

Building a Bed Frame

■ Dovetailed Coffee Table

■ A Weekend Mantel Clock

TODAY'S

Issue 16

■ \$3.95

WOODWORKER™

PROJECTS, TIPS AND TECHNIQUES



TODAY'S

WOODWORKER™

PROJECTS, TIPS AND TECHNIQUES



8 A Maple and Padauk Bed Frame

By Chris Inman

Dramatic color contrasts and hybrid styling are beautifully combined in this unique bed frame.



14 Dovetailed Coffee Table

By Brian

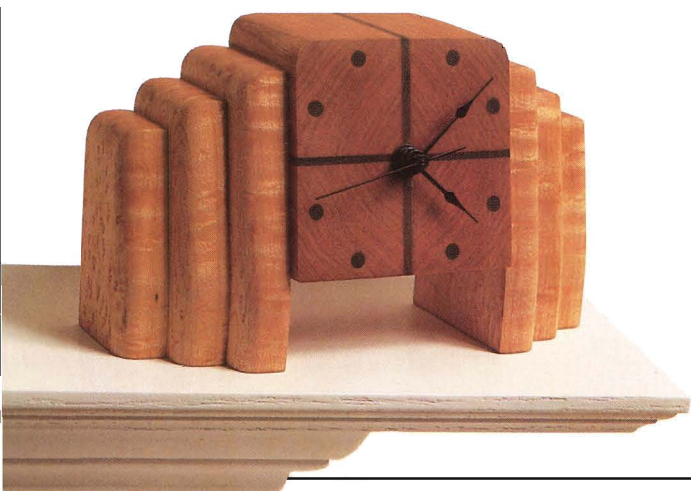
Ruonavaara

Highlighted by bandsawn dovetails, this table is an excellent introduction to traditional joinery and contemporary design.

18 Mantel Clock

By Rick White

Work up a production line on this easy to make clock and you'll have plenty of time for visiting this holiday season.



20 Yesterday's Woodworker

By Drew Langsner

A centuries old Swiss craft is described by a devoted artisan.



3 On the Level

Targeting project goals.

4 Tricks of the Trade

Quick tips for your shop.

6 Hardware Hints

Resurrecting an old hardware standard.

7 Techniques

Installing butt hinges.

17 What's In Store

The chairmaker's dream.

22 Readers Gallery

A whimsical child's bed.

23 Today's Wood

Searching for domestic exotics: Osage Orange.

The cover: Our thanks to Darrell Peterson and New Creations Homes for the use of their model home in St. Michael, Minnesota.

Safety First

Learning how to properly operate power and hand tools is essential for developing safe woodworking practices. For purposes of clarity, necessary safety guards have been removed from the equipment shown in some of the photos and illustrations in Today's Woodworker. We in no way recommend using this equipment without safety guards and urge readers to strictly follow manufacturer's instructions and safety precautions.

LARRY N. STOIAKEN
Editor

JOHN KELLIHER
Art Director

CHRIS INMAN
Associate Editor

STEVE HINDERAKER
Associate Art Director

NANCY EGGERT
Production Manager

JEFF JACOBSON
Technical Illustrator

GORDON HANSON
Copy Editor

DAN JACOBSON
Project Designer

ANN JACKSON
Publisher

JIM EBNER
Director of Marketing

VAL E. GERSTING
Circulation Director

DEB HOLM
Circulation Coordinator

NORTON ROCKLER
RICK WHITE
STEVE KROHMER
Editorial Advisors

HUGH FOSTER
BRUCE KIEFFER
JERRY T. TERHARK
Contributing Editors

Today's Woodworker, (ISSN: 1041-8113) is published bimonthly (January, March, May, July, September, November) for \$18.95 per year by Rockler Press, 21801 Industrial Blvd., Rogers, MN 55374-0044. Second class postage paid at Rogers, MN and additional mailing offices.

POSTMASTER: Send address changes to Today's Woodworker, PO Box 6782, Syracuse NY 13217-9916.

One year subscription price, \$18.95 (U.S. and possessions); \$28.95 (U.S. currency—other countries). Single copy price, \$3.95; (other countries, \$5.50, U.S. currency). Send new subscriptions to Circulation Dept., Today's Woodworker, PO Box 6782, Syracuse NY 13217-9916. Subscribers are welcome to submit project proposals, tips and techniques to the editor, Today's Woodworker, Box 44, Rogers, MN 55374. For purposes of clarity, illustrations and photos are sometimes shown without proper guards in place. Today's Woodworker recommends following ALL safety precautions while in the shop.

Today's Woodworker is a trademark of Rockler Press.

Copyright 1991, by Rockler Press.
All rights reserved.

Planning an Issue

When we sit down and plan each issue our first goal is to come up with projects that can be built by weekend woodworkers. But following close on the heels of this objective is our second goal: creating attractive, sophisticated designs that look much more complicated to build than they actually are. By doing this we hope to promote basic woodworking skills in an innovative way, with an end product that makes the effort worthwhile.

The projects in this issue are a perfect example. If you have only a few hours to spend during the coming weeks, you might want to make the mantel clock just

to keep your skills honed. Those with a little more time should try their hand at the dovetailed coffee table to discover how accessible a contemporary design can be. And finally, our maple and padauk bed frame, which looks like a million bucks, will keep a more ambitious woodworker busy for several weekends and a few evenings.

It's a broad range of projects with challenges for woodworkers at every skill level.

We hope you enjoy this issue and look forward to your comments.

Larry N. Stoiaken

I enjoy your magazine. I am enclosing a photo of the breakfast tray featured in January 1990 which I recently finished as a birthday gift. I made a couple of slight alterations, substituting 3/8" dowels for the 1/4" (mainly because I had a stock of them) and using mahogany splines, which provided a nice contrast to the maple. There are numerous other projects I have been saving in your magazine which I have yet to find the time to make. Those on my list include the Futon sofa, Adirondack chair, European style workbench and step stool. I receive quite a number of woodworking magazines and yours seems to be the only one to feature plans for Scandinavian/European style furniture. I hope you continue to fill this niche.

Tina R. Walters
Ravenna, Ohio

TW responds: Great job Tina. I'm sure we'll have more projects for you.

I believe there is an army of Today's Woodworkers out here using hand-tools and perhaps a fine workbench with a wood vise, a table saw, an orbital sander and a power drill. I suggest a department in your magazine for useful "one night" or "one weekend projects" for people like us. We are an enthusiastic army!

Don't misunderstand me—I love your magazine. I suggest a timely "Christmas Projects" issue featuring gifts that can be made with hand-tools. I once made eight beautiful maple napkin boxes with a real fancy front handle to carry it. That was 15 years ago and every one is still in use and handed down.

Robert J. Berkey
Zanesville, Ohio

TW responds: Fair enough, but let's add a router to this list. It's a tool we consider essential for Today's Woodworker projects.



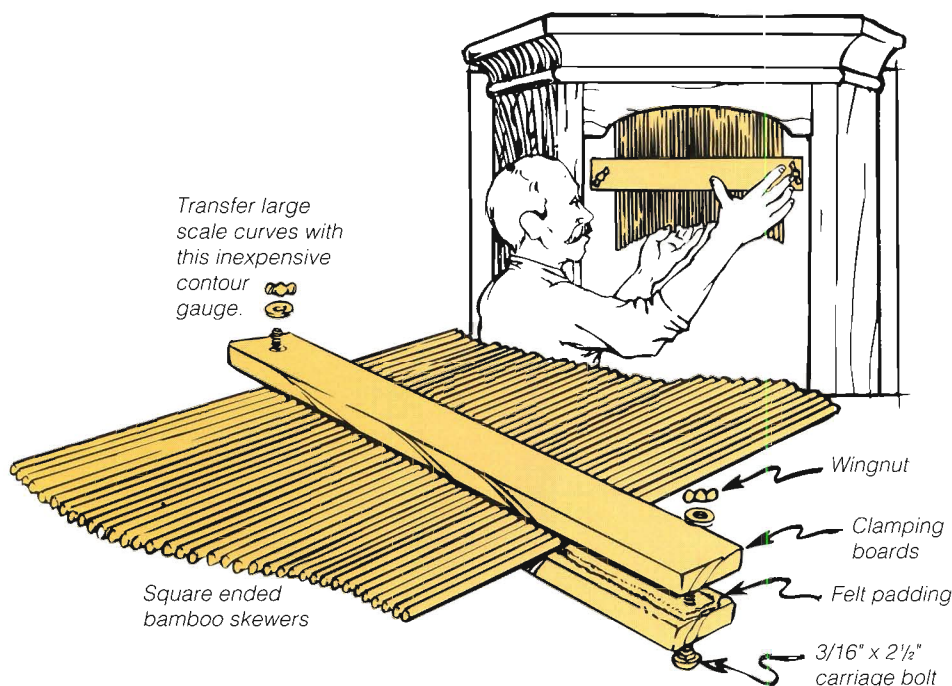
I would like to compliment you on the high quality of your publication.

I would also like to express an opinion. While I enjoy the section describing various types of woods used for projects, could you insert a reminder that for exotic species of wood (or those in short supply), your readers ask where the wood was grown? Please remind them that exotic species are sometimes harvested from rain forests and other ecologically sensitive areas. Some of these woods are now farm grown. Many of us enjoy woodworking but, I believe we can be environmentally conscious and "have our cake, too". Thank you and keep up those high quality standards!

Michael Kinney
Alexandria, Virginia

TW responds: It's a complicated issue. Many feel that if we completely stopped using exotics their value would drop, causing an increase in slash and burn practices to make room for cattle grazing. One possibility is to accurately track our lumber so we buy it from conservation minded sources. All these issues are being hotly debated, and hopefully woodworkers will play a key role in preserving the rain forests. To get more involved, we suggest writing to: WARP, P.O. Box 133, Coos Bay, OR, 97420 (503-269-6907).

Saving With Homemade Jigs



Custom Contour Gauge

Once in a while I have large areas on projects that need duplicating, but no contour gauge on the market is big enough. I constructed a suitable tool using 2 $\frac{3}{4}$ " x 14 $\frac{1}{2}$ " wood scraps, and glued felt on the inner surfaces of both blocks. I then drilled 3/16" holes at each end of the blocks. Next, I placed 135 bamboo skewers (purchased at the local supermarket) between the felt covered sides of the blocks, and clamped everything with 3/16" x 2 $\frac{1}{2}$ " long bolts. I placed washers and wing nuts on the bolts for making quick adjustments and, voila! —a great contour gauge that doesn't scratch my project, is easy to use and only cost a couple dollars to build!

*Don J. Begnaud
Lafayette, Louisiana*

Getting A Better Grip

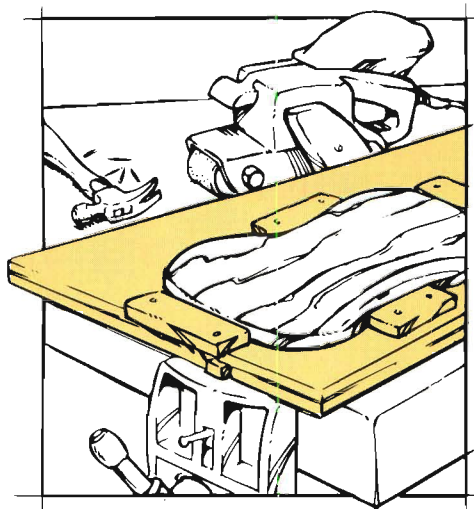
When I need a better grip while working round stock into a hole, such as a chair rung, I use one of those small rubber sheets sold at grocery stores to assist in opening jar lids. They're cheap, and they come in enough different shapes and colors to suit even the most discriminating woodworker.

*M. P. Carroll
Sacramento, California*

Sanding Thin Flat Pieces of Wood

To hold a thin, flat piece of wood for sanding, place it on some plywood that's larger and nail three or four scraps of the same thickness around its perimeter. The scrap pieces should be nailed tightly against the sides of the thin stock to hold it securely. The plywood can then be held in a vise or clamped to a workbench during the sanding operation.

*C. E. Rannefeld
Decatur, Alabama*



Bed of Nails Support

Years ago, when I first began making handy items for my home, as well as toys and gifts for the children, I applied finishes to projects while they rested on a few pieces of scrap wood. To improve this process I made a bed of nails for the project to rest on that wouldn't affect the drying finish. Lay out a grid on plywood using a snap line, spacing the lines about 1 $\frac{1}{4}$ " apart, then carefully drive bright #4-1 $\frac{1}{2}$ " common nails into the plywood where the lines of the grid intersect. Now, when I finish a project on this platform, any excess finish simply drains down the nails and, after the finish dries, it's impossible to detect where the bed of nails made contact with the work.

*Roger W. Marsters
Lyndhurst, Ohio*

Instant Paint Booth

When spray painting small objects, I make an inexpensive paint booth from cardboard boxes. I use different size boxes to suit the particular job at hand. The results are always good, with no overspray getting on my workbench or tools.

*Ben Keenum
Longwood, Florida*

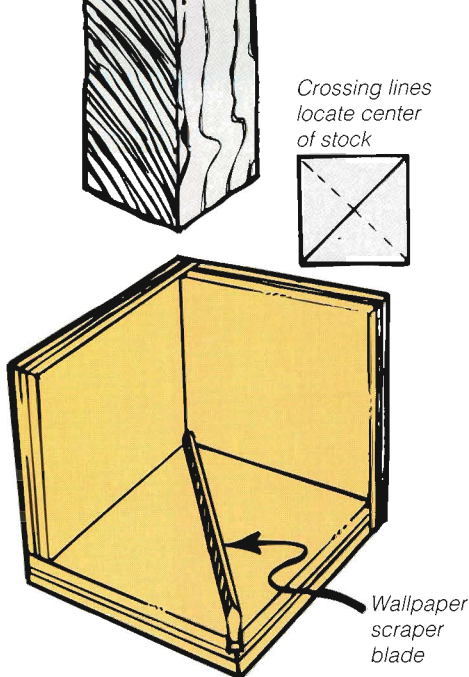
Film Can Glue Pots

A pair of empty 35mm film containers sunk in a thick wood base are used to hold an application brush and glue in our wood shop. The 1 $\frac{1}{2}$ " diameter by 1 $\frac{3}{8}$ " deep holes keep the small containers upright.

