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The Editor's Angle

Two good deeds
I wish we had done earlier!

About a decade ago, my in-laws had a death in their family that required them to be away for Christmas. After some discussion, the rest of us decided to wait and celebrate when they returned. Doing that turned out to be the luckiest thing we have ever done.

Sitting around the kitchen table, we decided we'd like to somehow make Christmas less commercial. I forgot who it was, but someone mentioned going to a local residential care facility on Christmas Eve to spread some cheer. We baked some cookies, the kids made and then decorated enough greeting cards for all of the facility's residents, and then we piled into my brother-in-law's van.

As it turns out, we did have, but they were in pretty rough shape. So several of us spent some time one afternoon touching up and repairing the ornaments. As you can see in the photo, the residents reacted favorably to the colorful ornaments that we presented to them. And according to Steve Mueller, executive director of The Homestead, the ornaments helped raise the spirits of families and staff, too.

I relate these experiences to you because I'd like to encourage you to use your woodworking talents to bring joy to those you know, and even those you don't. There are plenty of opportunities to do good. And believe me, by getting involved, you will receive much more than you give.

Larry Clayton

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A screwy difference between countries

After reading in issue #103 of WOOD magazine about “Robertson” and “square-drive” screws, I decided to do some research. To my surprise, I discovered that they are actually two different products.

It turns out that when Canadian Peter Lymburner Robertson patented his screw head and driver, he specified that they only be manufactured in Canada. After its introduction, though, U.S. woodworkers discovered the advantages of the Robertson screw and began requesting it.

Because of trade limitations, U.S. manufacturers developed the “square-drive” screw and driver. The two products are just slightly different. The Robertson’s socket has a slight inward taper, and the square-drive screws have square-cornered sockets as shown below.

—Tom Rawley, Cambridge, Ontario

It’s better to shim than punch tailstock

I was shocked when I read the article, “Tuning Your Lathe” in issue #101. Shocked, because it’s a bad idea to center-punch the tailstock to raise it. I have been in machine repair for 37 years, and believe this a temporary fix at best. Those sharp center punch marks will eventually score the ways, and create bigger problems than what you started with. It would be far better to raise the tailstock with brass shims. Shim stock is available in .0015” and thicker for this purpose. I suggest leaving the stock long, bending the material up on the ends as illustrated below, and fastening the brass to the tailstock using ¼” pop rivets or metal screws.

—Ken Klass, Orchard Park, N.Y.

Let us know what’s on your mind

We welcome your comments, criticisms, suggestions, and yes, even compliments. We’ll do our level best to publish letters of the greatest benefit to all of our readers. Write to us at: Talking Back, WOOD Magazine, 1912 Grand Ave., Des Moines, IA 50309-3379.
Turning scraps into teaching tools

Pete Stephano's article in the January 1997 issue, "Woodworkers to the Rescue," made me want to share a way that almost any woodworker can help others. Many woodworkers have saved small pieces of hardwood—pieces too big to throw away and too small to ever use. These scraps, along with ¼" dowels, can become indispensable by turning them into alphabet blocks for kids trying to learn Braille.

—Ray Duffee, Boone, Iowa

Ray, we were so intrigued by your idea that we contacted Nancy Lavack, of the Texas School for the Blind and Visually Impaired. Nancy told us that while there is some need in the U.S., other countries need these materials even more. One school in Nigeria has over 400 unsighted children and virtually no teaching tools.

Readers, if you're interested in helping out, write to Nancy and she will send you a Braille chart with the 27 symbols you need to know. Every Braille symbol consists of different combinations of dots placed on a six-point grid. With 27 combinations, your set will help a child learn all the letters and numbers. Making extra blocks for some of the letters, like vowels, will allow the kids to spell simple words. If you want to spend an afternoon making a set, here are some tips that will help.

1. Make the blocks: Cut the scrap into ¾" x 2½" x 3½" blocks. Each block will require from one to five ¼" dowel pins. Drill the necessary ¼" holes ⅜" deep, using the grid shown in the illustration right. Round the edges, and sand each block.

2. Make the pins: Cut the ¼" dowels into pieces ¾" long. Sand the tops to a round shape so they will better simulate the actual Braille type children will eventually read. Then, glue the dowel pins in the holes.

3. Leave the blocks unfinished: Blind children must "see" with their fingers, noses, and ears. Leaving the blocks unfinished gives the children an opportunity to feel and smell the differences between wood varieties. Consequently, not only will they be learning to read, they will begin to understand and appreciate wood. So, feel free to use a wide variety of woods in a set. Of course, avoid potentially toxic woods, such as cocobolo.

4. Mark the blocks: So the kids will know which end is the top, saw a ¼" kerf in the top of the block. Also, write the kind of wood and the character represented on the back of each block. This way, even teachers who don't know Braille or wood can help kids learn with your blocks.

To receive a Braille chart and additional information, write to Braille Blocks Project, Texas School for the Blind and Visually Impaired, 1100 W. 45th St., Austin, Texas. Remember, postage and materials are tax deductible, and you just might help someone learn to love wood as much as you do.
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Woodworking's Greatest Hits
You'll be in the swing with these handy hammers

Woodworkers accustomed to putting pieces together with screws and glue might not think of a hammer as an essential tool. But even if you don't drive 16-penny nails, here are two hammers and a mallet that will earn their keep in your shop.

---

**Nail hammer: the old woodworking standby**

While most carpenters rely on a 16- or even 20-oz. nail hammer, a lighter one, say 12 or 13 oz., often serves cabinetmakers and furniture makers best. One like the 12-oz. claw hammer, shown left, fills the bill for general woodworking use.

If you drive a lot of small brads or escutcheon pins, try a Warrington pattern hammer as your nail hammer. Instead of the usual nail-pulling claws, this one has a straight cross peen, shown right. The narrow face makes starting small nails easy, as shown.

---

**Dead-blow hammer: a solid hitter with a gentle touch**

The dead-blow hammer's hollow head, filled with steel shot, delivers a solid blow without rebounding. Some dead-blow hammers feature replaceable steel or plastic faces. For woodworking, however, we prefer a 14-oz. urethane-encapsulated type, shown below.

The resilient covering, coupled with the no-bounce hit, minimizes surface marring when you use this hammer against wood. There's no better tool for tapping joints together or knocking them apart. You usually won't have to take mighty swings with this hammer, which also prevents damage to project parts.

Use a dead-blow hammer for:
- Assembling/disassembling joints.
- Aligning parts.
- Setting dowels or splines.
- Adjusting/tuning tools.

Don't use it for:
- Striking chisels.
- Driving nails or other fasteners.
- Hitting sharp objects that could damage the covering.

Continued on page 10
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New FEIN “Multi-Master” Saws Flush to any Surface

Now you can saw flush to any surface with your FEIN “Triangle” Sander. The newly named FEIN “Multi-Master” comes equipped as a Detail Sander, but now also includes a Flush cutting blade, and a Scraper blade.

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It’s easy to get more information, simply call: (800) 441-9878 and ask for a free color brochure.

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WHAT WOODWORKERS NEED TO KNOW
Continued from page 8

Woodworking’s Greatest Hits

Wooden mallet: your best bet for striking a chisel
If you own woodworking chisels, you need a wooden mallet like the one shown below. It’s the tool best suited to driving chisels.

The mallet’s large, flat, angled faces ensure that you’ll hit the chisel squarely every time. Hitting the end of a chisel with a nail hammer’s small face calls for unerring aim and concentration—which means you end up watching the top of the chisel handle when you should be paying attention to the sharp end. (A steel hammer head can clobber up a wooden chisel handle pretty badly, too.)

Count on a wooden mallet for:
• Striking woodworking chisels—the tool’s main purpose.
• Assembling or disassembling joints.
• Aligning parts.

Don’t use it for:
• Striking anything metal or sharp.

Check out these commonsense hints for hammering
Hammering is practically instinctive. Nonetheless, observing a few rules will make it safer and easier.

✔ Always wear eye protection. Any number of things can start flying around when you’re wielding a hammer, many of them sharp. And most of them will fly right toward your eyes.

✔ Strike only on the face or peen of the hammer. Never hit with the side of one.

✔ For greatest power, grip the handle near the end, placing your thumb along the top of the handle. Take a long swing, using your arm, not just your wrist.

✔ For more control on delicate jobs, choke up toward the hammerhead, and take a shorter swing. Here you can swing from your wrist.

✔ Don’t use a hammer with a damaged handle, loose head, or chipped face. Beware of old hammers, too. Some may have cast-iron heads, which can shatter. Virtually all hammers manufactured today feature forged, heat-treated heads.

Photographs: Hetherington Photography

New FEIN “Multi-Master” Saw Flush to any Surface

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If you've considered making your own custom windows or French doors, but thought the task was a little too involved, here's a bit set that helps you get great results without a lot of fuss. Window sash sets consist of two bits like those above. With them you can make traditionally styled rail-and-stile frames with coped joints and a rabbeted side for accepting glass. You can also make the narrow sash bars and muntins for holding multiple panes of glass (our window right shows four panes, but your window or door may have many more depending on its size). All of the coped joints are reinforced with tenons for long-lasting durability.

Because you will plow these bits through 1/4"-thick stock, they come with sturdy 1/4" shanks. For safety and good results, use them with a router rated at 1 1/2 hp or more mounted in a table. All set? Let's go through the easy steps in using this bit.

1. Cut your stiles, rails, sash bars, and muntins to width and length from 13/4"-thick stock. Here's how to calculate the lengths of your parts, using an 18x24" window with 3"-wide rails and stiles as an example.

   First, cut the stiles to the full height of the window (24"). To figure rail length, subtract the combined width of the stiles (6") from the finished width of the window (18"). To this number (12"), add the length of two tenons (1 1/4" + 1 1/4")

Continued on page 14
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and ½" (for the coped joint). So, for our example we cut the rails 15" long. Cut the sash bars and muntins ¾" wide and calculate their lengths as you did the rails. (Plan to cut 1¼"-long tenons on both ends of the sash bar and muntins; you’ll trim the muntin tenons that intersect with the sash bars to ¼" long later.)

2 Mark the face side of your workpieces (the inside surface of your window or the most-viewed side of your door). Also mark the outside edges of the rails and stiles, and place marks centered on the rails and stiles where they intersect with the muntins and sash bar, and on the sash bar where it intersects with the muntins.

3 To cut 1¼" tenons on both ends of the rails, sash bars, and muntins, install a full-width dado set in your tablesaw and adjust it for a ¾"-high cut. Position the saw’s fence 1¼" from the side of the dado set farthest from the fence. Place the workpiece on the tablesaw face down with one edge against a miter gauge, and one end against the fence. Make the cut in multiple passes as shown below.

4 Position the rail, sash bar, or muntin face side up on the tablesaw. Place a ½" spacer between the workpiece and tablesaw top as shown below, and make the same cut as described in the previous step. Your tenons should be ¼" thick.

5 Complete the tenon cuts on the rails by placing them outside edge down on the tablesaw. Make multiple cuts with the dado set ¾" high as before.

6 Install the coping bit in your router table. Place the face side of a rail on the table and adjust the coping bit up so the tops of its cutters contact the tenon. With the fence adjusted so the coping bit cuts ¼" past the tenon shoulder, cut both ends of the rails, sash bar, and muntins. (For a 1¼"-long tenon, set the fence ¼" from the cutter tip with the tip rotated to its farthest distance from the fence.)

7 Mark the positions of the mortises on the stiles by using the tenon that mates with it. First, as shown below, stand the stile inside edge up on a work surface.
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and position the rail to mark the length of the mortise. Then, rest the rail on top of the stile as shown above to mark the mortise width. Use the same steps to mark the position of the mortises that hold the sash bar and muntin tenons.

Cut the mortises ¾” deeper than the length of the tenons. The mortise in the sash bar will go completely through it.

9 To perform the same operation on the sash bar and muntins, clamp a secondary fence onto the router table as shown above. Make this fence from 1¼”-thick stock, and position it so the sash bar and muntins slide snugly between it and the main fence.

10 Mold both edges of the sash bar and muntins. Use pushsticks to pass the stock between the fences. Use a fine-toothed saw to remove the small amount of material on the outside end of each stile mortise as shown in the illustration above and in the Stile Detail drawing on page 12. If you make more than one window or door you may want to set up a router table with a straight bit to do this more quickly.

Now’s a good time to trim the muntin tenons that intersect the sash bar. Cut them to ¼” long.

11 Assemble the project without glue to check for fit and squareness. Disassemble, apply glue to all mating surfaces, and clamp. Check for square again before the glue sets up.

12 Install the glass in the rabbeted openings on the back face of the door or window. Each pane should be ½” smaller in width and length than the rabbeted opening it fits into. Mount the glass in place with glazing points and glazing putty, or with quarter-round strips of wood mitered on their ends and nailed down (see the Glass Stop Detail drawing on page 12).
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Hold it! These hold-downs are homemade

While building a project, I found myself needing a hold-down clamp. Because I live over 200 miles from the nearest home improvement center, I thought I'd try to make my own. The clamp shown below works so well, I've made several more since.

I cut the handle, arm, and base from scraps of hard maple. To make the shoe, I ground the head of a carriage bolt flat and epoxied a faucet washer to the head.

The clamp screws to a jig or fence from the bottom, but when that's a problem, I bolt it to a larger plate, then screw the plate to my work surface. You can also accommodate thicker workpieces by making a taller base, or by inserting a spacer to raise the clamp height.

—Allan Kruger, Eagar, Ariz.

Tips From Your Shop (And Ours)
WOOD Magazine
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Visit our web site at www.ppgaf.com INTERIOR PRODUCTS
Speedy sorter for mixed nuts (and bolts)

I collect nuts and bolts like a magnet. But I couldn't use them if I couldn't find them, so I needed a way to quickly size and sort them.

In a piece of scrap lumber, I mounted T-nuts of the most common thread sizes, and wrote the size of the nut next to it. I drilled a hole at the top of the sizer, and hung it on the pegboard over my workbench.

Whenever I have bolts left over from a project, I try them in each hole of the sizer until I get a fit, then store them according to size.

It works so well, I made another one to sort nuts, by putting bolts through the T-nuts from the back.

—Jim Jaffe, Hawthorne, N.J.
Rack keeps extension cords at the ready

After watching me wrestle with a 50' extension cord to wind it back onto a flimsy plastic holder, my wife suggested a more convenient solution—a wall-mounted rack next to the electrical outlet. The rack I built, shown below, leaves both hands free to wrap up the cord. To make the cord easier to remove, I installed “latches” that swivel out of the way.

—Michael Ward, Spring Valley, Ill.

Custom pushblock safer for small pieces

I needed to chamfer the edges of a small block of wood to make a decorative post cap. But when I tried to use my regular pushstick, the tablesaw blade twisted the block away from the fence, gouging the workpiece beyond repair.

To keep the workpiece under control, I built a custom pushblock from 2x4 scrap, as shown at right. By cutting a notch in the scrap to fit the workpiece, the pushblock holds the workpiece firmly when making the cut, and prevents the saw blade from twisting and pulling the stock away from the fence.

