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Volume 26, Number 2 April 2002

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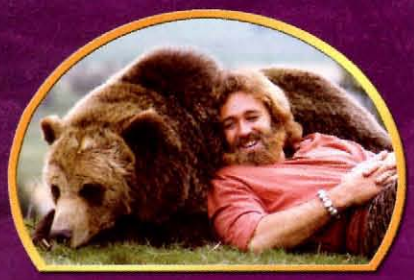

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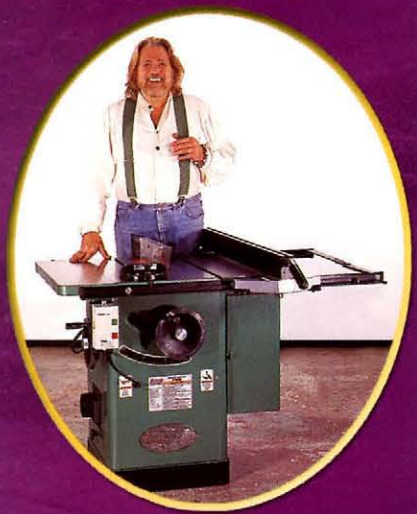

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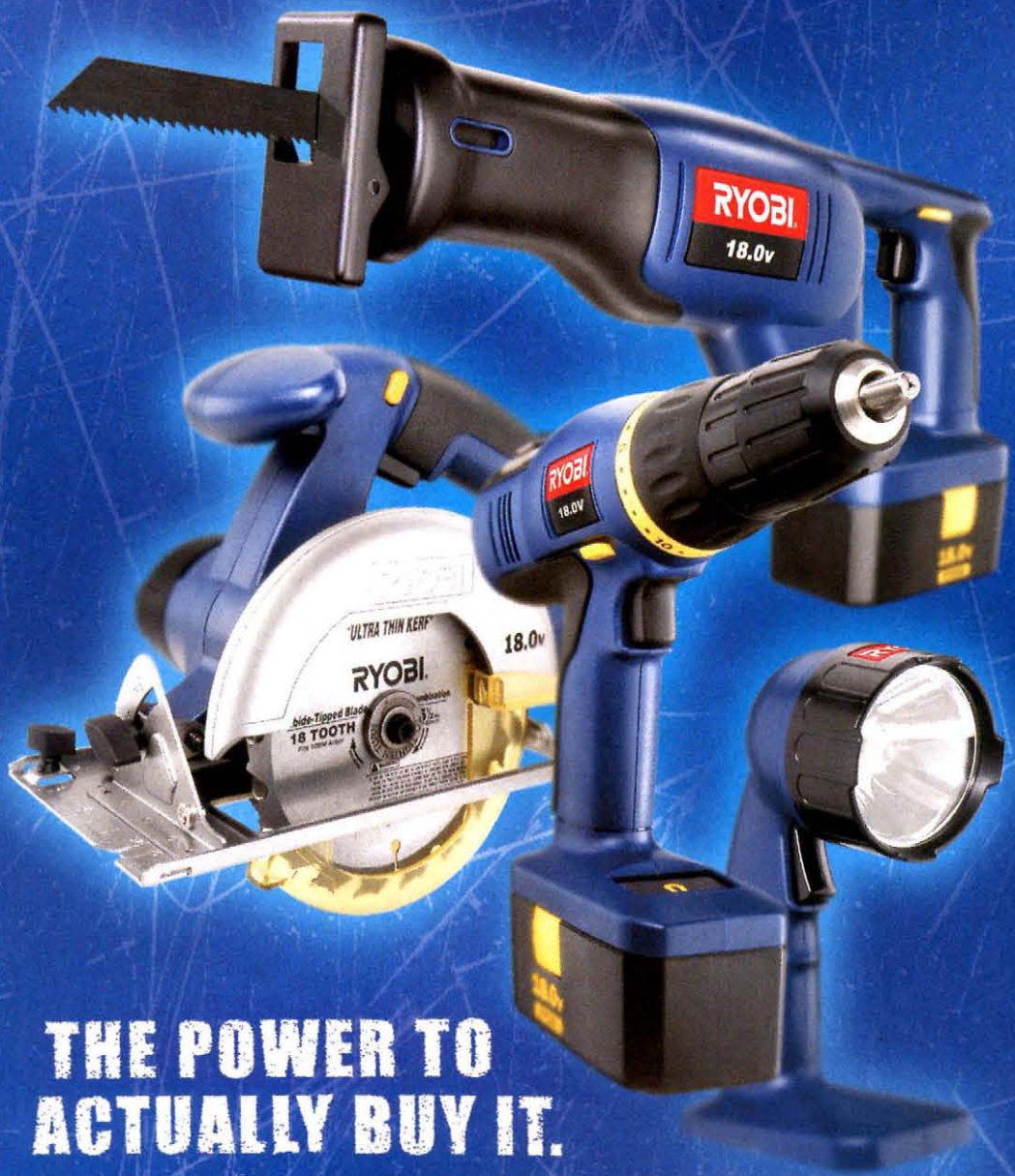

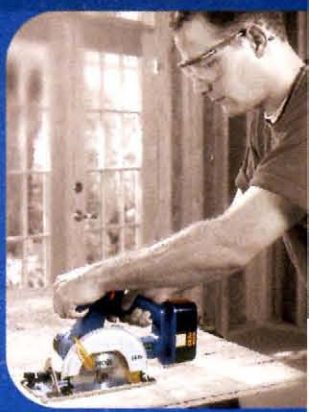

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Woodworker's Journal

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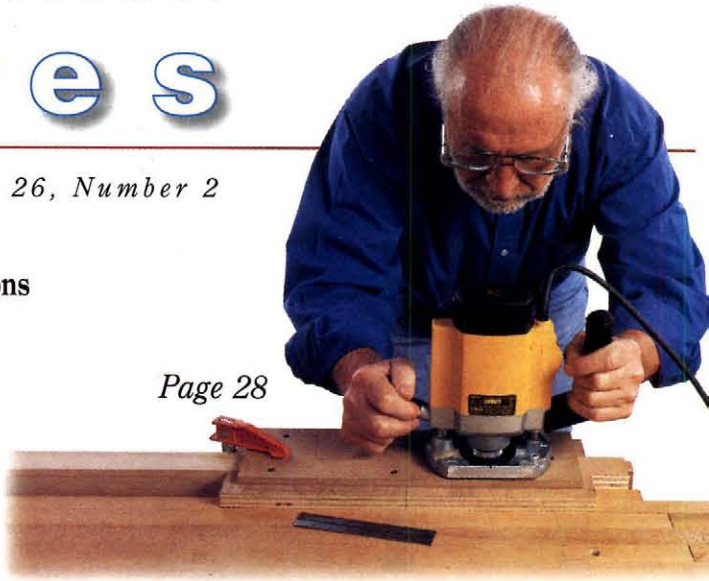

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34 **"Inside Out" Turning**
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38 **The Downdraft Workbench**
By Rick White
Tight on shop space? Rick came up with a combination we've never seen before ... but what a natural.

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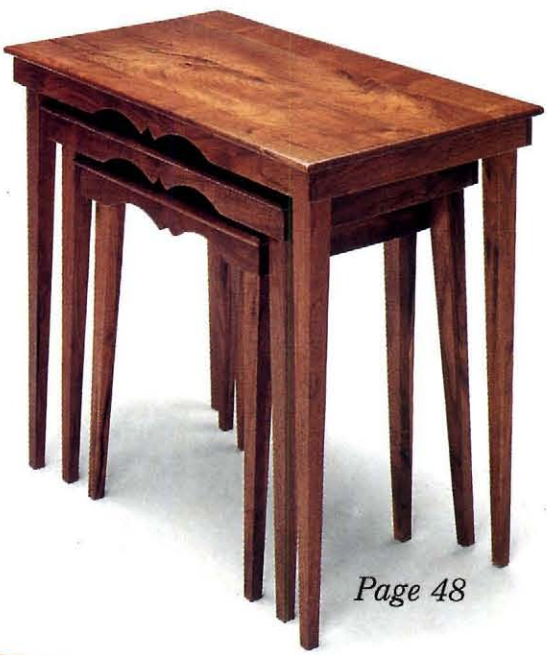

48 **Nesting Tables**
By Stan Cloney
A long-time subscriber had his very first "stump-to-finish" experience with this classic set of tables.

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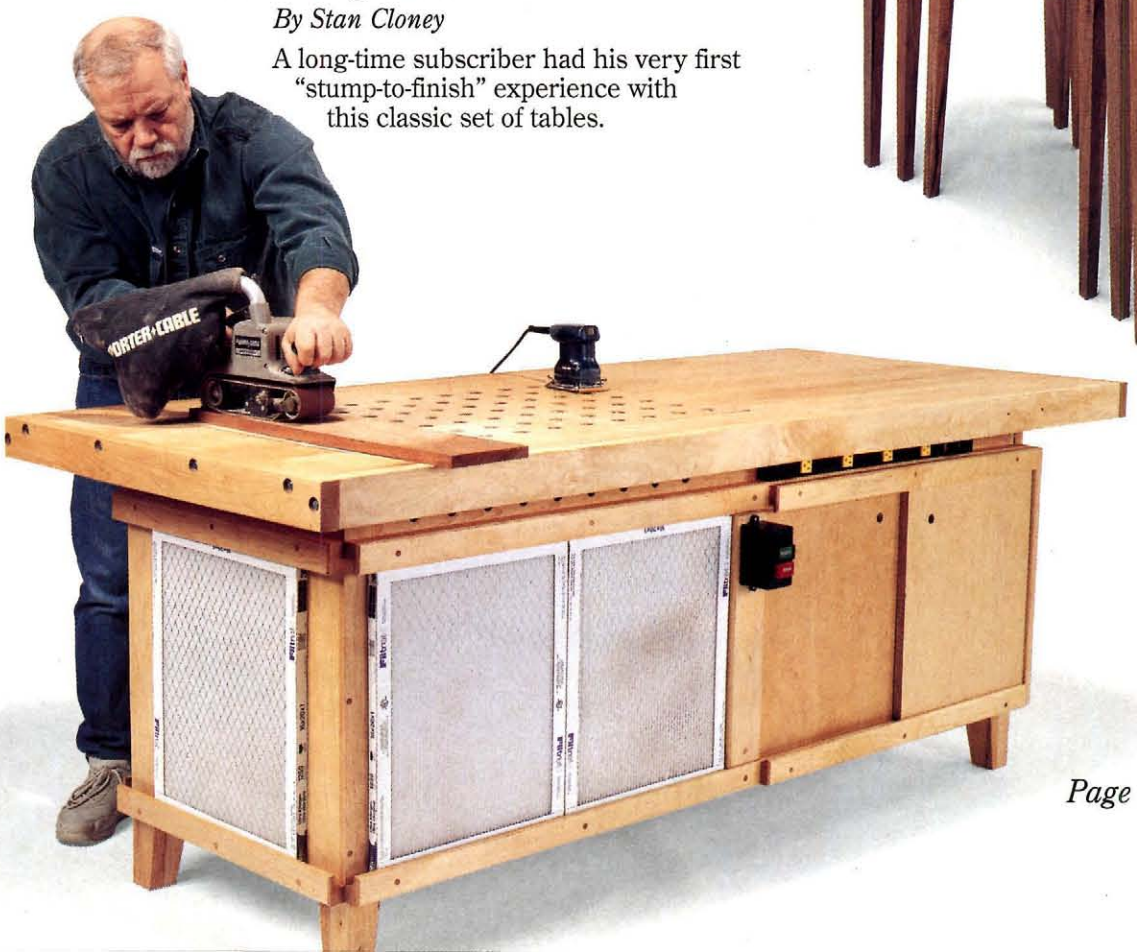

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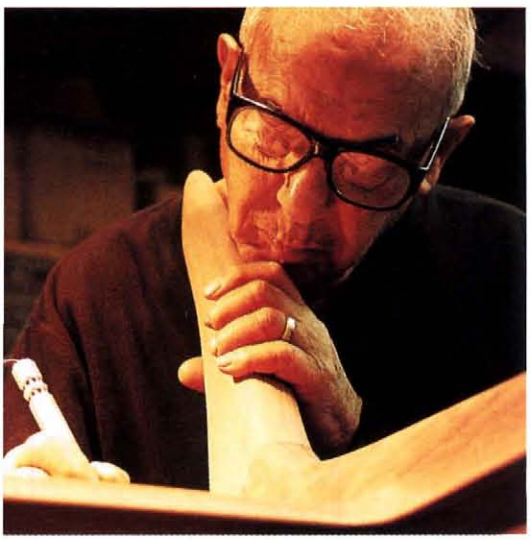

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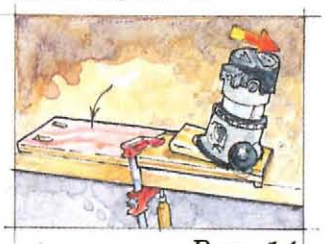

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72 Shop Journal
Smooth and tough. The Craftsman 27511 plunge router earns "Tools that Endure" honors.

84 What's In Store
New tools that make it all look easy.

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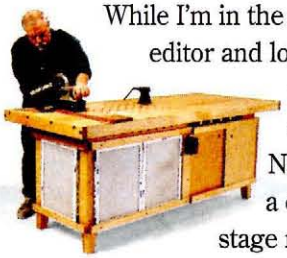
Growth Rings

Looking back over the last four years at *Woodworker's Journal* stopped me in my tracks recently. Was it only May 1998 when we merged *Today's Woodworker* magazine into the *Journal*? I remember well the last *TW* issue prior to the merger — a power-packed 40-pager serving 100,000 subscribers. In the four years since, we've more than doubled both our page count and the number of readers (about 220,000 these days). Another 150,000 less patient subscribers get our *eZine* every two weeks via e-mail — if you want to have a look (it's free), sign up at our home page or go to woodworkersjournal.com/ezine/currentissue.cfm. Thanks to all of you for your continuing support and for helping us add a few more growth rings!



While I'm in the mood, I want to say thanks to our contributing editor and long-time shop foreman, Rick White. A self-taught woodworker, Rick's skills have been improving steadily since his first appearance in 1989 (Vol. 1, No. 1 of *Today's Woodworker*). These days Rick is a critical part of our day-to-day team, from the design stage right through final sanding. In fact, the downdraft workbench featured in this issue *(see page 38)* started out as a drawing on the back of a napkin, over lunch with Rick. Like many of our shop projects, the idea started with the words, "Wouldn't it be nice if ..." There's nothing like having a true shop rat around to help finish those sentences!

And finally, some thanks from another quarter. Just after Thanksgiving, contributing editor Michael Dresdner's sixteen-year-old daughter was diagnosed with cancer. As soon as we got the news, *Woodworker's Journal* set up a donation account at a local bank in Michael's neck of the woods and editor Rob Johnstone shared the news with our eZine subscribers.

"Soon after," Michael told us, "the bank called and we learned that woodworkers from all over the country were sending money to help a young woman they'd never even met. I always believed woodworkers were the best bunch of people in the world. Now I know it for sure."

A fair number of you don't subscribe to the eZine and are hearing about this for the first time right now. If you would like to help out, please send what you can to *The Kaitlin Dresdner Fund*, Key Bank: 152nd and Meridian, 15117 Meridian East, Puyallup, WA 98375.

Thanks!