We put glue in one canister and a small brush in the other. At the end of a work period we set the brush in the glue, which keeps the brush pliant while the glue remains usable for the next 24 hours. Any dried glue can be easily chipped off the containers before adding fresh glue.

*Alice and Robert Tupper
Canton, South Dakota*

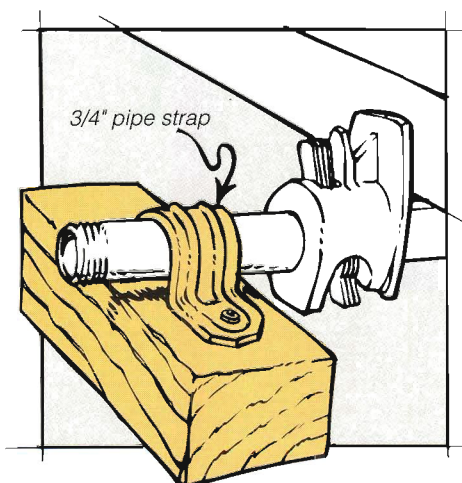
Today's Woodworker pays from \$20.00 (for a short tip) to \$100.00 (for an elaborate technique) for all Tricks of the Trade published. Send yours to Today's Woodworker, Dept. T/T, Rogers, MN 55374-0044.



Center Finder

This little unit makes it very easy to find the center of a square or round piece of wood. I make the jig from plywood and install a wallpaper scraper blade in the base. To use, just set the square or round stock into the corner of the jig and tap it with a mallet, leaving a thin kerf on the end of the stock. Turn the piece 90° and repeat this procedure. Where the kerf lines cross is the center.

*C. E. Wardell
Circleville, Ohio*



No Tip Pipe Clamp

Here's a little trick I use to keep pipe clamps from falling over. I set a pair of 3/4" pipe straps over the pipe and screw the straps to square oak blocks. Use one at each end of the pipe clamp and just loosen the screws if you need to move the blocks to different locations on the pipe. I have these on all my pipe clamps.

*W. E. Barrett
Wellston, Michigan*

Easy Layout of Biscuit Joints

The usual method of laying out the locations for biscuit joints is to mark each board being joined with a pencil line. While this method will get the job done, there are a couple of drawbacks—the pencil marks must be removed, and this is not always so simple, and for those of us with less than 20/20 vision, the pencil lines are sometimes difficult to see.

As an alternative I place strips of masking tape across the joints at locations where biscuits are needed. I then draw a line on the masking tape with a bold marking pen, which helps overcome my vision problem. I label each joint with a letter or number and then, with a razor blade, cut the tape at each joint.

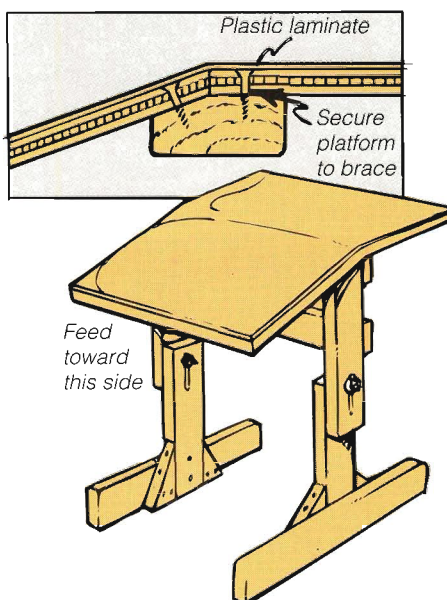
When using biscuits in angled joints, I place the masking tape at a right angle to the joint.

*William E. Moulic, Jr.
Bloomington, Illinois*

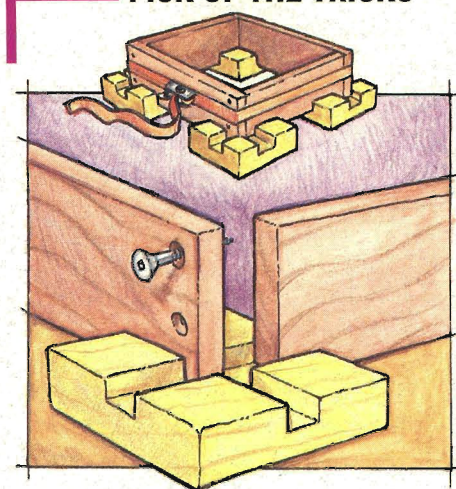
A Better Work Support

The support shown below takes the place of a roller support, but it's much sturdier. It was made of plywood with the joint rounded with a belt sander, then covered with formica. The 2 x 6 legs and 2 x 4 bracing make it very strong. Mine was designed to be stationary but you could easily put casters on it.

*Roman D. Hershberger
Millersburg, Ohio*



PICK OF THE TRICKS



Jig For Holding Boards On Edge

Ever have trouble getting the corners of boards to match up for gluing or just need to hold a board on edge while you check a measurement or the fit of a joint? The solution that works best for me is a simple stand made from 3/4" plywood that's dadoed for holding my cabinet stock on edge.

I cut the plywood into 5" x 6" pieces then cut crossing dados sized for 3/8", 1/2" or 3/4" boards.

Be sure to set the dado blade for a tight fit, otherwise the boards will flop around too much. I cut the dados 1/2" deep.

I've made eight blocks for each dado width, which allows me to hold a box or drawer together on both its top and bottom edges. When I want to assemble a box I spread glue on the joints and set the boards in the jig, then I wrap a web clamp or two around it. These corner blocks keep the sides of the box at 90° to each other while the glue dries.

*William B. Timberlake
Richmond, Virginia*

Win Three Japanese Saws

Congratulations to William Timberlake who won the joiner's mallet for his trick of the trade (shown above) We continue getting great tricks and shop tips from all over the country; seems everyone has a better mousetrap. We'll send the author of our favorite trick in the September/ October issue a terrific set of three Japanese saws.



How To Build A Sturdy Folding Table

When company arrives for holidays or special events there never seems to be enough table space. One solution is a folding table that can be hidden away when it's not in use. To that end, an old hardware standard has recently been reintroduced by The Woodworkers' Store, (21801 Industrial Blvd., Rogers, Minnesota 55374).

Good table leg hardware should allow the legs to lay flat against the underside of the table, lock the legs when they're folded upright, and provide plenty of rigidity when the table is in use. Most commonly available folding table leg brackets do fine on the first two counts, but are notoriously deficient on the third.

The unit manufactured by The Woodworkers' Store is an improved version of a mechanism made by National Lock Company until the mid-sixties, when it was completely phased out of production. Not only did the bracket go off the market, but the dies and machines used to make it were lost or destroyed too. The only available resource was a bracket taken off an old card table and used as a rough prototype for the new design.

The new bracket is made of heavy gauge steel and all the parts that show from under the table are coated in bright zinc. In operation, the bracket

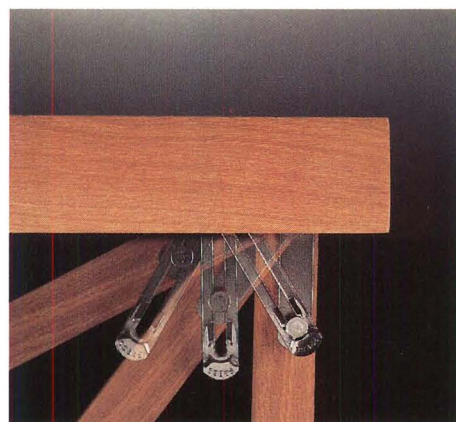
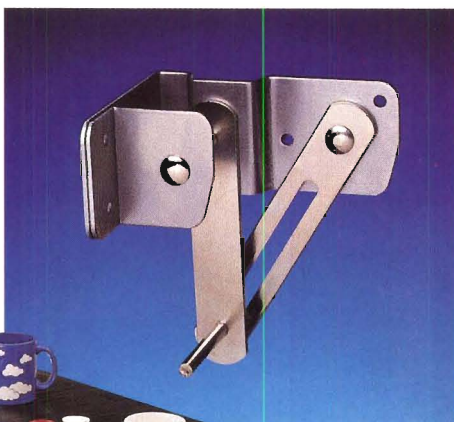
allows the leg to freely swing into position and then locks it in place. The leg pivots on a $3/16"$ pin, which means the builder must complete the assembly on the job. This pin and one other are actually long rivets that, after passing through the bracket and leg, must have their ends peened over to form the retaining head. It's a simple operation, but one that most people don't come across very often.

The folding table leg bracket comes completely disassembled so you can build it around your own $1\frac{1}{4}"$ square leg stock. The table must have an apron to which the bracket can be attached, and it should extend at least $1\frac{3}{4}"$ below the underside of the table to completely hide the mechanism and folded leg. The leg brackets fold in a counterclockwise direction as viewed from underneath the table.

The brackets are sold in pairs, which is convenient for those build-

ing a table that hinges to a wall (only two legs are needed to support the outboard end of the table in this case). Tables of this type are often used in boat cabins, recreational vehicles and workshops, or wherever space is very limited. If you're making a conventional four legged table, be sure to order two sets of brackets.

The table below was built in just two hours and required less than \$20.00 of lumber to complete. The construction was simple. First the fir plywood was cut into a $34\frac{1}{2}"$ square and then it was edged with $3/4"$ thick by $2\frac{1}{2}"$ wide pine. The pine edging is mitered at the four corners for a nicely finished look. The legs were ripped and cut from one six foot $2" \times 4"$ into $1\frac{1}{4}"$ by $1\frac{1}{4}"$ by 29" long pieces. All the hole locations for mounting the legs in the brackets are illustrated on a full size template that comes as part of the instructions. Just cut the template out and lay it on each



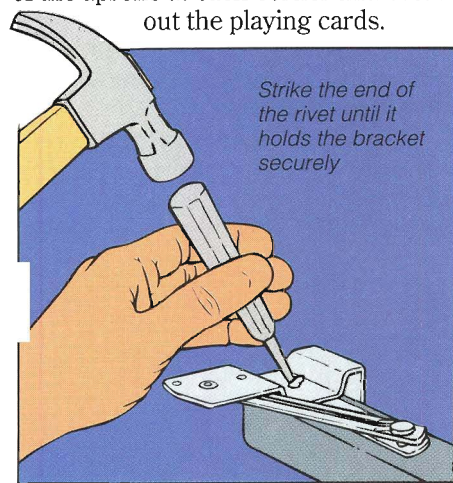
Everyone needs more table space at least a few times a year, and the best answer is a unit that folds up and hides away the rest of the time. The folding leg hardware recently reintroduced by The Woodworkers' Store makes it possible for you to easily build a very sturdy table to your own specifications.



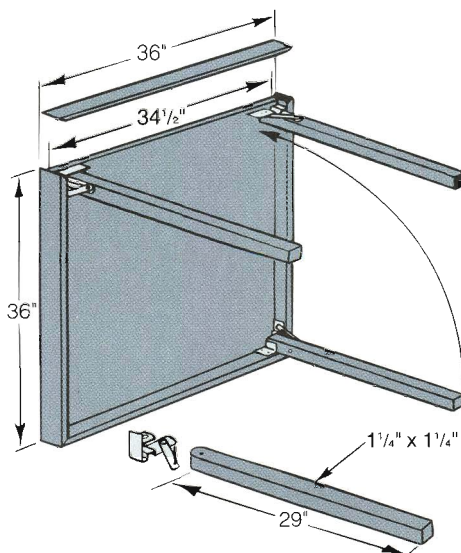
Hinge Mortising

By Bruce Kieffer

leg to mark the holes and the curve on the ends of the stock. One thing you want to be sure to do is paint the table and legs before you assemble the hardware. It's not much fun brushing around the metal plates, trying to avoid the zinc finish. Finish up by securing the brackets to the legs, driving the rivet pins through each hole and mashing the end of the rivets with a hammer and broad tipped nail set. Screw these assemblies to the inside of the aprons at each corner and break out the playing cards.



Position the leg and bracket so the finished end of the rivet is on a metal plate while you strike its other end with a hammer and nail set.



Building a folding table can be as simple as wrapping a piece of plywood with an apron and securing four legs in the corners with the brackets.

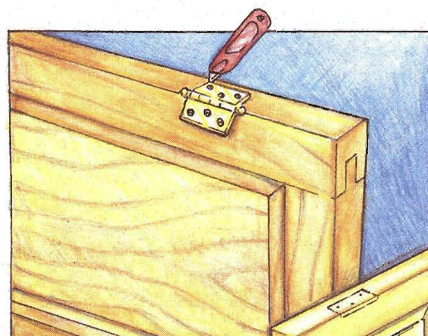


Figure 1: With the hinge itself serving as a guide, a sharp utility knife is used to deeply score the outline. Start your cuts at the hinge corners so you don't cut past the intended mortise.

When woodworkers need to cut a hinge mortise they grab a chisel and start chopping. Sure it works, but it's slow, and requires a fairly high level of skill. As for me, I favor speed and accuracy with my woodworking techniques, as opposed to some of the more traditional methods.

I developed my hinge mortising technique some years ago by embellishing on a simple trick a master carpenter once showed me. He used only a utility knife to completely cut his mortises. As strange as this may sound, he was very proficient at the task. I also use a utility knife, but then I let my router do most of the hard work and finish up with a chisel. Here's how it's done.

Start by laying out the locations for your hinges. Align and screw the hinges to the wood. Now use a utility knife with a sharp blade to make a scoring cut around the outside edge of the hinge (See **Figure 1**). Make several light passes until the overall cut is almost as deep as the thickness of the hinge. Always start your knife cuts at the hinge's corners, moving inward so you don't accidentally cut further than the corners of the required mortise. Now unscrew and remove the hinge.

Chuck a 1/4" straight bit in a router. Set the router so the bit cuts



Figure 2: Carefully rout away the flat bottom of the mortise, staying 1/32" inside the cut you made with the utility knife.