—Richard Rosencrans, Cody, Wyo.

Continued on page 24
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TIPS FROM YOUR SHOP (AND OURS)

Continued from page 23

Powder prevents stuck spindle sleeves

I love my oscillating spindle sander, but when I wanted to change grits, the sanding sleeve invariably stuck to the rubber drum. My wife Lyn suggested I put a little talcum powder on the drum before I slipped the sleeve on. Sure enough, I haven’t had a stuck sleeve since.

—Peter (and Lyn) Hurney, Kailua, Hawaii

A FEW MORE TIPS FROM OUR WOODWORKING PROS

- For projects requiring a smooth graceful curve, try using a fairing strip as shown on page 40.
- Making louvers is a snap using our jig and process described on page 74. The jig allows you to make mating pieces with perfect consistency.
- Instead of smashing your fingers or trying to hold small brads with a comb, try a Warrington pattern hammer. Read about it on page 14.
- To make thin, narrow stock safely, read how we cut the springs for the pinball gum ball machine on page 54.

Sanding drum

Apply talcum powder to drum before sliding on sanding sleeve.

Sanding sleeve

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A surefire way to free frozen screws

It never fails: Every time I want to remove a screw from a piece of wood, I strip the head before I get the dang thing to budge. Is there something I can do to help free these frozen screws?

—Jason Bane, Dallas

With time, Jason, wood tends to swell and settle in around the threads of a screw, and 99% of the time, that's exactly what we want. But for those other occasions, try this.

Slowly heat up the screw head with a soldering iron. Be careful, though. Too much heat, too fast, will scorch the wood and finish around the screw. As the screw gets hot it will expand and push the wood away from it. This heat will also break up glue, finish, and other chemicals sticking to the threads. Keep the heat on for a couple of minutes, allowing time for it to work. Then, quickly hold an ice cube on the screw until the ice quells steadily dripping. The metal will shrink, the wood will swell, and the screw should turn right out.

Repairing a mirror image

I've just finished restoring an antique dresser with a round, beveled mirror on it. The wood looks so good now that the flaws in the mirror really stand out. There are places where the silvering has come off the mirror, leaving spots of clear glass. Is there something I can do to fix the mirrored look, or am I going to have to replace the whole thing?

—Robert Boulineau Sr., Wrens, Ga.

As long as the glass itself isn’t etched or discolored, you can fix that antique mirror yourself. Start by removing all the old silver. Use paint remover, and carefully scrub it away with steel wool. Then have a thin, flat mirror cut at a glass store to exactly the same size. Mount the new mirror behind the now clear beveled glass, and for half the cost of resilvering, it’ll look like new.

Since we’re talking about an antique, Bob, replacement should always be the last choice. Other options exist that you should explore first.

If the spots aren’t too bad, you can touch them up. There used to be a product on the market for home resilvering, but it has since been pulled from the shelves for environmental and safety reasons. Instead, try applying silver fingernail polish in place of the missing silver. You won’t get a perfect match, but the spots will be much less noticeable, for not much money.

If the mirror is beyond touch-up, resilvering is a second option, though there aren’t many businesses that provide this pricey service anymore.

Have a question for our woodworking experts?

No matter how simple or perplexing your woodworking problem, we would love to hear from you. We’ll do our level best to publish answers to questions that interest the greatest number of our readers. You can write to us at Ask WOOD®, 1912 Grand Ave., Des Moines, IA 50309-3379.

Or, visit our internet page and ask your question in one of our discussion groups at: http://woodmagazine.com
Homemade ornamental tools

I plan to turn some Christmas tree ornaments on my lathe, and the plans call for them to be hollowed out to reduce the weight of each ornament. What material should I use, and how can I make hollowing-out tools that can fit into small holes?

—Rudy F. Hrelechek, West Allis, Wis.

To make your own small turning tools of any kind, Rudy, we suggest starting with Allen wrenches. They’re inexpensive, made from good steel, and are readily available in a wide range of sizes.

Start with the largest Allen wrench that fits into your project. This will help dampen vibrations and lead to a smoother cut. Grind a beveled scraper-type end as shown below that forms a profile to meet your needs. Then, grind flat a reference surface for the cutting edge that’s two or three wrench diameters long and parallel to the wrench axis as shown below. Now, grind a bevel. This relief is called the rake angle. On inside work of a small-diameter vessel, such as a Christmas tree ornament, you’ll need a rake angle greater than 10°.

To help control and hold your new turning tool, grind the bottom flat where it sits on the tool rest, and make a wooden turned handle for it.

Grind to desired shape

Reference surface

TOP VIEW

Grind to desired shape

Reference surface

SIDE VIEW

Rake angle at least 10°

Reference surface

Ground surfaces

Allen wrench

Continued on page 28

(A) 68-year-old company known for its quality tools has hit the nail on the head with a new staple+nail gun that shoots six different size staples and can drive a 5/8-inch nail as well (far left). Also shown is a new model staple gun that shoots both round crown staples and flat crown staples (far right).

(NAPS)—Interest from homeowners to professional handymen is building in two remarkable new multifunctional tools.

One can shoot six different size staples and drive a 5/8-inch nail as well.

The other shoots flat crown staples for general usage and round crown especially for all the cable and wires that need to be tucked away at home.

The new staple plus nail gun product, from Arrow Fastener Co., is reported to allow a user to accomplish a wide variety of jobs because of its six different size staples: 1/4-inch, 5/16-inch, 3/8-inch, 1/2-inch, 9/16-inch and 17/32-inch ceiling tile. Jobs that can be done range from delicate upholstery work to installing carpeting, carpet padding, ceiling tile and more. When the staples are removed and a strip of 5/8-inch nails are loaded into the machine, users can trim and decorate door panels, install moldings, fix table edging, or build doll houses and toys for the youngsters.

The Arrow T50PBN is all steel with high carbon hardened steel working parts to give it added years of dependable performance. The tool is quickly identified by its high visibility cushioned non-slip grip.

The company has also released a new Dual Purpose staple gun called the T2025”. The new model shoots both round crown staples and flat crown staples. Round crown staples are used to install wire and cable, while the familiar flat crown staples are used for every routine stapling job from putting down carpet padding to installing installation.

Arrow Fastener, a 68-year-old American company, manufacturers a variety of products, for professionals, handymen and hobbyists, that are sold throughout the world in hardware stores, lumberyards and home centers.
**Ask Wood**

Continued from page 27

**A dye-hard finish**

I'm thinking of trying aniline dyes, but am not sure which type to try. I am wondering when it is best to use the kind that is mixed with water, and when to use those that are mixed with alcohol.

—Mark Nelson, via internet

---

Aniline dyes come in a powdered form and in a wide variety of colors.

There are some definite advantages to using aniline dyes as an attractive alternative to premixed pigmented stains. Pigmented stains coat the wood. Aniline dyes completely dissolve and soak into the wood. The color is "in" the wood, not on it, and you'll see the grain like never before! With six or seven basic colors available, you can mix about any tone you like.

Most anilines are water soluble because of their ease in mixing. But, different bases will give a different color. For instance, alcohol-soluble anilines give colder, greenish tones when mixed with the same dye that gave warmer, reddish tones in water. Dyes are inexpensive enough that you can afford to experiment.

A couple of points to be careful about when working with water-based dye. One is that the water from the solution will probably raise the grain of the wood. You can remedy this by dampening the wood and sanding before you dye, or fine sanding (220 grit) after you dye. Also, a water-based sealer will react to the water-based dye. So, apply an oil-based sealer coat after the dye, and then you can finish with whatever you like.

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**Wood Magazine**

August 1998

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The lake states’ lumber tree

Anyone who has spent time hiking the northern shores of Lake Superior and Lake Huron or in Michigan's Upper Peninsula finds memorable the vast stands of pine. Much of the spectacular scene, though, results from extensive plantation plantings by forest products companies, state forestry departments, and the U.S. Forest Service. And, while Mother Nature traditionally mixes white pine with red, spruce with fir, and adds dashes of birch, ash, and aspen, men planting forests for future timber production feel no such compulsion. That’s why after the turn of the century’s great log harvests, foresters replanted much of the felled forests with seedlings of red pine, a hard-wooded conifer trusted to grow quickly and straight.

That’s the reason the standing volume of sawtimber today in the Great Lakes states consists of great quantities of red pine. In Wisconsin, nearly 34 million board feet of red pine saw logs were harvested in 1995, a figure greater than that for any other of the state’s timber species. The wood meets the needs for strong dimensional stock in construction and for flooring, door and window frames, and other millwork. Red pine logs are also popular for rustic homes and cabins.

Wood identification

Commonly called Norway pine because of an early mistaken association with a similar-looking species found in that country, red pine (Pinus resinosa) is truly a tree of the North. Its primary range extends from eastern Canada to northern-most Minnesota and south to Pennsylvania and southwest Wisconsin. It thrives in the sandy soils of the Great Lakes region and does well in the dry gravels of New England. In prime conditions, red pine annually grows a foot in height for its first 60 years, then growth tapers off to maturity at 100 years. The tree can attain a height of 140' with a diameter of 4'. The average tree, however, runs 60-80' tall with a diameter of 2-3' at breast height.

The most recognizable feature of the red pine is its reddish brown bark divided into flat, irregularly shaped, flaky scales. This thick bark protects the tree from fire and insects. Red pine’s dark green, glossy needles of 4-6” in length appear in pairs. In the spring, small purple blooms occur near new growth followed by round, red flowers. Conical seed cones are produced every two to four years, and remain high in the tree’s crown. Where the tree is grown for timber, the hard-to-gather seed cones fetch a good price.

Although red pine’s Latin name implies large amounts of resin, its wood is comparatively non-resinous. At 33 pounds per cubic foot air-dry, it’s a bit heavier than either Douglas fir or eastern white pine. Bordered by a thick layer of light yellow sapwood, the light red heartwood is both straight- and close-grained, and moderately strong. When seasoned, the wood remains stable in use.

Uses in woodworking

Use red pine for the same projects as eastern white pine, with which it was once marketed. That means furniture and cabinets as well as doors, sash, shutters, and trim. Don’t use outdoors unless treated.

Availability

As dimension lumber and boards, you’ll find red pine at most outlets throughout its range. Boards in common grades (Nos. 1, 2, etc.) cost about $1.25 per foot. Wide boards (over 12”) and clearer finish grades (C, C&Btr.) cost more.
Although red pine will grow to 4' diameter, such a large tree is rare today. That's because most of the harvest comes from plantation plantings where trees run smaller. Therefore, wide boards prove scarce. But at the same time, plantation trees growing close together produce wood with fewer knots and straighter grain. With those positives in mind, pick boards for your project that contain the smallest amount of light-colored sapwood (unless you like contrast).

You'll be lucky if you run across red pine that's been kiln-dried to 6 percent moisture content. In the construction industry, where most of this wood goes, 12 percent is considered dry. Look for the stamp "KD15" or "MC12" on boards that indicates a moisture content averaging 15 or 12 percent.

Be sure to stack and sticker the wood in your shop for a week or two so it can acclimate before working it. Then, keep the following tips in mind.

**Machining methods**
- Red pine may be strong and stiff, but as a softwood, it's not hard. So you can work it with either hand or power tools.
- If you have worked white pine, expect more pitch in red. This means that to avoid burning and blade wander caused by pitch buildup during ripping or routing, you'll have to occasionally clean cutting edges with acetone or other solvent. A Teflon-coated blade or cutter also works well.
- This wood will also chip and splinter on cross-grain cuts—always use a backing board.
- Because of the pitch, drilling can also cause burning. Drill this wood at a faster speed than hardwood, but be sure to back the bit out of the hole every so often.
- Only sap pockets in a joint will hinder adhesives. If you can't avoid it, wipe the pocket or knot with acetone before gluing.
- Seal all knotholes or sap pockets with shellac before painting.
- To reduce chances of blotchy staining, first seal the wood with a washcoat of thinned shellac, use wood conditioner, or rely on gel stains for even coloring.
- Under a clear finish, red pine will darken and yellow with age.

**Carving comments**
- Red pine has departures in softness between early wood and late wood, making detail work difficult.
- Remember to clean gum buildup from power tool cutters.
- Limit long cuts with the grain due to this wood's tendency to splinter.

**Turning tips**
- Should resin droplets emerge on your work, let them dry, then scrape off before finishing.

**SHOP-TESTED TECHNIQUES THAT ALWAYS WORK**

- For clean cuts, rip with a rip-profile blade that has 24-32 teeth. For crosscutting, use a blade with about 40 teeth.
- Avoid drilling with twist drills. They tend to wander and cause breakout. Brad-point bits work better. Always use a backing board under the workpiece.
- Drill pilot holes for screws.
- Rout with sharp, preferably carbide-tipped, bits and take shallow passes to avoid burning.
- Carving softwoods generally means fairly steep gouge bevels—20° or more—and deeper cuts.
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Shaker's Maine Man

Thomas Moser has rekindled America's appreciation of Shaker style.

Continued
I

If it weren’t for Thomas Moser, the furniture designs of the Shakers would probably still be residing mostly in museums. True, a few discerning craftsmen did and still do reproductions. But for the past 25 years, more of the straightforward chairs, desks, stools, tables, and other furniture reminiscent of 1800s Shaker style have made their way into homes from Moser’s shop than from any other.

In 1998, though, the term “shop” is a misnomer. Rather, it’s a 60,000-square-foot facility neatly nestled on the outskirts of Auburn, Maine. Yet, the gilt-lettered sign outside reads “Thos. Moser Cabinetmakers” rather than “Moser Manufacturing.” And that alludes to the secret of Thomas Moser’s successful rise from a lone woodworker building pieces one at a time to head of a furnituremaking business that continually satisfies the demands of customers numbering in the thousands.

Moser’s philosophy: sales allow creation

Thomas Moser was born in 1935 in suburban Chicago. His father was a stereotyper who laid out printing plates for newspaper presses. Tom, though, became a college professor at Bates College in Lewiston, Maine.

“After 10 years of that, I was feeling a sense of incompleteness. I had always enjoyed making things,” Tom says, the twinkle in his brown eyes indicating that he still does. “My wife, Mary, and I for years restored old houses and antique furniture. That’s how I got interested in woodworking. I learned by taking apart antique furniture—so my tutors were 18th- and 19th-century craftsmen. I had to teach myself their skills. Because of them, my work has always had a historical side.”

When Tom finally started a woodworking business, it admittedly wasn’t much. “Mary and I began it in an old Grange hall in New Gloucester, Maine, in 1973. I had a 10” Sears tablesaw, a Skil belt sander with a 4”-wide belt, a 24” bandsaw, and some hand tools. That was it.”

Today, Tom is still learning. And it just may be the learning that keeps up his enthusiasm for the business. However, he’ll give you other reasons.

