screws.

Drill the dog hole in the jaw's top, and a series of holes in line with it on your bench's top.

Use the adjustment pin (E) to set the vise's opening according to your workpiece's size. I fastened my adjustment pin to the jaw using screw eyes and a light chain, so it doesn't get lost.

I used a 16" pipe for this vise. Like the face vise, reach under the bench and squeeze the clutch plates to adjust the clamp.



Insert the adjustment pin in the hole that gives you the jaw opening best suited to your workpiece. Adjust the pipe clamp by squeezing the clutch plates to release their grip.

Fig. C
Exploded View

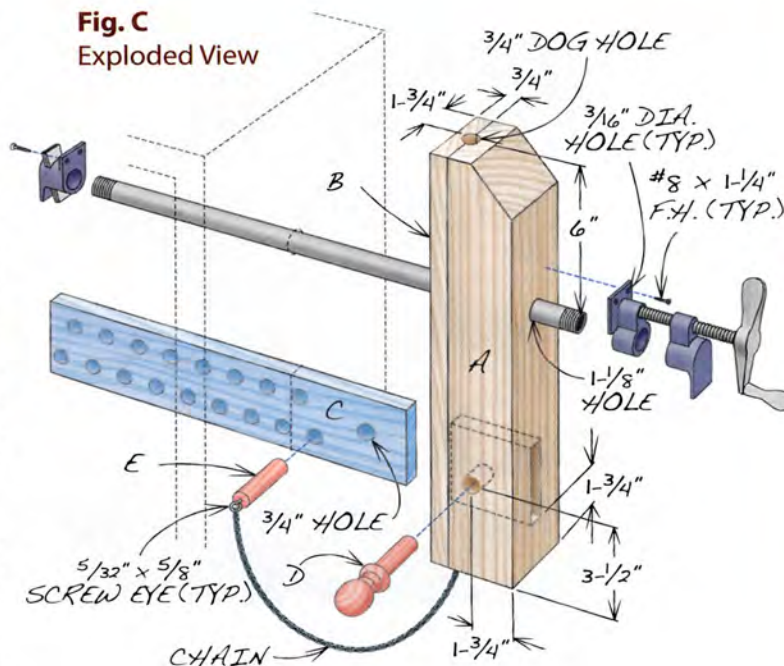
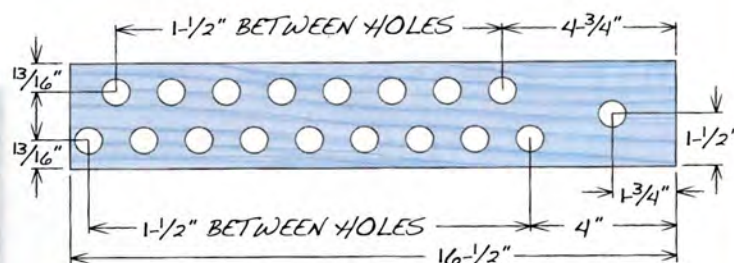


Fig. D Guide Board Hole Pattern



Cutting List

Overall Dimensions: 16" H x 16-1/2" W x 3-1/2" D (a)

Part	Name	Qty.	Material	Th x W x L
A	Jaw	1	Pine	3-1/2" x 3-1/2" x 16"
B	Faceplate	1	Oak	3/4" x 3-1/2" x 16"
C	Guide board	1	Oak	3/4" x 3" x 16-1/2"
D	Knockdown pin	1	Oak	3/4" x 6"
E	Adjustment pin	1	Oak	3/4" x 6"

Notes:

a) Overall dimensions do not include pipe clamp.

Moxon Vise



Pull the handle towards you to release the clutch plates for quick adjustment of the front jaw.

Cutting List

Overall Dimensions: 10" H x 28" W x 16-3/4" D (a)

Part	Name	Qty.	Material	Th x W x L
A	Front jaw	2	Oak	3/4" x 5" x 28"
B	Top and bottom	2	Baltic birch	3/4" x 14-1/2" x 28"
C	Buildup	2	Baltic birch	3/4" x 14-1/2" x 22-1/2"
D	Filler	4	Baltic birch	3/4" x 2" x 14-1/2"
E	Outer side	2	Baltic birch	3/4" x 14-1/2" x 8-1/2"
F	Inner side	2	Baltic birch	3/4" x 14-1/2" x 7"
G	Rear jaw	1	Oak	3/4" x 5" x 28"
H	Rear jaw buildup	1	Oak	3/4" x 5" x 21"
J	Guide block	2	Pine	1-1/2" x 2" x 6"
K	Lever	2	Oak	3/4" x 1-5/8" x 6-1/2" (b, c)
L	Handle	1	Oak	3/4" x 1-1/2" x 8-3/4" (d)
M	Dowel	2	Oak	3/8" x 1-1/2"
N	Push bar	1	Oak	3/4" x 1-7/8" x 14-1/4" (e)
P	Push bar retainer	2	Baltic birch	1/4" x 3-1/2" x 5-7/8"

Notes:

- a) Overall dimensions do not include pipe clamps.
- b) Draw radii before drilling holes.
- c) Length includes 3/4" long tenon.
- d) Cut 1/2" wide x 3/4" deep notches in both ends.
- e) Slightly round all edges.

NAMED AFTER 17th-century woodworker and author Joseph Moxon, this vise specializes in securely holding wide boards. Two clamps provide even clamping pressure across the whole board with no racking. The main feature my version has that the original didn't is a quick-release mechanism (Fig. G and photo at left).

Another benefit of the Moxon vise is its height. It clamps to your bench's top, so your work is at about chest height. When you need to be close to your work, such as when cutting dovetails, this is the vise to use.

Unlike the other vises, I used 1/2" instead of 3/4" pipe clamps. Half-inch pipe clamps provide all the holding power I need, and I saved a few bucks. The pipes are 12" long.

A good vise must be extremely stable. I made this one extra-beefy, since it isn't actually attached to a bench. Using two thicknesses of 3/4" plywood allowed me to make deep, strong, rabbeted dado joints without having to actually cut dados.

To build the vise, glue up the front jaw pieces (A) and set the assembly aside. Meanwhile, assemble the top and bottom (B), including the buildup (C) and filler (D) pieces. Use a plywood offcut as a spacer to create the dados. Trim the front jaw to final size and round over the outer edges if you wish.

Glue and screw the outer and inner sides (E and F) in place. Turn the assembly upside down and position the front jaw, rear jaw (G), rear jaw buildup (H), and guide blocks (J).

Mark and drill the front jaw holes using a drill press and then reposition the front jaw on the assembly. Slide the drill bit into the jaw's holes to mark the hole centers on the rear jaw. Mark and drill the rest of the jaw/guide block assembly in the same manner. Finally, drill the holes in the ends of the guide blocks (Fig. F).

Next, cut out the levers (K, Fig. E) and handle (L). Mark the levers' radii before drilling their holes. If you drill the holes first, you won't have a place to position your compass for drawing the larger radius. Drill the holes in the levers, cut the bridle joints, chamfer the handle and glue the dowels (M) in the levers.

After the glue dries, slide the guide blocks onto the dowels (do not glue) and screw the whole assembly in place.

Before attaching the bottom, assemble the vise as you did the other vises, by removing the sliding heads and inserting the pipes through the jaw assembly. Set the push bar (N, Fig. H) in place and make sure the sliding heads are oriented properly before screwing them to the guide blocks. There should be about 1/16" of play between the push bar ends and the clamps' clutch plates. Adjust your push bar's ends as needed to fit behind your clamp's clutch plates.