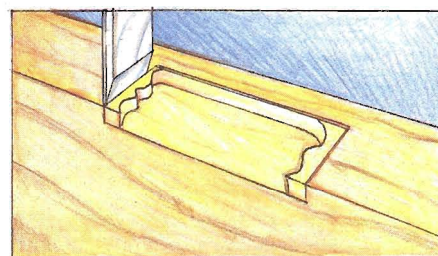


Figure 3: Use a sharp chisel to "pop" away the remaining waste to complete the mortise.

to a depth equal to the thickness of the hinge, or to the depth of the mortise you desire. Carefully rout away the majority of the mortise using an alignment guide to stay 1/32" inside the cut made by the utility knife (See **Figure 2**).

Finish up by using a sharp chisel to complete the mortise, removing the last bits of unrouted wood along the utility knife cuts (See **Figure 3**). These small pieces will "pop" off, leaving a perfectly flat bottomed and snug fitting mortise. Remount the hinge and your ready to continue on with your project.

You'll also find this technique handy for mortising locks and strike plates, or, for that matter, any other hardware that requires a shallow mortise. And as you can see, the results are quick and clean!

Bruce Kieffer, a professional furniture builder, is a contributing editor with Today's Woodworker.

Crossing Classical Lines

Getting a look of sophistication can sometimes be simpler than you ever imagined. The distinctive lines of this bed frame were achieved using basic joinery and one primary tool, the router.

By Chris Inman

Furniture projects generally fall into stylistic categories. There's Shaker, Scandinavian, Country and many other specific styles common to our woodworking repertoire. However, the design of this bed frame is quite unique; a hybrid that captures elements from two different styles. First, the overall design reflects strong influences from the Arts and Crafts period, particularly the designs of Frank Lloyd Wright.

On the other hand, the bedposts are reminiscent of shapes frequently found on post-modern pieces. Of course the bed can be made from any number of different woods, but the contrast of honey colored maple with the deep blood red of padauk creates a striking combination.

It's a treat to build such an elegant piece of furniture, especially once you discover how uncomplicated the construction is. The primary joint in this bed frame is a basic mortise and tenon made almost entirely with a router. With the addition of a table saw and a few hand tools, you can readily make this bed.

The construction took about 40 hours and the materials cost about \$300. You'll need sixteen lineal feet of 3" x 3" maple for the posts, 30 board feet of 6/4 maple for the rails (milled to 1 1/4" thick), eight board feet of 1/2" thick padauk and a small amount of 1/8" thick padauk for the stripes in the posts and ball caps. There are a few other odds and ends in the material list that you'll also need. Bed rail fasteners and the 3" diameter wood balls are available from The Woodworkers' Store.

I advise having your stock milled at a lumberyard. I planed my own material, and hefting

around all that thick maple got to be very tiresome after three hours of work.

Cutting the Stock

When you get your planed material back from the lumberyard you can begin ripping the major bed components to width. Rip the side rails (pieces 1) and lower rails (pieces 2) to a width of 7" and cut the upper rails (pieces 3) 3" wide. Rip the 1/2" thick padauk into 1 1/2" wide slats (pieces 4 and 5) and cut a 24" long piece of 3/4" thick padauk to a width of 5 3/4" for the platforms (pieces 6) that sit on top of the posts.

Before moving on, it's important to remember that all woods are toxic to varying degrees, and this is especially true of exotics. Always be sure to use a dust mask, wear a long sleeve shirt and possibly gloves, all depending on how sensitive you are to inhaling or contacting the fine dust you create while working with these woods. In my own case, I know that padauk is a slight irritant on my skin. If you have a dramatic reaction to working with a certain wood, and this is possible with any species, contact your doctor immediately.

Once you've ripped these pieces to width, crosscut them to the lengths shown in the material list. The lower and upper rail lengths include enough



material for 1¼" long tenons at both ends. Cut your bedposts (pieces 7 and 8) to length at this time too. Make sure your crosscuts are square as this will greatly affect upcoming steps.

Working at the Router Table

The edges of the padauk slats (pieces 4 and 5) are routed with a ¼" roundover bit, which creates a total roundover of ½" on the slat edges. The advantage of this technique is the slats will fit perfectly in mortises routed with a ½" diameter straight bit. Set up your router table with the ¼" roundover bit and rout all the slat edges (See **Figure 1**). A small ridge will likely remain after routing the edges, so lightly sand the pieces to smooth the roundovers.

Replace the bit in the router table with a 3/8" roundover and rout the edges on the platforms (pieces 6) in a similar fashion, again sanding lightly to remove any ridges. I found that sanding the platform edges with a Sand-O-Flex wheel worked very well.

Now switch to a 1/8" diameter straight bit in your router and set the fence 1½" from the bit's center. Raise the bit to a height of 3/32" and rout a groove centered in the front and back of the four bedposts (pieces 7 and 8). Proceed slowly since a 1/8" bit is somewhat fragile.

Before routing the mortises in the bedposts, rip the padauk inlay strips (pieces 9) to go into the grooves you just routed. Set your tablesaw blade to a height of 1/4" and rip eight strips 1/8" wide. Normally I wouldn't trap a narrow strip between the blade and the fence, but this material is so light and flexible that it's unlikely to shoot out of the saw as long as you maintain control of the stock. Rip the padauk to within a foot of its end, cutting the strips to fit the groove snugly, then reach

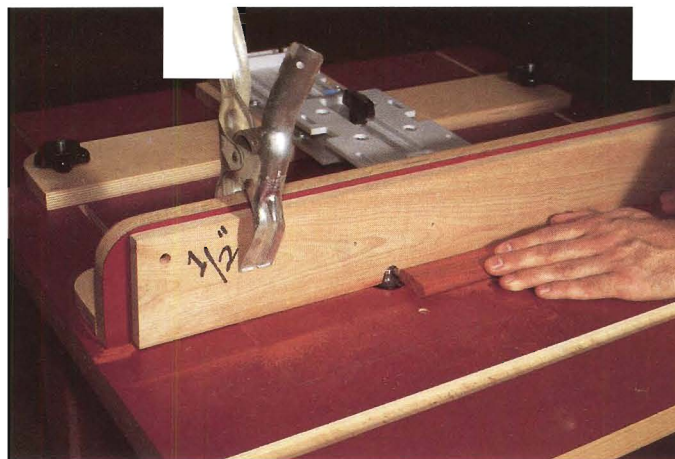


Figure 1: Roundover the edges on the padauk slats by raising the ¼" bit so the outside tip of its curve is even with the table surface. Align the face of the fence with the outside edge of the bit's bearing.

around and pull the last few inches through the blade. Run a small bead of glue in each of the post grooves and press the inlay strips in place.

Routing Mortises

Routing the mortises in the upper and lower rails is tiring work. There are lots of cuts to make here for all the slats, and it takes concentration to remove the material in the right places. The first thing you need to do is make a jig (See **Figure 2**) that limits the length of cut to 1½". The jig I made from scrap plywood is simple and easy to set up; just be sure to alter the spacing between the stop blocks to accommodate the size of your router's base.

Lay out the slat mortises on the rails (see page 12) and equip your router with a ½" straight bit. Adjust the router's edge guide to center the bit on the rail's edge. Line up the registration mark on the jig with the mortise location mark and clamp the jig to the rail. Set the router on the edge of the rail between the jig stops and plunge the bit into the

to take a 1/4" deep pass, followed by a 1/2" deep pass to complete the mortise. Continue this process until all the slat mortises are cut in the upper and lower rails.

Sand the padauk inlay strips flush with the bedposts, then follow the drawing on page 12 to layout the mortise locations in the posts. Precision really pays off here, so take your time and mark everything carefully.

Now chuck a 3/4" diameter straight bit in your plunge router and adjust the edge guide to center the bit on the 3" wide post. Set the depth of cut to 1⅝".

I selected the best side of each post to face me when I stand at the footboard, which is the most frequent view of the bed from within the room. When routing identical pieces like the posts, make it a habit to rout them all with the guide riding against the same point of reference. For instance, always bear the edge guide against the outside face of the posts. This way any slight variation will be the same from post to post. Now take a number of increasingly deeper passes to rout two mortises in each post for the upper and lower rail tenons. You'll find the router is easy to control with the edge guide attached and that stops aren't necessary to control the length of your cut.

Once the post mortises are cut, install a 5/8" straight bit in the router and leave the edge guide set

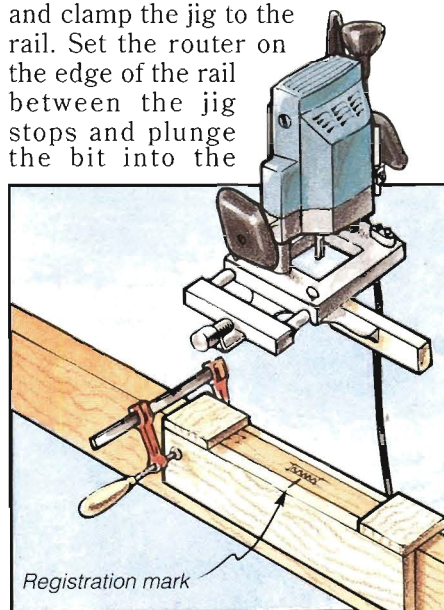
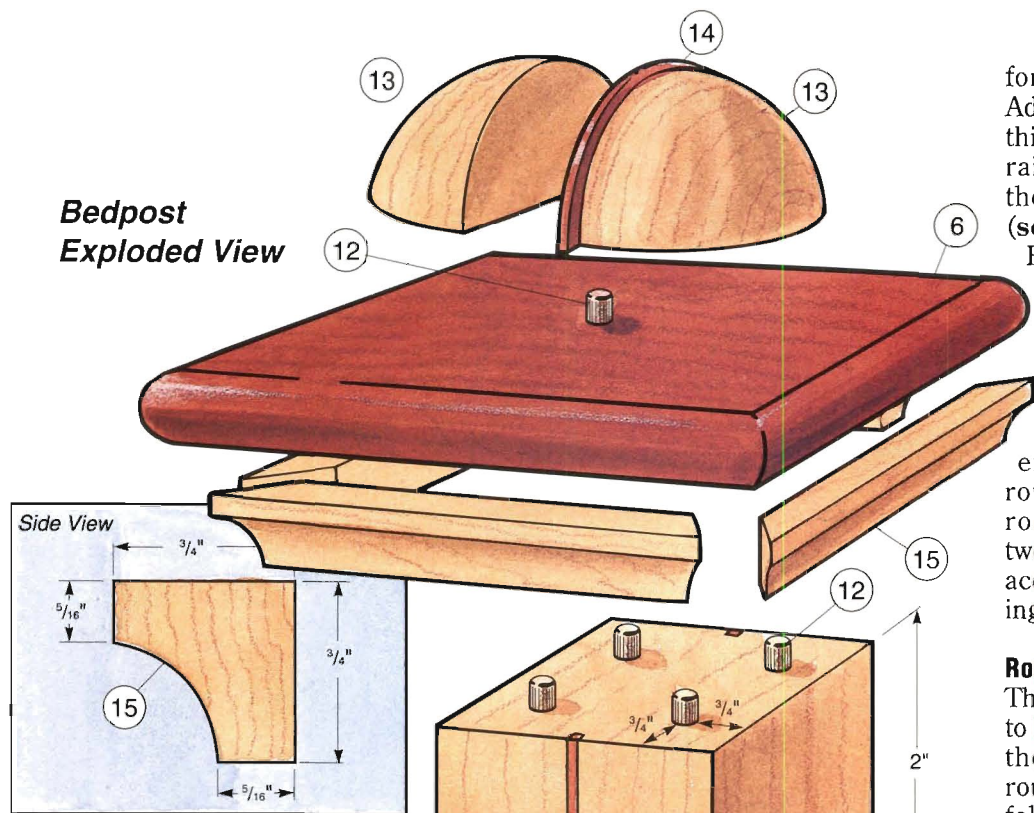


Figure 2: Simplify the mortising process by making the jig shown at left. The jig opening must be designed for your router to limit the length of cut to 1½". The edge guide rides against the jig while centering the bit on the 1½" thick rail stock. Align the centering mark on the jig with the center of each mortise.

Bedpost Exploded View



Cove Moulding Detail

Cheek

Edge

3

Shoulder

for routing the center of the posts. Adjust the cutting depth to equal the thickness of the back plate of the bed rail fasteners (pieces 10) and rout these shallow mortises in the posts (see exploded view on page 11).

Finish this step by squaring the corners of the mortises with a chisel to fit the slotted piece of each pair of fasteners.

With a pencil, outline the slots that will engage the hooks on the other fastener piece and exchange the 5/8" bit in your router for a 1/4" straight bit. Now rout 1/4" deep channels at these two locations within each mortise to accommodate the hooks on the mating fastener pieces.

Routing the Tenons

The rails are really too long and heavy to handle on a table saw while cutting their tenons, so I suggest using a router to remove the cheek material followed by a fine cutting Japanese saw and chisel to cut the shoulders (see exploded view at left).

Use a 3/4" straight bit in your router and set the edge guide to limit the cut to 1 1/4" from the end of the rail to the outside edge of the bit. Lower the bit 1/4" and pass the router over both sides of a piece of scrap to make sure the tenon fits the mortise. When you rout this way, don't define the shoulder with the first pass, but rather, work toward it and make the shoulder cut the last pass. Once you're satisfied that everything is correct, rout the cheeks for the eight rail tenons.

With a Japanese saw or other small, fine toothed handsaw, cut the edge shoulders on every tenon, then pare the shoulders square with a very sharp chisel. The last step in forming the tenons is rounding over the edges with a file so they fit into the router cut mortises. Use a medium toothed cabinetmaker's file to round the edge corners, and you'll need to use a chisel to cut the small hump of wood that always remains at the inside corners of the shoulders after filing. I also chamfer the leading edges of the tenons with the file so they slip into the mortises easily.