“I believe there are four reasons we’re in business. One is that we like to spend our days here. Almost half a person’s waking life is spent working, so it better be enjoyable,” Tom says reflectively, then continues. “The second is the furniture and the quality that we build into it. What we’re making should last for generations. The third is efficiency. How do you make stuff? Are there ways to build it more efficiently? And the last reason we’re in business is to make a profit. That’s a by-product. I sell furniture in order to make it. I don’t make it in order to sell it.”

Little boards from big boards: factory efficiency

“When I started in woodworking, I had no ambition to build a big company,” Tom explains as he inspects a batch of chairs destined for a university library. “I only wanted to rediscover the craft. I made furniture and Mary sold it. Then I hired a helper. Pretty soon there were four. Next, we grew to six. Why did we grow? Because the possibilities were there.”

The growth of Tom’s furniture-making wasn’t without detractors, he points out. “The minute you grow you’re going to lose quality. The second you start dividing labor you’ll get mediocrity.” But I proved that none of those things are true.

Despite its size—Thos. Moser Cabinetmakers now numbers 58 in production and another 25 or so in administration—quality indeed gets attention. It’s evident everywhere, but begins with the wood.

“Our furniture cherry comes from the Allegheny Mountains in Pennsylvania, where the best cherry grows,” comments Tom. “We specify 100% red on one face, 95% red on the second face. That means very little sapwood. We don’t want sap streams running through the furniture. That specification alone triples the cost.”

The company also inventories white ash for chair spindles, stool legs, and other round pieces, and walnut and maple for custom work. The stock runs from 16/4 (4”) to 4/4 (1”) in thickness.

“This is where the business is made or broken,” says Tom with a sweep of his arm around the wood-storage room. “If the wood selection isn’t proper from the very get-go, the furniture is going to be mediocre. When wood is pulled for a project, it is laid out, color matched, and grain matched. If a guy lost interest for three

Continued

36
Photo left: Today, Tom’s major role in the furniture company is to design pieces to add to the line. Here he works on a clock prototype with associate Rick Foss to get out the wrinkles for production.

Each continuous arm for a chair is built up of 10 \( \frac{3}{10} \) -thick pieces of cherry. Larry Mosqueda frees the arm lamination from one of the machines that bent it to shape under 20,000 pounds of hydraulic pressure.

To create the final shape of a continuous arm, Eric Simons first routs the edges. Then, over the course of an hour, he works the wood by hand with a rasp.

Glen Dehetre, one of the 58 hands-on craftsmen at Thos. Moser Cabinetmakers, takes pride in the small cherry chest he’s just completed. He and the other cabinetmakers use pneumatic tools for accuracy.
Photo right: The division of labor is evident at the Moser facility. This area, marked by wood parquet floors, is where the cabinetmakers assemble furniture. The parts production area sits on concrete.

Cindy Morin rubs boiled linseed oil into the post of a bed. When the coats of applied oil have dried, she'll rub on a coat of paste wax, then buff the entire piece.

Final sanding on Moser furniture is done with 400-grit. The platform on which the chair stands adjusts up and down to eliminate bending by the employee.

The dovetail joints on this cherry blanket box are representative of the detailed, fine joinery in Thos. Moser furniture.
from 1/8-inch cherry laminations, we do wood wants to do,” Tom says. “If we steam-bend it to shape. At Thos. Moser Cabinetmakers it’s made from 1/4-inch cherry, then lay it up as it came away from. We get our efficiencies here,” he says. “This is almost like a factory. But the concept is serial production, not mass production. We replicate parts to capture efficiencies in set-up time. Set up once, make parts for 40 or 60 or whatever. We don’t make furniture from lumber. We make furniture from components.

“We have enough parts on hand to build certain amounts of what we produce,” he adds. “The worst thing is to not have one part and make it by hand. There goes the profit right out the door!”

Consistency adds quality to the product
The Continuous Arm Chair is the benchmark of Thos. Moser. It has changed little in over 20 years. One secret to the enduring popularity of this signature piece is the flowing, curved back.

Most furniture factories would turn the wood on a lathe, then steam-bend it to shape. At Thos. Moser Cabinetmakers it’s made from 1/8-inch cherry laminations, then bent to shape by machine. It looks one-piece.

Tom explains: “We knife-cut the cherry, then lay it up as it came from the board. When the pieces are glued back together with aliphatic resin glue, then hydraulically pressed at 20,000 pounds pressure, no one will ever know that the wood was ever apart.”

While the rough, laminated chair-arm blank is in the press, a radio frequency modulator sends a 5,000 megahertz signal through the wood. This aligns the glue molecules like metal filings on a magnet. “That’s how we get absolute consistency from one bend to another, through all the arms. We actually change forever what this wood wants to do,” Tom says. “If we do it right, when we rasp these arms—an hour of handwork per arm—you won’t see the seams.”

The division of labor at Thos. Moser Cabinetmakers is obvious. Tom has separated the workplace into a “machine” area with a concrete floor and a “people” area with a wooden floor, both equally important in creating truly fine furniture. But it’s in the people area where the craftsmen at their own workbenches assemble the furniture. “These are the men and women who actually have their hands on the work that is going to people’s homes,” he notes. “They’re my cabinetmakers.”

To ensure more accuracy, such as in drilling, workbenches have three air lines to power pneumatic tools. “With air, they have more control, and it makes the workplace a lot quieter. Plus, there’s no vibration,” Tom says.

“We use very low-tech finishing methods,” Tom explains as he strides through the rows of naked furniture awaiting final finishing. “Lots of sandpaper, boiled linseed oil, and wax. Every piece is sanded to 400-grit, which polishes the wood. Then, we spray the oil on and let the piece sit before wiping off the residue. That’s done three times. When the piece is dry, it’s waxed with wax mixture, then buffed by hand.”

But before a piece is oiled, it’s signed by one of the cabinetmakers. “It’s in ink and should last as long as the furniture.”

“Well-designed furniture is a piece that nothing can be added to or taken away from.”

Well-designed furniture is a piece that nothing can be added to or taken away from.

The Shakers have noticeably influenced the designs of Thomas Moser, and he gives them due credit. “I like the work that they did between 1830 and 1850—the Golden Age of Shaker design,” Tom comments. “I also respect the Scandinavian designers of the 1950s. To me, the economy of form and materials is important. I like quiet performance, and the Shakers and the Scandinavians understood this. Well-designed furniture is a piece that nothing can be added to or taken away from. It’s a perfect balance.”

Tom also believes that a well-designed piece of furniture will still look “at home” 100 years from now. And it should be worth more then. “I can’t think of any major American furniture manufacturer whose products are worth more today than they were 20 years ago,” he says. “But I would say that our furniture is. In fact, I’ll buy back our furniture for three times what people bought it for—and be glad to because it appreciates. The chairs we now sell for $800 to $900 I used to sell for $240.”

In Tom’s view, of all the furniture in the Thos. Moser line, the Continuous Arm Chair probably fits his design parameters best. Sitting back in his desk’s armchair, he almost seems to be thinking aloud: “If any piece of furniture goes on into the next century as kind of a symbol of what we are, it will be that. Maybe 100 years from now, somebody, someplace, is going to say, ‘Oh yeah, there was a guy, there was a company in Maine, that made that chair.’”

Get a catalog from the cabinetmakers
For a copy of Thomas Moser’s 38-page color catalog, send $3 to cover postage and handling to: Thos. Moser Cabinetmakers Customer Service P.O. Box 1237 Auburn, ME 04211-1237

Written by Peter J. Stephano with Larry Clayton Photographs: John Kane/Silver Sun Studio Graphic Design: Perry McFarlin
Looking for the perfect home accent to match your seafaring tastes? How about our novel boat shelf? Designed by Jim Shotwell, an accomplished boatbuilder and woodworker from Nescopeck, Pennsylvania, this folk art project lets you display a variety of unique collectibles—from antique fishing reels to miniature lighthouses. Jim refers to his boat shelf as the “Pooles Island Skiff.”

Let's begin with the curved-sided boat bottom

Note: This project requires several thicknesses of mahogany and ash. Plane or resaw your own stock, or see the Buying Guide for our source of a hardwood kit.

1. Cut the bottom blank (A) to the size listed in the Bill of Materials from ¾" stock (we used mahogany; ¼" mahogany plywood would also work).

2. Working on the bottom side of the bottom blank (A), mark the transom (B) and shelf locations (C, D). See the Bottom drawing on the Parts View on the WOOD PATTERNS® insert in the center of the magazine for reference. Now, mark the three nail-hole centerpoints for bending the fairing strips against in step 4. The fairing strip (a thin bendable piece of wood) allows you to mark a long smooth curve.

3. Cut a strip of wood to ¾"x⅝"x48" for use as a fairing strip.

4. Drive the nails about ¼" into the bottom blank at each marked nail centerpoint dimensioned on the bottom (A) of the Parts View drawing. Bend the fairing around the outside of the the nails, and clamp the ends of the strip to the bottom blank where shown in photo A. Now, mark a line along the inside edge of the strip as shown in photo A. Remove the nails and repeat the process to mark the opposite edge.

5. Mark the screw-hole centerpoints on the bottom side of the bottom for attaching the transom and shelves later. Drill a counterbored screw hole through each screw-hole centerpoint.

6. Form the 15° bevel along the side edges of the bottom by tilting your bandsaw table 15° from vertical and making the cuts; or you can make a square cut on the side edges with your bandsaw or jigsaw, and disc-sand them at 15°.

Add the transom and shelves

1. Cut the transom (B) and shelves (C, D) to the sizes listed in the Bill of Materials plus 1" in length.

2. Add a wood extension to your miter gauge. As shown on step 1 of the Miter-Cutting the Transom and Shelves drawing, angle the gauge 15° from center and tilt the blade 8° from vertical. Make the cut shown in step 1 to miter-cut one end of the transom (B). Tilt the miter gauge 15° in the opposite direction as shown in step 2. Mark the cutline and hold the transom against the bottom (A) to ensure the outside edges of the transom will be flush with...
Round over front edge of bow and gunwale.

Bill of Materials

<table>
<thead>
<tr>
<th>Part</th>
<th>Finished Size</th>
<th>Material</th>
</tr>
</thead>
<tbody>
<tr>
<td>A bottom blank</td>
<td>4&quot; x 10&quot; x 42&quot;</td>
<td>M 1</td>
</tr>
<tr>
<td>B transom</td>
<td>4&quot; x 11&quot;4&quot; x 9&quot;1/2&quot;</td>
<td>M 1</td>
</tr>
<tr>
<td>C shelves</td>
<td>4&quot; x 4&quot; x 10&quot;4&quot;</td>
<td>A 2</td>
</tr>
<tr>
<td>D shelf</td>
<td>4&quot; x 4&quot; x 9&quot;4&quot;</td>
<td>A 1</td>
</tr>
<tr>
<td>E topside blanks</td>
<td>4&quot; x 7&quot;4&quot; x 47&quot;1/2&quot;</td>
<td>M 2</td>
</tr>
<tr>
<td>F gunwales</td>
<td>4&quot; x 4&quot; x 47&quot;1/2&quot;</td>
<td>A 2</td>
</tr>
<tr>
<td>G short spacers</td>
<td>4&quot; x 1/2&quot; x 1&quot;</td>
<td>A 8</td>
</tr>
<tr>
<td>H long spacers</td>
<td>4&quot; x 1/2&quot; x 11&quot;4&quot;</td>
<td>A 2</td>
</tr>
<tr>
<td>I inner rails</td>
<td>4&quot; x 4&quot; x 43&quot;</td>
<td>A 2</td>
</tr>
<tr>
<td>J foredeck blank</td>
<td>4&quot; x 7&quot;4&quot; x 13&quot;</td>
<td>A 1</td>
</tr>
</tbody>
</table>

Cut parts marked with an * oversized. Trim to finished size according to the how-to instructions.

Materials Key: M-mahogany, A-ash

Supplies: #8 x 1\"1/2 flathead wood screws, #8 x 4\" flathead wood screws, #8 x 3/4" panhead sheet metal screws, hanger, primer, paint, clear finish.
2 Mark the angled bow line on one topside blank where dimensioned on the Topside drawing on the pattern insert.

3 Mark the nail-hole centerpoints, drive the nails, and use the fairing strip to mark the curved top and bottom edges on the topside blank.

4 With the edges and ends flush, use double-faced tape to adhere the two blanks together. Then, cut and sand the topsides to shape. Separate the pieces and remove the tape. (We used a splash of lacquer thinner to weaken the bond between the pieces.)

5 Clamp the bottom, transom, and shelf assembly to your workbench vise as shown in photo B. (We found it critical to hold the assembly steady when attaching the topsides in the next step.)

6 Using rubber-tipped clamps (they slide less on the curved surfaces than their metal counterparts), clamp one topside to the bottom, transom, and shelf assembly, making sure the front edge of the topside (E) is flush with the front edge of the bottom (A), and the back end of E is flush with the back surface of the transom (B).

7 Use a combination square to mark a reference line up the sides of the topsides. Then, drill counterbored mounting holes, and glue and screw the topside in place as shown in photo B. Repeat for the opposite topside.

8 Cut two pieces of stock to 1/4 x 4 x 5" to act as clamp blocks. Adhere these to the front of the topsides with hotmelt adhesive, and use these to clamp the front ends of the topsides in place. Drive the screws. Repeat for the remaining shelves (C, D). (We cut an 8"-wide spacer to position the shelves exactly 8" apart and keep them parallel to each other when driving the screws.)

Now, bend and secure the topsides in place

1 From 1/4" mahogany, cut the topside blanks (E) to the size listed in the Bill of Materials.

the outside edges of the bottom (A). Adjust your cutline if necessary. Then, make the second compound miter cut.

3 For the center shelves (C), leave the miter gauge at 15° and tilt the blade to 4°. Again, check your cutline before making the second cut. For shelf (D), tilt the blade back to 8° to make the cuts.

4 Glue and clamp the transom in place, and use the previously drilled holes in the bottom (A) as guides to drill a pair of pilot holes into the bottom edge of the transom. Drive the screws. Repeat for the remaining shelves (C, D). (We cut an 8"-wide spacer to position the shelves exactly 8" apart and keep them parallel to each other when driving the screws.)
topsides together. Without the blocks, the clamps tend to slide off the topsides. With the topsides squeezed together, run a fillet of epoxy on the inside along the mating joint between the topsides.

And now for the gunwales and spacers

1. Cut the gunwales (F) to the size listed in the Bill of Materials plus 2" in length. Then, cut the spacers (G, H) and inner rails (I) to size. Cut four extra spacers (G) also.

2. Cut or sand an 8° bevel across one end of each rear spacer (G) and inner rail (I) to mate flush with the transom where shown on the Spacer detail accompanying the Exploded View drawing.

3. As shown in photo C, glue and clamp the gunwale, spacers, and inner rail to one side of the boat, keeping the top edges flush. To keep a continuous curve to the inner rail when clamping it in place, use an extra spacer (not glued in place) and clamp between the glued-in-place spacers. Repeat on the opposite side.