Larry N. Stoiaken

MARCH/APRIL 2002
Volume 26, Number 2

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Woodworker's Journal (ISSN: 0199-1892), is published in February, April, June, August, October and December by Rockler Press, 4365 Willow Dr., Medina, MN 55340. Periodical postage paid at Medina, Minnesota and additional mailing offices. Postmaster: Send all address changes to Woodworker's Journal, P.O. Box 56585, Boulder, CO 80322-6585. Subscription Rates: One-year, $19.95 (U.S.); $25.95 U.S. funds (Canada and other countries). Single copy price, $4.95 (U.S.); $6.95 (Canada/other countries). Reproduction without permission prohibited. Publications Mail Agreement Number 0861065. Canadian mail distributor info: Express Messenger International; P.O. Box 25058; London BRC, ON; Canada N6C 6A8. Printed in the USA.

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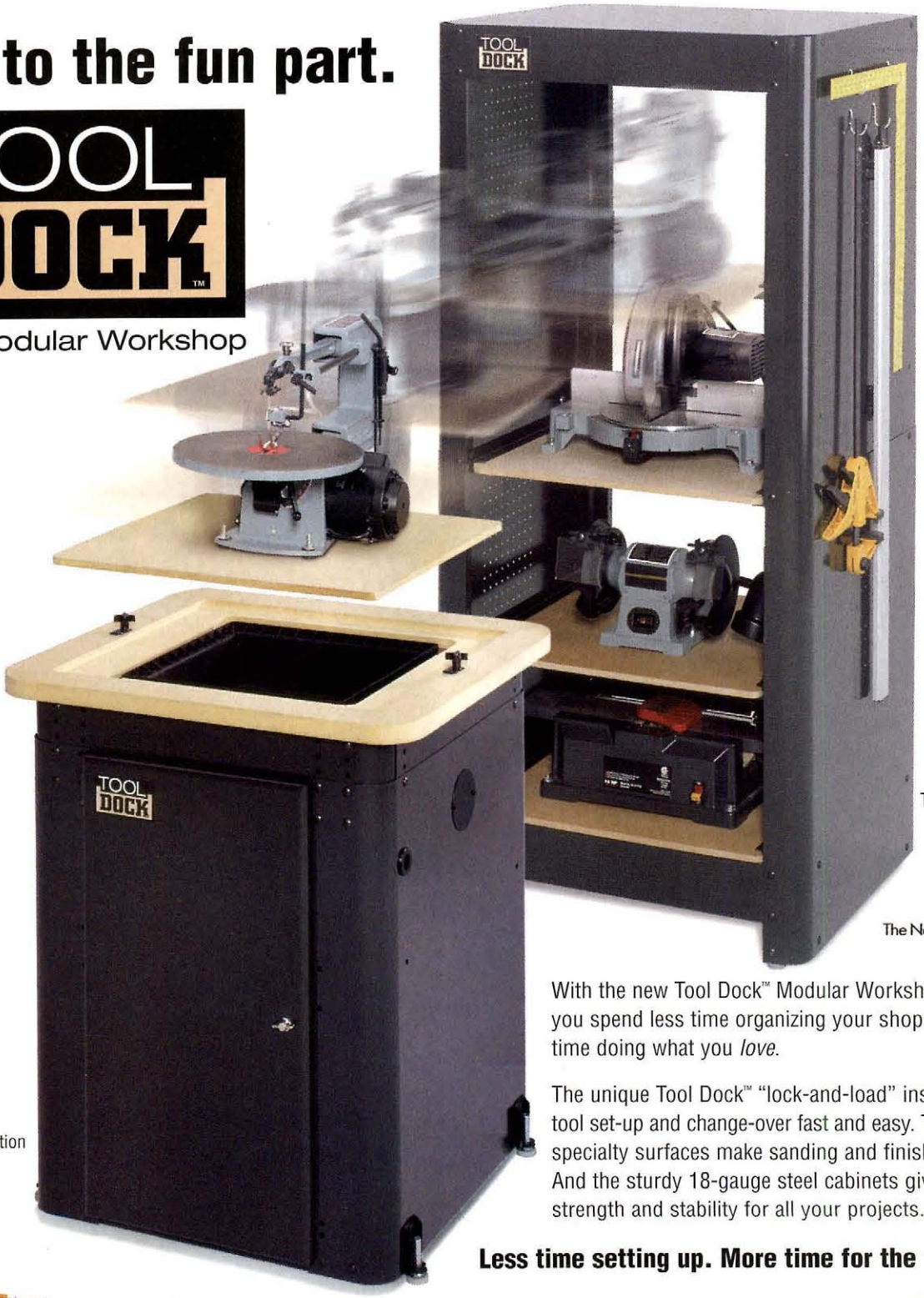

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Ultimate Improvements

Our readers offered a few improvements to Ralph Bagnall's "ultimate router jig" featured in our December 2001 issue.

Adjusting the Jig

I recently finished reading the article by Ralph Bagnall on the adjustable dado jig in the December 2001 issue (*Jigs & Fixtures*). I couldn't help but wonder why he didn't set the fixed part of the router base flush with the cutting edge of the bit, then make the adjustable base flush with the bit on the inside edge when the other edge was flush with the edge of the jig. This would leave a 1/2" gap between the base parts when the jig was set for "0."

With that modification, he could set the perfect dado width directly from the stock intended to fit into the dado simply by inserting the end of the stock between the two base parts, sliding the adjustable base in until it was snug, then locking it down. Locating blocks and a reference mark on top of the jig would allow replacing the router in the same location and orientation each time to prevent errors and a nonconcentric collet.

Bob Hamilton
Forest, Ontario

Like a typical woodworker, I found some things that I thought could be improved on the adjustable dado jig.

First, one of the reasons for a jig is to speed up a process. As illustrated, I would have to take the existing plastic base on my router off prior to installing the jig, or install a dedicated base. I would suggest routing a recess in the upper plate with the same shape as the router base and holding the router in place with a couple of clamps. This recess would still have to locate the router bit at 3" from the edge.

Second, I would enlarge the gap made by the saw kerf in the lower plate to 1/2" or whatever diameter bit is being used. Then, the jig could be placed over the board being installed in the dado, and the resulting routed opening is exactly the width of that board. The result would be a dado that is the same dimension as the board. That would eliminate any errors caused by misreading the width of the opening, measuring the board thickness or reading the installed scale on the self-stick scale tape.

Third, I would install a piece of Formica® or low-friction tape (UHMW) on the bottom of the jig to make it slide more easily.

Dan Gallagher
Longview, Washington

Safety Tip

I want to make sure readers are aware of an important point that didn't get into my article on waterbased finishes (*Finishing Thoughts*, February 2001). Waterbased finishes contain ammonia or other amines to keep them from separating. If you brush or spray in a basement or garage that contains your home's heating system, make sure the room is well ventilated, even while the finish is drying. The ammonia or amines that off-gas from the finish will attack and corrode aluminum. Many heaters have aluminum heat exchangers, and frequent assaults of waterbased finish fumes can destroy them prematurely.

Michael Dresdner
Contributing Editor
Woodworker's Journal

Mail Call! Contact us by writing to "Letters", Woodworker's Journal, 4365 Willow Drive, Medina, Minnesota 55340, by fax at (763) 478-8396 or by e-mail: letters@woodworkersjournal.com We ask that all letters, including e-mails, include a mailing address and phone number. We reserve the right to edit for length and clarity.

Crikey, it's a Sheoak!

In the August 2001 issue, Myron Janisch asked about Australian Pine growing in Florida (*Questions & Answers*). There is no such thing as Australian Pine in Australia.

We call *Casuarina equisetifolia* Beach Sheoak, though it's no more an oak than a pine (the nickname English Oak became abbreviated to Sheoak). Apparently it can be turned, but the general view is that it's too brittle, with a tendency to split along the rays. It's also very difficult to season without degradation such as cracking and cell collapse. In short, you can

In Australia, this isn't an Australian pine.

use it, but it's too much trouble for most people.

Western Australian Sheoak, *Causarina fraserana*, is a completely different story: the first choice of West Australian turners and carvers, and probably second only to Jarrah in cabinetmaking.

Anyway, now we know what Australian Pine is!

Steven Burrows
Managing Editor
The Australian Woodworker

Lewis likes this turned candlestand project — he's just not a big fan of sanding.

How Do You Really Feel?

First of all, let me say, I HATE TO SAND. No ifs, ands or buts about it: I hate to sand. However, when I saw the *Spiral Candleholder* in the December 2001 issue, I knew I had to give it a try. I did pretty well until it came to sanding the flutes. Did I mention I hate to sand?

Maybe I didn't take off enough material with the drill bit, or maybe I'm too impatient, but after several hours of sanding I was about to give up. That's when my stubborn streak kicked in, and I started thinking "there has to be another way." I tried mounting the drilling cradle on my oscillating spindle sander to finish the flutes. That didn't work. Back to hand sanding. Frustration sets in again.

Then I noticed my Dremel tool. IDEA!! The 1/4" sanding drum attachment might just do it. After discovering the proper angle (about a right angle to the scallops left by the Forstner bit), everything was humming along. I kept thinking, "I'll bet this is what Norm would have done."

continues on page 12 ...

LETTERS

The project — originally destined to be a Christmas gift for a friend — was abducted by my wife. Thanks for a great magazine and projects.

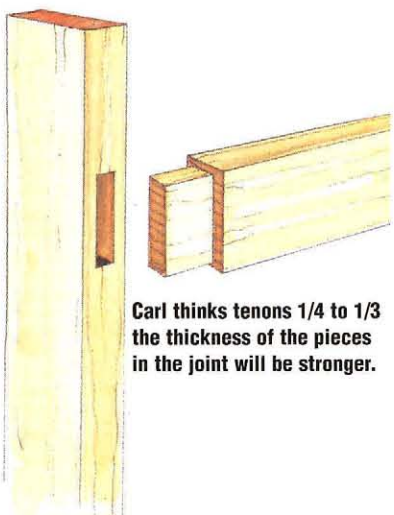
Lewis Kauffman
Chambersburg, Pennsylvania

How Thick a Tenon?

I wanted to take exception to a point in Ian Kirby's article on mortise and tenon design (*Mortise and Tenon: A Primer*, December 2001). He points out that making the tenon half the thickness of the piece when joining pieces of equal thicknesses results in a balanced joint. If wood were a homogenous material, this would be true. But the strength of wood varies considerably with the grain orientation.

If you were to break a M&T joint in a frame by torquing the rail down relative to the stile, it would most likely fail by splitting the grain in the stile. This occurs because the tensile strength across the grain is many times less than the strength along the grain. To more closely balance the joint, it makes more sense to make the tenon 1/4 to 1/3 the thickness of the pieces.

Carl Stammerjohn
Torrance, California



Carl thinks tenons 1/4 to 1/3 the thickness of the pieces in the joint will be stronger.

Safety First: Learning how to operate power and hand tools is essential for developing safe woodworking practices. For purposes of clarity, necessary guards have been removed from equipment shown in our magazine. We in no way recommend using this equipment without safety guards and urge readers to strictly follow manufacturers' instructions and safety precautions.

This Bench Glider was the first piece of furniture Michael Colicchio built. He says it was a big boost to his confidence.

Plan Helps Him Build Glider

Enclosed, please find pictures of my Bench Glider project I completed from plan #52256 ("Plans, Plans, Plans," *woodworkersjournal.com*). I used Honduran mahogany and finished it with ZAR tung oil, which highlights the natural color of the wood.

This was probably a little ambitious for my first furniture piece; however, the plans, along with some interpretation and assistance, helped me see it through. This effort proved to be a big boost to my level of confidence and I am now on my way into a computer workstation for my wife's business.

I live in the Florida Keys, over 150 miles from the mainland. Your magazine, the Internet and woodworking catalogs are my only source for education. After only two years as a retired hobbyist, my successes are attributable directly to these media.

Michael Colicchio
Summerland Key, Florida

Rod and Reel — and Poles

Small point of semantics: Rick White apparently didn't get a chance to proofread the caption of the photo on page 53 of *Woodworker's Journal* Volume 25, Number 6 (*An Angler's Cabinet*, December 2001). Those are fishing rods in the photo, not fishing poles. Rods (casting, fly, trolling) use reels for the line; poles are long stems of Calcutta cane with a line tied to the end. You can't cast with them, and those are casting rods in Rick's cabinet.

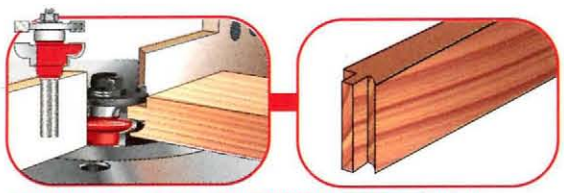
Barney Howard
Sisters, Oregon

Rick White knows woodworking — and fishing equipment.

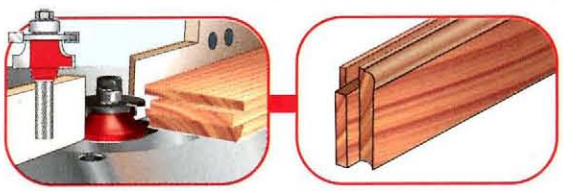
What's the secret to building perfect panel doors?

Freud panel bits...now available with backcutters

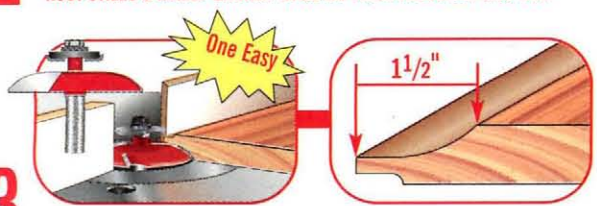
STEPS TO BUILDING A PERFECT PANEL DOOR:



1 ROUT RAIL ENDS. SHOWN: RAIL BIT FROM FREUD SET #99-260.



2 ROUT STILES & RAILS. SHOWN: STILE BIT FROM FREUD SET #99-260.



3 IN ONE STEP, ROUT DOOR PANEL PROFILE AND BACK CUT. SHOWN # 99-569

4 ASSEMBLE STILES, RAILS AND DOOR PANEL.

In the past, the only way to make architecturally correct panel doors required the use of two bits. Or, with other raised panel backcutter bits, you had to settle for a smaller profile.

Finally, in one easy step, you can produce panels from $^{3}/_{4}$" wood with a $1^{1}/_{2}$" reveal that are flush with the door frame for an architecturally correct appearance. Freud introduces 2+2 Raised Panel Bits With Backcutters.