Post and Side Rail Details

Before assembling the footboard and headboard, take care of a few minor details on the bedposts while

they're still easy to maneuver. The first thing to do is layout four dowel holes on the top of each post (see exploded view at left) for securing the padauk platforms (pieces 6). Mark the locations and drill 1/4" holes 5/8" deep using a portable drill. Now insert 1/4" dowel centers into the holes and center the platforms on each post. When the platforms are positioned, press down on them to dent the wood with the dowel centers. Now drill 1/4" by 1/2" deep holes at these locations. Don't glue the platforms to the posts until after assembling the headboard and footboard.

The four corners of the posts and the top edges of all the rails are routed with a cove bit. On the rails this detail extends the entire length, but on the posts the routing is stopped short of the ends. Layout the stopping points on the posts (3" from the top and 2" from the bottom) and chuck a 1/2" radius cove bit in your router. Set the bit to cut 1/4" deep and rout the edges of the posts, stopping when you reach the end point lines. I always make my first pass a shallow one and stop slightly short of the lines. On the second pass I cut full depth and rout right to the line. Try to avoid lingering at the line or you'll burn the wood—if this happens, fashion a round tipped scraper to remove the burned wood. After the posts are done, rout the top edges of the rails from end to end.

Take care of one other small item by turning the posts upside-down and routing a 3/16" chamfer on their bottom edges. This makes the post appear to be set off the floor a bit and prevents catching the wood and tearing the corners when the bed is moved.

The ends of the side rails are also mortised to accept the hooked bed rail fasteners. Once again, this is easily done with a router, an edge guide and a 5/8" straight bit. Adjust the guide to center the bit on the edge of the 1 1/4" thick rails and set the depth of cut to equal the thickness of the back plate on the fasten-

ers. Now lay out the start and stop points on the ends of the rails (See **Figure 3**). Clamp on a wide auxiliary board so it's flush with the end of the rail, then plunge the bit into the stock and rout the mortise. Do this to both ends of each rail, then square the rounded ends of the mortises with a chisel. Now set the fasteners in place and give them a sharp blow with a hammer. When you remove the fasteners you'll notice two separate indentations caused by the stamped hook retainers on back of the fasteners. Rout 1/4" channels at these locations so the fasteners will sit all the way into the mortises as shown below.

Set the fasteners into the mortises and mark their screw hole locations. You might as well do this for the posts now too. Drill 2" deep pilot holes with a 5/32" bit, which should be just right for #10-2" flathead wood screws (pieces 11). However, don't install the fasteners until after the bed is finished.

Assembling the Head and Foot Boards

Prior to joining all the pieces in the headboard and footboard I sanded everything to 150 grit. Be sure to ease all the edges on the maple, but don't lose the definition on the coved edges.

Organize all the parts for the footboard first, and I do mean organize. Once you've started putting glue in the mortises, you won't have time to go looking for a slat.

Padauk, due its oily composition,

sometimes fails to bond well with conventional glues. To overcome this problem I use Behlen's Rivit glue, which is concocted for bonding dissimilar materials. Begin spreading glue into all the slat mortises in the lower and upper rails

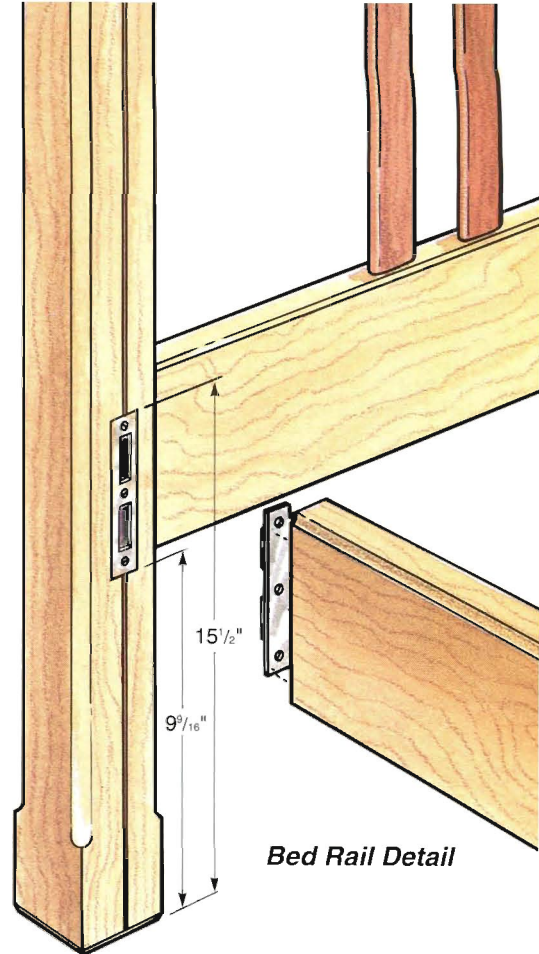
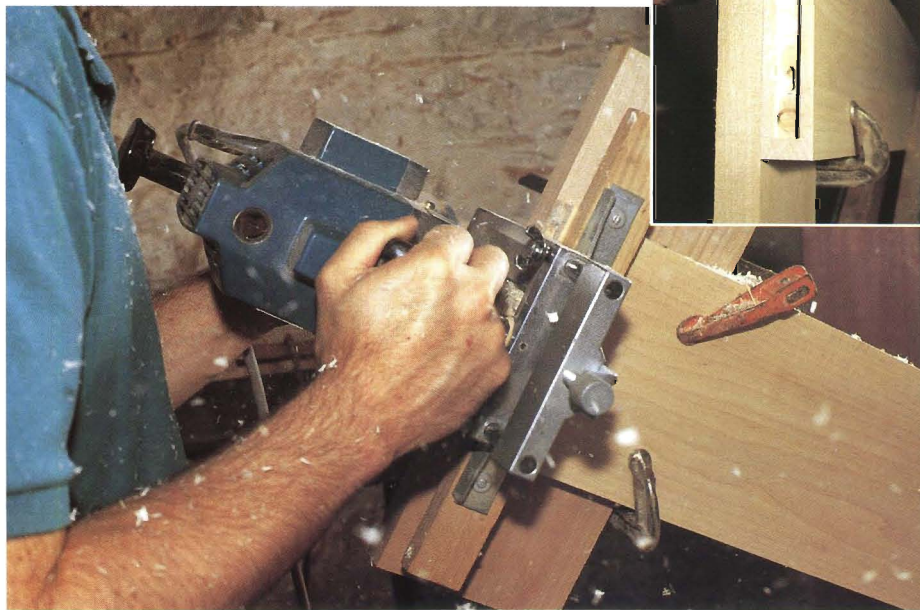
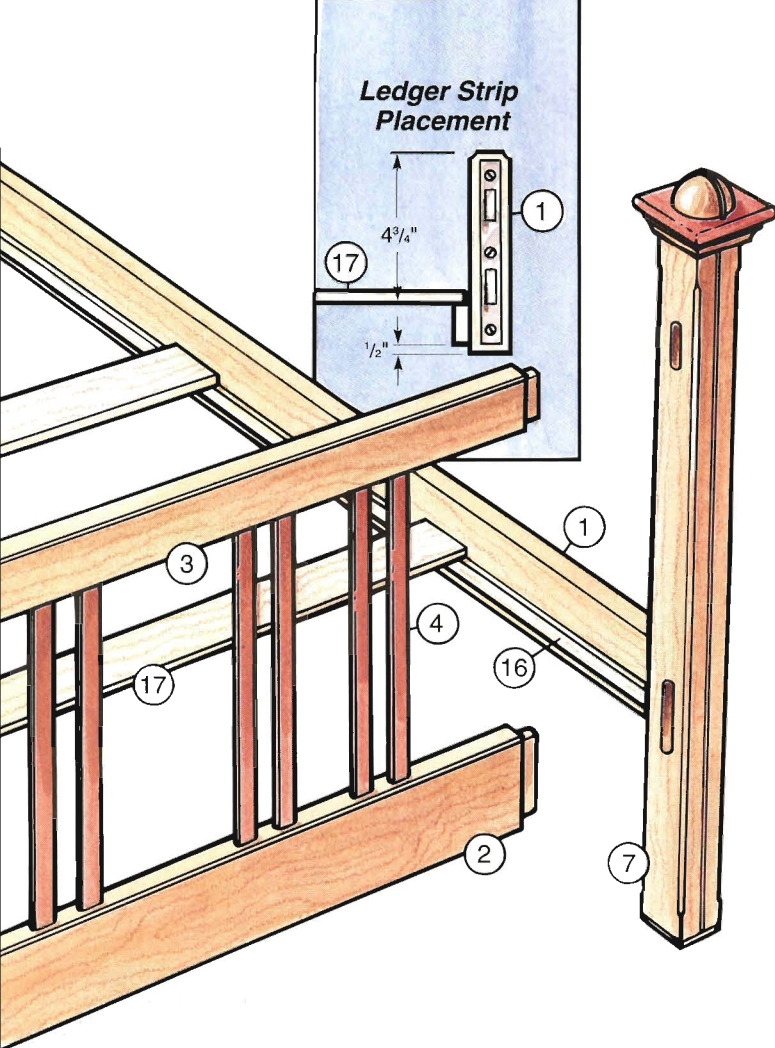


Figure 3: Hold the side rail in a bench vise while routing the bed rail fastener mortises. Clamping a scrap board flush with the rail's end stabilizes your router during this cut. Remember, you also need to cut two deeper channels within the mortise with a 1/4" bit so the fasteners lay flat.

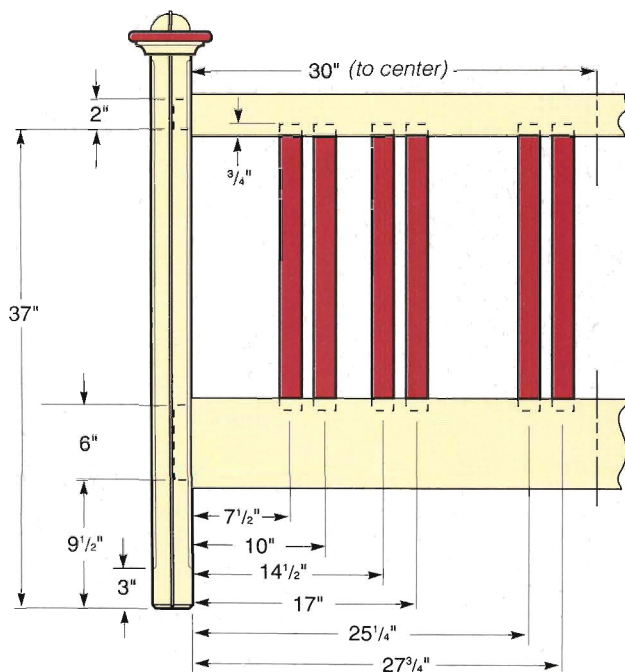




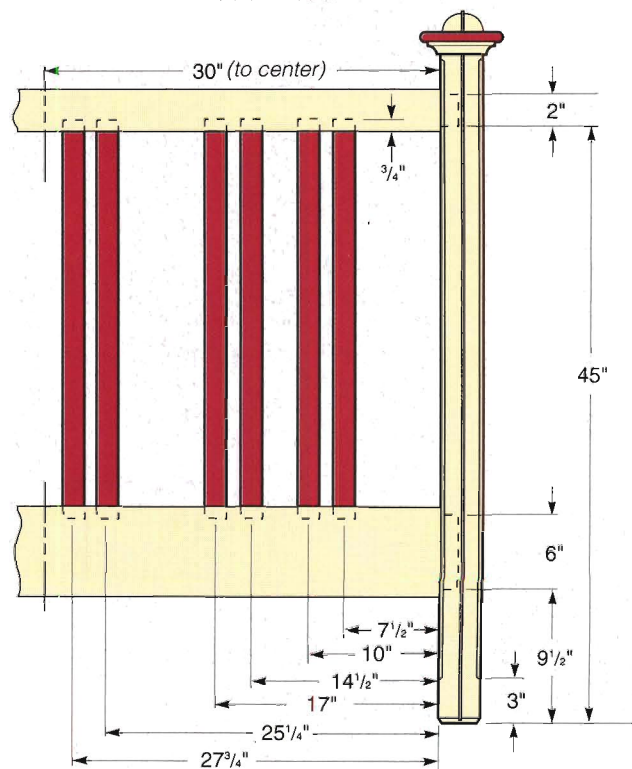
MATERIAL LIST

	T x W x L
1 Side Rails (2)	1 1/4" x 7" x 80"
2 Lower Rails (2)	1 1/4" x 7" x 62 1/2"
3 Upper Rails (2)	1 1/4" x 3" x 62 1/2"
4 Footboard Slats (12: Padauk)	1/2" x 1 1/2" x 22"
5 Headboard Slats (12: Padauk)	1/2" x 1 1/2" x 30"
6 Platforms (4: Padauk)	3/4" x 5 3/8" x 5 3/8"
7 Footboard Posts (2)	3" x 3" x 43 3/4"
8 Headboard Posts (2)	3" x 3" x 51 1/4"
9 Post Inlay Strips (8: Padauk)	1/8" x 1/8" x 53"
10 Bed Rail Fasteners (1 Set)	6"
11 Bed Rail Screws (24)	#10 - 2"
12 Spiral Dowels (20)	1/4" x 1"
13 Maple Balls (2)	3" Diameter
14 Ball Dividers (4: Padauk)	1/8" x 1 5/8" x 1 5/8"
15 Cove Moulding (16)	3/4" x 3/4" x 6"
16 Ledger Strips (2)	3/4" x 1 1/4" x 80"
17 Stretches (4)	3/4" x 3 1/2" x 61 1/2"

Footboard



Headboard



and inserting the slats into the lower rail. Now pull the upper rail onto the other end of the slats, then spread glue in the post mortises and on the rail tenons. Pull the posts onto the rails and check for squareness by measuring the diagonals. Use long bar clamps to hold everything together until the glue sets. At this time I also glued the platforms onto the the footboard posts using 1/4" x 1" long dowels (pieces 12). Set the footboard assembly aside and follow the same procedure for the headboard.

Making the Ball Caps

To safely cut the 3" diameter maple balls (pieces 13) you must make a couple of simple V-jigs; one for cutting the balls in half on the band saw (See **Figure 4**), and another for quartering them on the table saw (See **Figure 5**). Size each jig spacer so the balls are squeezed tightly.