4. Trim the rear ends of the gunwales (F) flush with the back surface of the project.

5. Sand the bow to the shape shown on the Bow detail.

6. Cut the foredeck blank (J) to size.

7. As shown in photo D, hand-sand the top edge of the gunwale assembly flush. Toward the front of the boat, you'll need to sand the gunwale assemblies flush with each other, so the foredeck blank sits flush with both assemblies and that no gap exists between the foredeck blank and gunwales.

8. Mark and cut a 3/4" radius on the wide end of the foredeck blank where shown on the Foredeck drawing. Rout a 1/4" round-over on the foredeck where shown on the Exploded View drawing.

9. Hold the foredeck blank against the front top surface of the project where shown on the Foredeck drawing, and trace around the gunwales onto the foredeck blank. Cut the foredeck to shape.

10. Glue and clamp the foredeck to the boat. Then, sand the edges of the foredeck flush with the edges of the gunwales and bow.

You're almost there, mate; just fill the holes and add the finish

1. Using wood putty, car-body filler (we used Bondo), or Zar latex wood filler, fill the counterbored screw holes. Later sand the filled holes flush. Finish-sand the entire boat project.

2. Apply a clear finish to the boat interior and gunwales (we used satin polyurethane). Then, mask off the clear-coated areas, and prime and paint the topsides' (E) and bottom's (A) exterior with spray enamel or paint with a foam brush. (We sprayed on three coats of Krylon Burgundy, being careful to avoid runs. Later, remove the masking.)

Buying Guide

Hardwood kit. All the individual pieces shown on the Cutting Diagram cut oversized from the thickness and species listed in the Bill of Materials. Kit no. W1071, $89.95 ppd. Heritage Building Specialties, 205 North Cascade, Fergus Falls, MN 56537. Call 800/524-4184 to order.

Boat and brochure. To order a finished Pooles Island Skiff Shadowbox (signed and numbered), a kit for the same, a copy of Jim Shortwell's newest book (Building the Sunrise Dinghy), register for a boatbuilding class, or a free brochure of his work, contact Jim Shortwell-Boatbuilder, 100 Diana's Cove Road, RR 2, Box 2718, Nescopeck, PA 18635; call him at 717/759-1290, or visit his website at www.jimshotwellboats.com.
If it's never happened to you, count yourself lucky. The scenario goes like this: You're trying to rip a board barely a few inches wide on your tablesaw. There's the whirling blade, the fence, the workpiece, and your hand. You grab a scrap to use as a pushstick to move the workpiece through the cut and beyond the blade. You push, guide, then suddenly WHAM! Flying wood.

Shaking, you shut off the saw and examine yourself for injury. What went wrong?

How pushstick accidents happen

Here's why such accidents happen: The pushstick hits the blade and breaks or gets kicked back. Simple enough. But the pushstick wouldn't have contacted the blade if it hadn't been too thick, or if it hadn't slipped off the workpiece. There are contributing factors, too, such as having the blade raised too high through the workpiece (¼" to ¾" of teeth should extend above the wood). To avoid accidents with pushsticks, it's good to understand why and where you should use them.

Stock less than 5" wide is considered narrow stock, and your hand guiding it across the tablesaw while ripping won't pass safely between the blade and the fence. That's where a pushstick comes in. But there are a few guidelines to keep in mind.

So that it won't hit the blade, your pushstick should always be thinner than the distance between the saw blade and the fence. That is, it should never be thicker than the width of the stock you're ripping. Ideally, you should have several pushsticks on hand—each of a different thickness—to use with wood of varying widths.

Choose a pushstick style that works best for you

A pushstick can take many a shape. The most common shopmade, wooden pushsticks appear as extensions of your index finger, but angled to exert pressure on the stock. The business end has a notch to engage the end of the wood; the grip end is rounded to comfortably accommodate your hand, and usually has a hole for hanging at or near the tablesaw.

There's another type of pushstick that takes a saw-handle or shoe shape, as shown in the homemade example, opposite page. This type provides greater contact with the surface of the workpiece and offers a surer grip for your hand.

The shopmade pushbox takes the handle or shoe shape another step. This type rides the fence, contacts a greater area of the workpiece, and positions your pushing hand well away from the blade. Shown opposite page, it's suited for thin-strip ripping.

Of course, you can buy ready-made pushsticks in several shapes, styles, and made of various materials. The models shown on these pages are just a few examples.

Know the proper way to push

Just as a refresher, here's how to rip narrow stock: Standing to the left of and out of the way of the blade, use your right hand to push the board forward and your left (or a feather board) to hold it firmly against the fence to start the cut. When the workpiece clears the front edge of the tablesaw, grab the pushstick with your right hand and use it to complete the cut, as shown left. Don't remove the pushstick until you have moved the stock beyond the blade. Turn off the saw and retrieve the wood. Never ever reach across the blade to pick up the workpiece.
WAY TO SAFETY

Aluminum pushsticks often have metric rule on blade.

Hard plastic pushblocks, above and below, feature friction cushions.

PL'istlc Power-Hands pushshoe has rubber sole.

Pushbox built for thin-strip ripping

The difference that material makes

Most shopmade pushsticks are of standard ¾" or thinner plywood rather than cut from a board of solid stock. That's because grain direction presents a breakage hazard in other than a straight stick. However, Baltic birch plywood proves a stouter, safer choice because it has no voids and more plies. Another good, solid material from which to make pushshoes is medium density fiberboard (MDF). It cuts, shapes, and sands easily, and takes abuse. Although it comes in several different thicknesses, use ½" or thicker for durability and strength.

Store-bought, molded pushsticks made of hard plastic are inexpensive and well designed. But when a blade hits them, they can fragment or even shatter. More durable are ones manufactured from ABS plastic—a softer, resilient material—or of fiber-filled nylon. Aluminum pushsticks, while they won't harm your saw blade if they contact it, can throw flak back at you.

Ready-made pushsticks and -blocks shown available from Eagle America. Call 800/872-2511 for a free catalog.
With all of the gluing products on the market today, choosing the right type for your needs, and using it correctly, can get tricky. For help, we turned to the WOOD magazine staffers who design and build the projects featured in our publication: Jim Downing, Jan Svec, and Chuck Hedlund. We'll tell you about the eight types they rely on, and share their tips for using each successfully.

First, choose the glue that's right for the job
The first time you glued two pieces of wood together, you probably reached for your bottle of good ol' yellow woodworker's glue. It worked, so you stuck with it. But if you've ever wondered if there's a better glue for a particular job, check our chart at right, and be confident in your choice. Make a copy of this chart and post it near where you store your glues, and you'll never again scratch your head over which glue to use.

Our pros' best gluing tips
One sure way to gauge the expertise of a woodworker is to examine the joints on his projects. Are they free of glue squeeze-out and rock-solid, even after many years of use? If so, he probably learned (the hard way, in some cases) many of the tips we'll share here. Beginning on page 48, you'll learn how to use each of the eight glues in the chart, but since yellow, white, and water-resistant glues are similar in the way you apply, work, and clamp them, we'll discuss them together.
## What's What in Woodworking Glues

<table>
<thead>
<tr>
<th>Glue Type</th>
<th>Open Time (1)</th>
<th>Minimum Clamp Time</th>
<th>Cleanup (2)</th>
<th>Color When Dry (3)</th>
<th>Shelf Life (4)</th>
<th>Approximate Cost Per Quart (5)</th>
<th>Key Properties</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Yellow (Aliphatic Resin)</strong></td>
<td>5 - 10 minutes</td>
<td>30 minutes</td>
<td>Water, damp cloth.</td>
<td>Yellow*</td>
<td>1 year</td>
<td>$ .66</td>
<td>Fast tack time. Excellent for general use. Indoor furniture and cabinets.</td>
</tr>
<tr>
<td><strong>White (Polyvinyl Acetate)</strong></td>
<td>10 - 15 minutes</td>
<td>60 minutes</td>
<td>Water, damp cloth.</td>
<td>Clear</td>
<td>2 - 3 years</td>
<td>$ .24</td>
<td>Longer open time than yellow glue. Inexpensive. Cribs, galley rails, and complex casework.</td>
</tr>
<tr>
<td><strong>Water-Resistant</strong></td>
<td>5 - 10 minutes</td>
<td>60 minutes</td>
<td>Damp cloth before setting, scrape or sand after setting.</td>
<td>Yellow</td>
<td>1 year</td>
<td>$ .37</td>
<td>Fast tack time. Water resistant. Sheltered outdoor furniture and outdoor riding toys.</td>
</tr>
<tr>
<td><strong>Polyurethane</strong></td>
<td>30 minutes</td>
<td></td>
<td></td>
<td>Yellow</td>
<td>1 year</td>
<td>$ 1.11</td>
<td>Waterproof. No mixing required. Gap-filling. Exposed outdoor projects and planter boxes.</td>
</tr>
<tr>
<td><strong>Epoxy</strong></td>
<td>5 minutes - 12 hours (depending on formulation)</td>
<td>4 hours (loss in high humidity)</td>
<td>Tools: mineral spirits. Hands: soap and water before cured.</td>
<td>Clear (can be changed with filler)</td>
<td>1 year</td>
<td>$ 1.25</td>
<td>Waterproof. High strength. Bonds even oily woods such as teak. Excellent for end-grain joints. Gap-filling. Boxbuilding, threaded parts on shoe jigs, and furniture repair.</td>
</tr>
<tr>
<td><strong>Instant (Cyanoacrylate)</strong></td>
<td>15 seconds</td>
<td>0 - 1 minute</td>
<td>Acetone</td>
<td>Clear</td>
<td>1 year</td>
<td>$ 5.00</td>
<td>Bonds instantly (with accelerator). Works well for bonding solid-surface materials. Model building, and fragile carvings and turnings.</td>
</tr>
<tr>
<td><strong>Hotmelt</strong></td>
<td>2 - 45 seconds</td>
<td>0 - 15 seconds</td>
<td>Let harden, then gently scrape. Remove residue with mineral spirits.</td>
<td>Clear or yellow</td>
<td>2 years</td>
<td>$ .53</td>
<td>Excellent for crafts. Sets quickly without clamping. Good temporary bond. Crafts, temporary fastening of parts, and holding small parts for routing.</td>
</tr>
<tr>
<td><strong>Contact Cement</strong></td>
<td>15 minutes - 3 hours</td>
<td>Clamping not necessary</td>
<td>Mineral spirits, * * Soap and water when wet, xylene solvent when dry. **</td>
<td>Clear</td>
<td>1 year</td>
<td>$ .16 - .25 **</td>
<td>Adheres large surface areas. Plastic-laminate countersurfaces and flexible veneers.</td>
</tr>
</tbody>
</table>

**Notes:**
1. Open time refers to how much time you have, after the glue is applied, to complete the job.
2. (*) A citrus-based hand-cleaner (**) Solvent-based formula (***) Low-solvent, water-based formula
3. (*) Also available in dark-colored formula for use with darker woods.
4. Assuming proper storage and handling.
5. (*) Exposure to air can quickly reduce shelf life.

### Why not hide glue?
Antique furniture restoration experts and some woodworking purists may wonder why we don’t use hide glue in our shop. Historical considerations aside, hide glue’s chief advantage—is extremely long open time—is also its chief disadvantage. Jan says, “We just never use it. White and yellow glues allow enough open time for virtually any assembly you’re likely to run across, and you won’t need to wait overnight for every joint you clamp. Also, unlike joints made with hide glue, joints made with these glues won’t weaken over time.”
Woodworking Glues

Polyurethane glue: the promising newcomer

Chuck says, "Resist the temptation to wipe it off when it's wet, or you'll end up with a sticky mess." After this foam hardens it can be cleaned up by slicing it off with a sharp chisel, bevel side down, working the edge across the joint.

- Buy only as much as you'll use in a year because humidity can cause this glue to prematurely turn to a useless gel. Extend the shelf life by keeping the glue bottle closed as much as possible.

- To minimize squeeze-out on the face side of your projects, Chuck suggests you bring the two pieces together at a slight angle, joining the face edges first as shown right. As you lay the pieces flat to clamp them, most of the squeeze-out will be on the back side.

Here are a couple of tips that apply only to water-resistant glue:
- It tends to separate, so mix it well before each use.
- Wear your shop apron when using water-resistant glue—it doesn't wash out of clothing.

Yellow, white, and water-resistant glues: the old standbys

You probably use one or more of these three similar glues more often than any other type—with good reason. They are versatile, easy-to-use, and affordable, and they provide strong bonds. The next time you reach for one of these glues, consider trying the following:
- For the strongest bond, make sure your pieces fit together well. Then cover both joining surfaces with a thin layer of glue. You can spread it with a brush, a paint roller, or Jim's favorite—the plastic core of a disposable foam paintbrush as shown above.
- Clamp with even pressure all along the joint, but not too hard or you'll squeeze all the glue out and make a weak joint.
- For small areas, mask the wood adjacent to the joint with masking tape to prevent the squeeze-out from getting on your work. For longer joints, remove the squeeze-out with a damp cloth while it's still wet, "rolling" the cloth as you go to keep from smearing the excess glue on the adjacent surfaces.

Before this glue debuted on the market a few years ago, you had to mix two components together to create a waterproof glue. Not any longer. For your outdoor projects, give this glue a try and you'll like it—just keep the following points in mind:
- This product needs a little moisture to make a strong bond. So before applying polyurethane glue to dry woods, wipe the area to be joined with a damp cloth.
- After clamping, the squeeze-out will appear as a brownish foam. Chuck says, "Resist the temptation to wipe it off when it's wet, or you'll end up with a sticky mess." After this foam hardens it can be cleaned up by slicing it off with a sharp chisel, bevel side down, working the edge across the joint.

- Buy only as much as you'll use in a year because humidity can cause this glue to prematurely turn to a useless gel. Extend the shelf life by keeping the glue bottle closed as much as possible.
Epoxy: tough-as-nails

If you need to join different materials such as metal or glass to wood, or if you're working with an oily wood such as teak, use epoxy. Just follow the mixing instructions on the package and these tips:

• Most epoxies mix to a thick, gooey consistency. But for more versatility choose a thin, two-part epoxy to which you can add silica thickener—it's the strongest thickener you can add.
• Keep lots of waxed paper handy when using epoxy. Use it to protect surrounding work areas from accidental bonding.
• Use just enough clamping pressure to keep the joint from moving while it sets. Too much clamping force starves the joint of glue, and the remainder absorbs into the wood.
• For strong end-grain joints, Jim says, "First, saturate the wood on both sides of the joint with a coat of the thin epoxy. Then mix up another batch, this time adding silica thickener. Apply the thickened epoxy over the thin layer, and clamp."
• Warm temperatures cause epoxy to set faster. So if you need more working time, keep the mixture cool by placing your mixing container in an ice bath as shown in the photo left.