Install the push bar retainers (P) and test the handle's operation. Lastly, attach the bottom using glue and screws. 

Technical drawing of a wooden handle with the following dimensions and labels:

- Top width: $1\frac{5}{8}"$
- Top left radius: $\frac{1}{2}" \text{ RAD.}$
- Top right radius: $1\frac{1}{8}" \text{ RAD.}$
- Top right vertical dimension: $1\frac{1}{8}"$
- Top right vertical dimension: $1\frac{1}{4}"$
- Center hole diameter: $\frac{3}{8}" \text{ HOLE}$
- Center hole offset from right edge: $\frac{1}{2}"$
- Bottom notch depth: $\frac{3}{4}"$
- Bottom notch width: $\frac{1}{2}"$
- Bottom total width: $1\frac{1}{2}"$

1-1/2"

1/2"

2"

1-1/4"

3/8" DIA. HOLE

A diagram of a tapered piece of wood. The height is labeled as $\frac{1}{4}"$ and the length is labeled as $3"$.

A collage of ten American Woodworker magazine covers from the 1990s, featuring various woodworking projects like workbenches, bookshelves, kitchen cabinets, and picture frames. The covers are arranged in an overlapping fashion. The titles visible include: 'HOW TO MAKE Workbenches & Shop Storage Solutions', 'HOW TO MAKE Bookshelves & Bookcases', 'Getting the Most out of your Wood-Buying Bucks', 'No-Fuss Wood Finishing', 'UNDERSTANDING WOOD FINISHING', 'GREAT BOOK OF Woodworking Tips', 'HOW TO MAKE Outdoor & Garden Furniture', 'TOOLSMARTS Routers and Router Tables', 'Workshop Dust Control', 'HOW TO MAKE Kitchen Cabinets', and 'HOW TO MAKE Picture Frames'. Each cover features a photograph of a completed project or a person working on one. The American Woodworker logo is present on most covers.

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Make a Butcher-Block Top

Create a thick top without using thick boards.

by Tim Johnson

IN THE 1970s, wooden counters and tabletops made from narrow laminated boards—a staple of restaurant kitchens—began to appear in upscale residential kitchens. These trendy surfaces came with the catchy name “butcher block,” which tied in perfectly with the growing interest in practicing the culinary arts at home. In fact, these work surfaces are only distantly related to the classic butcher-shop chopping block for which they’re named—but they’re far more useful.

Construction

You can make a perfectly good butcher-block top by gluing together leftover strips of wood. But this story focuses on a construction method that’s more elegant and purposeful (see Fig. A, at right).

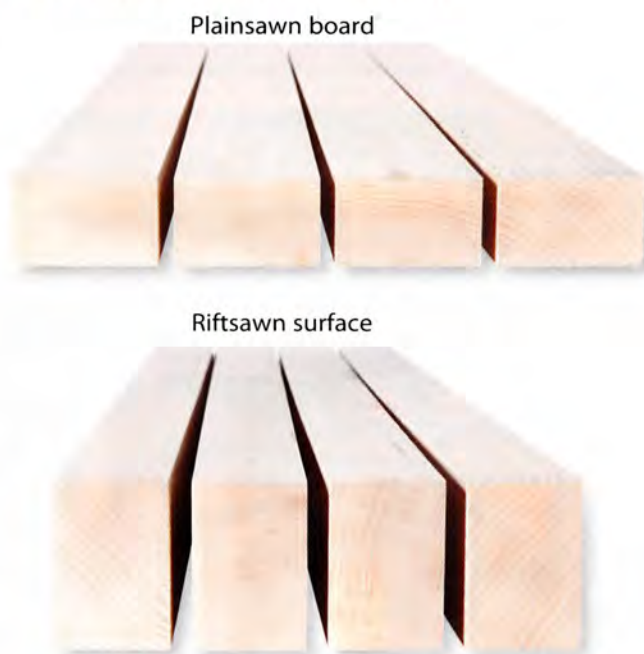
This method creates a top that will stay flat because its surface is entirely riftsawn (or even quartersawn) and stabilized by multiple glue joints. A top made this way is much less likely to cup or warp than a top made from plainsawn boards and will exhibit noticeably less seasonal movement. It also has an orderly appearance, because all of its pieces are the same thickness, show straight grain and are oriented so the grain runs in the same direction.

This method saves money, too, because it allows creating a thick solid-wood top without using thick lumber—which can be both costly and hard to find. Woodworkers will recognize a top made this way from workbenches as an exceptional surface for working wood.

Tools

Because the building process consists mainly of ripping, jointing, clamping and planing, you’ll need a well-equipped shop. Make sure to have a tablesaw outfitted

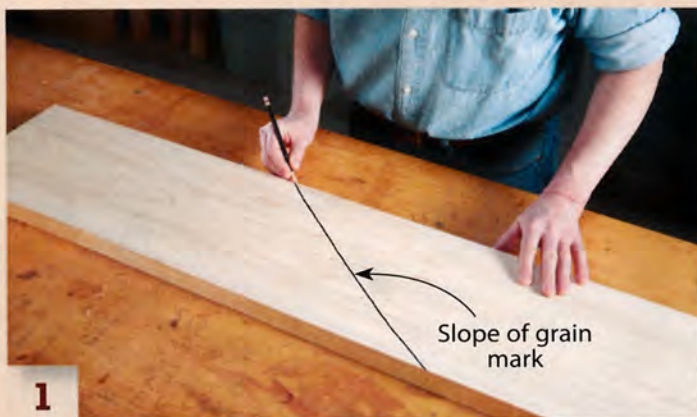
Fig. A Butcher Block Construction



Rip a plainsawn board into narrow pieces. Then stand these pieces on edge to create a riftsawn “butcher-block” top. The width of the narrow pieces determines the top’s thickness. Similarly, the thickness of the plainsawn board determines the width of the top’s laminations.



See how to use a planer to flatten wide glue-ups at AmericanWoodworker.com/WebExtras



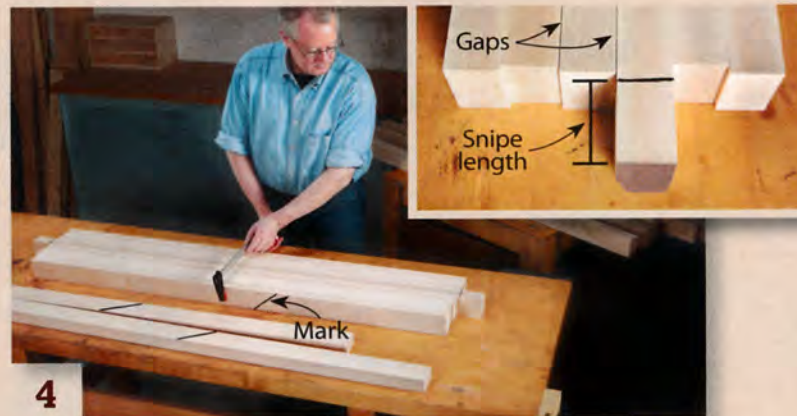
1 **Mark** the slope of the edge grain across both faces of each board. Then joint one edge flat, following the grain.



2 **Rip** each board into narrow pieces. The width of these pieces determines the thickness of the top.



3 **Joint** one edge of each narrow piece, following the slope of the grain according to the mark made earlier. Then rip all the narrow pieces to the same width.