Clamp a fence to your band saw table so the blade is centered on the V-jig and push a ball into the jig with its end grain pointing right and left. Slowly engage the blade and cut through the ball. Turn off the machine as soon as the blade exits the ball, then reach in and remove the two halves. Don't try pulling the jig back through the blade as the tension on the ball will have closed the kerf and you'll just untrack the blade.

Now cut each ball half into quarters using the table saw jig. Adjust the saw's fence to center the blade on the jig, then proceed with the cut until the ball is just past the teeth and resting against the body of the blade. Stop the machine and remove the ball quarters from the jig. Again, don't try to back out of the cut or continue through the other side of the blade because the teeth, which are wider than the blade body, will shave more material off the ball.

Next, cut out the dividers (pieces 14) that go between the quartered maple balls. Lay out two 3/8" diameter circles on 1/8" thick padauk and draw a center line through them. Now cut out the circles and split them in half on a band saw.

Put glue on one face of each quartered ball and align each pair with a divider (See **Figure 6**). I used a wooden handscrew clamp with sandpaper folded and taped on the ends of the jaws to press the cap assemblies together. The sandpaper

helps keep the clamp from slipping. A band clamp could also work. Once they're assembled, refine the edge of the divider on a drum sander, then sand the cap with a Sand-O-Flex wheel. Use a belt sander to smooth the bottom of the caps.

Use a center finder to position a dowel hole on the bottom of the four caps. You should also find the center of each post platform. Drill a 1/4" by 1/2" deep hole at each of these locations and glue the caps to the platforms with a dowel (pieces 12).

Final Details

The next construction step is making the small cove mouldings (pieces 15) that fit under the platforms. Use two pieces of 3/4" thick maple that are at least 3" wide and 24" long and rout a 1/2" radius cove on their long edges. Now, with the table saw fence set 3/4" from the blade, rip the edges off the boards. Miter the strips to surround the top of the posts and glue them in place, holding them to the platforms with spring clamps. You can use small brads if you're having trouble holding the moulding with clamps.

The last detail on the bed frame is adding the ledger strips (pieces 16) along the inside of the side rails. Glue the 1 3/4" wide strips 1/2" from the bottom of the rails. Once the glue dries cut the ends of the strips flush with the ends of the rails and use a chisel to chamfer their sharp edges. Make four stretchers (pieces 17) to reach from rail to rail for supporting the box spring. Just use pine 1" x 4" material for these pieces, cutting them to fit between the rails while resting on the ledger strips.

Sand everything through 220 grit before applying a finish. I applied *Nordic Oil*, which is a tung oil mixture that builds to a nice luster in three or four coats. Apply the first two coats with a brush, wiping off the excess each time about fifteen minutes later. After the first two coats, sand the entire frame with 400 grit silicon carbide paper to remove any fine particles caught in the finish and apply another thin coat with a cotton rag. Add a fourth coat if you want more gloss.

Screw the bed rail hardware into their mortises and mount the rails to the posts. Now set the four stretchers so they span between the



Figure 4: Use a V-jig for cutting the maple balls in half, making sure the ball fits very tightly. Cut slowly and stop the saw when the blade exits the ball, then reach in and remove the two halves.

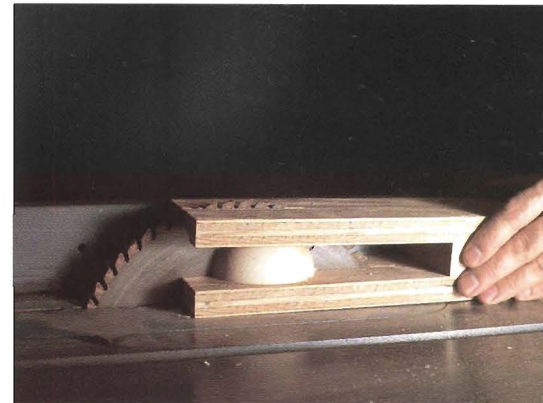


Figure 5: A V-jig with only the top piece grooved is used for quartering the ball on a tablesaw. Once the ball is completely within the blade body, stop the saw so you can remove the quartered pieces.



Figure 6: A wooden handscrew clamp works well to assemble the ball caps. Tape a folded piece of sandpaper to the ends of both jaws to get a better grip and to protect the maple ball sections.

ledger strips, and drop in your box spring and mattress.

A good router is, without a doubt, the key tool required for constructing this bed frame. With the addition of a table saw you can complete almost every step of the process, and the result, as you can see, is an elegant, sophisticated piece of furniture.

Chris Inman is the associate editor of Today's Woodworker magazine and a professional woodworker.

A New Twist on an Old Joint

By using a band saw to cut the dovetails in this project you'll increase your speed without sacrificing on accuracy. You'll also end up with a versatile and innovative table design.

By Brian Ruonavaara

Exposed dovetail joints are commonly used on contemporary furniture, but using them to structurally connect legs to a table top isn't seen very often. The table I've designed is built around this joint, and the result is a simple, sturdy piece whose construction can be adapted to many variations, such as a set of nesting tables. By utilizing a band saw and a simple fence for most of the cuts, I get predictable results and great repeatability, plus I save myself lots of time by reducing the amount of handwork involved in completing a table.

The top is made of butternut, which is a very forgiving wood when cutting dovetails. Not only does it cut easily, but as you drive your pieces together butternut tends to compress slightly, enabling the pieces to go together even if the fit is a little tight. For a striking contrast with the top I use walnut legs. The table requires 15 board feet of 8/4 butternut (7 square feet) for the top and four board feet of 8/4 walnut for the legs, all of which cost under \$75.00.

One of the most important ingredients in constructing this table is the accuracy of your band saw. There are a number of books on tuning-up a band saw, but the best one I've come across is *Band Saw Handbook* by Mark Duginske. Make sure your saw is operating properly and check that the blade is running true and at a right angle to the table. I recommend using a 1/2" wide regular tooth blade with eight or more teeth per inch.



Attention to details make this table special. The small reveals where the legs meet the top, for instance, give added dimension and texture while creating the illusion that the dovetail pins were applied to the legs rather than a continuation of them.

Select pieces of butternut for the top that have nice grain patterns and are well matched. Mill the butternut and walnut to a thickness of 1 3/8", then joint and glue the butternut pieces together to make the top 16 1/2" wide by 32" long. Now rip four pieces to a width of 2 3/8" from the planed walnut stock for the 17" long legs. Joint and plane the undressed sides of the legs to a thickness of 2".

Cutting the Pins

The pins on the top of the legs are formed on the band saw using a special fence and first tilting the table one way for cutting one cheek of each pin, then tilting the table the opposite way for cutting the other cheek on the pins.

The fence for cutting the pins is a typical T-square straight edge assembly with a stop screwed to its body 2" past the tips of the blade's teeth. The fence overhangs the front

edge of the band saw table and is held in place with a C-clamp.

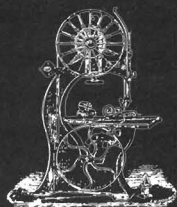
Tilt the bandsaw table to the right 7° and clamp the fence so it just barely brushes the left side of the blade (See Figure 1). The stop block will limit the length of the cuts to 2". Orient your leg stock so one of its narrower sides is laying on the band saw table and proceed with cutting the outside cheek of the left pin on each leg, pushing the stock through the blade until it contacts the stop block. Next, slide the blade exactly 1 3/8" to the left and cut the inside cheek on the right pin for each leg.

Now prepare to cut the pin's right side cheeks by tilting the table to the left

7° and adjusting the fence so the blade just splits the lower corner of the leg stock. Following the same procedure you just did for the first set of cheek cuts, cut the outside cheek on the right pins, then move the fence exactly 1 3/8" to the left and cut the last four pin cheeks. Remember, the success of this operation has a great deal to do with the accuracy of your set-up and the tuning of your bandsaw. Double check to see that your angles are accurate, using a sliding bevel gauge to make sure your table is tilting the same amount to the left and right.

Now that all the cheeks are cut on the pins you need to clear the waste from between them and on their outside edges. With a square and a mechanical pencil draw a line completely around each leg 2" from their top ends. Use a Japanese dovetail saw or tenon saw and carefully splice the

Band saws were first developed in the early 1800s, but it was the blades more than the machines that limited their use. With advances in steel processing and brazing techniques, they soon became the most versatile milling machine available. Their quality greatly improved during the Victorian era when gingerbread fretwork was popular, and after the turn of the century smaller band saws became standard tools in most shops.



shoulder line to remove the outside waste. Remove the bulk of the waste between the pins with a chisel. Be careful not to mar the pins and start tapping your chisel about 1/16" away from the shoulder lines, then pare back to them after most of the waste is gone. It's best to undercut these pin openings slightly, not exceeding 2°.

Cutting the Tail Openings

By now the glue ought to be dry on the top assembly, so take it out of the clamps and plane the joint smooth on both sides of the slab. Next, joint one long grain edge and then crosscut the slab to a length of 31". Belt sand the ends smooth and follow with an orbital sander to 180 grit. Now rip the slab to its final 16" width. Proceeding in this order with your tables will always leave you some recourse if you tear out any wood while crosscutting or sanding.

Lay out the tails on the underside of the top by using the pins on the legs as guides. First, number each leg and set them around the top in clockwise order, then mark each corner of the

top with the same number as its corresponding leg. Now lay out a line 1 7/8" from the end grain edges of the top and another line 1 3/4" in from the long grain edges as shown in the elevation drawing on page 16. Hold the legs in position as they will be installed and trace the outline of the pins onto the slab with a sharply pointed mechanical pencil (See Figure 2).

Reset the band saw table so it's at a 90° angle to the blade to cut the tails in the top. Again, make sure your saw is accurately set by checking the blade and table with a right angle square.

I do the tail cutting free hand, carefully staying within the pin layout lines, and taking my time to get it right (See Figure 3). Once the tail cheeks are cut I remove the waste with a sharp chisel (See Figure 4). Try to undercut the end grain side of the openings with the chisel to allow the pin to slide into the opening a little easier. This also insures a tight fit at the top of the joint.

The next step is best approached with patience and a keen eye. Even though the tail openings were marked directly off the pins, it's inevitable that some fitting is required for the joint to go together. Carefully pare very small amounts of wood off both the pin and tail cheeks until the pieces begin fitting together. Your goal here is a good, snug fit. Don't pare the wood until the pieces slip together easily; you want the joints tight. Furthermore, don't drive the joints more than half-way together at this point because you'll just crush the wood fibers. The first time the joints go completely together is at the final assembly. A cabinetmaker's file may also come in handy for slight adjustments, especially on the pins.

Leg Details

The leg pins extend through the table top 1/8" and also project out of the end grain edges of the top by

Figure 2: A mechanical layout pencil is an excellent layout tool due to its thin, dark line. When you have the legs positioned next to the layout lines, use the pencil to outline the pins on the underside of the top slab.

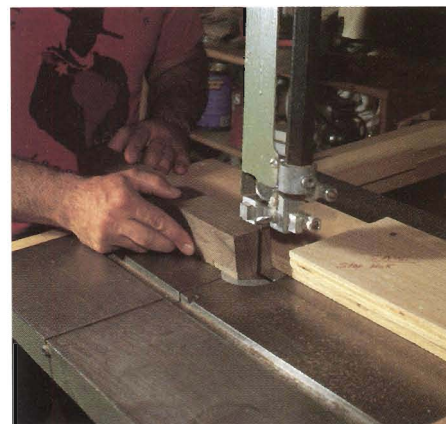


Figure 1: One essential ingredient to cutting accurate pins with a band saw is having an adjustable T-square fence and stop block.

1/8". The pins were cut long so they stick through the top the right amount, and the tail openings are laid out on the next page so the pins will stick out slightly.

You'll notice the outside face of each leg below the pins is flush with the table edge. I accomplish this by reducing the leg thickness below the pins on a jointer. Lower the infeed table on your jointer 1/8" and clamp a stop block to the outfeed table 14 1/2" from the top of the blade's cutting arc (See Figure 5). Take a test pass with some scrap wood to see that everything is properly set. Once you're satisfied that the jointer is removing exactly 1/8" of material, pass the outside face of each leg over the cutter until the stock contacts the stop block. The lower portion of each leg is now 1 7/8" square.

Now use a Japanese dovetail saw to cut shallow kerfs below each pin in the small hump remaining on the outside face of the legs. Each cut should line up with the edges of the pins. To protect the legs from scarring during

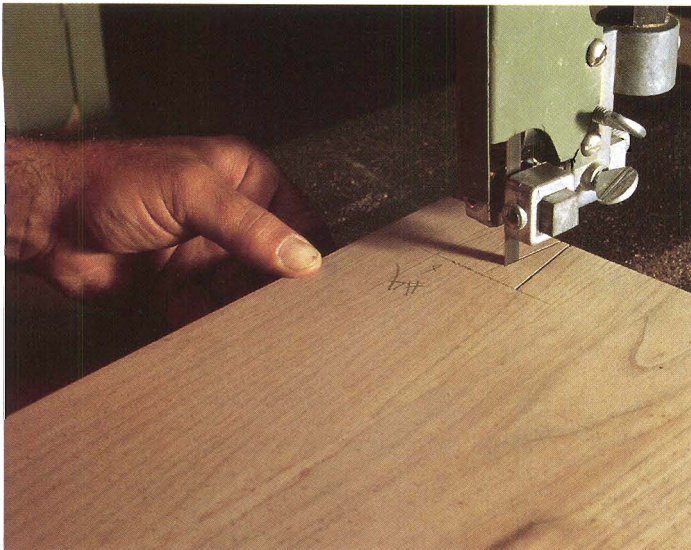


Figure 3: Patience, a steady hand and a well tuned band saw combine to make successful tail cheek cuts. For each cut use one fluid motion.



Figure 4: Remove the tail opening waste with a series of chisel cuts, setting the chisel just inside the layout line and tapping the mallet lightly.

these cuts, wrap a few layers of masking tape over the teeth about 2" from the end of the blade. Once the kerfs are established, use a chisel to level the small areas not aligned with the pins. This small detail makes the pins appear as if they were added to the structure, rather than an actual part of the legs. This has proven to be an interesting optical illusion.