Continued
Woodworking Glues

Instant (cyanoacrylate) glue: holding fast

This glue has been around since the guy on TV glued his head to the bottom of a steel girder, but you may not have thought about using it in your woodshop. Here are some “instant” ideas:

• For joining wood, pick an instant glue with a thick or gel consistency—a thin instant glue absorbs into the wood, robbing the joint of glue.
• Use a drop or two of a thin instant glue on fragile parts of wood turnings or carvings. It quickly absorbs into the wood and fortifies it.
• You can use a spray-on “accelerator” that makes the bond instantaneous. To do this, apply accelerator to one side of the joint, instant glue to the other, and join them. But, use just a light spray because too much accelerator will actually weaken the bond. Most stores catering to the needs of modelbuilders carry instant glue accelerators.
• For tough-to-clamp pieces that require precise positioning, like the broken letter in the scrollsawn sign below, try this. Apply instant glue, position the pieces while the glue is still workable, then hit the joint with a spritz of accelerator. The accelerator will seep into the joint and bond the pieces instantly.

• Instant glues work well for joining solid-surface materials, such as Corian. But, the joint requires just the slightest moisture for full strength, and solid-surface materials are bone-dry.

To get the best joint, clean the surfaces to be joined, then wipe one of the surfaces with a damp paper towel (or you can simply breathe on the surface—there’s adequate moisture in your breath). Apply instant glue in a thin, even coat to the other piece, then position and clamp the joint as tightly as you can with a screw-type clamp. Leave the pieces clamped for 10 minutes. After 20 minutes, you can machine the joint.

Hotmelt glue: the temporary fixer

Crafters have used these little sticks of hotmelt glue for years because it sets fast without clamping, and easily joins dissimilar materials that aren’t under a lot of stress. So, grab your gun and remember these tips:

• Hotmelt glues are great for temporarily holding workpieces in position so you can join them with fasteners. For example, Jim positions false drawer fronts with the help of two spots of hotmelt glue as shown below. Then, he fastens the front to the drawer with screws.

• The hotter the glue, the better the bond. So give the glue gun at least five minutes to warm the glue fully before you begin, and work quickly—the glue begins to cool right after it leaves the gun.

• If you need more open time, warm your shop and materials to around 90°—maybe with a heat gun on a low setting. You’ll gain a few seconds.
Contact cement: for the really big job

When gluing together two large surfaces, such as veneer to plywood, you can’t beat contact cement. Spread the cement on both pieces, let them set, touch them together, and they’re bonded! Here are a few things to keep in mind when working with contact cement:

- If you have a choice, buy the low-solvent (water-based) type. It’s more expensive than the solvent-based formulas, but it covers about twice as much surface area. The fumes are nonflammable so you won’t risk an explosion, and cleaning hands and tools is a snap with just soap and water or a citrus-based solvent.
- Jan uses a small short-nap paint roller to apply the cement. It provides a smooth and consistent layer, which is especially important when gluing flexible veneer.
- And, he says, buy the best roller you can. “Inexpensive rollers fall apart when used with solvent-based cements.”
- The cement is ready when it appears dull and becomes just slightly tacky to the touch (from 5 to 15 minutes).
- As the name implies, contact cement bonds on contact, so have a helper handy to keep the veneer off the substrate until you can position it. Starting from one end, press it down with a 3” rubber J-roller, rolling down the center first as shown in the photo below, then rolling out to the edges from there. Roll the entire surface to make sure the two surfaces make good contact.

WHERE TO CALL FOR MORE INFORMATION

If you’d like more information about glues, contact these manufacturers:

- ARROW, hotmelt glue, 201/843-6900
- DAP/WELDWOOD, contact cement, 800/327-3339
- DEVCON, epoxy and instant glues, 800/375-2525
- ELMER’S, yellow, white, water-resistant polyurethane, epoxy, instant, and contact cement, 800/848-9400
- EXCEL (from AmBel Corp.), polyurethane glue, 800/779-3935
- FORMICA (from TACC International), 516/623-6000
- GORILLA GLUE, polyurethane glue, 800/966-3458
- LOCTITE, instant and polyurethane glues, 800/562-8483
- LOKWELD, contact adhesive, 800/433-3222
- SYSTEM THREE, epoxy, 206/782-7976
- TITEBOND (from Franklin International), yellow, white, water-resistant, polyurethane, and contact cement, 800/347-4583
- WEST SYSTEM, epoxy, 517/684-7286

MAIL-ORDER SOURCES:

- CONSTANTINE’S, 800/223-8087
- CRAFT SUPPLIES, USA, 800/551-8876
- GARRETT WADE, 800/221-2942
- GRIZZLY, 800/523-4777
- TOOL CRIB OF THE NORTH, 800/358-3096
- WOODCRAFT, 800/225-1153
- THE WOODWORKERS’ STORE, 800/279-4441
This colorful machine delivers gum balls, along with exciting pinball-style action. It's just the thing for your game room.

The frame starts the game

1. Cut the sides (A) to the size shown in the Bill of Materials. Saw or rout 1/4" and 1/8" grooves where shown on the Groove detail and Side Section View drawings. Rout a 1/8" round-over along all four edges of each piece.

2. Cut the base (B) to the dimensions shown. Lay out the 1"-radius corners on the base, and scroll saw or bandsaw them. Sand the edge smooth, then rout a 1/4" round-over around the top of the base.

3. Cut parts C and D to size.

4. Photocopy the Full-Size Front View drawing (it's in the WOOD PATTERNS® insert in the middle of the magazine), and trace the cutting line for the opening onto the face (D). Trace the outlines for parts G, H, I, J, K, N, and O onto the face, and mark centers for screw pilot holes for the flippers (L) and spinner (M).

5. Drill 1/8" pilot holes for the flipper and spinner screws, using a drill press to keep them square to the surface.
This gum ball machine delivers excitement

6 Bandsaw the opening in the face.  
7 Dry-assemble the sides (A), back (C), and face (D). Clamp together, and position on the base (B) where shown. Mark and drill \( \frac{1}{32} \)" holes through the base and \( \frac{1}{8} \)" deep into the sides (A). Enlarge the holes through the base to \( \frac{3}{32} \)" and countersink them on the bottom. Disassemble, and sand all parts.  
8 Glue and screw the sides (A) and base (B) together. Slide the back (C) and face (D) into place for spacing, but don’t glue them yet.  
9 Cut a piece of \( \frac{3}{16} \)" acrylic to \( 9\frac{1}{16} \times 17\frac{7}{8} \). Drill \( \frac{1}{8} \)" holes at the centers shown on the Full-Size drawing, then cut the slots.

Continued
Have a Ball

Add the ramps and flippers

1 Adhere a copy of the part E Top View Pattern to a piece of \(4\times2\frac{3}{4}\)" stock about 10" long. (Rubber cement or spray adhesive will hold the pattern.) Scrollsaw or bandsaw the notches. Sand three bevels and a radius where shown on the Front View Pattern.

2 To make part F, tilt your tablesaw blade to 45°, and bevel-rip one edge of a piece of \(1\frac{1}{2}\times2\)" stock about 12" long. The Top View Full-Size Pattern for part F shows the profile. Refer to the Front View Full-Size Pattern, and trim the part to length, beveling the end.

3 Cut the lower ramp (G), lower guide (H), upper guide (I), upper ramp (J), and middle ramp (K) to the sizes shown. Round one end of the lower guide (H) and both ends of the others.

4 Now, fashion the three flippers (L) and the spinner (M).

   To make them, plane a piece of \(3\times3\)" stock about 12" long to \(\frac{5}{8}\)" thick. Cut blanks from the stock for the flippers and spinner, and adhere the patterns to them.

   Drill and countersink a hole through each part where shown. The holes must run straight through the flippers and spinner, so drill them with a drill press. Scrollsaw each piece to shape.

5 Adhere the pattern for the delivery ramp (N) to a \(3\times4\frac{1}{4}\times8\frac{1}{4}\)" blank. (We positioned the pattern to place the long upper surface of the ramp along the straight edge of the stock.) Bandsaw the part slightly outside the line. Sand to the line.

6 Cut out the loop (O), following a similar procedure. Sand all parts.

Prepare for launching

1 Make the loading block (P) and firing block (Q).

   Start by ripping two 1"-wide blanks from the remaining \(\frac{5}{8}\)"-thick stock. Crosscut one piece to the length shown for each part. Drill a \(\frac{1}{4}\)" hole in each where shown on the Full-Size drawing.

2 Trace the notch outline onto part P, and scrollsaw it. Sand the depression in one end of part Q. Glue a \(1\frac{1}{2}\)" length of \(\frac{1}{4}\)" dowel rod into the hole in each part. Sand the blocks to slide freely in the channels.

3 Cut the two spring leaves (R, S) to the dimensions shown.

   Here's an easy way to make them. Start with a piece of oak measuring \(3\times5\times9\frac{1}{2}\)". Position your tablesaw's fence \(2\frac{1}{6}\" from the blade (assuming a \(\frac{1}{2}\)"-wide blade kerf), and rip a \(\frac{1}{6}\" strip on the outside of the blade, as shown below. Move the fence to \(2\frac{5}{16}\" from the blade, and rip another strip.

   Trim one strip to \(7\frac{3}{4}\". Drill a \(\frac{3}{8}\" hole through the center of each.

4 Center the spring support (T) from side to side on the base so it will sit about \(\frac{3}{8}\" in front of the acrylic. Drill \(\frac{3}{4}\" holes \(1\frac{1}{2}\" deep up through the base into the support. Enlarge the holes through the base to \(\frac{3}{2}\", and countersink them on the bottom.

5 Make the delivery cup (V).

   Here's how to do that. With a compass, draw a \(1\frac{1}{4}\"-diameter circle on a piece of \(\frac{3}{4}\"-thick stock about \(2\times4\)". Draw the circle tangent to one end of the stock, as shown by the pencil circle in the photo on the opposite page.

   At the center of the circle, bore a \(1\frac{1}{4}\" hole \(\frac{3}{4}\" deep. A Forstner bit chucked in a drill press will do the job easily.

   Using a try square, draw a cutting line straight across the stock, \(1\frac{1}{4}\" from the end, shown opposite page. (You could draw it on the back, if that is easier.) Bandsaw or scrollsaw the part to shape. Sand the flat face true. Sand all parts.

Rip the \(\frac{1}{2}\"-thick spring leaves (R, S) on the outside of the blade for safety. Install a zero-clearance table insert when sawing the thin pieces.
Top it off and paint it up

1. Cut the arch front (W) to the size shown. Transfer the arch outline from the Full-Size Half Pattern to the workpiece. Bandsaw or scroll-saw the part. Sand the sawn edge as necessary. Rout a 1/4'' round-over along the front of the arch. Sand a similar round-over on the ends.

2. Cut the top (X) to size. Rout a 1/4'' round-over along both ends and the back on the upper face.

3. Cut the plug (Y) to size. Sand parts W, X, and Y.

4. Glue the arch front (W) to the front edge of the top (X). Keep the bottom surface and both ends flush. Clamp the assembly.

5. Glue the plug (Y) to the bottom of the arch front/top assembly where shown. Center the plug from side to side, and clamp.

6. Paint the side/base assembly and the top assembly. (We primed the wood, then sprayed on several coats of Krylon no. 1910 True Blue, sanding between coats.)

7. Mask gluing areas on the face (D) for the guides and ramps (E, G, H, I, J, K, N, and O) and loop (O). Then, prime the back (C) and face (D), and paint them. (We sprayed on several coats of Krylon no. 2103 American Beauty Red, sanding between them.)

8. Paint the remaining parts, except the spring leaves, gloss white.

(Don't apply any finish to the spring leaves.) Leave gluing surfaces unpainted.

Finally! Time to play pinball

1. Slide the back (C) and face (D) into their grooves in the sides without gluing them. Glue parts G, H, I, J, K, N, and O to the face where shown. (We laid out the parts without glue first.)

2. Mark where the top of the delivery ramp (N) meets the left side (A). Measure 3/16'' up from there, and center a mark between the front and middle grooves. Transfer that point to the outer face of the side, and drill a 3/4'' hole through the side. Sand the hole, and touch up the paint with a brush.

3. Attach the flippers and spinner to the face with #5 x 1'' flathead wood screws. Place one or two washers between each piece and the face to allow free movement.

4. Glue the back and face into their grooves. Glue the loading ramp (E) and bevel block (F) into place.

5. For a flashier look, you can add stickers, as we did. (We bought a sheet each of red and white Coverite Graphics stars for model airplanes from a hobby shop.)

6. Put the loading block (P) and firing block (Q) in place, and slide the acrylic front into its grooves.

7. Screw the spring support (T) to the base. Slide the spring leaves (R and S) under the dowels on the loading and firing blocks. Center the springs on the support, and secure them with a screw through the spring block (U).

8. Glue the delivery cup (V) to the side, just below the hole. Scrape away some paint for better gluing.

9. Finally, fill the machine with gum balls. (We bought bags of them at a Walgreen's drugstore.) Pour them into the top, between the face and back panel. Don't overfill—few dozen is enough.
Using the Full-Size Half Patterns in the WOOD PATTERNS insert, make patterns for the top, parts B, D, and F, and parts C and E. Make two copies of the Parts B, D, and F pattern. Note that each one shows nested parts for baskets of three different sizes. Cut apart the three pieces on one copy of the parts B, D, and F pattern to make individual patterns for the bottoms (F). Photocopy the handle patterns.

To make the set of three baskets, cut blanks A-G to the sizes shown in the Bill of Materials. Cut bottom blanks (F) to all three sizes shown. (A \( \frac{1}{2} \times 6\frac{1}{2} \times 5\frac{1}{2} \) piece of walnut and a \( \frac{1}{2} \times 6\frac{1}{2} \times 2\frac{1}{2} \) piece of maple will yield all the blanks.)

Temporarily laminate the part B and D blanks with double-faced tape. Do the same with the two part C and E blanks.

Adhere each pattern to its blank or stack of blanks, using rubber cement or spray adhesive. With spray adhesive, follow the label instructions for temporary bonding.

Drill blade start holes where indicated. Starting with the Top-patterned piece (A), insert the blade through the innermost hole. Scrollsaw the inside of the smallest top piece. (A \#7 blade, \( 0.045 \times 0.018 \) with 11½-14 teeth per inch, will handle the cutting.) Then, put the blade through the next hole outward. Saw around the outside line of the smallest top piece. Set the piece aside, then cut around the inside of the middle-size top piece. As before,
These baskets may look woven, but they aren't. Instead, they're stacked scrollsawn sections that are so easy to cut that even a novice will achieve great results.

cut around the outer line of that piece, then cut out the inside and outside of the largest top.
6 Following a similar strategy, cut out the stacked basket sides, parts B and D and C and E.
7 Scrollsaw the basket bottoms (F) and handles (G).
8 Sand all parts as necessary. Sand slight round-overs on the handle, top, and bottom where indicated.
9 Referring to the Exploded View drawing, glue parts B, C, D, and E to the bottom (F). Glue the basket top (A) to the top of the stack. Clamp the glued assembly between two pieces of scrapwood.
10 After the glue dries, unclamp the basket. Apply glue to the handle slots in the top (A), and slide the handle (G) into the slots. Clamp with spring clamps.
11 To finish the baskets, spray on a coat of semigloss polyurethane or other clear finish.