4 **Group** the pieces in sections sized to fit your planer—including a long piece to eliminate planer snipe—and test the joints by clamping the center. Gaps at the ends indicate joints that require re-jointing.

with a rip blade, a 12" planer, a long-bed jointer (8" width is best; plan to add infeed and outfeed support tables, if necessary), a bucket full of pipe clamps, a quart or two of waterproof glue and a clamping surface that's flat and suitably sized. Plan to use your circular saw and router, too.

Rip narrow pieces

Calculate the number of boards needed to create a butcher-block top of the desired dimensions. Then begin by milling the boards flat and to thickness. The 2-1/2" thick top shown here was made using 8/4 hard maple milled to 1-3/4" thickness, but you can use almost any wood (except knotty wood) and stock of any thickness. Thinner stock just requires more laminations to create the desired width.

Joint one edge of each board flat after determining which way its grain runs. Maple grain can be hard to read, so make passes from both directions and go with the direction that produces the best result. Then draw an angled line across both faces of the board to indicate the edge-grain's slope (**Photo 1**). Make sure the lines on both faces slope in the same direction. You'll use these lines throughout the building process to orient the pieces.

Install a rip blade in your tablesaw. A rip blade is specifically designed to cut with the grain. It will cut cleaner, faster and with less effort than a general-purpose or com-

bination blade. Set the fence to cut the board into narrow pieces. Some of these pieces are likely to bow as the board is cut, so it's essential to install a splitter or a riving knife for this operation, along with anti-kickback pawls, to reduce the risk of a dangerous kickback. For the same reason, plan to cut the narrow pieces at least 1/4" wider than the final thickness of the top you're building.

Rip the first narrow pieces with the jointed edge of each board against the fence (**Photo 2**). Set the narrow pieces aside, return to the jointer and joint the sawn edge of each plainsawn board. Then return to the saw and rip the next group of narrow pieces. Continue until all the boards have been cut. Then joint one edge of each narrow piece (**Photo 3**) and rip them all to the same width.

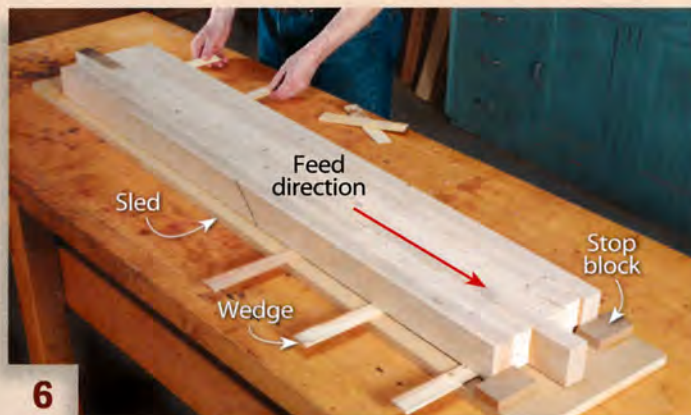
Assemble in sections

Divide the narrow pieces into sections that will fit your planer. If you come up short, dig through your offcuts; you may be able to use some of the pieces you discarded (see "Get the Most from Your Boards," page 63).

Cut the narrow pieces to rough length (1" to 2" oversize), but leave one piece in each section long enough to accommodate the planer's snipe. Clamp each section together with the pieces on edge, using the marks made earlier to make sure all the grain runs in the same direc-



Glue each section in stages, two or three pieces at a time, so you can pay attention to each joint. Use a roller to evenly spread the glue and cauls to evenly spread the clamping pressure.



Make a sled to support each section so you can use the planer to flatten its top face. Position the section against stop blocks on the front end. Then install wedges under the high spots.



Cover the section's face with squiggly lines before planing it. When the lines are gone, the surface is flat. Minimize tearout by dampening the surface before each pass.



Joint both edges of each section. Use a straightedge and a router if the section is too long or heavy for your jointer. Start by cutting a shallow rabbet.

tion. Orienting the grain the same way helps to minimize tearout when the section is planed during the next step.

Rearrange the pieces as necessary—while maintaining the correct grain orientation—to minimize the gaps at the end (**Photo 4**). Mark each gap. Then mark the location of each narrow piece so you can correctly reassemble the section. Remove the clamp and then eliminate each gap by jointing the faces of the two boards it appears between. Take your time with this step. For the best results, plan to repair only one or two joints at a time and glue together each section in stages (**Photo 5**). I use waterproof glue.

Flatten each section

Joint one face of each section flat, using the planer and a sled (**Photo 6**). The sled is a piece of MDF that's longer and wider than the section, with stop blocks attached at the front end. Orient the section for planing with the grain and butt it against the stop blocks on the sled, with its anti-snipe extension between them. Then install wedges under all the high spots. Note that the section shown in Photo 6 has a twist, which will cause real problems unless it's removed. Adhere the wedges to the MDF and to the section with hot-melt glue. Set the planer to make a very light pass and then feed the assembly through it, stopped end first (**Photo 7**). Make additional light passes until the

surface is flat.

Tearout at this stage could cause real problems. Here's a neat trick to significantly reduce the risk: Simply dampen the surface with a sponge just before you plane it. You'll be amazed by the results.

After flattening one face of each section, plane them all to final thickness. You don't need the sled for this step, but it's a good idea to dampen the surfaces before planing.

Joint the edges and glue the top

Joint both edges of each section. If the sections are too long or too heavy for your jointer, using a router and a straightedge is a good alternative (**Photo 8**). The straightedge can be a board with a jointed edge or the factory edge of a piece of hardboard or MDF.

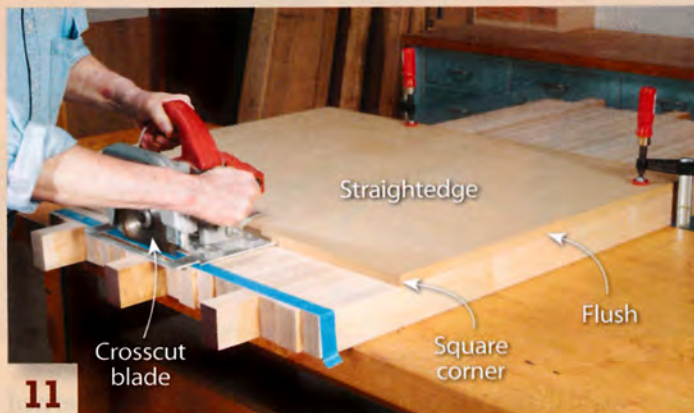
Position the straightedge for a shallow cut and make sure it's long enough to guide the router beyond both ends of the pass. A thick section like the one shown here will require two passes. First, install a 1" dia. straight bit and cut a rabbet that extends slightly beyond the midpoint of the section's thickness. (Here's another tip: A 1" dia. straight bit will make a much smoother cut than a 1/2" dia. bit). Switch to a flush-trim bit to complete the cut (**Photo 9**). Re-mark the grain direction on the edge immediately after jointing it.



9 Flip over the section and use a flush-trim bit to finish jointing the edge. Position the bit so its bearing rides on the rabbeted surface.



10 Complete the top by gluing together the sections one joint at a time, so you can make sure their surfaces are flush. Clamps at both ends help keep the joint aligned.



11 Square the ends using a straightedge and a circular saw. This straightedge has a square corner, so it's simply clamped flush with the top's edge.

Glue up the top one joint at a time. Clamp two sections together with the grain oriented in the same direction. Inspect the joint and make any necessary adjustments to eliminate gaps. Make sure the surfaces are flush when you glue the sections together (**Photo 10**).