Wrapping it All Up

Sand the top and legs thoroughly before gluing the pieces together, especially the end grain edges of the top since you won't easily get at these once the

legs are in place. Ease the top and outside edges of the pins and blend the lower part of the pins into the legs a little bit.

I like putting a first coat of oil on the wood to prevent any glue squeeze out from adhering in places it doesn't belong. Use a rag to apply this coat everywhere but in the joints. When the oil has dried, usually about eight hours after application, you can glue the legs to the table. Clamps shouldn't be necessary if the dovetails fit snugly, although sometimes I need one to pull a leg tightly up to the underside of the top. Clean up any excess glue right away, making sure that none remains on the extended portions of the pins. You may want to do a little more sanding now on the pin projections to refine their edges, and you also might have to trim some of the leg bottoms slightly so the table sits level on the floor.

The first order of business when leveling a table is find-

ing a flat surface upon which to set it. An ideal choice for small projects is the top of a table saw, but for larger pieces your workbench or a floor with plywood underlayment will be the best bet. Assuming your surface is level, adjust the table until it is parallel with the floor by sticking a wedge or slips of paper under the shorter legs. (If the surface is flat, but not level, just rig the table to follow the same slope.) Now lay a pencil on the level surface and trace a line completely around each leg. Cut off the bottoms of the legs at the lines with a dovetail saw and test the table on the flat surface. Any rocking should now be so minimal that a quick touch with a sander will fix everything.

One final task is beveling the leg bottoms to prevent the corners from catching on the floor and tearing. Use a cabinet file or sharp chisel to do this quickly.

Continue finishing the piece by applying two more coats of oil, sanding between each coat with 400 grit

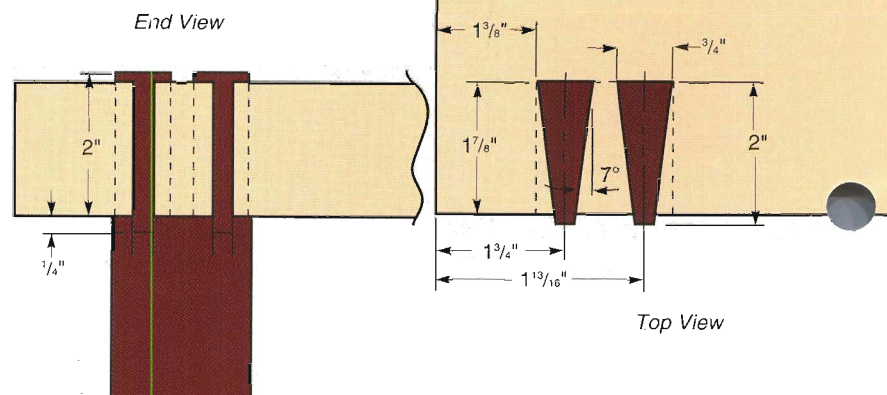
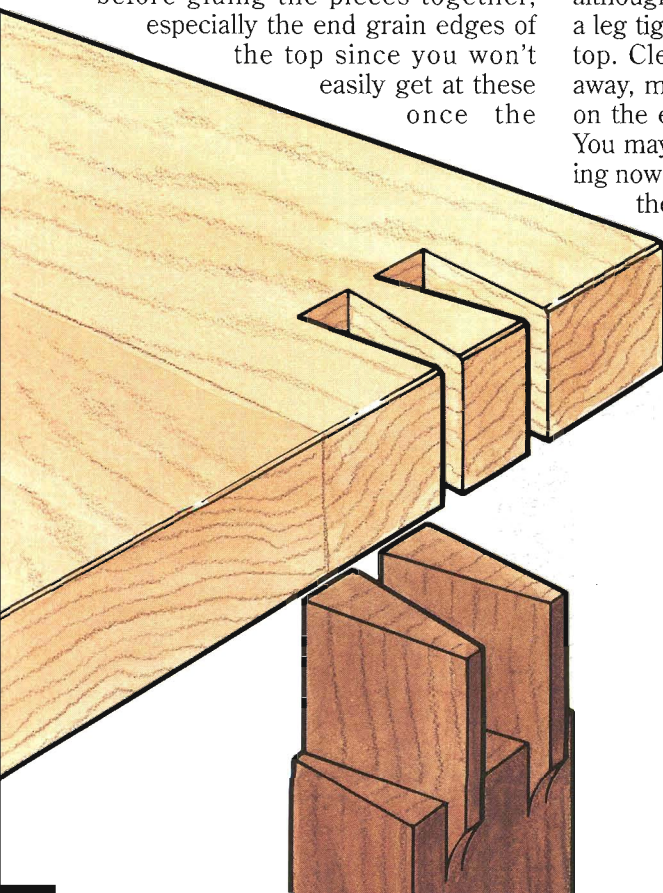




Figure 5: Take one pass to create the leg's reveal, pushing the stock through the jointer until it hits the stop block, then carefully lifting it away.

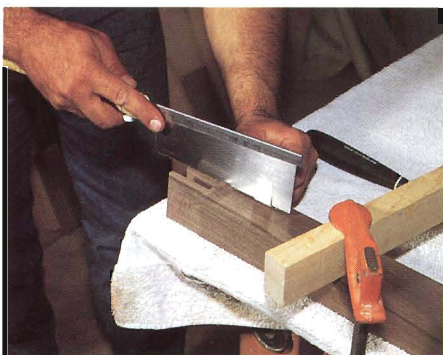


Figure 6: Define the leg pin extensions with a fine cutting Japanese saw, wrapping a little tape near the end of the saw to prevent scratching.

wet or dry paper. I like using Zar Wipe On Tung Oil because it gives me the satin sheen I like.

I use this design to make a variety of occasional tables for living rooms and dens. If you like the effect of these exposed dovetails, there are many adaptations you can try, and cutting the pins on a band saw saves time without losing any accuracy or compromising the integrity of this beautiful joint.

Brian Ruonavaara is a professional woodworker based in Big Lake, Mn.



WHAT'S IN STORE

Ryobi's New Woodcarver

By Hugh Foster

American woodworkers have been slower than their European counterparts in adopting angle grinders to everyday use. Now, with the introduction of Ryobi's *Woodcarver*[™], the popularity of the hand held angle grinder may escalate on this side of the Atlantic.

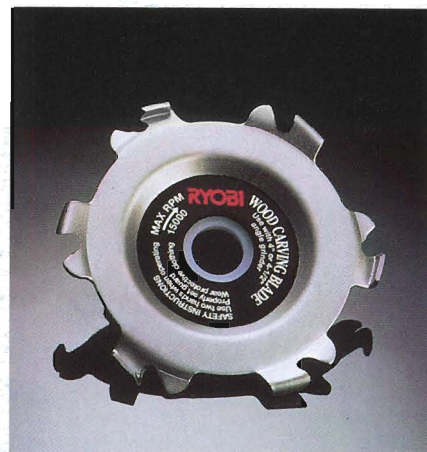
When I first came across it, the Woodcarver seemed like an ideal tool for rough shaping during the early stages of relief or three-dimensional carving. I soon realized its additional value for chairmaking —no other tool I've seen will hollow the contours of a chair seat more quickly. Experimenting with the new tool for just a short time convinced me that I was barely scratching the surface of its capabilities.

Ryobi, U.S. distributor of the Australian made Woodcarver, is as interested in selling the blade to tradespeople as they are in marketing it to woodworkers. Construction workers, for instance, can use it to remove large areas of wood in risers and joists to make room for plumbing pipe, electrical wire, and heating or cooling ducts. The tool is very good at getting into tight places where chisels and saws are difficult to maneuver.

The Woodcarver is a 4" diameter, six-tooth blade with teeth shaped much like those on a chain saw. It cuts best, and fastest, when the blade is held at a right angle to the wood. At first the power and noise generated by the unit is almost frightening but, with a little time and practice, handling the grinder is a snap. Ryobi's instructions insist that it be used only on a grinder that's outfitted with both an auxiliary handle and a safety guard.

Dressing safely is also important when using this tool. Wear hearing protectors, a face shield and heavy gloves. The blade shoots shavings right into the body of the grinder where a right handed user has his grip, and without gloves you'll certainly feel the sting of these chips.

After an afternoon's cutting, sharpening is probably a good idea. This is



The Woodcarver blade fits most any angle grinder and is ideal for removing large amounts of wood in construction and furniture projects.



Holding the grinder so the blade is at right angles to the workpiece yields the greatest control and the fastest cutting action.

easy to do. Ryobi sells an optional aluminum oxide dressing stick, but this may not be necessary as I was able to touch up the blade very nicely with my DMT and EZLap diamond paddles. Arkansas slip stones would probably be just as handy. After quickly touching up the edges the tool was ready to go again.

It's worth noting that the Woodcarver will work on virtually any 4½" grinder, but the light and powerful Ryobi grinders, notably the SG-1000 (pictured above) seem perfectly suited for use with the Woodcarver blade.

Hugh Foster is an English teacher, furniture builder and freelance writer based in Manitowoc, Wisconsin.

The Gift of Time

Having trouble finding the perfect gift? Spend a weekend making clocks and you'll have a little time for everyone.

By Rick White



Here's a wonderful gift item that only takes a day to build and, if you get a production line going, you can knock off a whole slew of them for wedding and holiday gifts. The main component in this clock is the body, which is built by laminating two 8" long cherry squares with a thin walnut strip in between. If you want to make more of these clock bodies at one time simply laminate longer stock initially, then cut it into 8" lengths for each individual clock you intend to build.

The technique used to make the clock face creates an interesting diamond pattern commonly seen with veneers. If you're like me, you've saved lots of scraps that have unusual grain patterns or color, and you're always looking for a clever way to show them off. With this clock design I at least put a dent in my supply.

The Clock Body

Select a 16" long piece of $1\frac{3}{4}" \times 1\frac{3}{4}"$ cherry with an end grain pattern that crosses the stock diagonally, and cut it in half lengthwise, forming two 8" long pieces (pieces 1). Now rip an 8" long piece of $\frac{1}{8}"$ thick walnut to $1\frac{3}{4}"$ (piece 2) and glue it between the cherry blocks,

making sure the assembly's end grain configuration forms half the diamond pattern.

Once the glue dries, cut the assembly in half to make two 4" long blocks. Rip a 4" long piece of $\frac{1}{8}"$ thick walnut to $3\frac{5}{8}"$ (piece 3) and glue it between the blocks, making sure that the end grain diamond pattern is completed.

Belt sand all sides of the clock body so everything is flush and square. Now cut a $\frac{1}{2}"$ thick slice off the back end of the assembly to use as the back cover plate (piece 8) and cut the rest of the block to its final 3" length. Resand these freshly cut surfaces and set the back cover aside.

Hollow the clock body in order to install the quartz clock movement (piece 11). Do this on a band saw after laying out the pattern shown in the elevation drawing at right. First kerf the top and bottom of the hollow, then cut the angled inside front wall. Start with the blade in the top kerf and turn the clock body gradually to cut along the angled lay out line. This removes most of the waste, but you'll have to take one more pass from the opposite direction to clean-up and straighten the inside front wall.

Now form the $\frac{1}{2}"$ deep setback for housing the back cover plate. Clamp your table saw fence $\frac{9}{16}"$ from the blade, which should be raised to a height of $\frac{1}{2}"$. Run the

clock body through the blade with the top of the block bearing against the fence.

This cut establishes the top of the setback. Now reset your fence $2\frac{1}{2}"$ from the blade and raise the blade 3" so it reaches the kerf you cut just a moment ago. Carefully slice off the bottom and top setback waste.

Bevel the face of the clock body by clamping a $2\frac{7}{8}"$ tall fence to your band saw table $2\frac{1}{2}"$ to the left of the blade, and tilting the table 10° . The setback areas of the clock body will slide against a fence of this height — a taller fence would only touch the top projection of the clock body, resulting in an unstable cut. Now cut the angle of the clock face and sand it to remove any saw marks.