Bill of Materials

<table>
<thead>
<tr>
<th>Part</th>
<th>Blank Size</th>
<th>Matl.</th>
<th>Qty</th>
</tr>
</thead>
<tbody>
<tr>
<td>A* top</td>
<td>1/4&quot; x 6 1/4&quot; x 9&quot;</td>
<td>W</td>
<td>1</td>
</tr>
<tr>
<td>B* side 1</td>
<td>1/4&quot; x 6 1/4&quot; x 9&quot;</td>
<td>W</td>
<td>1</td>
</tr>
<tr>
<td>C* side 2</td>
<td>3/4&quot; x 6 1/4&quot; x 9&quot;</td>
<td>W</td>
<td>1</td>
</tr>
<tr>
<td>D* side 3</td>
<td>3/4&quot; x 6 1/4&quot; x 9&quot;</td>
<td>W</td>
<td>1</td>
</tr>
<tr>
<td>E* side 4</td>
<td>3/4&quot; x 6 1/4&quot; x 9&quot;</td>
<td>W</td>
<td>1</td>
</tr>
<tr>
<td>F bottom (lg.)</td>
<td>3/4&quot; x 6 1/4&quot; x 9&quot;</td>
<td>W</td>
<td>1</td>
</tr>
<tr>
<td>F bottom (med.)</td>
<td>1/2&quot; x 5 1/4&quot; x 7/4&quot;</td>
<td>W</td>
<td>1</td>
</tr>
<tr>
<td>F bottom (sm.)</td>
<td>1/2&quot; x 4 1/4&quot; x 6 1/4&quot;</td>
<td>W</td>
<td>1</td>
</tr>
<tr>
<td>G** handle</td>
<td>1/4&quot; x 5&quot; x 6 1/4&quot;</td>
<td>M</td>
<td>1</td>
</tr>
</tbody>
</table>

*Blank size shown yields tops and sides for all three baskets or the large one built separately. To make the medium or small basket only, cut top and side blanks to the size shown for the medium or small bottom (F).

**Blank size shown yields all three handles or large one only. For medium or small handle, measure pattern to determine blank size.

Materials Key: M—maple, W—walnut
If you include mortise-and-tenon joinery in your projects—or would if you could find a fast and easy way to make the mortises—you may want to consider buying a mortiser. To help you decide on a model, we tested eight affordable benchtop units. All of them will cut a mortise, but we found distinct differences in their ease of use and effectiveness.
Fast Facts

- You can buy a 1/2-hp mortiser that makes mortises up to 1/2" wide for less than $300. Such a mortiser amply handles the needs of most home woodworkers.
- Depending on how many mortises you make, a drill-press mortising attachment may make more sense for you.
- You'll spend less money and still get clean mortises.
- Regardless of the mortiser you choose, the key to clean and low-effort mortises is an accessory: the hollow chisel and bit set used to make the cut. We'll tell you which sets make the grade—and which ones don't.

A few words about our test

We concentrated this review on six benchtop mortisers costing less than $300. These units have 1/4-hp motors and handle chisels up to 1/2" wide. They accommodate stock up to 2 1/2 - 3 1/2" thick (this varies depending on the model) and their hold-downs. Some models will mortise to the center of 9"-wide workpieces—others reach only to the center of 6 1/2"-wide stock.

For those of you who need something with more power, we also tested a 3/4-hp model that powers chisels up to 3/8" wide, and a 1-hp model that accommodates 1" chisels.

The mortisers made holes in pine with ease, so we pushed them to their limits by cutting mortises up to 1 1/2" deep in white oak and hard maple. We cut mortises into the edge of 3/4" stock to determine how well each machine's fence and hold-down work with thin material. And, to see how well these components handle thick material, we mortised 2 1/4"-square stock.

To put the machines on a level playing field, we tested all of them with 1/2" Clico-brand chisels and bits. We also conducted a series of cutting tests with the other brands of chisel/bit sets sold by the various mortiser manufacturers. Among other things, these cutting tests revealed much about the relative hardness of the chisels and bits (turn the page to see "Chisel/bit sets: The key components in mortisers").

But with a mortiser, the bit spins inside a hollow chisel that does not rotate. As the bit hogs away mortise material, the sharp edges of the chisel shear off the flat mortise walls. The debris spews out the open sides of the chisel.

The hole story of how mortisers work

Mortisers look and function much like drill presses. Both have a rotating chuck that holds a drill bit that plunges into a workpiece when you pull down on a lever arm.

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We concentrated this review on six benchtop mortisers costing less than $300. These units have 1/4-hp motors and handle chisels up to 1/2" wide. They accommodate stock up to 2 1/2 - 3 1/2" thick (this varies depending on the model) and their hold-downs. Some models will mortise to the center of 9"-wide workpieces—others reach only to the center of 6 1/2"-wide stock.

For those of you who need something with more power, we also tested a 3/4-hp model that powers chisels up to 3/8" wide, and a 1-hp model that accommodates 1" chisels.

The mortisers made holes in pine with ease, so we pushed them to their limits by cutting mortises up to 1 1/2" deep in white oak and hard maple. We cut mortises into the edge of 3/4" stock to determine how well each machine's fence and hold-down work with thin material. And, to see how well these components handle thick material, we mortised 2 1/4"-square stock.

To put the machines on a level playing field, we tested all of them with 1/2" Clico-brand chisels and bits. We also conducted a series of cutting tests with the other brands of chisel/bit sets sold by the various mortiser manufacturers. Among other things, these cutting tests revealed much about the relative hardness of the chisels and bits (turn the page to see "Chisel/bit sets: The key components in mortisers").

But with a mortiser, the bit spins inside a hollow chisel that does not rotate. As the bit hogs away mortise material, the sharp edges of the chisel shear off the flat mortise walls. The debris spews out the open sides of the chisel.
Benchtop Mortisers

Because of the chisel's shearing action, you exert considerable downward pressure on the lever (1"-wide chisels may take all the strength you can muster). A depth-stop bar controls how deep the bit and chisel cut, and a fence assures that each successive cut falls on a line parallel to the edge of the workpiece.

When you raise the lever to withdraw the bit, the chisel tends to grab the walls of the mortise, especially if the workpiece lifts or twists. A sturdy, properly adjusted hold-down prevents this.

Comparing these machines to other mortising options
If you cut a mortise-and-tenon joint only once in a blue moon, by all means, don't plunk down upwards of $200 for one of these machines. (A good set of chisels/bits could double your investment.) Rather, stick to your trusty drill press and conventional drill bits for hogging out the mortises, and hand chisels for cleaning them up.

If neither the idea of hand chopping with chisels, nor spending $200-plus for a mortiser appeals to you, there's one more option.

Drill-press mortising attachments like the one shown below left cost surprisingly little—$25 to $40 for most Taiwanese-made versions. (Again, a good set of chisels/bits will double or triple your total investment.) You'll save some money going this route, and in our tests the mortising attachments were just as effective as dedicated mortisers in making clean, accurate mortises.

Also, drill presses afford you more workpiece capacity because you can mortise to the center of wider pieces (the largest machine in our test mortises to the center of a 9"-wide piece, a 14" drill press drills to the center of 14"-wide glue-ups). And, because the table of a drill press tilts, you can cut angled mortises.

Despite those advantages, a dedicated mortiser still makes the most sense if speed and ease sit atop your priority list. Why? It's a snap to set up a mortiser, but you'll spend about 10 minutes installing a mortising attachment.

Although installation time doesn't matter if you dedicate an extra drill press to mortising, you'll still spend more time adjusting the fence on a drill-press attachment. That's because these fences—unlike a mortiser's fence—don't stay square to a chisel when you move them.

And, every cutting plunge takes longer with a drill-press attachment. For example, you rotate the long lever arm on a mortiser only 140° of arc for 4" of bit travel. With a drill press you rotate one of three short arms nearly 360° for 3" of travel, and you usually have to regrip to complete the stroke.

If a drill-press mortising attachment sounds right to you, be careful to buy one that's compatible with your drill press. Its yoke must fit your drill press' quill diameter. And, its fence should mount to the slots in your drill-press table—some slots run parallel front to rear, and some radiate.

How our test units compare in key areas

• Hold-downs. This critical component must be rock-solid. If it flexes upward when you withdraw the chisel from the workpiece, the chisel will bind against the mortise. Besides the frustration this causes, such binding can pull the chisel loose and damage the cutting edges of the chisel or drill bit.

As you can see in the chart at the end of this article, the Multico mortisers earned "excellent" ratings for hold-down effectiveness. They showed almost no flex because of their stiff, I-beam-like construction, and their solid connection to the machine's post (see the anatomy illustration based on a Multico machine on the previous page).

The hold-downs on the other mortisers attach to the fences as shown below. Although this

Drill-press mortising attachments cost less than dedicated mortisers, but you'll spend more time setting them up.

This side view of the Delta mortiser shows a fence-mounted hold-down and a chuck with access from two sides.

WOOD MAGAZINE AUGUST 1998
Chisel/bit sets: The key components in mortisers

No single feature of your mortiser will affect the quality of your mortises, and your level of enjoyment, as much as the chisel/bit set. With the standard \( \frac{1}{8} \), \( \frac{3}{16} \), and \( \frac{1}{4} \) sets available for our tested machines, we cut mortises up to \( \frac{1}{2} \) deep. We tested one brand, Multico Premium, that has extra long chisels and bits that permit mortises up to \( 4" \) deep in the \( \frac{3}{8} \) and \( \frac{1}{2} \) sizes. You can cut mortises \( \frac{3}{4} " \) deep with standard \( \frac{1}{4} " \) and \( 1 " \) sets.

As you can see in the chart below, the chisel/bit sets included in our testing ranged greatly in quality and price, costing as little as \$10, and as much as \$68, for a single \( \frac{3}{8} " \) set.

Why such a wide range? In our tests we found that the expensive bits held up much better than their low-cost counterparts. As shown above right, the low-cost Taiwanese chisels had shank barrels made of thin, soft steel that dented easily under the force of the setscrew that holds the chisel square to the workpiece. The cutting edge of the chisel, although sharp from the factory, dulled after only a few mortises.

The problems of low-cost bits became especially evident in the \( \frac{1}{4} " \) size. During deep cuts, when bits jam from time to time, the Taiwanese bits would actually distort—the flutes "unraveled," causing the bits to enlarge in diameter and not fit properly into the chisel. The Austrian-made \( \frac{1}{4} " \) bit shown in the photo was made of harder steel, but snapped when jammed (the other sizes of Austrian bits performed well).

The Clico \( \frac{1}{4} " \) bits, also made of hard steel, did not snap because they were the only two-flute bits in that size. Two-flute bits are inherently stronger because they have more steel mass in the flutes. Single-flute bits have precious little steel holding them together at their thinnest points.

Because the more-expensive bits are made from harder steels, you can expect them to go longer between resharpenings. And, you can buy accessory resharpening kits (about \$70-\$80) for the two higher-cost sets in our test—Clico and Multico Premium. These come in handy because few professional sharpeners have the necessary equipment to do the work. These sharpening kits are not compatible with many Far East chisels, which you may have to throw out when they dull.

In the chart we rate the various sets for "cut quality" and "cutting ease." The sets that scored higher in these areas had sharper factory-ground cutting edges on the chisels and bits. A sharp chisel will cleanly shear a mortise wall with minimal effort from you. A dull or incorrectly ground chisel will tear the wood fibers and make you bear down heavily on the mortiser's lever arm.

Our advice: If you make a lot of mortises, invest in Clico chisel/bit sets. If two or three Clico sets stretch your pocketbook too far, buy just the Clico \( \frac{1}{4} " \) set simply because of the tendency of bits of any other brand in this size to self-destruct. The Delta set(s), thanks to the hardness of their steel, represent the best buy of the lower-cost products. And, regardless of brand, check the bits for straightness. We came across several bent bits, especially in the \( \frac{1}{4} " \) size.
Benchtop Mortisers

*Ease of use.* Since you buy a mortiser to help you work faster and with less effort in the first place, don't settle for a machine that's not easy to use. To determine the "overall ease of use" rating in the chart right, we considered such factors as the effort required to plunge the chisel into the stock, the work required to change chisels and bits, and the number of tools and effort necessary to adjust and tighten the mortiser's various components.

To ease the effort of plunging the chisel, these machines have long lever arms ranging from 16¼" to 23" long. Among the ¾-hp units, the 19" Multico arms were the longest. This extra leverage contributed to their having the easiest plunge.

All of the machines have some means by which you adjust the starting point of the lever arm's arc. Depending on the height of the mortiser, your own stature, and the depth of the cut, you need to adjust the arc of the lever arm for comfortable operation.

The Delta arm proved easiest to adjust. As shown below, it has a spring-loaded pivot point that adjusts to any of six positions instantly by pulling out on the pivot and letting it go at the correct position. All of the other arms require a wrench or screwdriver for adjustment. The Harbor Freight mortiser gives you only two possible arm positions; the others give you four or six (see chart for specifics).

If you frequently change chisels and bits, take a look at the "chisel changing ease" and "chuck access" columns in the chart. The Delta proved tops in these areas because, like the Multicos, you can quickly access the chuck from two sides. (The Harbor Freight is open on two sides, but smaller openings inhibit access.) And, like the Harbor Freight, the Delta comes with a long chuck key that helps prevent you from skinning your knuckles on the housing that surrounds the chuck.

Mortisers have plenty of adjustments, so we appreciate that the Delta and Multico units have onboard storage for the chuck key and adjustment wrench. This may seem like a small point, but it sure cuts down on chuck key and wrench searches. The Delta also has onboard chisel/bit set storage.

*Chucks.* The English-made Multico units have German-made Rohm-brand chucks that we prefer over the Taiwanese-made chucks on the other units. The Rohm chucks tighten and release in about a ¼ turn, whereas the other chucks require up to a ¾ turn. Other than just the obvious time savings, the ¼ turn saves on skinned knuckles in the tight quarters around the chuck.

*Speed.* All of the tested motors turn the chuck at or around 3450 rpm except for the Delta, which goes half as fast at 1725 rpm. In our trials we found pros and cons to both speeds.

The 3450 rpm units had better debris ejection from the chisel on most species. Chisels stayed cooler with the Delta, but we had to slow its feed rate compared to the other units. Because of the extra heat, the chisels on the 3450-rpm machines tended to turn blue and scorch the walls of the mortises.