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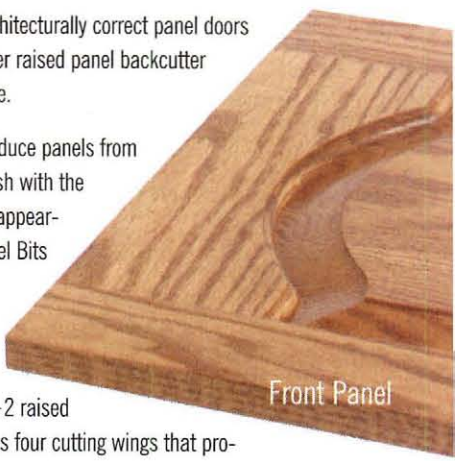

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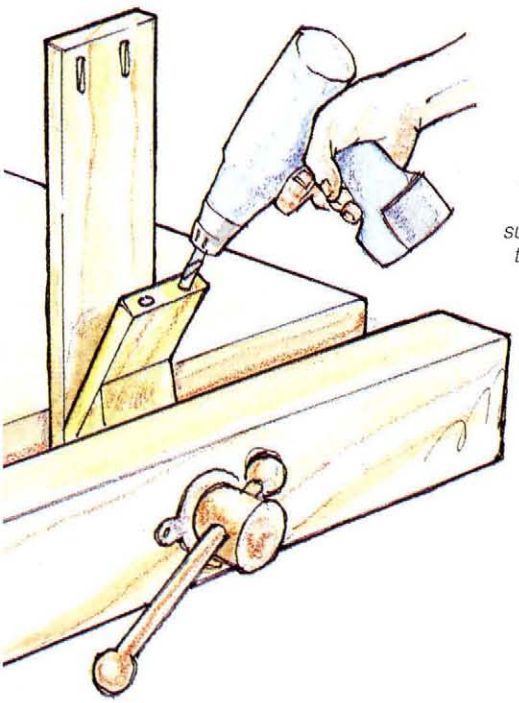
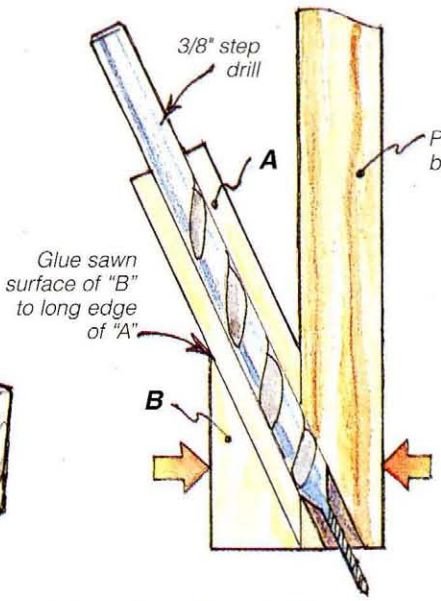
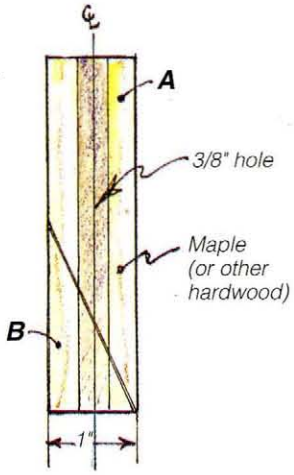
Pick a Pocket-hole Jig



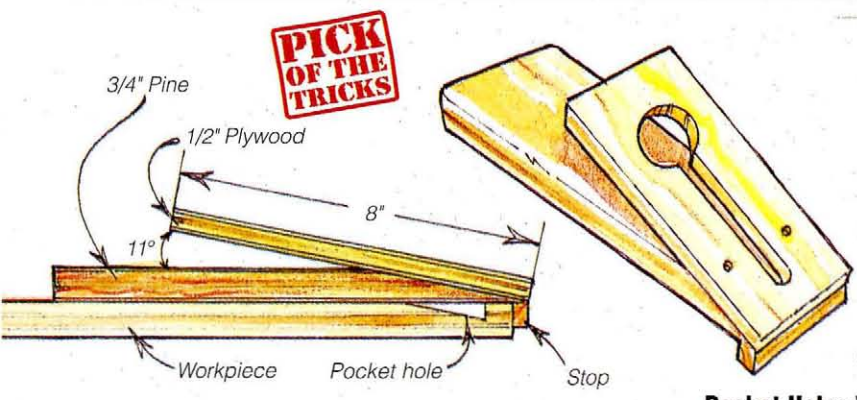


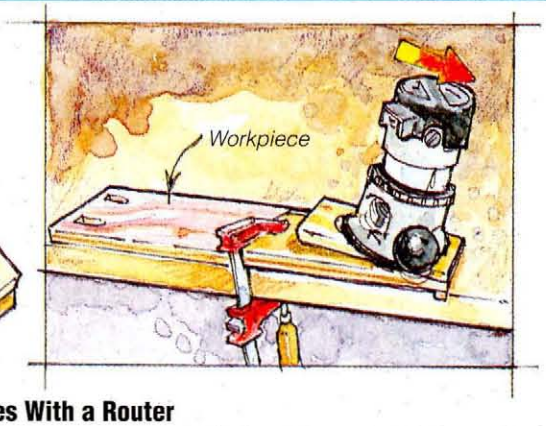


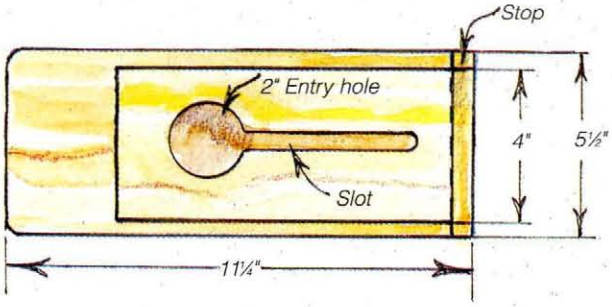
Pocket Holes With a Drill

This jig is quickly made and greatly simplifies the drilling of pocket holes in face frames, aprons, etc. First, drill a 3/8" hole down through the center of a 1" square piece of maple or other hardwood. Saw the block apart at a 15° angle and then glue the two pieces together as shown. To make a pocket hole, clamp the guide securely to the work and drill a 3/8" hole partway into the stock. Change to a smaller bit — according to shank diameter of the screws you're using — and complete the hole.

D.J. O'Donnell
New Bern, North Carolina



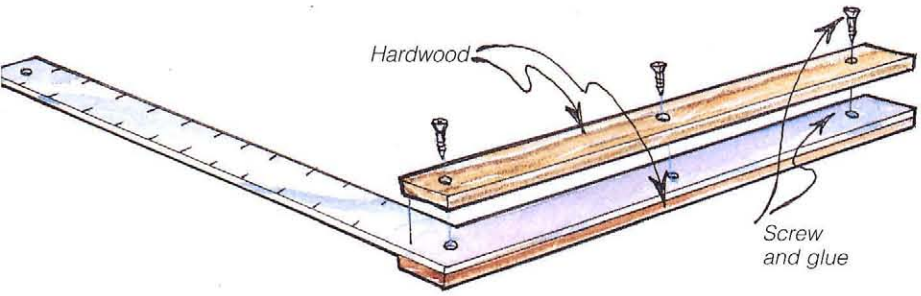




Pocket Holes With a Router

With this jig I can rout tapered slots for pocket holes in face frames or aprons. I used 3/4" pine (planed to an 11° slope) for the jig base and attached a stop to its bottom. Then I created a slot (for a 1/2" O.D. bushing) on a piece of 1/2" plywood and glued and screwed that to the base. The large hole in the jig lets me drop the bit and bushing into place. I use a 3/8" carbide straight bit to cut the slot and then drill shank holes with a 1/8", 3/16" or 1/4" diameter long bit depending on the size of screw I plan to use.

Robert Keilholtz
Tameytown, Maryland



Improving Your Framing Square

With the addition of two wood strips you can make that old friend the framing square even more versatile. Glue and screw two perfectly square hardwood strips, as shown, making sure that they are exactly parallel to the metal edge. You'll now find it much easier — and more accurate — to square across a board. Your new, improved square will also stand on its own when set on the wooden edges. If weight is a consideration, start with an aluminum square rather than steel.

Jay Wallace
Ashland, Oregon

WINNER!

In addition to our standard payment (below) Robert Keilholtz of Tameytown, Maryland will also receive a **Delta 22-580 portable two-speed finishing planer** *for being selected as the "Pick of the Tricks" winner. We pay from $100 to $200 for all tricks used. To join in the fun, send us your original, unpublished trick. Please include a photo or drawing if necessary. Submit your Tricks of the Trade to Woodworker's Journal, Dept. T/T, P.O. Box 261, Medina, MN 55340. Or send us an e-mail:* **tricks@woodworkersjournal.com**

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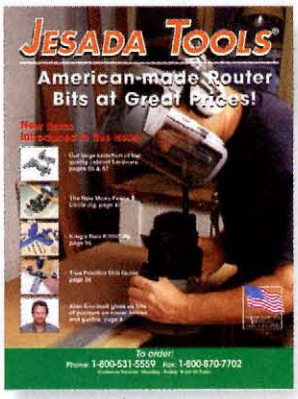

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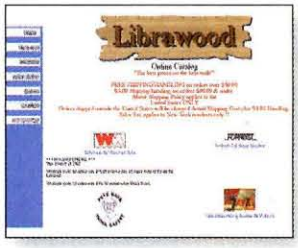

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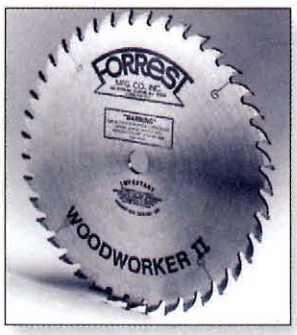

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How to Avoid Plane Marks

Q I recently read that you need to grind a convex shape on the iron to make a hand plane easier to push through the wood. Is this correct?

Ryan Vogt
Urich, Missouri

A There are two bevels on a plane iron. The sharpening bevel, made on a sharpening stone, is the sharp edge which cuts the wood. The grinding bevel, made on a bench grinder, is hollow (concave) as a consequence of passing across the face of a grinding wheel. The sole purpose of the grinding bevel is to make sharpening on an oilstone faster.

If you plane wood wider than your plane and the blade is straight across the end, it will make a shaving the full width of the blade. What you're cutting is a wide but very shallow groove, with visible edges. These small stops are called "plane marks." To avoid them you sharpen the blade with a slight curve on it — a "convex" curve! The amount of curve is governed by the thickness of the shaving you want to remove, but your aim is to get a shaving nearly the width of the blade. If you are making fine shavings, you'll have a small curve on the blade; thick, coarse shavings, a slightly bigger curve — it's trial and success to find the answer.

— Ian Kirby

When planing lumber that is wider than your plane, a very slight convex shape formed on the end of the iron will help you to avoid plane marks.

Q Someone suggested that I use Ponderosa Pine when making Colonial style furniture. I currently use clear pine or common pine. Is Ponderosa Pine a different species of pine, and where can I get it?

Martin C. Johnson
Howard Beach, New York

A There are nearly 100 species of pine in the world, 37 of them are found in the U.S. and Canada. Pine species vary in density, strength, appearance, ease of working, and so on. Woodworkers separate pine into several groups, depending on the grain, color, resin, dimples and price.

The three principal soft pines are Eastern white, Western white, and sugar pine. Ponderosa is one of the softest of the hard pines.

One in a hundred. Nearly 100 species of pine grow in the world.

Ponderosa is a Western species, growing from the eastern Rockies and into Oregon and Washington state. With the near total reduction in harvesting of this species due to the spotted owl hoopla, it is not easy to find in the South, Midwest or Eastern U.S.

The two white pines are my top choice for fine furniture pine. Unless you have a nice price break, use one of them. If you want a heavy grain, use Southern yellow pine or one of the other hard pines.

— Eugene Wengert

THIS ISSUE'S EXPERTS

Ian Kirby *is a master woodworker trained in the British Arts and Crafts tradition and the author of* Sharpening With Waterstones *from Linden Press.*

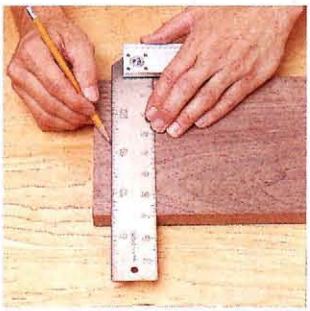
Dr. Gene Wengert *is a professor emeritus of wood processing at the University of Wisconsin-Madison and president of the WoodDoctor's Rx, a consulting and education company.*

Ellis Walentine *is a former editor of American Woodworker and the founder of* WoodCentral.com *and* WoodFinder *(Wdfinder.com).*

Michael Dresdner *is a nationally known finishing expert and author of* The New Wood Finishing Book *from Taunton Press.*

Q How can I check my try squares for 90° accuracy? Also, how much should I expect to pay for accurate squares?

Richard Matkus
Racine, Wisconsin



Is your square really square? There are simple and common sense ways to check its accuracy.

A Even the "best" squares aren't likely to be perfect, and try squares are usually among the least reliable. I once went through an entire carton of brand-new try squares and didn't find a single one that was sufficiently square.

The time-honored method for checking a square is to mark a line across a board, reverse the square, and mark another line over the first. If the lines aren't perfectly registered, the amount of the divergence equals twice the error over that distance.

This method can be extremely accurate, depending on how straight the edge of the board is, and how fine your line is. I don't trust a jointed edge to be straight enough, so I hold a machinist's straightedge against the side of the board and hook the square over that. I also use a very sharp knife instead of a pencil to scribe the lines.

You can also use a machinist's square, which resembles a try square except that it is made of stainless steel. Nest your try square inside the machinist's square and hold them up to a light to see any discrepancies. Make sure the edges of both squares are free of glue, rust and dirt. Or, stand the try

continues on page 20 ...

WINNER! *For simply sending in his question on sharpening hand planes, Ryan Vogt of Urich, Missouri wins a Bosch 1619EVS router. Each issue we toss new questions into a hat and draw a winner.*

square on a flat reference surface such as a table saw top and check it with a decent quality drafting triangle.

How much do you need to spend for accuracy? You could spend upwards of $100 for a reasonably good machinist's square that might be accurate to within .0005 inches over 8 inches, but inexpensive imported machinist's squares that cost under $30 are plenty good enough for woodworking.

— Ellis Walentine

Q I am planning an upgrade to my home, and the subject of our kitchen cabinets came up. My wife thinks they are too dark and wants them lightened. The cabinets are custom made, oak and stained in Minwax Provincial. There is no top coat of any kind on them. The question is, can these units be bleached to a lighter shade and, if yes, what is the procedure?

Morris Pollak
Thousand Oaks, California

A Unfortunately, the stain you described is self sealing — it contains a film forming material that locks the color onto and into the wood. Therefore, you can not easily wash it back out. As it is a waterproof material, water-based bleaches will not attack it.

The best bet is to scrub out as much of the finish as you can with a light application of paint remover, (the ones called "refinisher" will work here, but so will most any other). Scrub off as much stain as possible to get down to raw wood.

Lightening the stain on your kitchen cabinets involves a lot more than breaking out the laundry bleach. Restaining, using a stain with 100% pigment (no dye), is probably a better starting point.

At that point, you may be able to further remove any residual dye stain with fresh laundry bleach or, for the more adventurous (and foolhardy), two part wood bleach. Clearly, this is more mess and effort than is justified.

An easier approach may be to restain the wood with a much lighter stain, preferably one that contains 100 percent pigment and no dye. Pick a color of paint that you like from the variety of paint chips at the store, have them make up a small amount (quart or less if possible), then reduce the paint 50/50 with the appropriate thinner (mineral spirits for oil paint, water for latex paint).

In this case, oil-based paint will be easier to work with since it will give you a longer working time before it dries. Use the reduced paint as a stain. It will block some, but not all, of the colored wood grain already on there. Apply it too thickly and it will obscure the wood, but work thin and you may have results that work for you.

Remember when choosing the color that it will be added to the color already on there, so choose one that will be correct only after it is combined with the current stain on the wood. As always, test a sample first in a hidden area — like the back side of a rarely used door.

— Michael Dresdner

You'll reduce your paint 50/50 with the appropriate thinner (water for latex paint, mineral spirits for oil paint).

Contact us by writing to "Q&A", Woodworker's Journal, 4365 Willow Drive, Medina, MN 55340, by faxing us at (763) 478-8396 or by e-mailing us at: Q&A@woodworkersjournal.com We ask that all questions submitted, including e-mails, include a mailing address and phone number.