Cut to length and finish

Check the joints after removing the clamps and scrape or sand them flush, as necessary. Then use a circular saw and a straightedge to cut the top to final length (**Photo 11**). For the best results, spend \$15 on a new crosscut blade. Rip the top to final width and remove the saw marks by routing as before, or by sanding.

Sand the ends, starting with 80 grit to remove the saw marks. Then work your way through the grits until the sanding scratches are invisible. Why? Because sanding end grain to this level makes it as attractive as face grain.

Finish-sand the top (and the sawn edge) to the same grit as the end grain. Then ease all the sharp edges and corners using a router equipped with a 1/8" roundover bit. Lightly sand the rounded edges as necessary. Then remove all the sanding dust and apply a finish. For both looks and durability, polyurethane is an excellent choice (see "Food-Safe Finishes," page 64).

Get the Most from Your Boards

Using plainsawn boards to build a butcher-block top can be costly, so it's important to make the best use of each board. First, have a plan when you go to the lumberyard: Know the width of the narrow pieces you intend to rip the boards to, so you can minimize waste when selecting the boards. Here are three more tips to maximize the yield.



Create additional lengths of narrow stock by gluing together offcuts left by ripping. Joint one edge of this glued piece, mark the grain direction and rip it to width, as for the other narrow pieces.



Hide ugly stock inside the section. Only the top and ends have to look good. Avoid using stock that's twisted or contains unstable wood.



Butt short pieces together inside the section. Glue the butted joint and clamp it lengthwise from end to end when you glue it into the section.

Food-Safe Finishes

You are what you eat.

by Kevin Southwick

WOOD INHABITS almost every modern kitchen in the form of cutting boards, tables and countertops that are almost always made of hardwood and often feature butcher-block construction. As these surfaces are typically used for preparing and serving food, “What’s the appropriate finish?” is a question I’m frequently asked. My response is always based on the answer to one very important follow-up question: “Will you cut food on it?”

Safe for contact with food

If the surface won’t be cut on, the answer is simple: Any film-forming finish you would normally choose for durability and appearance will be just fine (**Photo 1**). The finish only needs to be safe for contact with food—meaning that no toxic chemicals from the fully-cured finish will get into food. While only a few wood-finishing products are labeled as “non-toxic when fully cured,” virtually all of them are generally considered to be so (**Photo 2**). The FDA doesn’t restrict any modern wood finish from being used on tabletops or counters in homes or restaurants; in fact, no U.S. government agency appears to consider it to be an issue.

The important thing to understand is that film-forming wood finishes are toxic as liquids, but non-toxic after the solvents evaporate and the finish has dried to a hard, fully-cured film. For example, furniture manufacturers almost always finish tabletops and kitchen counters with lacquer and other fast-drying materials that are typically stinky and toxic. But once the solvents have evaporated and the off-gassing that occurs during the curing time has passed, the hardened finish is usually considered no

more toxic than a plastic plate. So unless you’re concerned about eating food stored in or served on plastic, you don’t need to worry.

I knew I would never cut on the butcher-block counters that I made for my kitchen because I always use cutting boards. So I finished the counters with oil-based polyurethane, because I wanted a durable, waterproof and heat resistant finish that would require minimal maintenance. After ten years of daily use and washing, they still look great—and I’m still here, so I don’t believe they’ve poisoned me.

Cutting board finishes

If you plan to use your butcher block as a cutting board, you could conceivably ingest small amounts of the finish (and the wood) when you use it. So you may want your finishing material to contain only ingredients that you personally consider to be edible. This line of thinking probably rules out all synthetic, man-made film-building finishes and leaves the following options for you to choose from.

Option 1: Leave the wood bare. This is my favorite treatment for edge-grain butcher-block cutting boards that are frequently used. It’s quick, easy and the only maintenance required is washing and drying.

Although it will stain easily and is more likely to split or crack if allowed to soak up lots of water during cleaning, a wood cutting board doesn’t require any finish whatsoever to perform satisfactorily for many years. Just wash the board with soap and hot water after every use and allow it to

thoroughly dry on all sides (**Photo 3**). I've been using a cutting board made of solid pine and another made of glued-up maple strips for more than ten years. Both are slightly stained and show small end-grain cracks, but they'll both provide many more years of service. An interesting study done by the University of Wisconsin in 1993 documented that bacteria are much more likely to survive on a plastic cutting board than on wood.

Option 2: Apply an oil finish. All things considered, oil finishes are my least favorite choice for any cutting board because they dry too slowly or don't dry at all—and also because they require too much maintenance.

Tung oil and boiled linseed oil (the most commonly used drying oils in wood-finishing products) provide protection because they polymerize and “harden” in the wood. However, they're not made to be edible. Food-grade “pure” linseed oil (from flax seed) is available as a nutritional supplement. Unfortunately, this untreated linseed oil takes weeks to harden unless toxic metal driers are added, as is typically the case with boiled linseed oil. “Tried & True” brand linseed oil finishes (available at triedandtruewoodfinishes.com) stand out because they claim to contain no solvents or toxic metal driers. Instead, a heat-treatment process is said to be used to help speed the drying.

Walnut oil is often used because, like linseed and tung oil, it's said to harden. My own experiments show that it takes weeks to dry. It may also contain allergens that even in small amounts could potentially trigger severe allergic reactions in the small portion of the population with tree-nut allergies.

Non-drying oils (vegetable oils and mineral oil) offer a very limited amount of protection because they don't harden or cure. Constant maintenance is required because they wash off easily and must be reapplied frequently whenever the surface looks dry. Food-grade vegetable oils such as olive oil run the risk of turning rancid over time. However, washing the surface frequently with soap and hot water dramatically reduces the chance of this happening.

Mineral oil is the most commonly used non-drying oil because it doesn't turn rancid. And when purchased at a pharmacy as a laxative, it definitely qualifies as edible, even though in reality, it's nothing more than highly refined petroleum. (Note: Mineral oil is sometimes marketed as a food-safe finish for butcher blocks at a much higher price than it commands at your local pharmacy).

Option 3: Blend oil and wax. This is my favorite finish for pretty edge-grain cutting boards and other wooden utensils that I want to keep looking their best (see “What About Utensils, and Bowls,” page 66).

Mixing oil with wax (usually mineral oil and beeswax) makes an easy-to-use, edible product that seals the wood much more effectively than oil alone and requires no drying time. Oil and wax blends are made by warming the oil to the melting temperature of the wax and then stirring in the wax. This melts the wax without adding any solvents and the oil and wax remain in solution even after the mixture cools. The right amount wax depends on the desired

Any finish is safe to use on a butcher-block table or countertop that won't be used as a cutting surface. Oil-based polyurethane provides a durable, waterproof and heat resistant finish that requires minimal maintenance.



Labels can be confusing. Only the bottom two wood-finishing products are labeled “non-toxic when fully cured,” but the ingredients listed on the back of all three products are virtually the same.



No finish at all is my first choice for a frequently used cutting board. Just wash the board with soap and hot water after every use and allow it to thoroughly dry on all sides.



A blend of oil and wax that's food-safe is a much better choice for any cutting board than oil alone. It protects better and requires less maintenance.





5 **Mix** your own non-toxic, edible oil and wax blend by melting one part grated beeswax in about four parts of mineral oil that's been safely heated to approximately 150° F.



6 **Molten** beeswax is a superb food-safe finish for end-grain cutting boards. Rather than heating the wax, I heat the board (**Photo 7**) and then let it melt the wax. One application lasts for years.