The moment of truth: where to put your money

Among the ½-hp mortisers priced near or under $300, two units were clearly better than their
A FEW MORE MORTISER MORSELS

<table>
<thead>
<tr>
<th>BRAND</th>
<th>MODEL</th>
<th>HORSEPOWER</th>
<th>SPEED (RPM)</th>
<th>MAX. SPINDLE TRAVEL</th>
<th>HOLD-DOWN UNDER (1)</th>
<th>MAX. FENCE-TO-DOOR DISTANCE</th>
<th>DIAL SHANKS ACCEPTED BY MACHINE</th>
<th>MAX. RECOMMENDED DIAL SHANKS (2)</th>
<th>MIN. STOCK-HANDLE HOLE UNDER (3)</th>
<th>LENGTH (INCHES)</th>
<th>MAX. NUMBER OF POSITIONS</th>
<th>CHANGING EASE</th>
<th>DIAL-SHANK HOLE SIZE AND EFFECTIVENESS</th>
<th>HORIZONTAL EASE OF USE</th>
<th>OVERALL EASE OF USE</th>
<th>QUALITY OF MATERIAL</th>
<th>OWNER'S MANUAL</th>
<th>WARRANTY (MONTHS)</th>
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NOTES:
1. Measured with hold-down in recommended position. You can gain more height by turning the hold-downs upside down, and by reversing column on base.
2. (') Hold 1/4" shanks if you purchase 1/4" bushing from another supplier.
3. Lowest position of hold-down “without spacer blocks under workpiece.

Conclusion:
Competitors: the Delta 14-650 and Multico PM10. Most woodworkers will be perfectly happy with the $250 Delta. For about $75 more ($299 plus $25 shipping) the Multico offers more-refined construction and a stouter hold-down.

Multico mortisers are available in the U.S. only from Garrett Wade (New York, N.Y.) and Injecta Machinery (Altadena, Calif.). Both outlets will ship your order—see phone numbers at the bottom of the chart above. You can buy the Delta from many local and mail order distributors.

Among the machines capable of making mortises more than 1/2" wide, the Woodtek 900-881 offers lots of value. Although not as well made as the Multico PM16SP, it has more power (making mortises up to 1" wide versus 3/4" for the Multico), and costs about $250 less. If you opt for one of these large machines, be forewarned that you can't buy inexpensive chisel/bit sets in sizes over 1/4". Expect to pay $70-$160 per set in sizes from 1/8" to 1/4".

Written by Bill Krier  Technical consultant: Dave Henderson  Photographs: William Hopkins  Illustration: Kim Downing

WOOD MAGAZINE  AUGUST 1998  63
Caricatures always top woodcarving's "most fun" charts. On the respect scale, though, caricatures thud to the bottom. A talented, fun-loving group of carvers is aiming to change that.

Whether you're chuckling over Pete LeClair's Cowboy at the Bar and The Cowboy's Sidekick, through the window above, or hewing out some crazy character of your own, comical caricature carvings bring nothing but pleasure. So, it's anybody's guess why so many people—including lots of woodcarvers—hold caricature carvings in low regard.

It may be because the carvings violate so many rules of formal, realistic sculpture, with their ridiculously exaggerated poses and proportions, as in the figures on the opposite page.

You'll certainly never meet people who look just like Joe Wannamaker's The Dancing Couple, Dave Dunham's The Saloon Piano Player, or Rich Wetherbee's Sleazy Girl on the Piano. But chances are, at least one of these figures reminds you in some way of some real person.

Too funny to take seriously?
The humor that makes these carved cartoons such fun sometimes works against them. People who believe art should be serious stuff think anything that tries so
Joe Wannamaker carved The Dancing Couple from one basswood block (except for the lady's hat feather—an afterthought). Overblown features characterize them, and also Dave Dunham's The Saloon Piano Player and the songstress, Rich Wetherbee's Sleazy Girl on the Piano.

hard to make them smile can't be worthy of their respect.

Design and workmanship are often underappreciated because the carvings aren't true to life. Granted, some caricatures are crude. Yet, to do one well calls for the same kind of planning, design sense, and carving skill exhibited by "more serious" work. Beyond that, the caricaturist must invest additional effort into incorporating exaggerations that help tell a story or give a character personality, as in Marv Kaisersatt's The Seated Cowboy, on page 66.

CCA rides to the rescue
To help dispel the myth that a caricature carving is just a realistic figure that didn't turn out quite right, a group of leading woodcarving caricaturists banded together several years ago. Tagging themselves the Caricature Carvers of America (CCA), they set out to educate other carvers and the general public about the art and techniques of caricature carving. They hope to increase appreciation for caricatures, and to entice others to join in the fun.

In carrying out this goal, the group has in recent years mounted two tableaux—the Full Moon Saloon and the CCA Circus, both populated with figures that show woodcarving at its lighthearted best. The examples here came from the saloon. To see them in that setting, along with the rest of the saloon crowd, turn the page.

Buying Guide
Books. See the Full Moon Saloon and the CCA Circus in detail, with carvers' comments and figure patterns, in Carving the Full Moon Saloon and Carving the Caricature Carvers of America Circus, available at local bookstores, or at $19.95 each plus $2.50 postage and handling from Fox Chapel Publishing Co., 1970 Broad St., East Petersburg, PA 17520. Call 717/560-4703. When ordering from the publisher, mention WOOD® magazine to receive a free CCA Circus poster.

CCA on the Web
Learn more about the Caricature Carvers of America (including demonstration schedules) at http://www.cca-carvers.org

Continued
The Seated Cowboy, slouched down with his shoulders turned, head tilted, and legs crossed, emerged after two months of sketching, clay modeling, and carving by Marv Kaisersatt. Everything you see is carved from a single block of basswood.

The Caricature Carvers of America’s first group effort, a 4’-long Old West saloon, includes pieces from 21 carvers. The figures and their carvers are: The Hanging Drunk by Keith Morrill on the coatrack at left, The Rail Rider by Randal Landen sliding down the banister, and crawling along the beam, The Lamp-lighter by Steven Prescott. Surveying the scene from the balcony are, from left, The Old Coot by Keith Morrill; The Drunk by Bob Travis; and The Reverend and Mrs. Farkus by Peter Ortel. Hanging Harley by Harley Schmitgen commands attention above the bar. Flat on His Back by Harold Enlow lies on the saloon floor at left, attended by Tom Wolfe’s Man’s Best
Moon Saloon

Friend. Behind them, Dave Dunham's The Saloon Piano Player pounds out a tune and Rich Wetherbee's Sleazy Girl on the Piano warbles while Joe Wannamaker's The Dancing Couple takes a whirl.

Mary Kaisersatt's The Seated Cowboy sips sarsaparilla or something as Doug Raines' Sweet Betsy and Ike head for the exit with different degrees of enthusiasm. The Janitor by Dave Rasmussen wrings his mop behind the card table, where The Lady Card Shark by Bob Travis seems to have garnered all the chips from an unnamed Travis figure and Garry Batte's Card Player with a Bottle. Tex Haase's The Bartender presides over the left end of the bar while at the other end Claude Bolton's The Assistant Bartender chats with The Cowboy's Sidekick, Cowboy at the Bar (both by Pete LeClair), and the suspiciously horse-looking Flirty Gertie by Desiree Hajny. They seem to be keeping an eye on Joe Wannamaker's pooch, who simply doesn't believe there's No Free Lunch.

Amidst all the frivolity, The Moose Hanger by Dave Stetson struggles to finish up his interior decorating chores and Sal and Igoo (the local mortician, Sal Monilla, and his assistant) by Jack Price try to drum up orders for pre-need headstones. And if looks could kill (not to mention that hatchet), Claude Bolton's Carrie Nation would be making business for them.

Wood Magazine August 1998
Buying wood can be just as much fun as working it, if you're informed. The basics here will get you started.

Understanding hardwood grades
No two hardwood boards look alike. That's why each hardwood board is assigned a grade at the mill by a lumber grader. Each grade, right, is based on a percentage of yield in clear face cuttings as seen from the clearest side of the board.

Easy board foot Calculation
Hardwoods sell in grades by the board foot, a basic unit of measurement that equals a 1"-thick board that's 12" wide and 12" long. That's because hardwoods—unlike softwoods—aren't cut and milled as dressed, sized lumber in standard nominal dimensions (2x4, 1x6, 4x4, etc.) to only be cut to length for construction. Instead, mills saw hardwoods into random widths and lengths to best take advantage of the clear wood in a log. Hardwoods do come in nominal thicknesses, such as 1", 1¼", etc. (often referred to as four-quarter, five-quarter, and so on), that actually are a bit shy of the stated thickness. Therefore, you'll pay for a 1"-thick measurement but actually be getting about ¼" less. Board widths aren't standardized. Typically, the dealer will "round up" to the next inch of width and charge you for it. To help you in estimating stock and cost for the projects you want to build, the chart right gives you the amount of board feet in a range of common hardwood dimensions you'll likely come across where you shop for wood.

### Grading Terms

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<thead>
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<th>GRADE</th>
<th>CHARACTERISTICS</th>
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<tbody>
<tr>
<td>FAS (First and seconds)</td>
<td>The best grade. Boards 6&quot; and wider, 8&quot; and longer. Almost clear. Yields 83½ percent clear face cuttings 4&quot; or wider by 5&quot; or longer and 3&quot; or wider by 7&quot; or longer.</td>
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<tr>
<td>Selects</td>
<td>Boards 4&quot; and wider, 6&quot; and longer. One side is FAS, the other is No.1 Common. Yields 83½ percent clear face cuttings.</td>
</tr>
<tr>
<td>No. 1 Common</td>
<td>Boards are 3&quot; and wider, 4&quot; and longer. Yields 66½ percent clear face cuttings 4&quot; or wider by 2&quot; or longer and 3&quot; or wider by 3&quot; or longer.</td>
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### Board Foot Calculator

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WOOD MAGAZINE AUGUST 1998
A guide to wood, its uses, grades, and board feet

Your Guide to Common Woodworking Woods

Puzzled by which wood to use for what? Much of the choice comes down to personal taste, then cost and availability. But until you know the qualities that help you choose one wood over another, the selection process can be confusing. Use the chart below to acquaint you with the woods in common usage.

<table>
<thead>
<tr>
<th>Wood Species</th>
<th>Price (1)</th>
<th>Availability (2)</th>
<th>Hardness</th>
<th>Strength</th>
<th>Weight</th>
<th>Stability</th>
<th>Rot Resistance</th>
<th>Split Resistance</th>
<th>Machine Quality</th>
<th>Turning</th>
<th>Carving</th>
<th>Planning/Joining</th>
<th>Gluing</th>
<th>Sanding</th>
<th>Staining</th>
<th>Painting</th>
<th>Use/Comments</th>
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<td>ALDER, RED</td>
<td>$S</td>
<td>R</td>
<td>Medium</td>
<td>Weak</td>
<td>Light</td>
<td>G</td>
<td>F</td>
<td>F</td>
<td>G</td>
<td>F</td>
<td>E</td>
<td>E</td>
<td>E</td>
<td>G</td>
<td>E</td>
<td>G</td>
<td>Cabinets, furniture, millwork</td>
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<td>ASH, WHITE</td>
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<td>Strong</td>
<td>Heavy</td>
<td>G</td>
<td>F</td>
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<td>G</td>
<td>E</td>
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<td>G</td>
<td>G</td>
<td>E</td>
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<td>G</td>
<td>Best for carving</td>
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<tr>
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<td>Hard</td>
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<td>F</td>
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<td>G</td>
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<td>E</td>
<td>G</td>
<td>E</td>
<td>G</td>
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</tr>
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</table>

Notes:
1. ($$$)$ Very expensive | ($$$) Expensive | ($$) Least expensive
2. (N) National | (R) Regional
3. E Excellent | G Good | F Fair | P Poor

Written by Peter J. Stefano Photograph: Marty Baldwin
This summer, move your woodworking outdoors by building and installing this deck delight. Our railing system relies on few visible fasteners, using instead tenoned rails and stiles to provide strength and support. Better still, it features lighted posts that accent your handiwork in the evenings while allowing for safe movement around your new or remodeled deck.

Note: If you're building a new deck, install the 4x4 corner posts first, and then center the other 4x4 posts between the corner posts. We kept our posts at or below 4' on center. Then, whether using new or existing posts, review the four-step Railing Installation drawing and the
Instructions in this article for the overall method of fitting the railing system between the posts before you begin crosscutting the rails (D, E) to length.

We recommend having a licensed electrician install the wiring for your deck lighting to meet codes in your area.

Determine the part sizes to fit your deck posts

1. Cut your 4x4 posts so they protrude 28½" above the surface of the deck where shown in step 1 of the Railing Installation drawing located on page 73.
2. Attach a porcelain light fixture centered on the top of each interior post (not the corner posts). Have the fixtures wired as shown on the Deck Wiring drawing located on page 72. Put bulbs in the fixtures and test the wiring. Then, unplug the system and remove the bulbs until the construction is completed.
3. Measure the thicknesses and widths of your posts, and adjust the

Continued
3 Lay out and cut the mortises in parts B and C where shown on the Railing Installation and Exploded View drawings and the Mortise detail accompanying the Exploded View. (We used a ¾” drill bit to drill a blade start hole. Then, we cut the mortise to shape with a jigsaw.) Mark the hole centerpoints, and drill the holes for screwing the louvers in place later.

5 Lay out and cut the mortises in parts B and C where shown on the Railing Installation and Exploded View drawings and the Mortise detail accompanying the Exploded View. (We used a ¾” drill bit to drill a blade start hole. Then, we cut the mortise to shape with a jigsaw.) Mark the hole centerpoints, and drill the holes for screwing the louvers in place later.

6 Clamp the tenoned balusters between the rails.

7 With the post covers still taped in place, screw the As and the non-mortised Cs to the posts. Do not secure any of the mortised pieces to the posts yet.

4 Crosscut the balusters (F) to length. (We ripped our balusters to thickness and width from 2x8 stock. We also cut a few extra balusters for making test cuts when forming the tenons on the ends in the next step.)

5 Fit your tablesaw with a dado blade, and cut 1”-square tenons ¾” long on the ends of each baluster. Attach a 45° support to your miter gauge, and cut a chamfer on each tenon of the balusters as shown in the photo below. Test-cut the extras first to verify the setting. The octagonal ends on the balusters should fit snug inside the 1” holes in the rails (E).

6 Tape parts A, B, and C to the posts as shown in step 1 of the Railing Installation drawing.

Add the rails and balusters between posts

1 Using step 2 on the Railing Installation drawing for reference, determine the lengths of railing parts D and E. Cut the rails (D, E) to the determined lengths.

2 Cut a 1x3” tenon on each end of the mid and bottom rails (E) to fit snug into the previously cut mortises in the post covers B and C.

3 Use the equation in step 3 of the Railing Installation drawing to determine if you'll need an even or odd number of balusters (F) between the posts. Next, locate and mark the centerpoints for the balusters (F). Drill a 1” hole at each centerpoint. (To speed up the process, we used a fence on our drill-press table to keep the holes centered.)

4 Crosscut the balusters (F) to length. (We ripped our balusters to thickness and width from 2x8 stock. We also cut a few extra balusters for making test cuts when forming the tenons on the ends in the next step.)

5 Fit your tablesaw with a dado blade, and cut 1”-square tenons ¾” long on the ends of each baluster. Attach a 45° support to your miter gauge, and cut a chamfer on each tenon of the balusters as shown in the photo below. Test-cut the extras first to verify the setting. The octagonal ends on the balusters should fit snug inside the 1” holes in the rails (E).