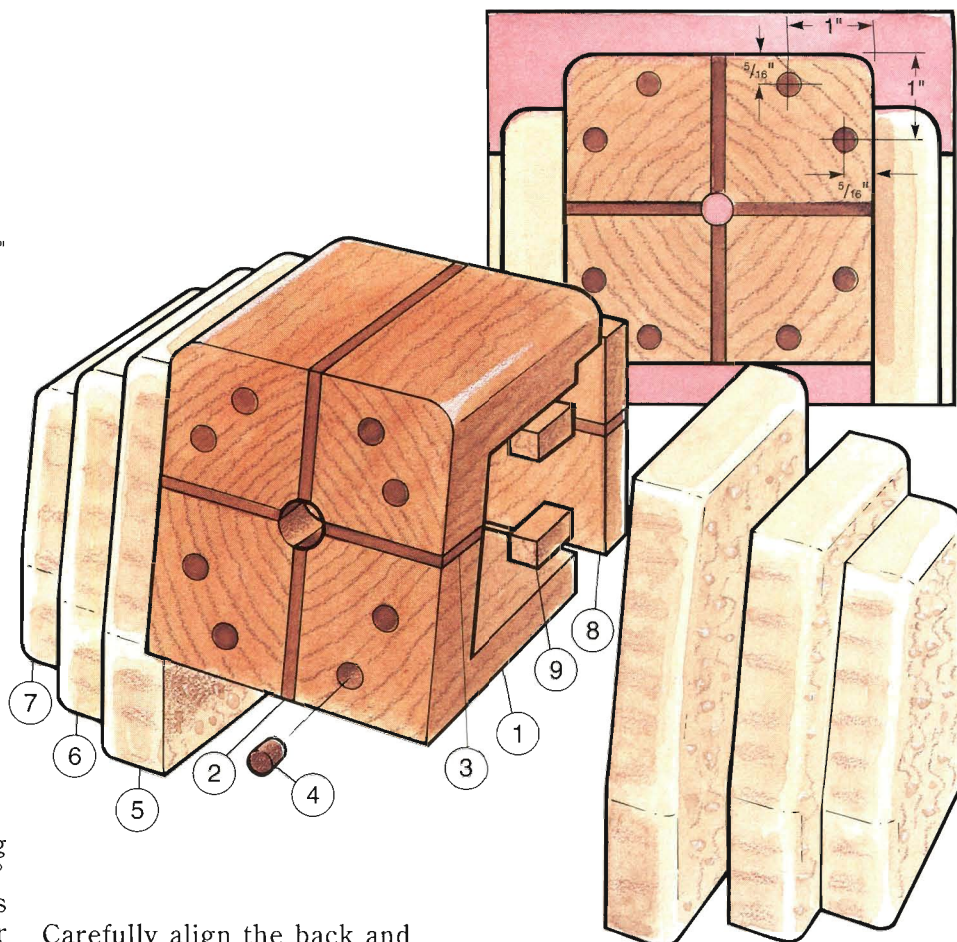
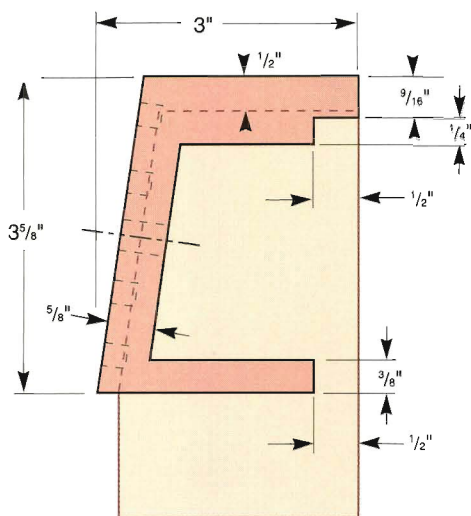
Mark the center of the face and the hour locations with an awl following the layout pattern on the next page. The best way I've found to drill these holes is with a Dowl-it jig. Spread the clamps wide apart to stabilize the jig and set it on the clock face. Chuck a $\frac{3}{8}"$ bit in your drill and insert the bit in the appropriate jig hole. Move the jig and drill set-up over the center punch mark and bore this hole completely through the face. Switch to a $\frac{1}{4}"$ bit and drill the hour holes to a depth of $\frac{1}{4}"$ using the same technique. Now glue short pieces of $\frac{1}{4}"$ diameter walnut dowel (pieces 4) into each hole and sand the face flush to 150 grit.

Making the Legs

Cut the six leg pieces (pieces 5, 6 and 7) to the sizes indicated in the

Clock Body & Leg

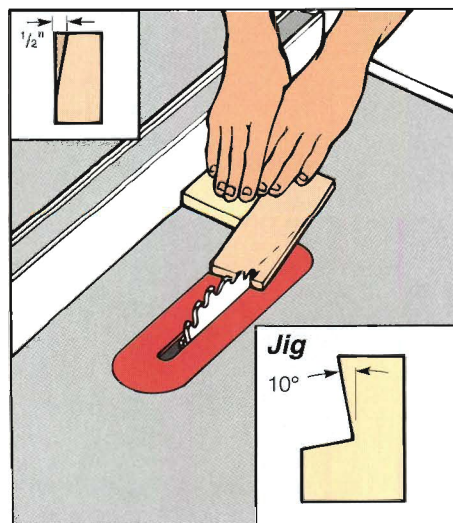
Side View



material list, then make the jig shown below to hold them at a 10° angle as you cut their front edges on the tablesaw. Set your fence for removing a wedge that's 1/2" wide at the top front edge of each leg.

Roundover the top and front outside edges of each leg with a 3/8" radius bit set-up in your router table, along with the top side edges of the clock body. Remember that the routed edges on one set of legs must be opposite the routing on the other set.

Glue each set of three leg sections together to form the leg assemblies.



The jig shown above angles the leg pieces as they pass through the table saw blade. You must readjust the fence for each of the three leg sizes.

Carefully align the back and bottom edges of the leg sections in the clamps after spreading glue on the appropriate areas of the stock.

Final Assembly

Sand the legs and glue them onto each side of the clock body, covering the back opening and leaving about 1/2" of the body exposed. Next, glue the 1/2" square screw blocks (pieces 9) to the four inside corners of the clock body. Cut the back cover plate (piece 8) to size so the walnut strips align with those on the body and fit it in the clock body. Drill countersunk pilot holes in each corner for the back screws (pieces 10).

Remove the back panel and sand the entire clock, paying special attention to polishing the end grain on the face. Coat the clock with several applications of a penetrating tung oil finish and top the finish off with a coat of paste wax.

Install the clock movement (piece 11) and batteries, and attach the back panel. The movement is available from Klockit (P.O. Box 629, Lake Geneva, WI, 53147). You get one set of

MATERIAL LIST

	T x W x L
1 Clock Body (1)	1 3/4" x 1 3/4" x 16" (Cherry)
2 Walnut Strip (1)	1/8" x 1 3/4" x 8"
3 Walnut Strip (1)	1/8" x 3 5/8" x 4"
4 Hour Markers (8)	1/4" x 3/8" (Walnut)
5 Inside Legs (2)	3/4" x 2 7/8" x 4 1/2" (Maple)
6 Middle Legs (2)	3/4" x 2 7/8" x 4" (Maple)
7 Outside Legs (2)	3/4" x 1 7/8" x 3 1/2" (Maple)
8 Back Panel (1)	1/2" x 3 5/8" x 3 1/4"
9 Screw Blocks (4)	1/2" x 1/2" x 3/4" (Cherry)
10 Back Screws (4)	#6- 1 1/4" (Brass)
11 Clock Movement (1)	Quartz; 3/4" Shaft
12 Clock Hands (3)	Black

hands with each movement. I retouched the exposed brass parts on the movement with black paint. Finally, mount the clock hands (pieces 12), set the time and wrap up your gifts.

Whoever receives your clocks will be overwhelmed by your effort, and you still have plenty of time to sit back and enjoy the holidays.

Rick White, a professional woodworker, serves on the editorial advisory board of Today's Woodworker.

Cooperage —A Fresh Look at an Ancient Craft

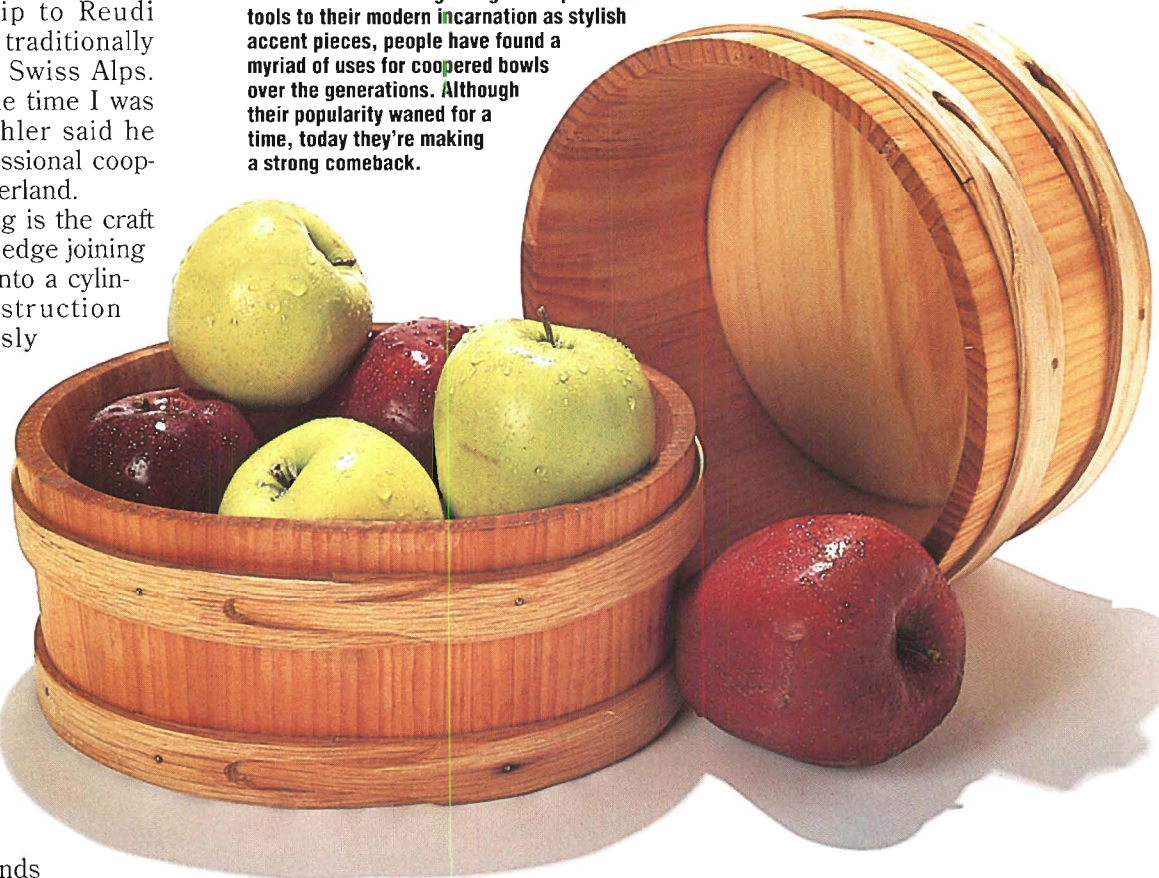
By Drew Langsner

My introduction to coopering began with an apprenticeship to Reudi Kohler, one of the last traditionally trained coopers in the Swiss Alps. Twenty years ago, at the time I was learning this craft, Kohler said he only knew of nine professional coopers still working in Switzerland.

In a nutshell, coopering is the craft of making containers by edge joining vertical wooden staves into a cylinder. The style of construction results in tremendously strong and durable containers, ranging in size from small, pint beer steins to huge wine vats. In all cases, the staves are forced tightly together and held in place by two or more wooden hoops. The length and shape of the hoops must take into account both the circumference and taper of the bowl. Wooden bottom boards, which stiffen the construction, fit in grooves near the ends of the staves. Some coopered items have two bottoms (as with barrels), and others just have one (as with buckets and tubs).

When I served my apprenticeship, Kohler was 71 years old and still working full time. Fifty years earlier, when he did his apprenticeship, coopers were servicing the needs of alpine dairy farmers who required various types of milking buckets, cream tubs, butter churns and other coopered wares. Throughout the span of his career, Kohler witnessed the decline of traditional farming, and with it watched the demand for hand crafted cooperage drop off severely. However, by the late 1960s, interest in traditional lifestyles and crafts was growing fast, particularly among tourists,

From their humble beginning as simple farm tools to their modern incarnation as stylish accent pieces, people have found a myriad of uses for coopered bowls over the generations. Although their popularity waned for a time, today they're making a strong comeback.



creating new markets for the few coopers still making a living from their craft. When Kohler “retired” from farm work at the age of 65, he actually found enough new demand to become a full time cooper.

In Switzerland today, cooperage is popular and highly regarded. One reason for this popularity is that the Swiss appreciate the integration of a functional design with superior aesthetic qualities. This isn’t surprising, especially when you think about the details commonly seen in a Swiss chalet.

Swiss cooperage is distinguished by its unique wooden hooping, which utilizes a sophisticated interlocking system. A great deal of skill and labor is involved in making these hoop joints

as well as in planing the precise angles and tapers on the staves. At least ten hours of intense work by a master craftsman yields just one milking bucket, which commonly gives fifty or even one hundred years of use.

During his years providing coopered items for the collectors’ market and home use, Kohler’s customers began requesting slight changes in the traditional designs. Tubs and buckets became smaller for use as display and serving bowls, and the small brass nails traditionally used to hold the hoops were replaced with wooden dowels. He also found a market for scaled down butter churns. Chip carving decoration became increasingly popular as well.

Cooperage is a challenging craft

No.2 Pencil Post Bed

that deals with problems not normally faced by most woodworkers. Because coopers work with tapered circular shapes in highly varied dimensions, metric measurements are typically employed—even in this country—since they're easier to use than fractions of an inch. Coopering also requires a number of specialized tools, although these can, for the most part, be made in the wood shop.

Material Selection

Woods used for staves have different requirements from those used for hooping. While it's possible to make a staved container using just one wood species—walnut, oak and ash will work for both staves and hoops—most Swiss coopers use several kinds of soft coniferous woods for staves and hard maple for the hooping. Hoop wood must be of the highest quality, without imperfections. It's important to avoid wood with any figure, as this will be hard to carve and will likely fail during the stress of bending. The wood staves should be clear if possible—any knots must be very small and tight.

Traditionally, both stave and hoop ing woods were split from clear, straight grained logs. For coopering, split stock is superior to sawn boards because the resulting material always follows the grain. However, Kohler also used some sawn stock that he carefully selected at a local lumber yard for its grain pattern.

For staves, I get the best results using eastern white pine and western spruce. I generally split white pine from log sections that are cut from between the annular rows of limbs. The staves must have a cross grain pattern—annular rings are perpendicular to the width of the stave, such as with quarter sawn lumber. Flat grained staves have twice the shrinkage rate and an unacceptable amount of distortion during the drying process, as well as any subsequent wet-



Woodworkers do get their ideas from the funniest places. Kris and Deb Heskin were watching the TV show "Full House" one night and saw the perfect bed for their two boys. After contacting the studio for more information they eventually got a picture and went to work building the pair of twin beds shown above. The boys were beside themselves with excitement when they received their furniture Christmas morning.

The Heskins used 4" x 4" pine for the posts and cut them into octagons

on their table saw, then turned the pointed ends on a lathe. They used pineapple cans for the eraser collar, and latex enamel paint for the bright colors on all the pencils. The two beds cost about \$300.00 to build.

Deb and Kris have been tinkering in their shop for about five years, and we want to congratulate them on their work. Since their beds are our choice for this issue's Reader's Gallery, they'll receive a \$100.00 gift certificate for merchandise from The Woodworkers' Store.

ting while using the bowls. I find that an 8" diameter log yields staves about 3" in width, and I never include the pith in a stave.