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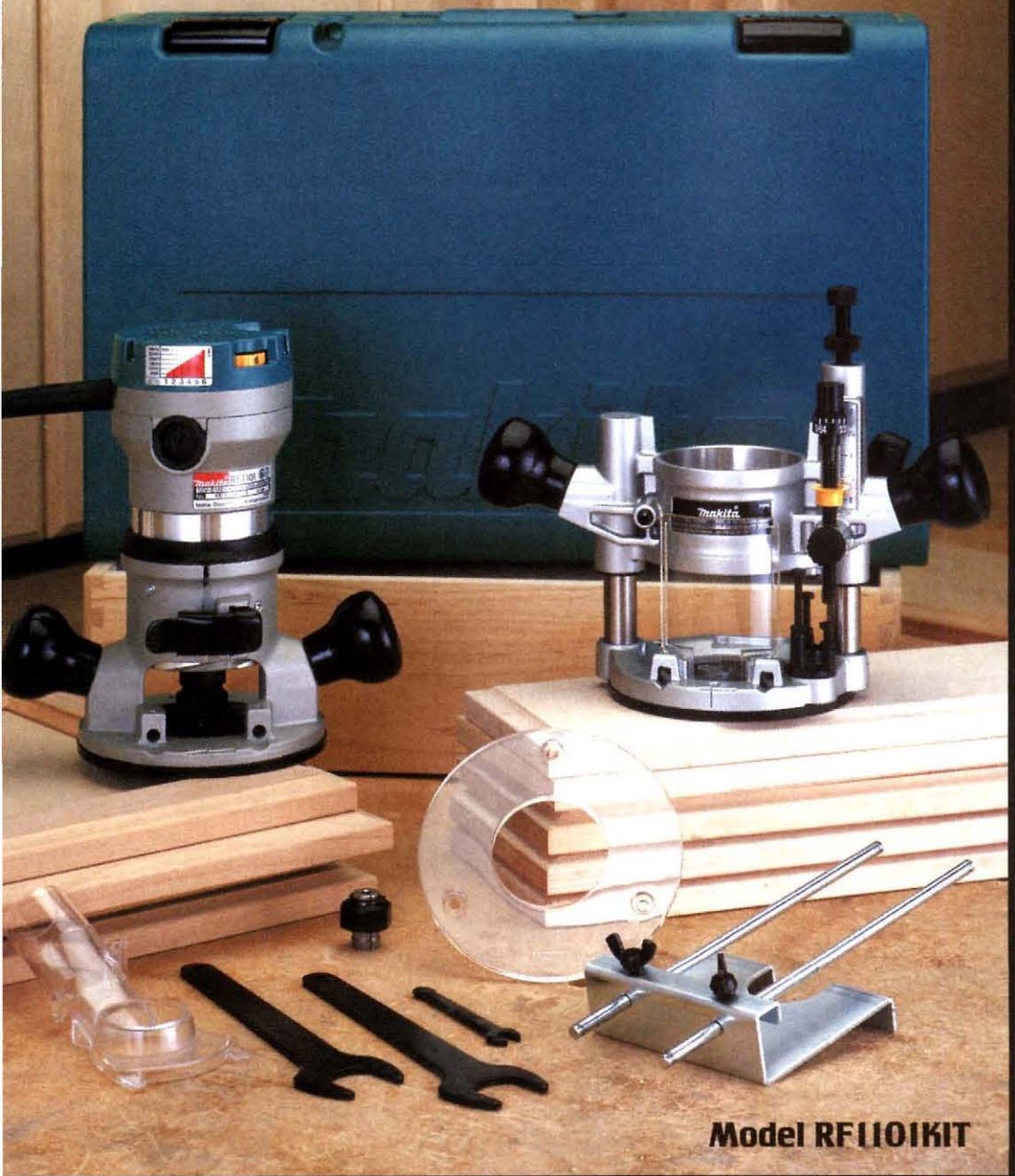

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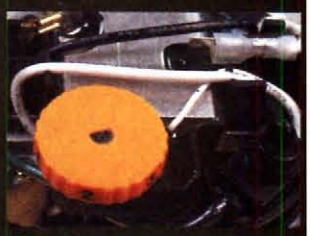

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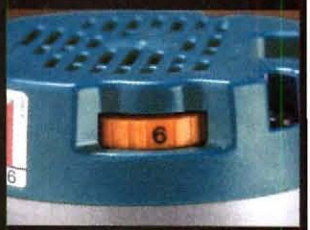

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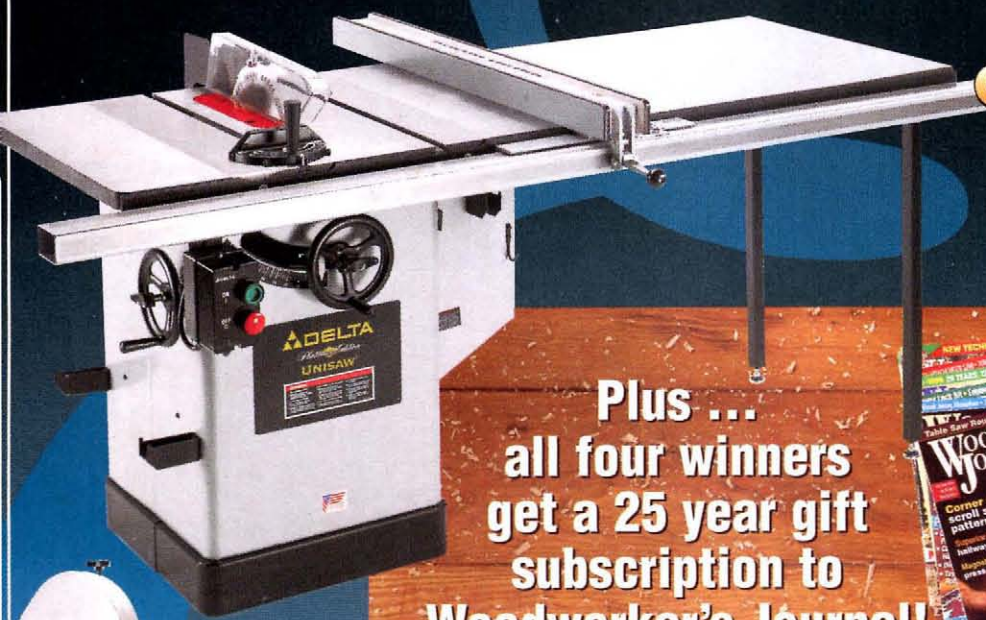

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Sam Maloof's Brand New Digs

By Joanna Werch Takes

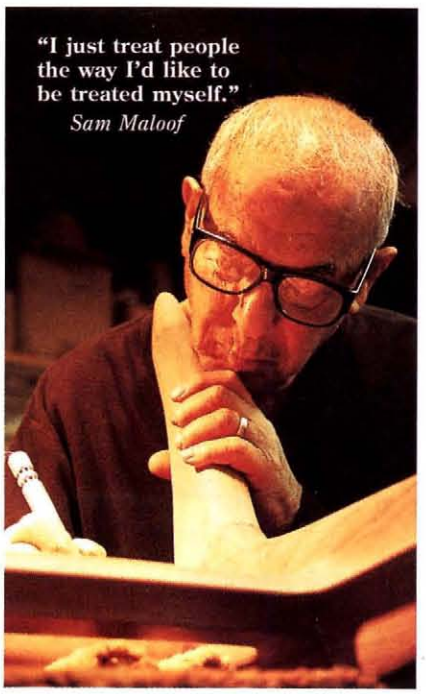
A Master at Home

Woodworker's Journal Pays a Visit

A while back, *Woodworker's Journal* art director John Kelliher was working on a project with renowned woodworker Sam Maloof, and Sam invited John to come out to his place for a visit. Ten years later, John took him up on that invitation — and, while he ended up visiting the same house, it was in a different spot.

A year ago, the California highway system decided to put a road right through the spot where Sam's house had stood for decades. In the process, they declared his old house a historic site and moved it eight miles away to become a museum. They also moved Sam's shop, and built him a new house. Sam's already talking about improvements to the new place, John says, and has planted some sequoias that he says he can use for porch furniture in about 25 years.

The 85-year-old woodworker showed John around the original home, which was built to showcase his furniture pieces. Over the years that Sam lived there with his late wife, Alfreda (who is buried on the grounds of his new estate), he built the house room by room, designing it in his mind. Since it was located in a lemon grove, though, he couldn't see how well it all worked together until the house was moved to its current hilltop location, overlooking its former valley.



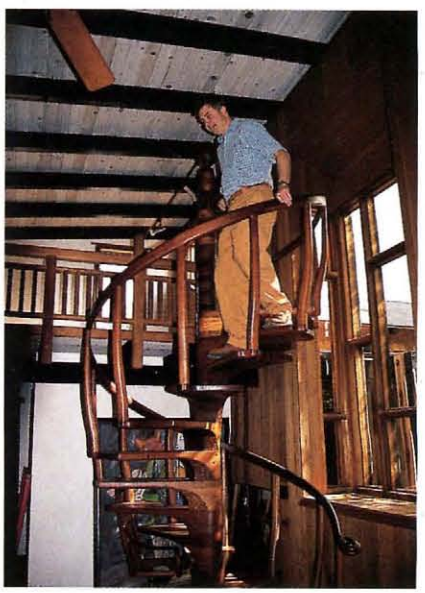
Master woodworker Sam Maloof signs each piece he creates. When Woodworker's Journal art director John Kelliher visited recently, Sam was completing a cradle.

Sam's assistants Mike Johnson, Larry White and David Wade (not pictured) help with a variety of tasks in the shop.

The house is currently open only for special exhibits and touring shows, but much of the work Sam has done over five decades was on display at the Smithsonian Institution earlier this year. The self-taught woodworker is known for well-crafted works and unique designs, particularly rockers, that have greatly appreciated in value. For instance, a table and chair seat he built in 1974 were recently appraised at over $400,000. He's built over 5,000 pieces from more than 500 designs in the course of his career — but 2001 was a slow year because of the move, with only 18 pieces completed.

Sam still does all the the shaping and assembly himself for every piece that goes out of his shop, while his assistants Larry White, Mike Johnson and David Wade help with cutting, sanding and finishing. All of Sam's assistants have been with him for lengthy periods. "I just treat people the way I'd like to be treated myself," Sam told John.

A few years ago, the MacArthur Foundation awarded Sam their "genius" award — he's the only craftsperson to have been so honored — and John said it was evident why he deserved it. "I had the feeling that I was truly with a genius," John said. "You know how some people get that little sparkle in their eye? Sam has that all the time."



Woodworker's Journal art director John Kelliher checked out the spiral staircase in Sam Maloof's old house. Sam built the house as a showcase for his clients to see his work; it's now a museum.

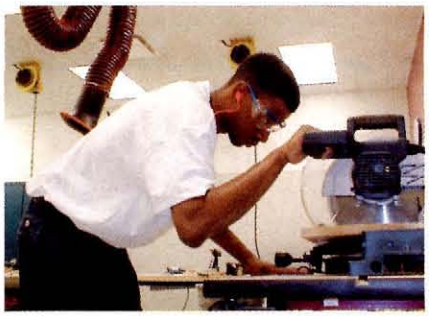
Future Woodworkers

Bosch Rewards Them Now

For the fifth year in a row, Bosch Power Tools will be sponsoring the FutureTech Challenge in 2002. College-level students will again come together to test their woodworking skills in a contest at Bosch's training facility in Addison, Illinois.

"One of Bosch's main objectives is to promote woodworking among students, and this is a great opportunity," said company representative Sil Argentin. The contest is held in conjunction with StudentAware Communications, an education-based company that promotes safety in all areas of technology education.

Last year's contestants built an outdoor organizer for gardening hoses and supplies. At the conclusion of the contest, Bosch donated the completed projects, as well as all of the power tools, hardware and lumber used during the event, to the local chapter of Habitat for Humanity. The student winners received Bosch tools and cash prizes.



Jessie Wilson, (top) a student at Atlanta Technical College in Georgia, took fourth place in last year's FutureTech Challenge, while Jonathan Graves (below, left) from Madison Area Technical College in Wisconsin, walked away with first place — along with $6,000 in Bosch tools and cash. He's shown with Sil Argentin from Bosch (center) and his instructor, Patrick Molzahn (who had extra reasons to smile ... a free trip to Chicago and $1,500 worth of tools for his school's shop).

Participating students were nominated by their instructors. College-level instructors in woodworking programs who wish to nominate students for this year's FutureTech Challenge can contact StudentAware Communications at 800-392-0509 or visit *www.futuretech101.com* to be placed on their mailing list for nomination forms.

Shop Talk continues on page 26 ...

Building Green Wood Chairs in England

A Tradition Carried On

A scorp (above), or curved drawknife, is used in shaping an elm seat for a greenwood chair. Cabinet scrapers will finish the job. At right, the splitting axe has no trouble on a nice straight grained piece of green ash.

Amongst the rich farming country by the Welsh border, lies Clissett Wood. This 10 acre ancient woodland was named after a Victorian chairmaker who coppiced and harvested his materials there, over a century ago. Nowadays the wood, containing mature oak, ash, hazel and sweet chestnut, is under the care of a group specializing in small wood lot management and green woodworking.

Chairmakers Gudrun Leitz and Mike Abbott offer a series of classes where students build and use a shaving horse and pole lathe to work their way through various woodturning projects. Most, however, come to try their hand at Clissett Wood's forte, the green wood chair.

No power cords are in sight at Clissett Wood's woodworking classes.

Green timber, Mike explains, has different working properties to its seasoned relative. It's softer and cuts more easily with less inclination to fail when dry. It lends itself to the technique of cleaving: splitting the wood along the lay of the grain using wedge shaped splitting tools like the "froe." The techniques are, in Mike's words, about "working with the timber and not against it."

Students use a shaving horse — a trestle with a hinged, foot-operated clamp — to hold the workpiece when shaping with a drawknife.

To form the chairs' turned legs, sawn-to-length ash thinnings are reduced to the required girth by progressive halving with a splitting axe operated by mallet blows. The cleaving is completed with steel wedges. When dimensions are close enough, the leg can be adjusted to a near workable shape with the side axe. Finally, it is worked with the drawknife.

The bow back shapes on some chairs were traditionally created with steambent ash; sweet chestnut is an experiment at Clissett. If the wood is cut at the right season of sap movement the bark will stay in place, its rich color contrasting handsomely with the other components.

"Free form" chairs, says Mike, require a good eye for a useful stick. A chairmaker who finds the right curve to create back posts can then cleft the stick in two so the posts mirror each other.

For assembly, tenons are initially finished oversized. When kiln dried for a few days they shrink into an oval shape, due to the grain formation, requiring a final turn for a tidy fit. The elm seat is left to dry naturally and, as it does so, it shrinks to tighten onto leg tenons and spindle joints.

For more info on classes, contact Gudrun Leitz at 44-1531-670325 (England).