7 **Bake** an end-grain cutting board at 350° for 10 minutes to prepare it for waxing. This raises its temperature to about 175° so the wax melts into the grain upon contact.

thickness of the mixture at room temperature. More oil makes the mix thinner and easier to apply (**Photo 4**). Just rub it in, let it soak and then buff. Because the wax in this finish seals the wood much more effectively than using oil alone, much less maintenance is required. Just reapply when the surface looks dry—a little dab will do. A mixture that contains more wax offers more protection but is harder to rub in.

Odie's Oil and Odie's Wood Butter (available at odiesoil.com) are oil and wax blends that are labeled as food-safe and solvent-free. These two blends have different consistencies—the oil is thinner than the butter. You can also mix your own oil and wax blend (**Photo 5**). For safety, use a crockpot set at “warm” to heat the mineral oil. Do not use an open flame.

Option 4: Rub in pure molten wax. Without a doubt, this is my favorite finish for end-grain cutting boards.

This method was often used to seal the massive end-grain butcher blocks in old-time butcher shops. Solid wax was melted and poured onto the wood hot, so it would spread easily and wick into the end grain. After the wax had cooled, the excess was scraped off and then the surface was buffed.

For an end-grain cutting board that's small enough, there's an easier (and safer) way to apply this finish. Let the solid wax melt into the wood after heating the board in your oven (**Photos 6 and 7**). Buff the surface after the wax cools and it's good to go.

This method uses no solvents, seals end-grain superbly and requires no drying time. I prefer to use beeswax (which I recently discovered is available from local beekeepers), but carnauba wax and paraffin will also work (both are considered edible). In over 10 years of daily use, I haven't needed to reapply molten wax to my end-grain cutting board. An occasional dab of oil and wax blend has kept it looking great with no solvents or drying time. My only regret is that this method is not nearly as effective or long lasting on edge-grain cutting boards. 🐾

Kevin Southwick is a wood-finishing specialist and furniture restorer/conservator in Minneapolis. Visit southwickfurnitureconservation.com to learn more.

What About Utensils and Bowls?

Although all modern finishes are food-safe, not all of them are considered edible. So deciding how to finish small wooden items that come in contact with food depends on personal preferences. Here are some examples of decisions I've made. The old wooden spoon has never been treated, except for washing with soap and hot water, because I don't really care much about its appearance. The cherry spatula is finished with an edible oil and wax blend, which I maintain to keep it looking good. The figured maple bowl has one coat of linseed oil to enhance the grain and two coats of thin wipe-on poly to make it waterproof.

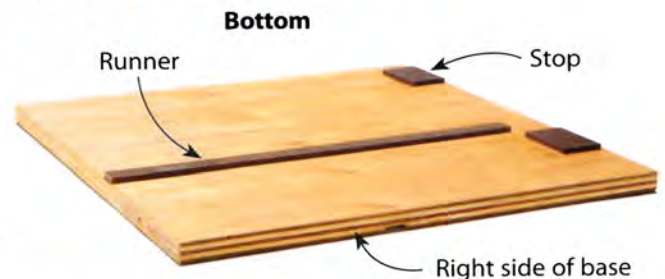
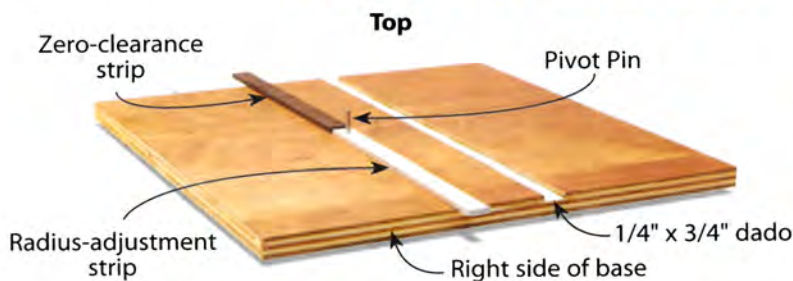


Precision Circle-Cutting Jig



by Tom Caspar

One of our favorite bandsaw accessories.



CUTTING A PERFECT CIRCLE freehand is just about impossible. Its edges will always be uneven. You'll get much better results using a classic jig that allows you to rotate the workpiece on a nail or dowel—a "pivot pin." When I needed to cut out some circles to an exact diameter, I made one of those classic jigs and added a new twist: The pivot pin on my jig is housed in a sliding runner. To make a circle of any radius, you simply adjust the runner's position.

For the jig's base, you'll need a piece of 3/4" plywood that's the same width as your bandsaw's table and 1" longer than your table's depth. For the jig's other parts, you'll only need a small piece of 1/4" tempered hardboard. Cut the hardboard to make a runner that fits the bandsaw's miter slot. In addition, cut two 1"x2" pieces of hardboard to serve as stops.

Glue the runner to the base, square to the base's front and back edges. Position the runner so that the right edge of the base will overhang the saw by about 3". Glue the stop blocks to the jig's back edge—they'll butt up against the saw's table.

Install a 1/4" or smaller blade in your saw. Turn on the saw and engage the base and runner in the table's miter slot. Push the base forward until the stops prevent it from going any farther. Turn off the saw and withdraw the base. Using a framing square, draw a line at a right angle to this saw cut, even with the end of the cut.

Next, cut a 3/4" wide dado all the way across the base's top, centered on the line you drew with the square. The depth of the dado must exactly match the thickness of your hardboard—about 1/4". Rip two hardboard pieces to fit the dado. One will act as a zero-clearance throat plate; the other receives the pivot pin. (I made the pivot-pin piece from hard maple, so pencil lines on it would be easier to see.)

I use metal dowels from the hardware store for pivot pins. The sliding runner can accommodate pins of any size up to 1/2"; just drill a hole for each pin along a line running down the runner's center. (Larger pins would require a wider dado.)

To use the jig, insert a pivot pin in the runner. Push the jig up to the stops and set the circle's radius by adjusting the runner in or out. Clamp the runner in place and slide back the jig.

Drill a hole in your workpiece that matches the pivot pin's diameter and place the workpiece on the pin. Start the cut by sliding the jig forward up to the stop blocks. Then rotate your workpiece to cut the circle. By cutting off the corners of my workpiece beforehand, I found I could use the jig to cut a circle up to 8-1/2" dia. 



Watch how to make this jig at
AmericanWoodworker.com/WebExtras

Indoor Planter



**Tricks for using dimensional lumber
make this project easy to build.**

by Tom Caspar

SOMETIMES “PRETTY GOOD” furniture is good enough, even though you may wish you could spend all your precious time in the shop making fancier stuff. When my wife asked me to build a large indoor planter “just like the one in this crafts book” for a sunny hallway, I winced. But then I thought, “What the heck?” The planter was made from 1x4s and 1x6s, looked way too clunky and was merely nailed together.

“OK,” I said, “but I’ll make it my way.”

That is, the way a woodworker makes things. I stuck with the cheap lumber (more about that later), lightened up the design and substituted biscuits for the nails. All in all, the project was pretty easy to build and is well within the range of any budding woodworker. It could also be the starting point for a cabinet with doors or drawers.

Materials

I built a prototype of the planter from one sheet of 3/4" MDF to work out the how-to steps and refine the design (see photo on page 69). Working with material that is absolutely straight and flat—with no jointing or planing—was a joy!