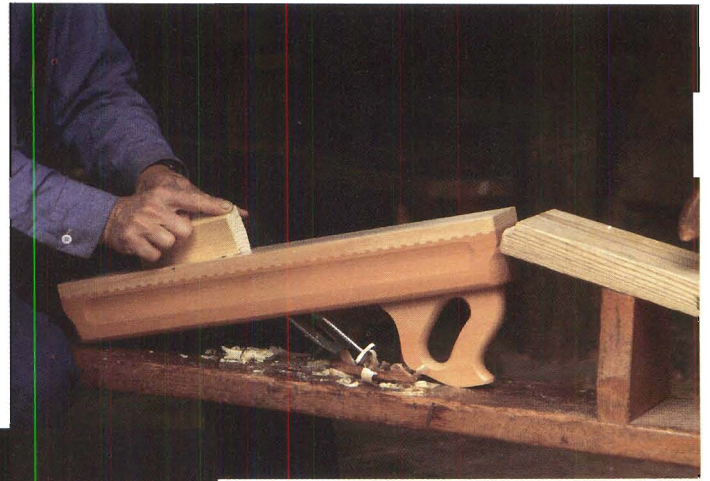
Western spruce can be found in lumberyards mixed in with construction grade hemlock and fir. I've found that 2 x 12s can be crosscut to length and then split into acceptable stave blanks. And 1 x 6s can be edge glued to make bottoms of just the right thickness. In searching for appropriate lumber, look for boards that include or come near the pith, since the material to either side of the pith on these boards is quarter sawn. I

work around the knots in the board, expecting about 50% waste.

For hooping material I've had the most success with maple (hard and red), ash, and oak (both white and red). Even if you select prime quality, straight grained stock, not all pieces of wood in these species will work due to the unpredictability of the bending process. Hooping blanks can be sawn from perfectly straight grained, clear lumber if you take pains to follow the growth rings. I generally prefer to split my hooping stock from the same logs I use for chair or basketry parts.



Drew works at his shaving horse with a drawknife to round the outside face of the staves and to bevel their edges close to the finished angle.



After staves are roughly shaped with a drawknife, the edges are refined on a long jointer plane so that each edge perfectly matches its neighbor.

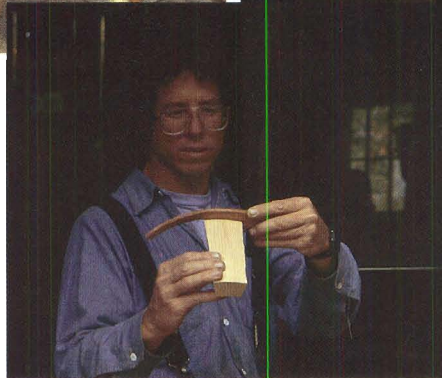
A Brief Review of the Process

If you're interested in trying a cooperage project, there's certainly plenty to challenge even the most experienced woodworker. Much of the work is done at a shaving horse, using a straight drawknife and a standard spokeshave. Some tools you'll need for the project include a long jointer plane, a metric ruler, a froe and club, a smoothing plane, a small drill, several carving knives, a 3/8" chisel, straight leg dividers and a fine toothed saw. You'll also need a variety of tools unique to the coopering trade, including a hollowing drawknife, a radius plane, a croze (for cutting a groove in the assembled staves that holds the bottom in place), a modell (a thin crescent-shaped bowl gauge), and a fumel (used to compress the edge of the bottom).

My bowls are generally 8-12" in diameter and 4-6" high. Once I've determined the diameter my next step is making a modell to fit this size. The inside curve of this gauge describes the outside curve of the bowl and its angled inside corner indicates the radius of this curve.



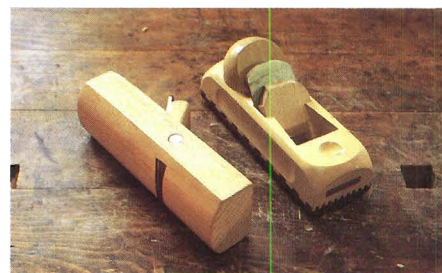
One pattern, or modell, is made for each different bowl circumference to indicate both the outside curvature and the edge angle of the staves.



For all the staves to form an evenly round shape they must be continually checked with a modell.

I crosscut a log and use a froe to split the staves. Shaping and sizing the staves begins by drawknifing a slight taper on their sides and then rounding their exterior face. I constantly check the stock against the modell to monitor the exterior curves and to get the correct bevel on each stave edge. I use a jointer plane propped upside-down on the shaving horse to refine the bevels.

The thickness of the staves is reduced with a hollowing drawknife or inshave, then I assemble the pieces to make sure that everything fits tightly. The bowl is held together in proper alignment at this point with small dowels spanning between the edges of each stave and a pair of temporary steel hoops.

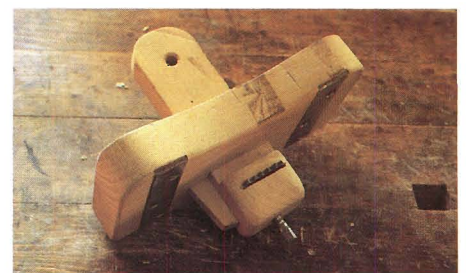


During one step in the coopering process the staves are temporarily assembled so the inside curve can be blended with a round soled block plane.

My next move is planing off the top rim and sawing and planing the bottom rim, then using a spokeshave to chamfer the exterior edge of both rims. I layout the thickness of the staves by cutting a bevel on the inside edge of the rims with a sharp knife.

Thickening is done with a small wooden plane having a sole that's rounded from side to side. These planes are traditionally made in sets by each cooper, but if you don't want to make a plane you can modify a small wooden block plane made by Primus. Thickening is easily done by shooting the plane through the assembled bowl (or you can disassemble the staves and hold them individually on a workbench while you plane each one). The staves are thinned down to the chamfer line cut earlier on the rims of the bowl.

After the interior is planed I cut the groove for holding the bottom. A traditional cooper's croze, which is basically a large marking gauge fitted with a small saw blade, is the only tool for this job. Generally, the fence on the croze is set so the groove is 3/4" from the bottom rim.



The croze cuts a groove in the staves while they're held together. Later, the bottom is inserted in the groove when the bowl is permanently assembled.

An Exotic Domestic

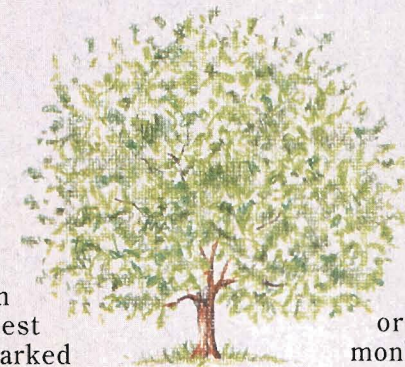
The bottom is usually 3/4" thick and sawn large enough to fit into the groove in the staves. Thinning the edges of the bottom is a multi-stepped process, beginning with drawknifing them into shallow pie tin shapes so the total thickness is just a bit thicker than the groove. Put a slightly convex shape on the upper edge to create a good, watertight seal when the bowl is assembled. Next, the edge is compressed to slightly less than 3/16" thick with an interesting tool called a fumel. This is simply a hardwood stick with a notch cut into one side. The fumel is run around the edge of the bottom several times, twisting the tool at an angle to squeeze the wood cells ever tighter. Once the bowl is assembled and wetted, the wood will expand to fill the dado and seal the bowl. Finally, I sand the inside of the bowl, then disassemble it one more time to sand the flat surfaces of the bottom.

A little white glue is dabbed onto the edges of the staves and the bowl is reassembled using temporary metal hoops to pull everything tight. After the glue is dry, I knock off the metal hoops and sand the outside of the bowl both with and across the grain.

I consider making the wooden hoop the most challenging part of Swiss cooperage. Splitting the hoops from straight grained hardwood is easy enough, but planing them to fit the taper of the bowl and cutting the interlocking joints is a little trickier. The key here is to have plenty of patience. Once they're formed I drop them into boiling water to make them pliable for bending. After soaking a while I remove them from the water and flex them across my thigh, carefully joining the tabbed end to the slotted end—some twisting is always necessary. Once the locks are connected, the hoop is rotated in the boiling water to limber it again and then quickly placed around the bowl and hammered tight. The hoop is generally nailed or pegged in place. Without fasteners the hoops will fall loose, particularly if the bowl is placed in a dry environment that causes the staves to shrink.

Drew Langsner will teach tutorials (2 students per week) in coopering and chairmaking from November to March at Country Workshops in Marshall, North Carolina (704-656-2280).

Woodworkers have long looked to the tropics for exotic woods that add unique colors and textures to their work. However, today's concern about rain forest resources has sparked an interest in finding unusual temperate climate woods. Osage orange, a novel species with a bright yellowish-orange heartwood, is one of the



Osage Orange
(*Maclura Pomerifera*)



finest examples of an exotic domestic—one that may actually grow in your own backyard!

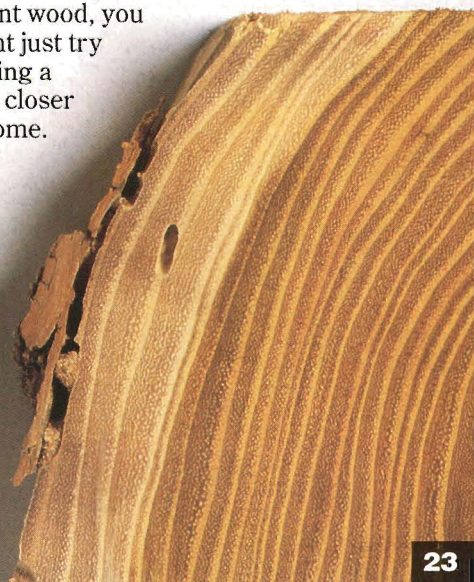
Osage orange is native to a small area of drought-ridden, wind swept prairie in Texas and Arkansas. Today its range extends throughout much of the southern United States. Osage Indians, the wood's namesake, often carried hunting bows and clubs made from this species, which was an excellent choice given its outstanding bending strength and shock resistance. In fact, on both of these counts, Osage orange exceeds the qualities of other species reputed to be among the best, surpassing ash for bending qualities and hickory for shock resistance.

Settlers found that Osage orange's decay resistance was unexcelled, especially as lumber for fence posts. Although eventually replaced by metals and synthetics, Osage orange was once commonly used for construction

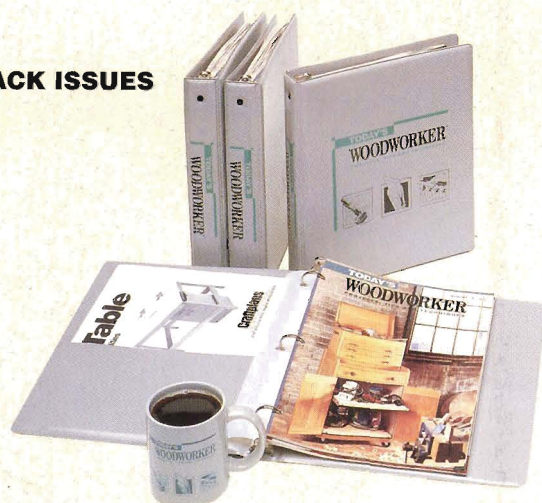
pegs in marine applications.

Beyond its orange-yellow coloring, this wood is full of other surprises. For instance, it's more than twice as hard as hard maple, offers better stability than black walnut and weighs more than hickory and teak. Extreme hardness and density make the wood challenging to machine and glue, but sharp blades and epoxy resin overcome potential problems.

Like tropical exotics, Osage orange is often used for smaller projects and as an accent wood. The supply of larger stock is generally limited since the tree is rather small, usually growing only 50 feet tall. Its availability is also limited. Most woodworkers wanting exotics look overseas, so wood suppliers have had no particular incentive to stock Osage orange. The next time you're after that perfect accent wood, you might just try looking a little closer to home.



BACK ISSUES



Binders\$7.95

(Order two or more for \$6.95 each.)

Stoneware Mugs.....\$5.95

(See order form on page 12 please.)

FREE binder with any six back issues!

1 A rolling tool cabinet, rotating end table, wall mounted shelf, tips for buying used tools and more. Issue 1\$3.95	2 An armoire, curio shelf, wedge tenon magazine rack, installing European hinges, etc. Issue 2\$3.95	3 Jewelry box, turning figured wood, a folding Adirondack chair, drawer slide options plus more. Issue 3\$3.95	4 A futon sofa bed, cedar-lined blanket chest, antiquing techniques and knock down fittings, etc. Issue 4\$3.95	5 An easel, children's activity center, folding footrest, model airplane and framing with inlay and more. Issue 5\$3.95	6 Modern pedestal table a classic rocking horse, holiday ornaments and mixing your own finishes. Issue 6\$3.95
7 A European style workbench, turned stamp holders, heart-shaped bandsaw box and a breakfast tray. Issue 7\$3.95	8 The kitchen work station, Shaker candlestand table, baker's rolling pin, a step stool and more. Issue 8\$3.95	9 A porch glider for two, continuous grain box, Chippendale mirror frame, shellac repairs and spoon carving. Issue 9\$3.95	10 Classic corner cabinet, a bent lamination fishing net, a white oak trivet using a scrollsaw and more. Issue 10\$3.95	11 A stately barrister's bookcase, spinning string tops, a kid's step stool and an inlay banded desk tray. Issue 11\$3.95	12 Uncomplicated butternut bureau, a Shaker inspired swivel mirror, and deep-reach hand screw clamps. Issue 12\$3.95
13 A precision router table, building a set of swiveling bar stools and tips on buying a new biscuit joiner. Issue 13\$3.95	14 Building a craftsman style rocking chair, a brightly colored toolbox, and a nifty compact disc holder. Issue 14\$3.95	15 A picnic table for four, a birdhouse project for turners, making a simple dulcimer and a stylish joiner's mallet. Issue 15\$3.95	To order back issues, binders or Craftplans™, please use the order form on page 12.		

NEXT ISSUE:

The September/October 1991 issue will be full of great holiday gift ideas, including a traditionally styled TV cabinet, a fun toy for the kids, a bureau caddy for holding your change and jewelry, and a wonderful mobile for all ages.