— Barrie Scott

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Machine Cutting Mortises and Tenons

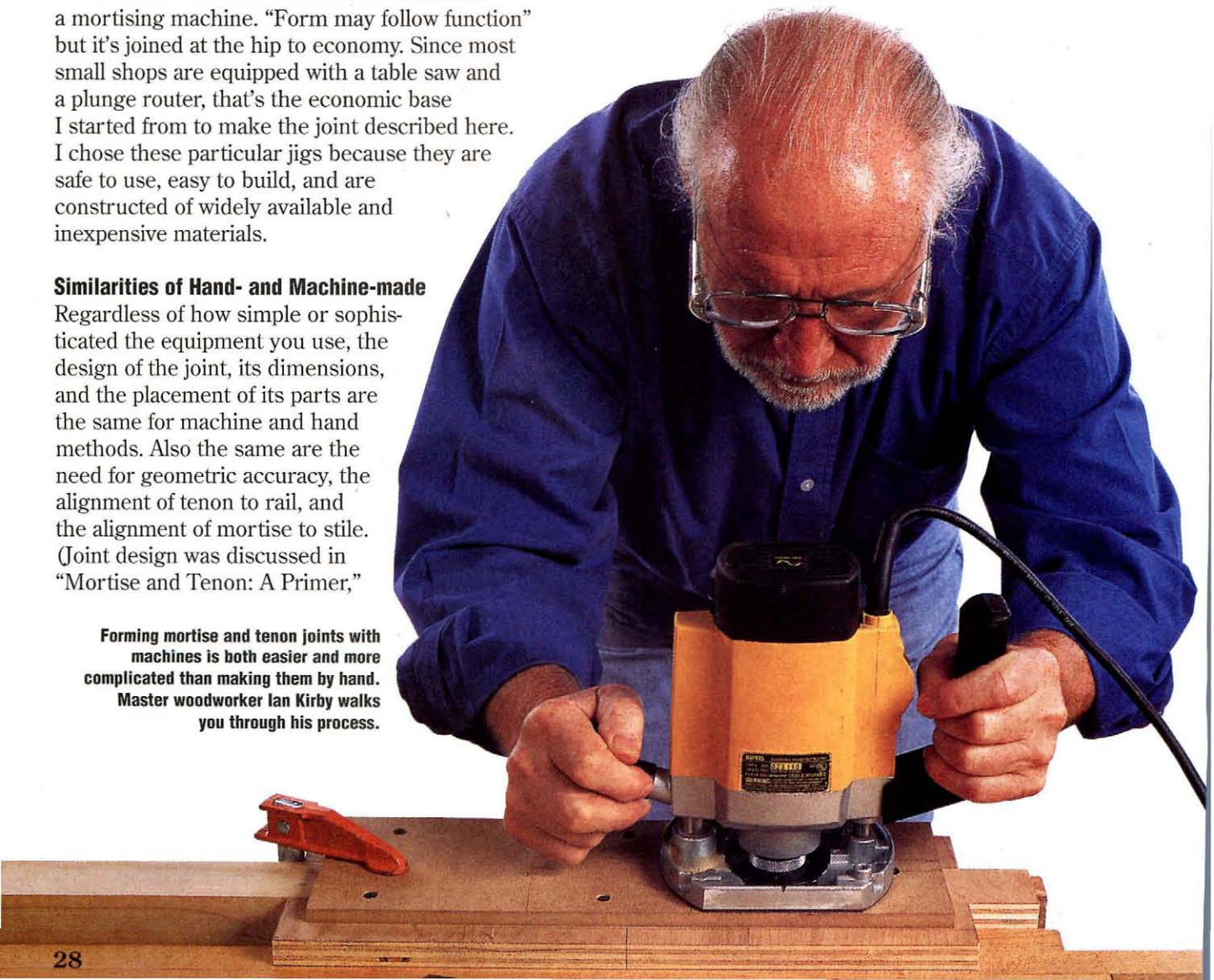
By Ian Kirby

No room in your shop or budget for dedicated mortise and tenon machinery? All you need is a table saw, a plunge router and the author's two safe, simple and economical jigs.

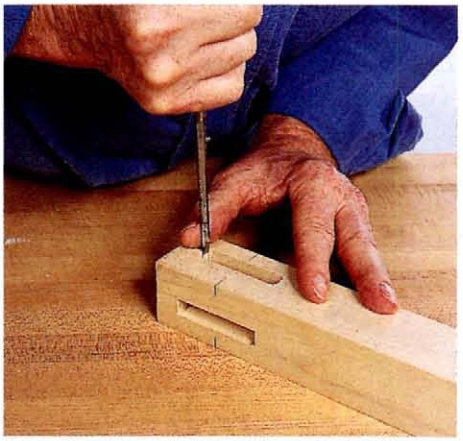
Cutting a mortise and tenon joint using hand tools is straightforward. The required tools are few and the method allows only minor variations. Using machines to cut the joint opens the door to a wide variety of inventive and personalized methods. Inevitably the methods you choose will revolve around the machines you have available and the jigs you design and build. In industry you would use a CNC router or a double-ended tenoner and a mortising machine. "Form may follow function" but it's joined at the hip to economy. Since most small shops are equipped with a table saw and a plunge router, that's the economic base I started from to make the joint described here. I chose these particular jigs because they are safe to use, easy to build, and are constructed of widely available and inexpensive materials.

Similarities of Hand- and Machine-made

Regardless of how simple or sophisticated the equipment you use, the design of the joint, its dimensions, and the placement of its parts are the same for machine and hand methods. Also the same are the need for geometric accuracy, the alignment of tenon to rail, and the alignment of mortise to stile. (Joint design was discussed in "Mortise and Tenon: A Primer,"



Forming mortise and tenon joints with machines is both easier and more complicated than making them by hand. Master woodworker Ian Kirby walks you through his process.



The author prefers to square up the mortise to match the tenon. To square the mortise, knife a line across the joint at each end ... then set a chisel that's the width of the mortise in the knife line and pare vertically down.

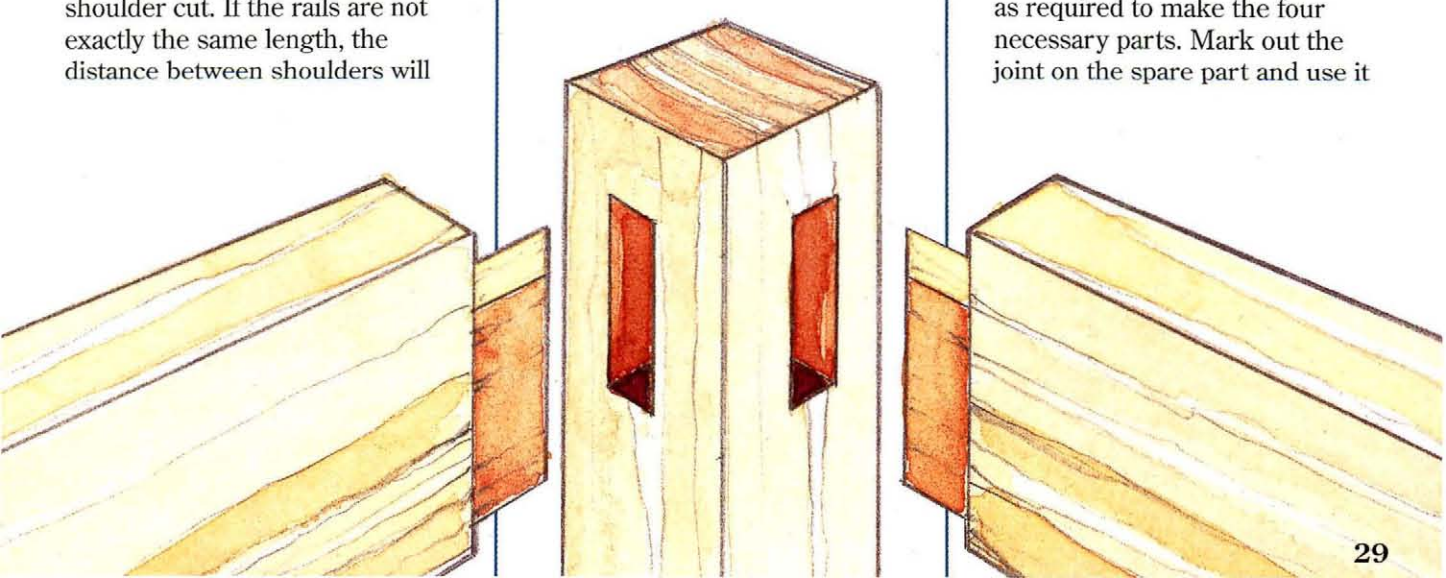
Woodworker's Journal, December 2001.) Since we're not using dedicated industrial machines, it's best to make the mortise first and fit the tenon to it as you would using hand tools.

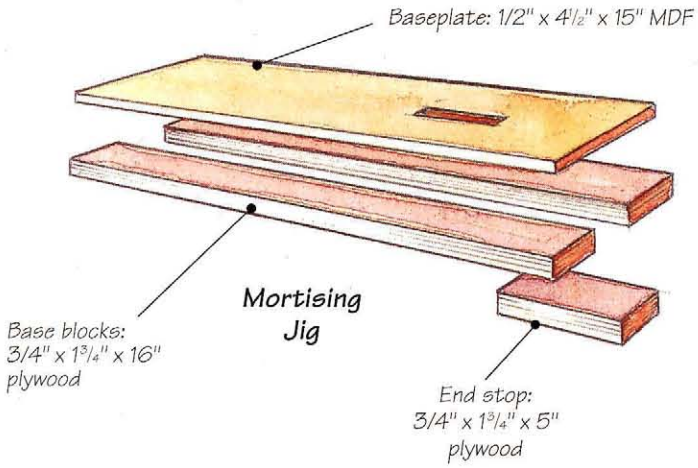
Essential Requirements for Machine-made Joints

Successful machine-made joints require that similar parts be milled and prepared to exactly the same dimension and geometric accuracy. This is because the jig is made to accept only a workpiece with specific dimensions. Even if no jig is involved, all repetitive machine techniques require this exactitude. Assume for the purposes of this article that you are making a square table using four top rails tenoned into four legs. To cut the shoulders of the tenons, you put the end of the rail against a stop to position the rail ready for the shoulder cut. If the rails are not exactly the same length, the distance between shoulders will differ and the table frame will not be square. In other words, accuracy of machining begins at the "Preparation of Stock" stage (see "Marking Up for Success: Prepare the Stock, *Woodworker's Journal*, February 2001).

"Form may follow function" but it's joined at the hip to economy. Since most small shops are equipped with a table saw and a plunge router, that's the economic base I started from to make the joint described here.

You need to know which side or edge of each furniture part is the inside and the outside and the upside and the downside. The simplest and best way to maintain order is to mark the face side and the face edge on each piece. Through this process you will get the best-looking faces on the outside and you will get the joints in the correct face. Machine-made joinery requires that you make a spare part for every run of necessary parts: in this case, a total of five rails and five legs, (or 41 rails and 41 legs, if you were making 10 tables). You use the spare part as much or as little as required to make the four necessary parts. Mark out the joint on the spare part and use it





to check machine setups and cuts. No marks are required on the necessary parts, save for the face side and face edge marks that tell you how to place the workpiece correctly in the jig.

Exactitude with Screws

Router jigs can be no more accurate than their component parts. MDF and plywood are stable and easy to cut and join with screws, though only plywood can be screwed on edge. Screw joinery is best done in two separate drilling operations, one operation for each part.

Using a combination bit, drill clearance holes and countersinks in the baseplate. To ensure a flat mating surfacing, make small countersinks on the back side to remove the bulge or rag-out typical of through holes. Clamp the baseplate to the base blocks. Where necessary, tap the parts into exact position with a hammer. Tighten the clamps. Drill a pilot hole for the screw threads in the base blocks. Drive the screws home and remove the clamps.

Drilling Out the Waste

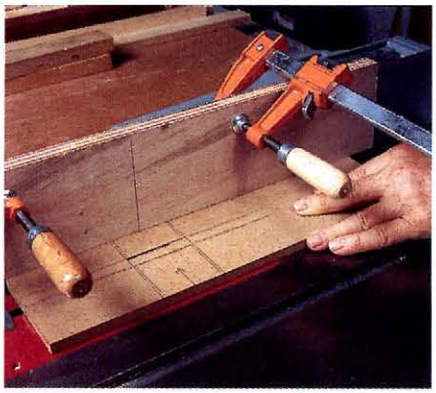
A table saw makes sawdust, a planer makes chips, but a router cutter turns at such a high speed that it produces extremely fine particles that remain suspended in the air for hours. Apart from adding to the general uncleanliness of your shop, such particles are unkind to eyes, nose, and lungs. An industrial CNC router is engineered to vacuum up the huge volume of fine dust it makes. Few small shops are equipped, however, to effectively collect the dust from a plunge router. My solution when mortising is to remove the bulk of the waste with a drill press, leaving the router to trim accurately to the line. Use a bit that's slightly narrower than the finished width of the mortise. If you don't have a drill press, a portable drill will work. Clamp the workpiece to the bench and use a smaller bit than with a drill press to compensate for the loss of accuracy inherent in a hand-held tool.

Do You Square the Mortise or Round the Tenon?

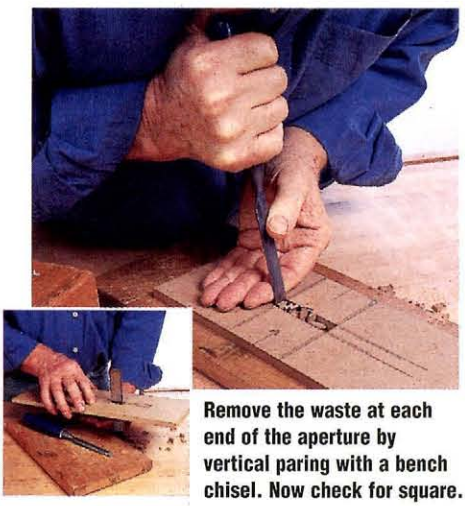
The table saw leaves a square edge on the tenon and the router leaves a round end on the mortise. The accuracy of these two faces determines the vertical alignment of the rail to the leg. A gap would allow the rail to float up and down during assembly and possibly be glued in the wrong place.

I prefer to square the ends of the mortise because it's easier to mate two flat surfaces than two radiused ones. Square the mortise ends after the tenons are made so you can use one as a guide. Knife a line at each end across the joint to locate the chisel in the correct paring position. Pare with a bench chisel that's the width of the mortise or as near as you can get.

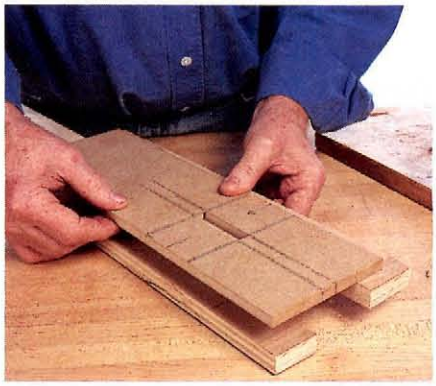
Set the first cut on the baseplate of your jig by aligning the outside of the saw blade with the aperture guideline.



Raise the saw blade through the baseplate (securely fastened by a hold-down clamped to the fence). The center line across the width of the aperture is aligned with the vertical line on the fence.



Remove the waste at each end of the aperture by vertical paring with a bench chisel. Now check for square.



Here are the finished baseplate and two guide blocks, separated by the mortise workpiece.

Rounding the Tenon

If you prefer to round the tenon, here are some tips to increase accuracy. If you use a 1/4" router bit, the tenon needs a 1/8" radius on each corner. Begin by finger gauging a pencil line down the center of the tenon edge. This mark must remain as you radius the edges — it's your proof that you haven't inadvertently reduced the width of the tenon. A 6-inch flat mill file with a safe edge is the best tool for the job. The safe edge is smooth so you won't damage the tenon shoulder. The technique used by machinists to make a radiused edge may seem counter-intuitive at first, but it gives the best results. Hold the work in a vise. The stroke follows the path of a stunt pilot pulling his plane out of a dive.