The thickness and width of all the planter’s parts correspond to the dimensions of wood commonly available in a lumber-

yard or home center (see Cutting List, p. 70). In these stores, you can usually find 3/4" clear pine, yellow poplar or red oak with square edges and smooth surfaces that would work quite well—just as it is—and with little waste. Most of this wood will be pretty straight, too, which will make the building process much easier. All you have to do is cut it to length.

I passed by this material, however, and chose the least expensive stuff: #1 common pine. I rummaged through a whole stack of boards looking for pieces that weren’t cupped, bowed, twisted or full of large knots. Even the best boards weren’t as flat as the premium wood, though. I bought about 25% extra, because many of the boards I chose had short sections that were unusable. I wasn’t able to find any good 1x2s, so back in the shop I ripped them from wider pieces.

Buy shelf and pots first

Sticking with the theme of simple construction, I also purchased a pre-made melamine shelf at a home center (E, Fig. A, page 70), rather than make one. Back in the shop, I realized that the overall dimensions of the planter’s base would then be determined by the exact size of the shelf, because it must fit inside. Knowing that I would be dealing with squirrely wood, I made the inside of the



Leg template

1

Lay out all the parts to rough length, using templates. This project is designed for lumberyard 1x4s and 1x6s; templates make it easier to mark around the knots.



Stop

2

Cut the boards on the rough-length marks, then trim them to final length. Use a stop to make sure similar parts will be the same length.



2" spacing stick

Leg

3

Build a pair of boxes joined with biscuits (Fig. F). Each box consists of three frames. Assemble each frame to mark centerlines for the biscuits. Use this spacing stick to draw centerlines for the top rails.



1-1/2" spacing stick

Spacing block

4

Draw centerlines for the bottom rails using a second spacing stick. Position these rails with a pair of spacing blocks butted up to the ends of the legs.



5

Cut biscuit slots in the legs and rails. Push down on each piece with a large block to make sure it stays put and sits flat on the bench.

base about 1/4" wider and longer than the shelf in case the base came out a little crooked and out of square—which it did. If you buy a similar shelf, check its dimensions before cutting parts to length. Alter the Cutting List as needed.

The top of the planter is designed to hold 8" dia. pots. Before building, I looked for pots having an attached saucer, which prevent drips (see Sources, page 72). The pots I found hung nicely into a 7-5/8" square opening (Fig. D), but an opening that size might not work for pots made by a different manufacturer. As with the shelf, you should buy the pots before cutting any lumber and make adjustments to the Cutting List as needed. If you rejigger the size of the openings or their spacing, you may also have to move the position of the upper cross rails (H, Fig. A and Fig. D).

Build two boxes

Start with the base. The easiest way to build it is to make two identical "boxes" and connect them later on (Fig. F). Each box has many similar pieces: the legs (A), leg returns (B), top side rails (C), bottom side rails (D), top end rails (F) and bottom end rails (G). Using scrap wood, make a template for each part. The widths of the templates are unimportant—it's their length that counts. Cut each one at least 1" longer than the

Build it from MDF?

To make the project even easier, you can build the whole thing from 3/4" MDF. One sheet will do it. Just be sure to coat every surface with paint, so over-watering the plants doesn't cause the MDF to swell and burst apart!



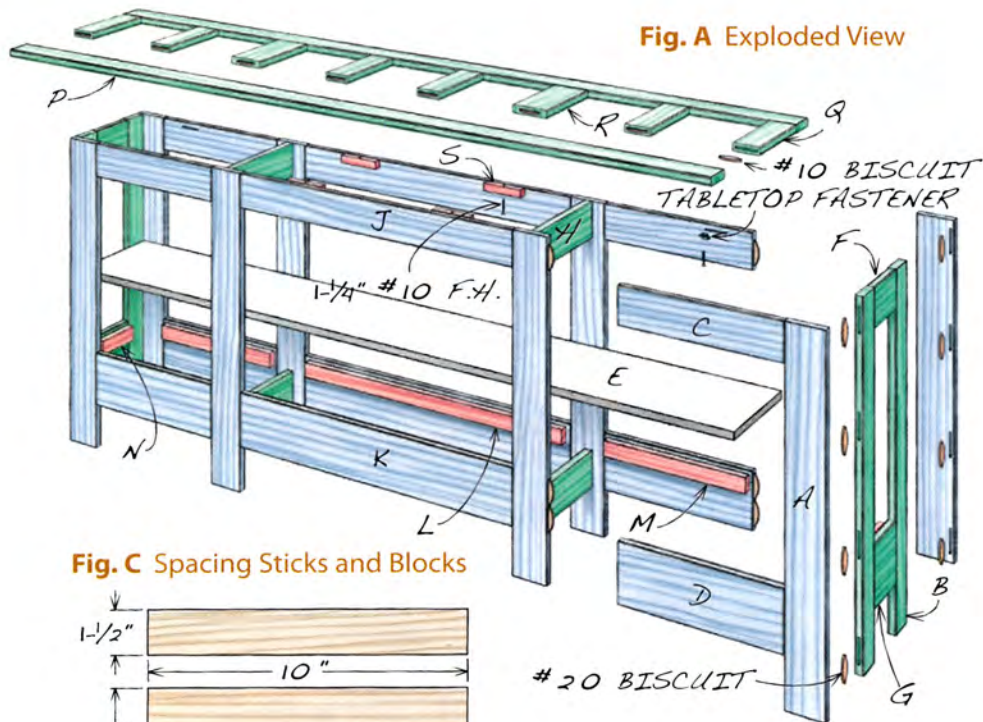


Fig. B Biscuit Layout for the Base

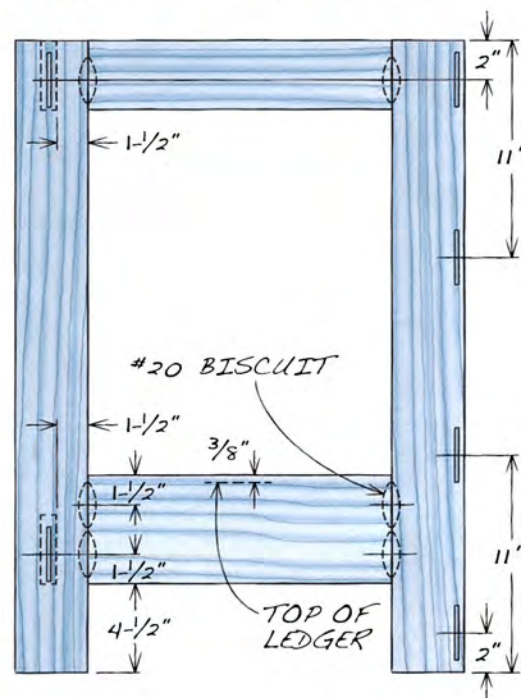
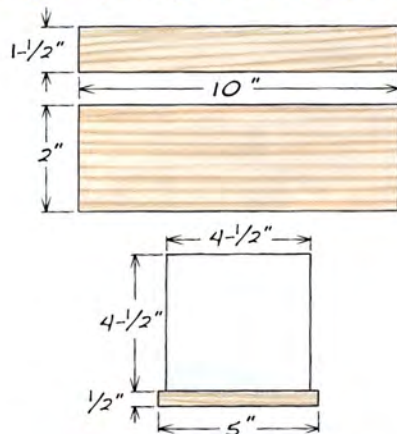
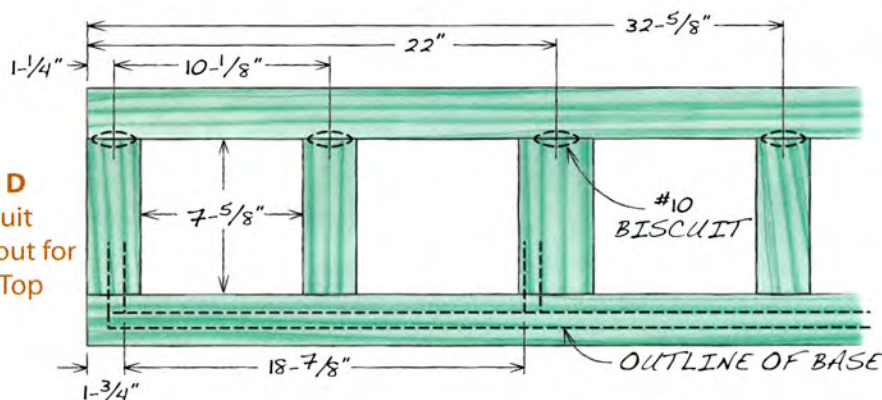