6 Clamp the tenoned balusters between the rails.

7 With the post covers still taped in place, screw the As and the non-mortised Cs to the posts. Do not secure any of the mortised pieces to the posts yet. Remove the mortised pieces (B, C), and glue and screw each section of railing together in the configuration shown on step 4 of the Railing Installation drawing. Slide each railing section between the 4x4 posts, and screw the sections in place.

8 With the post covers (A-C) and railing (D-F) in place, bevel-rip one face of the stock that will be used for the base pieces (G) at 20°. Then,
RAILING INSTALLATION

STEP 1
Wrapping and wiring the post

Porcelain lamp holder

STEP 2
Determining the rail lengths
Mortise in one part (C) for the corner post.

Measure distance between wrapped posts. Cut rails (D) to measured lengths. Cut rails (E) to measured lengths plus 1 1/4" for the tenons.

STEP 3
Locating the balusters

Determine the number of balusters by using the following formula.

\[
\text{number of posts} = \left\lfloor \frac{\text{measured length} - 8.25}{2.5} \right\rfloor
\]

If you have an odd number of balusters, start with the center baluster and work out.

If you have an even number of balusters, start baluster centerpoints 1 1/4" from center.

STEP 4
Securing the railing sections

Wood Magazine August 1998
mite-cut the post base pieces (G) to length from the long strip. Drill mounting holes, and secure the pieces to the cedar-covered posts.

**Try a jig for mass-producing the louvers**

1. To make the louvers, start by cutting the louver sides (H) to size. Cut a few extra for verifying the dadoes cut with the jig later.
2. For ease in cutting the dadoes in the side pieces, build the jig shown in the Louver Jig drawing.
3. Fit your tablesaw with a 1/4" dado blade, and raise it 1/4" above the surface of the saw table. Angle your miter gauge 45° from the blade, and clamp (no screw yet) the jig to your miter gauge and make the cut for the index pin.
4. Remove the clamp, and position the jig so the second cut will be 3/32" away from the first cut. Once you have accurately positioned the notch from the blade, screw the jig to your miter gauge where shown on the Louver Jig drawing.

5. Position one end of one side piece (H) against the stop. Make the first cut as shown in photo B.
6. Place the angled dado on the index pin, and make the second cut. Continue the process until all six dadoes are cut in the side piece. Check the location of the dadoes against the Louver Dado Location drawing. Cut the dadoes in half of the pieces as shown in photo B.
7. Angle the miter gauge 45° the other direction, and switch to the opposite side of the blade. Remove the jig from the miter gauge, and put the side that was down up as shown in photo C. Dado the remaining louver sides.
8. Hold the louver sides (H) in place, and measure the distance between the dadoes. Then, cut the louvers (I) to size.

---

**Bill of Materials**

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<th>Part</th>
<th>Finished Size</th>
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<th>Qty.</th>
</tr>
</thead>
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<td>C</td>
<td>TD</td>
</tr>
<tr>
<td>B post covers</td>
<td>1/4&quot; 5&quot; 34 1/2&quot;</td>
<td>C</td>
<td>TD</td>
</tr>
<tr>
<td>C corner post covers</td>
<td>3/4&quot; 3 1/8&quot; 34 1/2&quot;</td>
<td>C</td>
<td>TD</td>
</tr>
<tr>
<td>D top rails</td>
<td>1 1/4&quot; 3/4&quot;</td>
<td>TD</td>
<td>C</td>
</tr>
<tr>
<td>E mid &amp; bottom rails</td>
<td>1 1/4&quot; 3/4&quot;</td>
<td>TD</td>
<td>C</td>
</tr>
<tr>
<td>F balusters</td>
<td>1 1/4&quot; 1 1/4&quot;</td>
<td>TD</td>
<td>C</td>
</tr>
<tr>
<td>G post bases</td>
<td>1 1/4&quot; 2&quot; 7 1/2&quot;</td>
<td>C</td>
<td>TD</td>
</tr>
<tr>
<td>H sides</td>
<td>1 1/4&quot; 1 1/4&quot; 2&quot;</td>
<td>C</td>
<td>TD</td>
</tr>
<tr>
<td>I louvers</td>
<td>1 1/4&quot; 1&quot; 3 1/4&quot;</td>
<td>C</td>
<td>TD</td>
</tr>
<tr>
<td>J rails</td>
<td>1 1/4&quot; 6 1/4&quot;</td>
<td>TD</td>
<td>C</td>
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</table>

**Materials Key:**
- C - cedar

**Supplies:**
- 11/4", 2", and 21/2" deck screws; #8 x 1/4" brass wood screws; 1/16 x 19-gauge wire nails; aluminum flashing; porcelain fixtures; Romex 14/2; UF wire; wire nuts; weather-proof junction boxes; exterior finish.

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**LOUVER JIG**

**TOP VIEW**
- Tablesaw
- Guard
- Miter gauge
- 1/8 x 1/4 x 2 1/2" index pin
- 3/4 x 2 1/4 x 3" stopblock
- 3/4 x 2 1/4 x 18" fence

**FRONT VIEW**
- Center guard on fence flush with end.
- 1/4" dadoes 1/4" deep cut at 45°
- 3/4 x 2 1/4 x 3" stopblock
- 1/4" dadoes 1/4" deep cut at 45°

**LOUVER**
- 1/4" dadoes 1/4" deep
- 1/8 x 19-gauge wire nail

---

**continued**
1" tenon 3/8" long with a 5/16" chamfer
1" hole 7/8" deep

MORTISE DETAIL

#8 x 7/8" R.H. brass screw
1 x 3" mortise
1 x 3" tenon 5/8" long

TENON DETAIL

1" tenon 3/8" long
1" hole 7/8" deep

Ceramic lamp holder

1" hole 7/8" deep
1" tenons 3/2" long

EXPLODED VIEW

2" deck screws
2 1/2" deck screws

1/2" round-overs

Deck post

1 1/4" x 3 1/2" aluminum flashing

Porcelain lamp holder

20" 34 1/2"

Bevel-rip outside surfaces of (G) at 20°.

Biscuits join two lengths of (J)

Mitered ends

Romex 14/2 UF wire

5/32" hole countersunk

1" hole 7/8" deep

3/4" groove 3/8" deep

1 x 3" tenon 5/8" long

POST BASE SIDE VIEW DETAIL

1/2" hole, countersunk

Mitered ends

Bevel-rip outside surfaces of (G) at 20°.
9 Nail each louver assembly together, checking for square. Screw (no glue) the louver assemblies in place between the post cover pieces B. The louver assemblies need to be removable, allowing you to replace burned-out bulbs later.

Here's how to finish your masterpiece:
1. To reflect the heat and light from the light bulbs (don't use more than a 60-watt bulb) make a reflector for each light box. To do this, bend aluminum flashing in a U-shape where shown on the Exploded View drawing. Fit the heat/light reflector over each bulb.
2. Rip and crosscut the top rails (J) to length (we cut them from 2x8 stock). Rout and sand 1/2" roundovers along the top edges. (We miter-cut the top rails, centering the miter above the corner posts. Then, we cut and glued a double biscuit joint to connect straight lengths of the top railing and also to join the mitered corners.)
3. Drill angled holes through the D rails, and screw the top rails in place. The holes need to be angled, allowing you access to work from the bottom side of the D rails.
4. Leave the railing unfinished and it will age naturally. Or, seal the posts and railing with a quality outdoor finish. (We recommend a penetrating oil finish. A good finish will also minimize splitting and cracking.)
5. When a bulb burns out, simply remove one of the louver assemblies and replace the bulb.

Position one end of a louver side piece against the stop, and make the first cut. Place the angled dado on the index pin, and continue making the cuts until all six dadoes are cut in half of the louver sides. Check the location of the dadoes against the drawing at right.

To cut the dadoes in the other half of the louver side pieces, angle the miter gauge 45° the other direction and switch the jig to the opposite side of the blade. Remove the jig from the miter gauge, and put the side that was down in photo B up as shown in photo C.

Written by Marlen Kemmer  Project Design: James R. Downing  Illustrations: Lorna Johnson  Photographs: Bill Hopkins; Hetherington Studio
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Gas blast keeps finishes fresh for future use

What a waste! You've just opened a can of polyurethane—one that's darn near half full—only to find a thick skin over the surface. You know that once you break through the congealed varnish, you'll probably have to strain the product, if there's any that's usable at all.

You don't have to put up with that. A spurt of Bloxygen into the can before closing it keeps the finish from curing during storage.

When sprayed into a container, Bloxygen, a heavier-than-air blend of inert gases, settles on the surface of the contents. It forms an oxygen-free blanket to keep the finish from hardening.

To test Bloxygen, I poured about an inch of polyurethane varnish into each of two jars one Monday morning. I screwed the lid tightly on one, and sprayed a two-second burst of Bloxygen into the other before screwing the lid on.

I opened both jars every Monday morning thereafter for six weeks and allowed them to sit open for 20-30 minutes. After this simulated use, I sprayed Bloxygen into the test jar and recapped both containers. The varnish in the untreated jar (left in photo) thickened and skinned over within a few weeks; that in the Bloxygen-treated jar (right in photo) remained skin-free.

A can of Bloxygen feels empty right from the start (net weight of contents is a mere 0.6 oz.). But, it contains enough gas for about 75 two-second bursts, the prescription for treating quart-size or smaller cans. (A gallon can requires a four-second spritz.)

Bloxygen keeps finishes fresh and helps reduce waste. It's priced at $9.95. Available through woodworking stores and catalogs.

—Tested by Jan Svec
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<td>4-1/8” 3/4” MAIL</td>
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**Central Machinery**

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• Locks to three sides of a hex fastener
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PORTER-CABLE
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• 6-1/4" tool length
• 3-1/2 lbs. net weight
• Factory reconditioned, factory perfect.

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Motor: 2-HP, Depth cut: 3-1/8" @ 90° 2-1/8" @ 45°, Maximum rip: 25".
No load speed: 3450 RPM, Arbor: 5/8".
Table: 20-1/8" x 27".
Table extensions: steel 10-1/8" x 27".
Shipping weight: 233 lbs.

$319.99 $289.99
ITEM 36727-3FEA

Bosch 1567AVS-50
50TH ANNIVERSARY EDITION VARIABLE SPEED JIGSAW KIT
Four position orbital action combined with 600 to 3,000 RPM variable speed gives steady cuts in all kinds of materials. Three position dust blower keeps you off line of cut clear - turn off for metal cutting. Limited edition features gold front gear housing and cover, carrying case with gold leaf logo. Includes one block with 50th anniversary logo, 2 Progressive blades, standard three-blade pack, anti-slipper, steel and plastic inserts.

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Motor: 1/3 HP, 2.4 amp, 60 Hz, 110V, 3450 RPM
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• Table: 5-5/8" x 5", lift in 45°
• Belt: 30" x 450 RPM belt speed, 80 feet weight

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12V CORDLESS DRILL KIT
12V Cordless Drill/Driver Kit
• Includes: (1) drill driver
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E-Z Read Tape ends fractional fumbling

The E-Z Read Tape ranks as one of those products that’s so simple, you wonder why it’s taken so long to reach the market. Instead of just lines to divide up the inches, this tape has fractions in 1/8 increments printed right on it.

Now before you laugh it off as too simple or unnecessary, I’d venture a guess that few of us have never cut a board the wrong length because we misread the tape. I found the E-Z Read Tape eliminated that quick mental calculating we all do to figure out if it’s 1/8 or 3/16, for example.

As shown in the photograph below, the tape also contains foot and inch numbering, as well as standard stud markings for 16” centers. While this seems like a lot of information, the tape’s yellow background and bold numbers make it easy to read.

In addition to these special features, the E-Z Read Tape has the usual qualities you expect in a good tape measure including a smooth retraction mechanism and sturdy tape with triple-riveted end hook. I tested a 1”x25’ model, but the company also offers 1”x12’, 3/4”x16’, and 1”x33’ models. Prices range from $5.99 to $14.99.

—Tested by Dave Henderson
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- Blade instead of 3

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New 12" position table slides 0° to 6" tilted w/o saw blade. Use w/ or w/o saw blade.

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**DURALINE HI-AT FOR TABLE & RADIAL SAWs**

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**PORTABLE & PANEL SAWs**

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**FREEDOM CARBIDE CONVEYOR CARDS**

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- Provides extra-long honing time
- Research and development

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Gritty compound gives screwdriver greater grip

Stick a screwdriver tip into the slot of a rusty screw you want to remove from a piece of hard-wood, and you have the makings of an ugly workshop episode. All too often the screwdriver tip slips out of the slot, chewing up the screw head and making removal even more difficult.

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—Tested by Randy Zimmerman

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Continued from page 82

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In New England, trees once were married

In his renowned book, *A Reverence for Wood*, author Eric Sloane cites the fact that in the early days of the nation, people living in Connecticut's Berkshire Hills cleared the land of hardwood trees about every 35 years. This "coaling," as it was called, provided wood for charcoal to fire the area's many iron furnaces.

After such a clearing, the only trees to be seen for miles were the large "husband and wife" trees that farmers traditionally planted on each side of the entrance to their newly built homes. Even today, you can spot some of these matrimonial landmarks across the New England landscape.

Get some low-cost help identifying trees

What can you buy for three bucks these days that's educational as well as enjoyable? In most places, not even a ticket to the movies. The National Arbor Day Foundation, however, has a super deal that you can really use—if you're into wood and the trees it comes from.

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Dollywood's master carver

You don't have to be a woodcarver to enjoy watching Lee Warren at work. He's the master carver at Dollywood Entertainment Park in Pigeon Forge, Tennessee. And for six months of the year, park visitors get to see him carve while listening to his tales of carving history and explanation of techniques as he employs them.

Lee, 56, wasn't born with a carving knife in hand. In fact, he was a movie stunt man before he took up carving in 1977. But since 1982, he's been at it full-time, learning as he worked. He even spent 1990 in Austria and Switzerland studying traditional European Nativity carving.

At Dollywood, Lee has taken on a number of challenges. He replicated several of the animals featured on the park's turn-of-the-century Dentzel carousel, and sold one horse for $10,000. And he has become adept at creating cigar-store Indians, now his trademark.

His most challenging project to date, though, is "Jesus, the Good Shepherd," shown right, one result of his European study. The 7'-tall (with base) figure cradling a lamb took him two seasons to complete. "That's because in a 10-hour day, I'll spend seven hours talking," he laughs. Carved from laminated basswood blocks that totaled over 700 pounds and colored with oil stains, it (and two child figures in progress at press time) will occupy a commanding spot outside the park's Robert F. Thomas Church.

Visit Lee and see him and others demonstrate in Craftsmen's Valley during October, which is Crafts Festival month at the park. Dollywood is open May through October. Call 800/DOLLYWOOD. Or write Dollywood Information, 1020 Dollywood Lane, Pigeon Forge, TN 37863-4101.

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See page 56

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**FULL-SIZE PATTERNS FOR PARTS A, C, AND D**

Grain direction

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**FULL-SIZE PATTERNS FOR PARTS A AND B**

Grain direction

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**FULL-SIZE TOP PATTERNS**

Grain direction

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