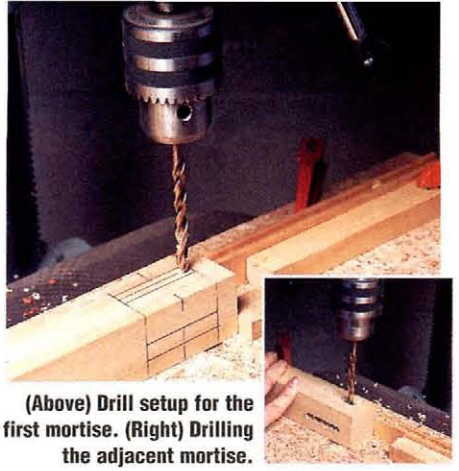
Bits and Jigs

Simply stated, there are three tasks to accomplish.

- You have to choose the right bit for the job.
- You have to start and stop the router in the right place.
- You have to steer the right line between start and stop.

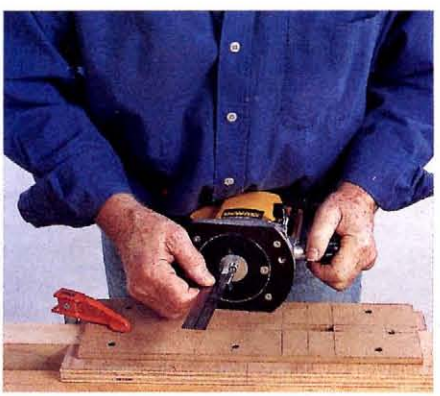
Choose a bit that is long enough to reach the bottom of the mortise. Either a spiral or straight bit is fine. If you use a bit whose diameter is smaller than the finished width of the mortise, you will cut one face at a time (provided you drilled out the waste as recommended) and you can make practically any width of mortise using the same bit. The jig controls this dimension, not the bit size.

The jig must hold the work squarely and firmly. It must be robust to withstand the bumping and pressure it gets from the router as it travels within the confines of its stop and start positions.

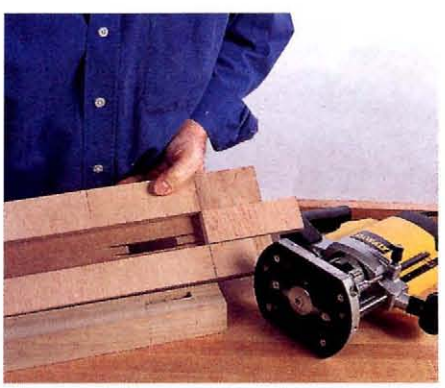


(Above) Drill setup for the first mortise. (Right) Drilling the adjacent mortise.

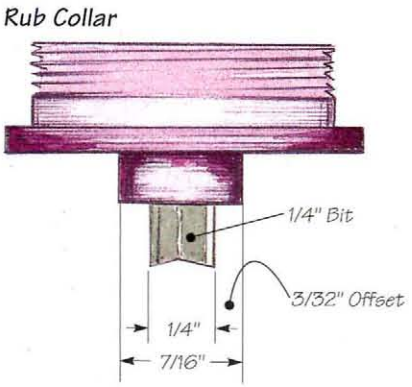
With the baseplate opening milled, attach the first base block and then add the second, using the leg as a spacer.



Continue using the leg as a guide to position the end stop, screw it in place and then set your bit to the correct plunge depth.



A finely-cut mortise – the first result of careful jig assembly and machine technique.



Designing and Building the Mortise Jig

Of the jigs I consider accurate and safe, the one shown is among the best and it meets all the conditions just described. A minor downside is that it requires a guide collar, which you may not own. The upside is that a set of collars is not expensive and once added to your shop inventory, they will also add speed and accuracy to a range of woodworking operations.

Mortise Jig Components

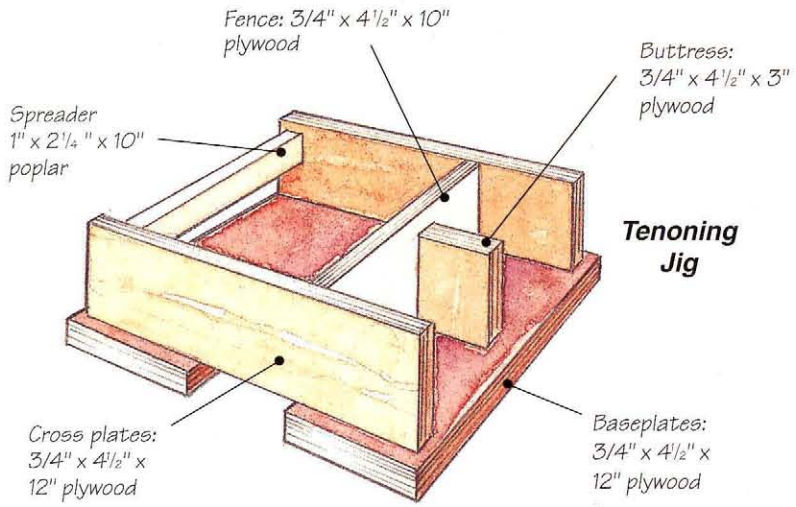
The jig comprises a thin MDF baseplate with a hole cut out of it so you can plunge the mortise in the right place, two plywood base blocks, and one end stop.

The 1/2" MDF for the baseplate is plenty tough for the job and its light color makes the layout lines easily visible. Since the flange on the guide collar is only 3/16" long, 1/4" Masonite would have done the job just as well. Plus, it would have given me an extra 1/4" of plunge depth had I needed it. The width of the baseplate is about 4" wide, just a bit wider than the router base to ensure that it sits and moves with stability.

Sizing and Marking the Aperture

The dimensions of the aperture are the dimensions of the mortise plus the "off-set." The off-set is the distance from the cutting circle of the bit to the outer edge of the flange of the guide collar (*Illustration* above). In this case, the off-set is 3/32", so the aperture is bigger on all four sides of the mortise by 3/32" of an inch.

Mark out the baseplate using a sharp pencil and project the lines



Tenoning Jig

all the way round the boards — ends, edges and flip side. Begin with two center lines and mark the width and length of the aperture from them.

Cutting the Aperture

Cut the aperture with a table saw. The operation involves clamping the baseplate and raising the blade through it. The operation is normal and safe, provided you avoid shortcuts or any "hot dog" procedures.

With the blade set below the top of the table saw, begin by marking the table and the fence with a line which is the point where the blade first touches the baseplate as it rises. Next set the fence for the first cut: the line around the baseplate helps determine this setting. Hold the baseplate firmly centered over the blade by clamping a stout board to the fence. Switch on the table saw and raise the blade until it breaks the surface and cuts to the end lines. Chances are that your saw rises on an arc and the blade will reach one end before the other. Switch off the power, lower the blade, and move the baseplate forward or backward as required to finish the cut. Once both sides of the aperture are cut, remove the waste and square the ends with a sharp chisel. MDF cuts easily.

Base Blocks and End Stop

The base blocks should be long enough to hold the leg securely between them. Drill and countersink holes in the baseplate for the first block, then clamp it in place. Check that it's the right distance from the aperture and dead parallel with it. If necessary, tap it gently in place with a hammer. Drill pilot holes and fasten with screws.

Attach the second base block to the baseplate, using the leg as a spacer. It should be a tight-push fit.

To determine the location of the end stop, center the baseplate over the marked out mortise on the spare part. Use the aperture and center line marks as guides. Clamp and screw.

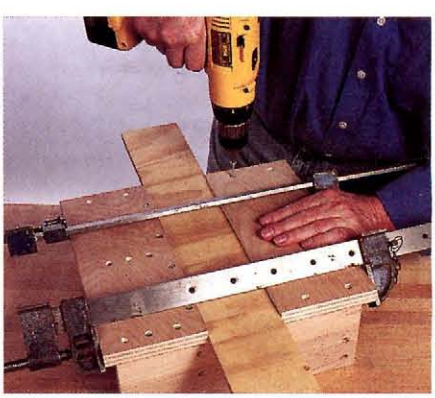
Drilling Out the Waste

Use a drill bit that's about 1/16" smaller in diameter than the finished width of the tenon.

Set up the drill press with a back fence which positions the bit in the center of the tenon on the marked out spare leg. Next, position the leg as if to drill a hole at the bottom edge of the tenon and clamp an end stop against the top end of the leg. Move the leg as if to drill a hole at the top edge of the tenon. Now make a block that fits the gap between the stop block and leg's

Step 1 (not shown): Join the fence to the first baseplate. Overhang the baseplate by about 1/16" to ensure the baseplate doesn't interfere with the correct placement of the workpiece. Step 2 (above): Saw the back edge of the first baseplate parallel to the fence.

Step 3: Attach the buttress to the middle of the fence/baseplate assembly. Clamp it both ways — length and width — and to the bench. Steps 4 and 5 (not shown): Clamp and screw the first and second cross plate. Use two clamps, length and width.



Step 6: Clamp and screw the second baseplate and the spreader. Use parallel scrap as spacer for accuracy and ease of alignment.

bottom edge. Set the drill bit to depth and drill out the waste on one side of all five legs.

Cutting the Mortises

First, clamp the spare leg to the jig, then clamp the leg in the vise. Everything is now solidly held — the goal of every machine jig setup. With the bit set at the correct depth and the router at full plunge, you can cut the mortise easily because there is so little material to remove. Check the mortise for accuracy, then repeat the cut on the four necessary legs.

The stop block must be reversed to drill out the second mortise on the adjacent side.

Making a Tenon

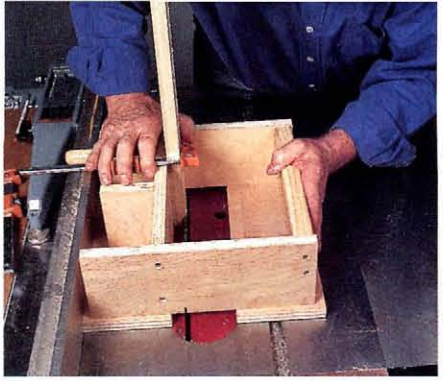
A table saw, equipped with a properly designed and made jig, provides a safe and effective way to cut tenons. The jig, guided by the fence, holds the workpiece vertical while it is passed over the blade. Adjusting the fence allows the cut to be made at any point while adjusting the blade height determines tenon length. Use the miter fence to cut the shoulders.

Tenon Jig Components

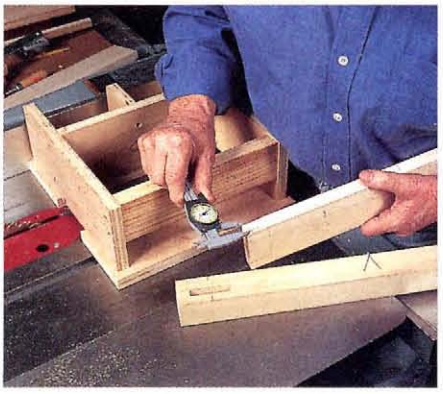
The jig comprises seven pieces. Six are 3/4" plywood, one is poplar, although ply could be used here, as well. All jig parts are cut square and held together with screws. MDF is unsuitable for this jig since its edges, unlike plywood edges, cannot hold screws.

Sawing the Tenon Faces

Mark out the tenon on the spare rail. Clamp the rail into the jig, making sure the rail is firmly seated in the jig and that the clamp head is firmly seated against the rail. Set the blade to height for cutting the tenon length. Adjust the table saw fence to cut the inside face of the tenon. Make the cut, then repeat it on the remaining four rails.



Set the blade to height and begin by cutting the inside tenon face on the spare rail.



Position the jig for the second face cut, using the spare rail. Make a test cut and check with a vernier caliper to confirm tenon thickness is correct.

Saw the tenon width and saw the cosmetic shoulder using the same blade height.

Saw all four shoulders with the miter fence. Note that the fence is well behind the workpiece so the falling piece can't get trapped between the blade and the fence.

The second cut is critical because it determines the thickness of the tenon. Position the jig, make a test cut on the spare rail, and check with a vernier caliper. Make the full cut, then remove a part of the waste with a handsaw to expose enough tenon to be offered up to the mortise for a test fit. Repeat the full cut on the remaining rails.

Using the same blade height, test procedures, and sequence of cuts, saw the tenons to width.

Sawing the Shoulders

The simplest way to saw the shoulders is with the miter fence. Use the saw fence to position the spare rail. The falling piece must not get trapped between the blade and the fence as it is cut off because it tends to take wing.

To avoid this, slide the fence back out of the way, as you can with a Delta Unifence or Sawguide. If your fence won't slide, set it about a foot from the blade and use a spacer block to set the shoulder out the correct distance. With the shoulders cut the last step is to use your chop saw to miter the ends of the tenons.

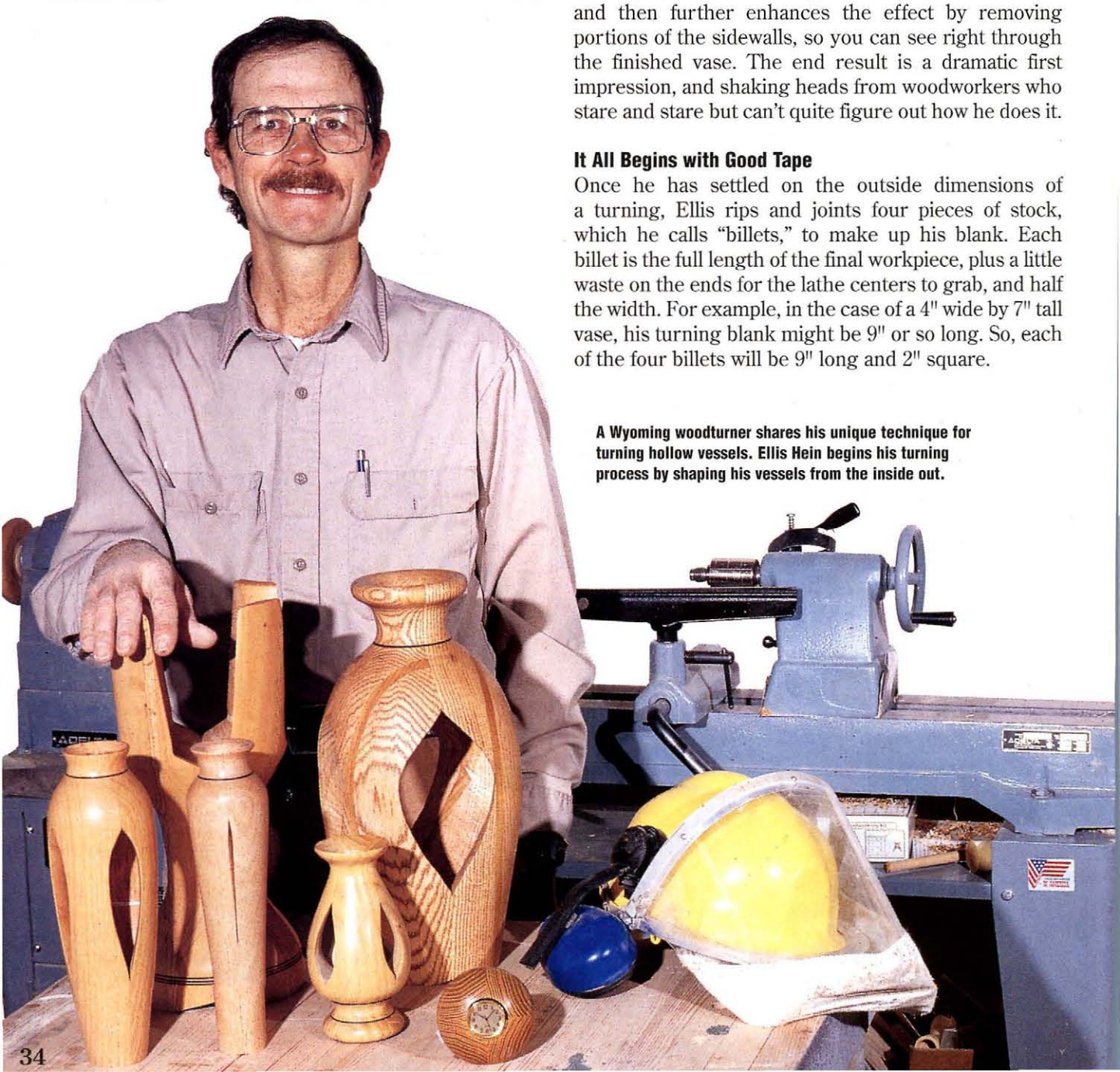
Ian Kirby is a practitioner of the British Arts & Crafts philosophy and a long time contributor to the Woodworker's Journal.