Fig. C Spacing Sticks and Blocks



#20 BISCUIT

Fig. D Biscuit Layout for the Top



To download free plans for this project, go to AmericanWoodworker.com/SketchUpPlans

Cutting List

Overall Dimensions:
32-3/4" H x 75-3/8" L x 12-5/8" D

Part	Name	Qty.	Mat.	Th x W x L	Rough lengths (a)			
					1x2	1x3	1x4	1x6
A	Leg	8	1x4	3/4" x 3-1/2" x 32"			8@33"	
B	Leg return	4	1x3	3/4" x 2-1/2" x 32"		4@33"		
C	Side rail, top	4	1x4	3/4" x 3-1/2" x 14-5/8"			4@16"	
D	Side rail, bottom	4	1x6	3/4" x 5-1/2" x 14-5/8"				4@16"
E	Shelf	1		3/4" x 9-13/16" x 71-3/4" (b)				
F	End rail, top	2	1x4	3/4" x 3-1/2" x 5" (c)			2@6"	
G	End rail, bottom	2	1x6	3/4" x 5-1/2" x 5" (c)				2@6"
H	Cross rail	4	1x4	3/4" x 3-1/2" x 10" (c)			4@11"	
J	Middle rail, top	2	1x4	3/4" x 3-1/2" x 30-3/16" (d)			2@31"	
K	Middle rail, bottom	2	1x6	3/4" x 5-1/2" x 30-3/16" (d)				2@31"
L	Ledger 1	2	1x2	3/4" x 1-1/2" x 29"	2@30"			
M	Ledger 2	4	1x2	3/4" x 1-1/2" x 14"	4@15"			
N	Ledger 3	2	1x2	3/4" x 1-1/2" x 4-3/4"	2@6"			
P	Top, front and back	2	1x3	3/4" x 2-1/2" x 75-3/8"		2@77"		
Q	Top, crosspiece 1	6	1x3	3/4" x 2-1/2" x 7-5/8"		2@9"		
R	Top, crosspiece 2	2	1x4	3/4" x 3-1/2" x 7-5/8"			2@9"	
S	Fastening block	4		3/4" x 3/4" x 4"				

Notes:

a) Rounded up by at least 1". b) 3/4" Melamine shelf purchased from home center. c) Cut length to fit shelf's width. d) Cut length to fit shelf's length.

Fig. E Details of Reveal

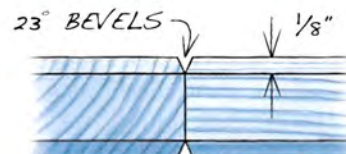
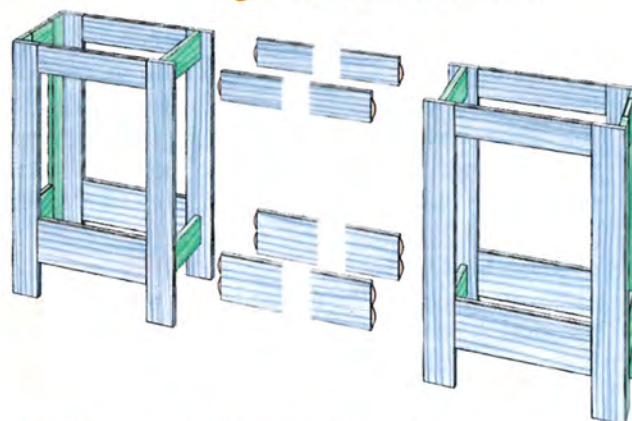


Fig. F Build End Boxes First



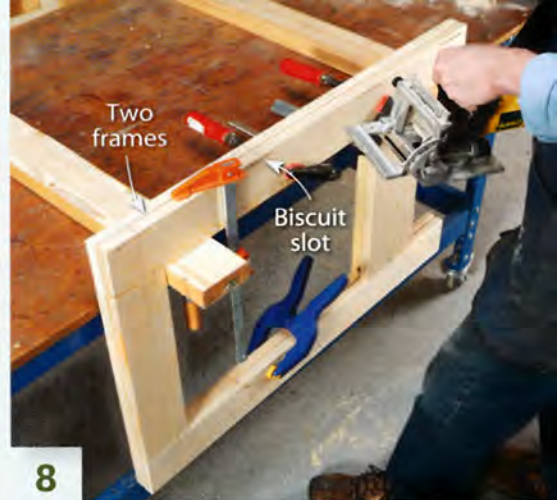
Watch how easy it is to make squaring blocks (photo 13) at AmericanWoodworker.com/WebExtras



6 **Rout** a small bevel around all the edges of each piece. These bevels create reveals that disguise any unevenness in the joints.



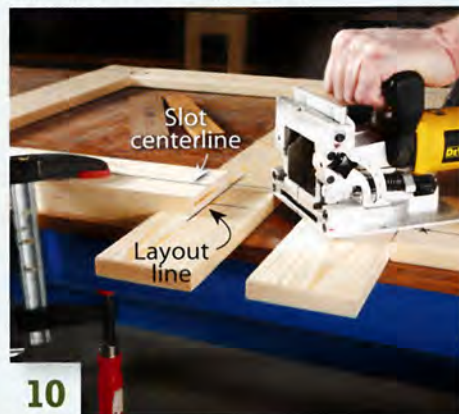
7 **Glue** two legs and two rails together, making a frame. Slide the bottom rail along the spacing block to ensure that the rail is in the correct position.



8 **Cut** biscuit slots along the outer legs of the frames. To create a wider edge for balancing the biscuit joiner's fence, clamp two frames back to back.



9 **Mark** the inner legs to cut biscuit slots for the cross rails. The cross rails go in the middle of the legs, requiring a different method of registering the biscuit joiner.



10 **Clamp** each cross rail on its layout line, flush with the rail below. Cut a biscuit slot in the rail's end. Leave the cross rail clamped in place.



11 **Stand** the biscuit joiner on its end to cut a corresponding slot in the middle of the leg.

part's finished length. (Use the "rough length" measurements in the Cutting List). Use the templates to lay out the crosscuts on your pile of boards (**Photo 1**). Use a miter saw to cut the boards to rough length first, then trim them to final length (**Photo 2**).

Each box you'll build is composed of three frames—two identical "side" frames and one "end" frame. All three frames are joined by biscuits in similar locations. When you cut biscuit slots, you always work off a centerline. All the centerlines for these frames are either 1-1/2" or 2" from an edge. With so many centerlines to draw, it's best to make two marking sticks—one that's 1-1/2" wide and another that's 2" wide (Fig. C). When you draw a centerline, position one stick by butting it against the other (**Photo 3**).