"Inside Out" Turning

A Wyoming woodturner shares his unique technique for turning hollow vessels.

By John English

When I promised Ellis Hein that this story wouldn't begin with the cliche "One good turn deserves another," I really did mean to keep my word. The problem is, that phrase so aptly describes what Ellis does, it should be the motto on his business cards. A quiet, serious craftsman with a distinctive history in turning, Ellis has developed a unique two-step technique for hollowing out the center of a vessel before turning the exterior. His process is so simple I was surprised I hadn't stumbled upon it already. But in two decades of checking out turnings at craft fairs and galleries, this was the first time I'd ever seen it. Ellis actually turns and finishes the interior of his four billet vases while the insides are facing "out." The best faces are taped to the inside during this first stage of his technique. In the next stage he turns the real outside and then further enhances the effect by removing portions of the sidewalls, so you can see right through the finished vase. The end result is a dramatic first impression, and shaking heads from woodworkers who stare and stare but can't quite figure out how he does it.



A Wyoming woodturner shares his unique technique for turning hollow vessels. Ellis Hein begins his turning process by shaping his vessels from the inside out.

It All Begins with Good Tape

Once he has settled on the outside dimensions of a turning, Ellis rips and joints four pieces of stock, which he calls "billets," to make up his blank. Each billet is the full length of the final workpiece, plus a little waste on the ends for the lathe centers to grab, and half the width. For example, in the case of a 4" wide by 7" tall vase, his turning blank might be 9" or so long. So, each of the four billets will be 9" long and 2" square.

"I like the visual harmony provided when the contrary contours of the inside shape are seen against the exterior."

Ellis Hein

The four billets must be absolutely square: gaps are not acceptable, for both safety and aesthetic reasons. For that reason, a quick trip to the jointer is necessary. After jointing, Ellis selects and marks the two best faces on each billet, then tapes the four parts together to create his blank. He applies two-sided tape to those good faces, orienting them to the inside as they will eventually be the visible faces.

"With the two-sided tape in place, I wrap several turns of Fiberglas™ reinforced packing tape around the outside, in areas where I won't be cutting", he says. "If I eventually need to shape those areas, I just put more tape in an area which has already been turned."

The packing tape's elasticity lends it some clamping characteristics, so it squeezes the parts together very tightly. After mounting the assembled blank between centers as shown in first photo on the following page, it's time to fire up your lathe.

Turning the Inside First

With the taped-up block between centers on your lathe, make sure the piece clears the toolrest. Ellis has turned projects of this sort so large that he needed to use a hand saw to cut a V-shaped notch in the blank, just to clear the banjo of his toolrest.

Begin turning at a relatively slow speed. The larger the block, the slower the speed. With a large gouge, form the contour that describes the inside curve of your vase (see the photo and *Full-sized Drawing* on page 36). Take care to stay clear of those rotating corners: they can hurt! Experience will tell you how deep to cut. For your first project, Ellis suggests that you use the *Drawing* on the following page to work your way through your first attempt at this technique.

Ellis usually leaves the interior walls of his vessels smooth, but a rough surface has its own charms.

"I've turned vases where the interior looked like it was hand carved," he says. "This creates a real puzzle when a client realizes that there is no opening large enough in the finished vase to admit a carving chisel or gouge!"

After shaping the inside curve, take a very light cut off the corners of the blank: when you turn the billets around and glue them together, these cut corners will form an alignment reference. They will also form a depression in the glued-up block, creating a seat for the drive center.

While the block is still between centers, apply the finish to the inside curve. Ellis likes to apply beeswax (as seen in the photo on the bottom of the next page), and then buff it with a soft cloth.

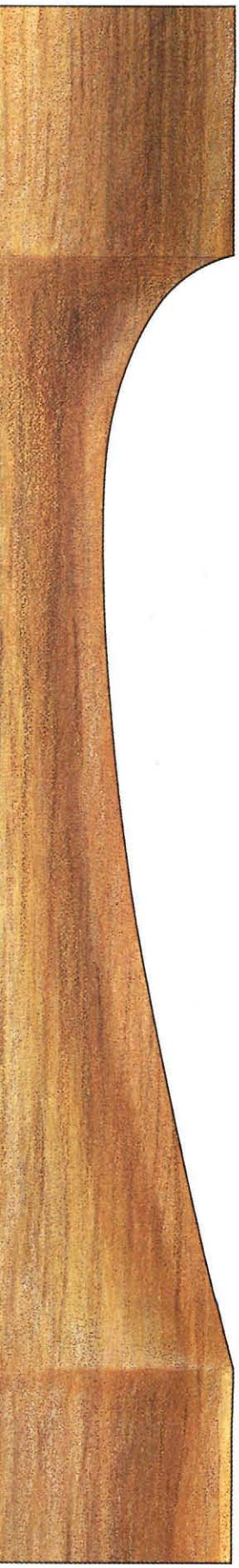
Turning it Inside Out

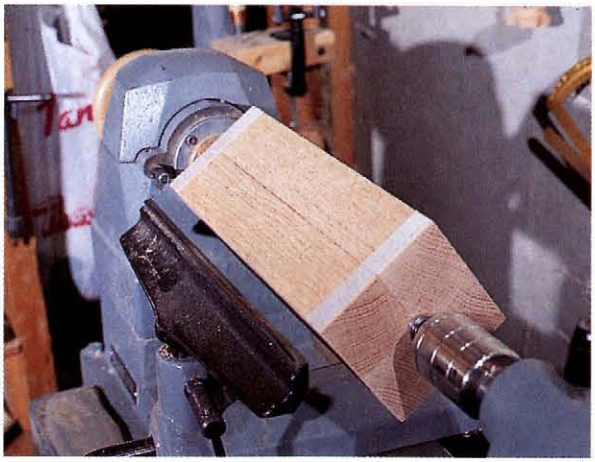
Before removing the block from the lathe, number the billets to help preserve their sequence. Remove the Fiberglas™ tape and, while they're still held together with the double-sided tape, run the block over the jointer to remove any finish from the glue surfaces. Take an equal number of very light passes on each surface, making sure the jointer cuts all the way across their width.

Pull your composite block apart, turning the billets so the outside corners now form the inside, and glue them up. Glue placement is important here: you want glue on the jointed surfaces, being careful to avoid the waxed curves. Secure the block with clamps (be careful to use good even pressure) and let it cure overnight.

This slender oak bud vase is an example of Ellis' signature turning style. Key elements are the "open windows" and the burned accent line under the lip.

Inside Curve
(Full size)





The author's process begins by taping four billets together, with their best faces hidden on the inside, to create the turning blank.

Start by forming what will be the inside of the vessel first, using a large gouge to create this gentle curve. This inside curve will later help describe the final shape of the vessel.

Before removing the project from the lathe apply a finish to the inside curve (the author prefers beeswax). Then polish the beeswax to a smooth, glossy finish with a lint-free cloth.

Turning the Outside

Mount the glued-up block between centers, with the base against the tailstock. The orientation is important: the neck must be held by the live center. Reduce the project to a cylinder using a sharp gouge (see photo at right, top). Switch to a smaller gouge and keep turning, taking it slow and easy. Pretty soon, you'll start opening "windows" to the inside of your vase (see photo at right, center), as your cut intersects with the previously turned interior contours. These windows can be dangerous, so it's a good idea to keep your fingers well away from them. They don't present any unusual problems for the chisel, however, which rather surprised Ellis when he started using this technique.

As the windows open, you'll get a surprisingly good view of the interior shape of the vessel. This makes it easy to fashion the outside contour so its shape flows with the inside one. The implication here is that the exterior shape is somewhat free-formed: it's hard to predict exactly how it will look before you start turning. This lends the project a certain elegant whimsy, as no two will ever be exactly alike.

Forming the Neck

Continue refining the vessel's outside profile with your various turning chisels, working slowly and carefully toward an ideal form (see photo at right, bottom). Work every part of the vase except the narrow lip that will eventually become the neck of the vase. This is usually about 1/4" wide.

When Ellis gets to this area, he begins by reducing it to a flat cylindrical segment. Then he turns off the lathe and mounts a steady rest that sits tight against this flat spot. Chucking a drill head in his tailstock, he then fires up the machine and

drills an appropriately sized hole through the neck, all the way to the interior of the vase. After that, it's back to chisels to shape the outside and inside curves of the lip, so they flow into this hole.

Switch the drill head for a cone center in the tailstock, then remove the steady rest and shape the rest of the vase, including rounding off the flat area at the neck. Make your final cuts so that all the curves flow together smoothly.

Sometimes Ellis likes to score and burn a line on the upper portion of his vases. Do this with a piece of wire wrapped around two dowel handles. Let the wire sit in its groove long enough to heat up and burn the wood, but be careful that the lathe doesn't grab the wire: the trick is to keep the wire stretched straight and tight, rather than bending it to wrap the revolving piece.

Ellis has had several people comment that they really like the effect of his "walnut inlays!"

Wrapping Up

If the edges of the windows have chipped during the cutting of the exterior, you'll need to dress them with sandpaper or a small file. Then, with the project still between centers, reduce the speed and finish the exterior with a buffed beeswax finish for a lovely, soft luster. Remove the vase from the lathe, trim the base flat on your band saw, and then attach a felt base to prevent your new vase from scratching the furniture.

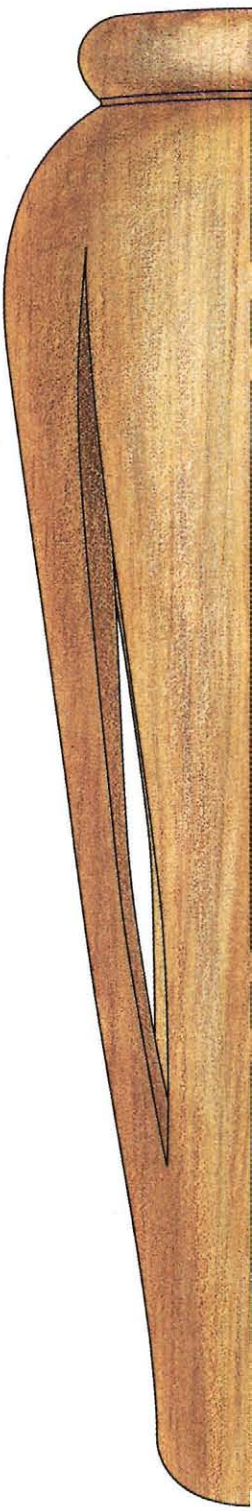
Ellis Hein is a Wyoming woodworker and past president of the Master Craftsmen's Guild of Wyoming. He began turning when he was 12 years old, after becoming intrigued by the candlesticks his father created. His work is displayed in various galleries and at www.woodturnedart.vcn.com.

With the billets glued together in their final orientation and remounted in the lathe, reduce the blank to a cylinder using a large gouge.

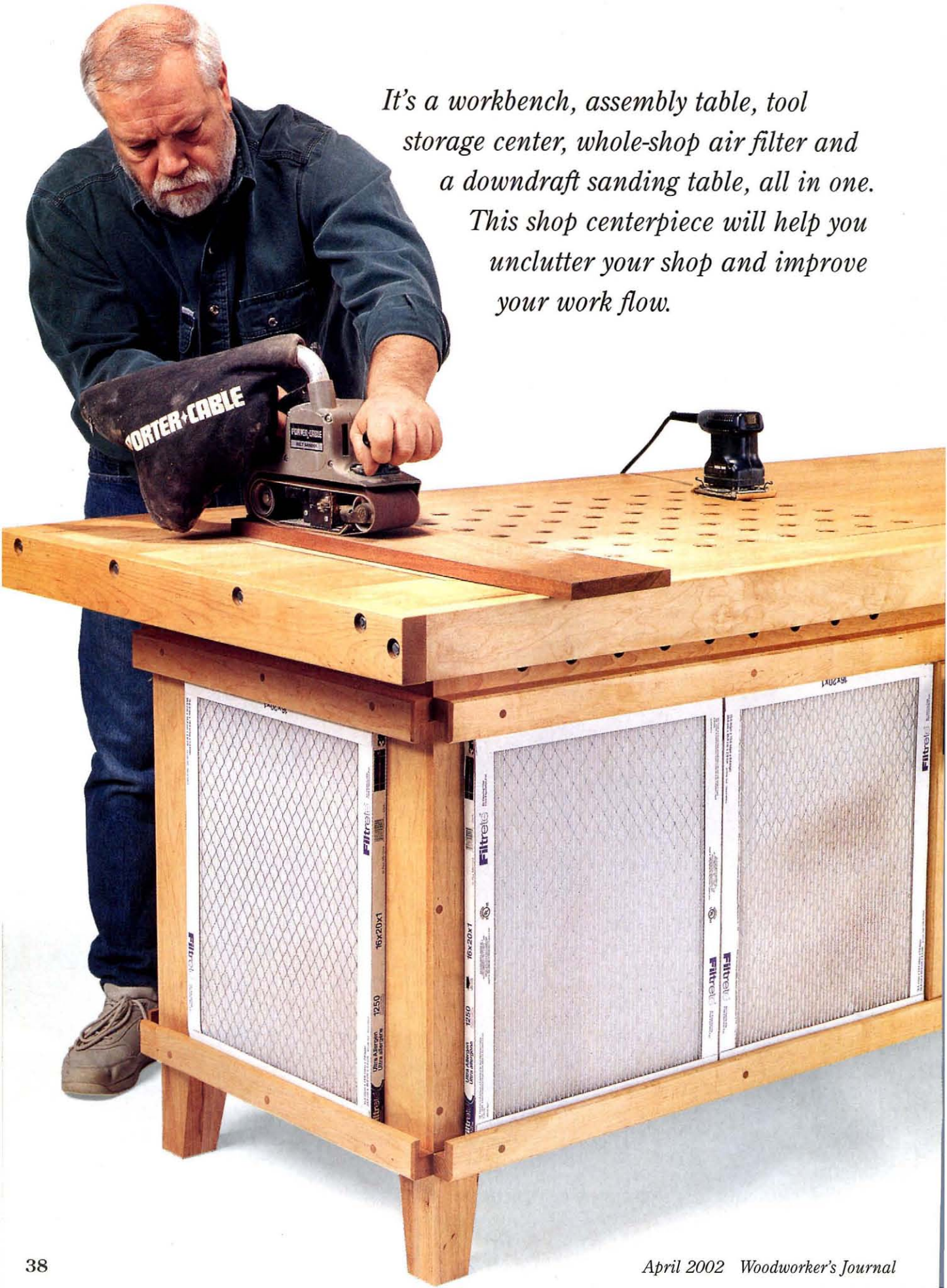
Stay with your large gouge to turn the outside profile of the vase until you begin to reveal the openings or "windows," then switch to a smaller gouge for further shaping.