Clamp each frame together in order to draw the centerlines. Make your marks on the inside surfaces of the frames (Fig. B). The marks won't be visible after the planter is complete, so you won't have to erase them later on. Make a pair of spacing blocks to position the bottom rails of each frame (**Photo 4** and Fig. C). Mark a small "x" on the centerlines opposite where each biscuit slot will go, then cut the slots (**Photo 5**).

Next, rout a small bevel on every edge of your pieces (**Photo 6** and Fig. E). This step is optional, but it will make your planter look much better. As you know, biscuit joints don't always come out perfectly aligned—particularly when they're

cut in this wood, which isn't flat. Routing these bevels adds a small visual gap between neighboring pieces (a "reveal"). The pieces will look like they're perfectly even. Without a reveal, you'd have to sand all the joints after gluing them up to achieve the same look, and that can be a lot of work. You can use this bit in a router table or a laminate trimmer (see Sources).

Glue the three frames together (**Photo 7**). Using a popsicle or craft stick, put glue only in the slots. You don't want a lot of squeeze-out, because it's difficult to remove glue from the reveals. Use a putty knife and a wet rag to remove the glue that does squeeze out, before it dries.

After the glue is dry, mark the two side frames to indicate which legs will go on the outside corners of the boxes. Stand each frame up on its legs and clamp all three together in the correct position. Mark centerlines on the outsides of the frames for the biscuits that will join them together (Fig. B). Unclamp the frames, then cut biscuit slots in the legs of the side frames (**Photo 8**). Use the biscuit joiner's fence to position the slots. Cut mating slots in the end frames, again using the fence.

There's one more set of pieces to deal with before gluing the boxes together: the cross rails (H). Cut these pieces 1" extra-long, then trim them so their length exactly matches the width of your end frames. Mark the inner legs of each side frame to indicate where the cross rails go (**Photo 9**), then cut the slots



12

Cut additional biscuit slots in the frames for the planter's middle rails. It's best to cut these slots last, so you don't cut them in the wrong legs by mistake!



13

Glue one end of the planter together. Clamp L-shaped blocks to adjoining sides to ensure the assembly is square.



14

Glue the two halves of the planter together. Clamp "lips" on the upper rails to temporarily hold them in place. Support the lower rails with blocks. Place the shelf inside the assembly to make sure everything stays aligned.



15

Hang the pots by their rims. Be sure to use pots with an attached saucer that collects water. They won't drip!

for them (**Photos 10 and 11**). In addition, cut slots on the inner legs for the middle rails (J and K, **Photo 12**). Use the same centerlines you drew for the side rails.

Glue up each box (**Photo 13**). The best way to do this is to hold each corner rigid with shop-made squaring blocks and proceed in two stages, gluing only one-half of the box at a time. First, glue the cross rails and end frame to one of the side frames, as shown in the photo. Place the second side frame in position, with biscuits—but no glue. When the glue is dry, remove the second side frame and glue it in place. Gluing and clamping in stages gives you more time to spread the glue and to make sure all the parts are in alignment.

Now you can deal with the middle rails. Their length depends on the shelf's length—you'll want the inside dimension of the base to be about 1/4" longer than the shelf. Trim the middle rails to this length, cut biscuit slots in their ends, rout bevels on all of their edges and glue them in place (**Photo 14**). You'll need 4 pipe clamps that open at least 40". Finish the base by making ledger strips to support the shelf (L, M and N). Glue them 3/8" below the top edges of the bottom rails (Fig. B).

Make the top

Cut the front and back pieces (P) and crosspieces (Q and R) to final length. Mark the locations of the biscuit slots (Fig. D), cut

the slots, bevel all edges and glue.

Make fastening blocks (S) for holding down the top. Glue them to the base. From an abundance of caution, I used tabletop fasteners on the side rails—rather than blocks (See Sources). If you're using #1 common wood, it may continue to dry and shrink after you build the planter. As the inner legs become narrower, the base will become a little bit shorter; tabletop fasteners will accommodate this shrinkage. (That's also why the gaps at the ends of the shelf are so generous.) I cut slots for the fasteners with the biscuit joiner.

To prepare for finishing, wet all the wood with a damp sponge. Wetting the wood will cause areas bruised by machining to rise above the surface—and #1 common boards will have plenty of these. Sand with 100-grit paper, then apply one coat of water-based polyurethane to all surfaces. Sand with 240-grit paper, then apply two more coats. Drop in the pots (**Photo 15**) and you're ready to turn it over to the gardener! 🌱

SOURCES

- Porter Cable, porter-cable.com, 23° Bevel Laminate Trim Bit, #43335PC.
- Amazon.com, Bloem Living 8" Lucca Self-Watering Planter, \$12 ea.
- Woodcraft Supply, woodcraft.com, 800-225-1153, Table Top Fasteners, #27N10, \$2.25/10.

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Balls Away!

I'M A BIG FAN of Space Balls, those little rubber balls that install in frame-and-panel constructions to stop rattles and keep the panels centered. I use Space Balls so frequently I buy them by the thousands and keep them in a bin that I store in my parts cabinet.

A few months ago I was assembling a run of interior doors, each containing several raised panels, so naturally, I'd stationed the Space Ball bin on my bench. Unfortunately, as I moved the last assembled door from the bench to my clamping table, it clipped the bin and knocked it to the floor.

Instantly, my shop was filled with Space Balls zinging in every direction, just like those crazy Super Balls from the '60s. I spent the rest of the morning recovering the little suckers, which ended up in every corner of the shop. And to this day, I'm still finding holdouts.

Mark Claypool



Fibrous Finish

AFTER SANDING the walnut bead loom I'd made for a friend, I discovered I didn't have a tack cloth to wipe it down prior to finishing. So I used one of those disposable floor-duster cloths instead. It removed all the dust and seemed like a perfect tack-cloth substitute ... until I noticed micro-fibers snagged all over the loom.

I sanded again and thoroughly wiped the loom with a T-shirt. Then, thinking I'd removed all the fibers, I applied the first coat of poly.

But there they were still, tiny vein-like fibers covering every surface. My friend now has a beautiful bead loom that looks somewhat fuzzy.

Dean O. Travis

Correction

The illustrations in "Wooden Bar Clamps" (AW #166, June/July 2013, page 59) show the threads on the screw and inside the head block pitched left-hand instead of right-hand. Fortunately, the woodthreading kit shown in the story (and listed in the Sources) makes right-hand threads. Of course!



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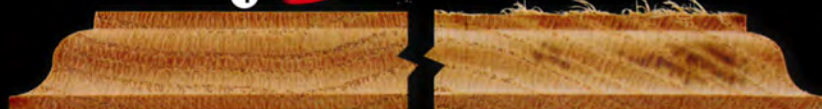
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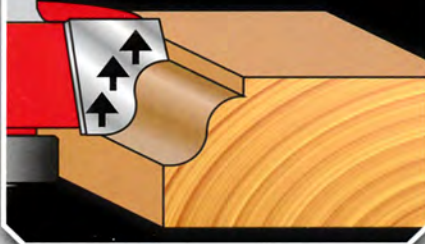


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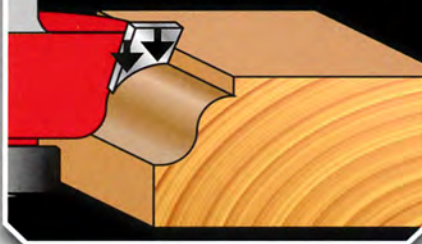
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