Refine the vessel's shape to its final form. Leave a flat area at the neck of the vase, so you can mount a steady rest there to support the piece while you drill an opening through the top.

Outside Shape
(Full size)



It's a workbench, assembly table, tool storage center, whole-shop air filter and a downdraft sanding table, all in one. This shop centerpiece will help you unclutter your shop and improve your work flow.



The Downdraft Workbench

By Rick White

Sometimes when I am building a project just for my shop I feel a little guilty. But for the longest time I've been pining for a work center that's large enough to assemble big casework projects on and strong enough to withstand some serious pounding. On the other hand, I also needed more storage space ... and a downdraft table was still the missing link in my pursuit of a truly dust-free shop.

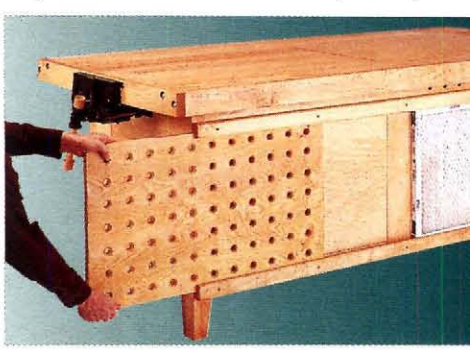
Meanwhile, my trusty old workbench was making the discussion somewhat irrelevant, since it was already occupying most of the space in the center of my shop.

When the answer came to me, it was just too simple ... I'd make a new work center that serves all these functions! A workbench that also incorporates a downdraft table. Sometimes when you can't get what you want, you have to settle for something even better! My new unit would feature a power strip, full-extension pullout shelves and room for sanders, drill drivers and routers, in addition to an efficient, built-in downdraft unit. For durability and strength, I'd go with a solid maple top, and for good measure I'd toss in a vise and an interchangeable second top. It all worked out great, and you know, when I was all done, I didn't feel the least bit guilty.

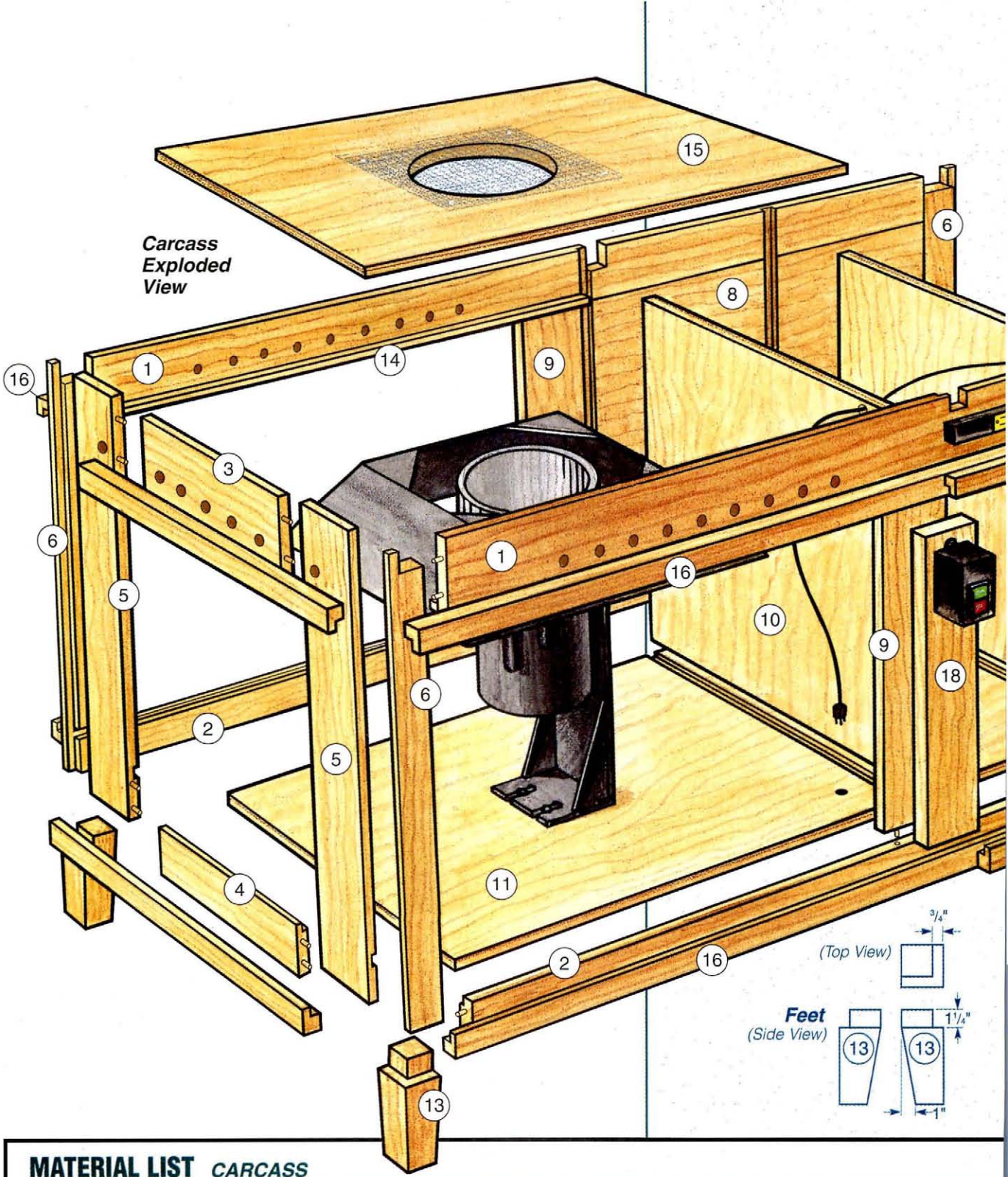
From the Bottom Up

I started with basic casework joinery on the carcass. The stiles and rails as well as the end and back panels (pieces 1 though 9) are made from solid hardwood lumber. In my case I used hard maple, to match my top. Find the dimensions for all these pieces in the *Material List* on page 40. The machining details and the subassemblies you'll be creating are shown in the *Elevation Drawings,* also on the following pages.

Make the front, back and end subassemblies separately. Where the stiles and rails meet, I used dowels to join them. Like I said, I wanted this bench to really stand up to a beating. Glue up the solid panels (pieces 7 and 8) a bit oversized, then trim and sand them smooth after the glue has cured. Form 1/4" tongues on their edges, as shown in the *Drawings*. Note that where the stiles and rails capture the end and back panels,



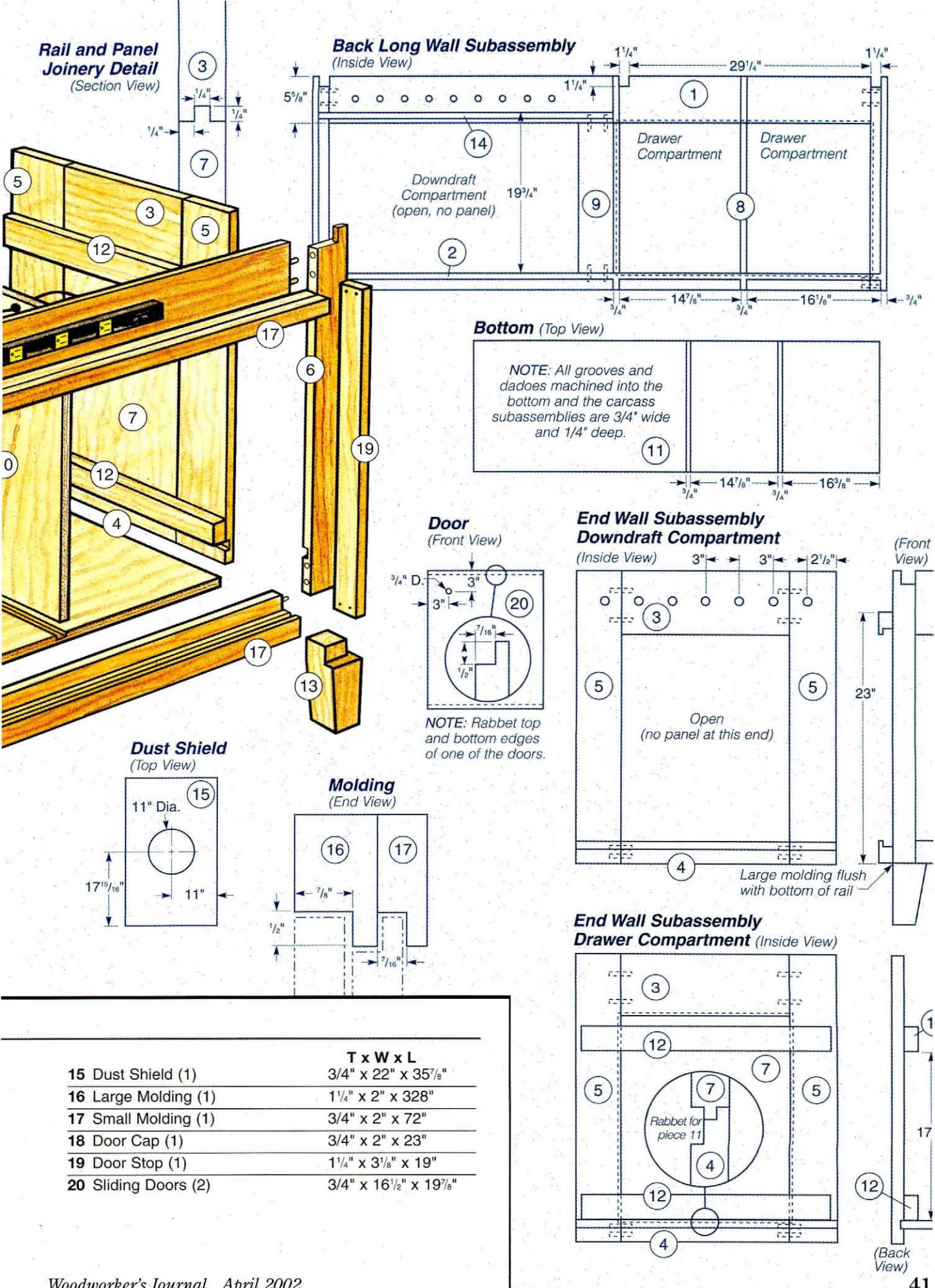
The worktop of this bench has two inserts which fit into a rabbeted opening over the downdraft unit. When not in use, either insert can easily be stored on the back face of the bench.



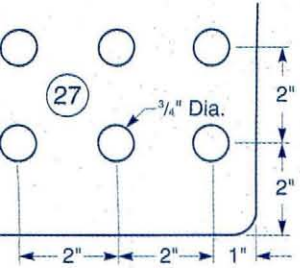
MATERIAL LIST *CARCASS*

	T x W x L
1 Upper Long Rails (2)	3/4" x 5 5/8" x 66"
2 Lower Long Rails (2)	3/4" x 2" x 66"
3 Upper Short Rails (2)	3/4" x 5 5/8" x 14 1/2"
4 Lower Short Rails (2)	3/4" x 2" x 14 1/2"
5 End Stiles (4)	3/4" x 3 7/8" x 26 1/4"
6 Front & Back Stiles (4)	3/4" x 2" x 26 1/4"
7 End Panel (1)	3/4" x 19" x 15"

	T x W x L
8 Back Panel (1)	3/4" x 19" x 31"
9 Center Stiles (2)	3/4" x 5" x 18 1/2"
10 Dividers (2)	3/4" x 22 1/2" x 24 1/2"
11 Bottom (1)	3/4" x 22 1/2" x 69"
12 Spacers (2)	1 1/4" x 2 1/4" x 22"
13 Feet (4)	2 3/4" x 2 3/4" x 6 3/4"
14 Cleats (2)	3/4" x 3/4" x 36"



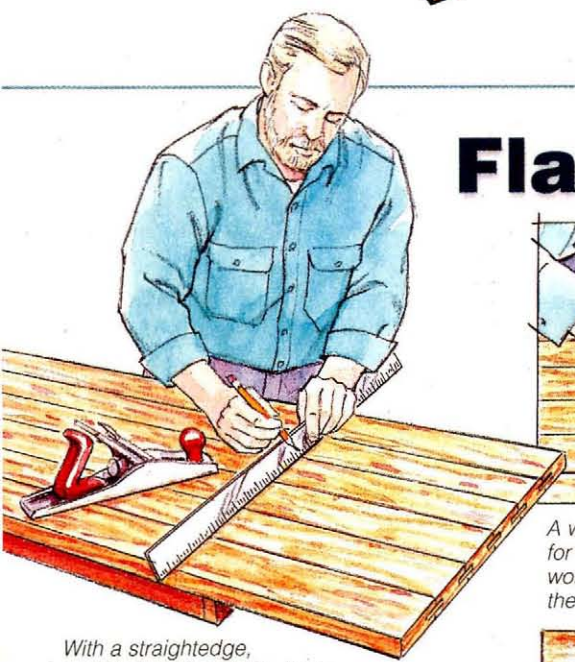
	T x W x L
15 Dust Shield (1)	3/4" x 22" x 35 7/8"
16 Large Molding (1)	1 1/4" x 2" x 328"
17 Small Molding (1)	3/4" x 2" x 72"
18 Door Cap (1)	3/4" x 2" x 23"
19 Door Stop (1)	1 1/4" x 3 1/8" x 19"
20 Sliding Doors (2)	3/4" x 16 1/2" x 19 7/8"



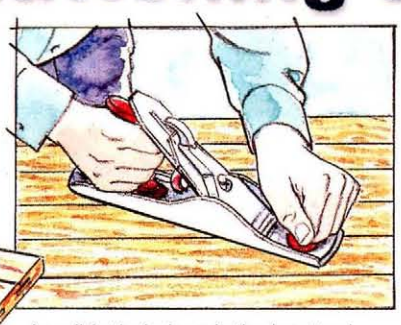
Draft Vent *(Hole Layout)*
Begin laying out holes from center. Distance from last hole to edge of panel is not critical.

Top Exploded View

Flattening a benchtop

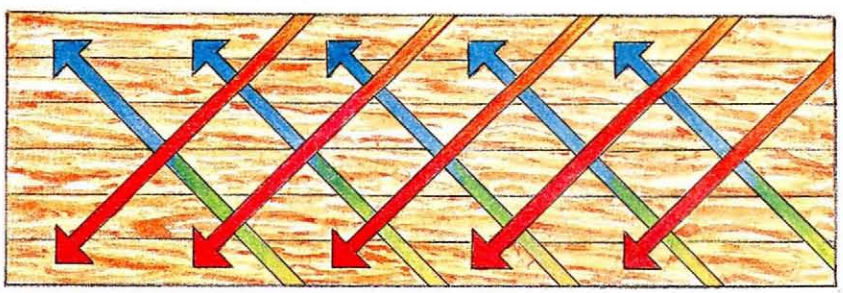


With a straightedge, establish and mark the low areas of the glued up top with a pencil.



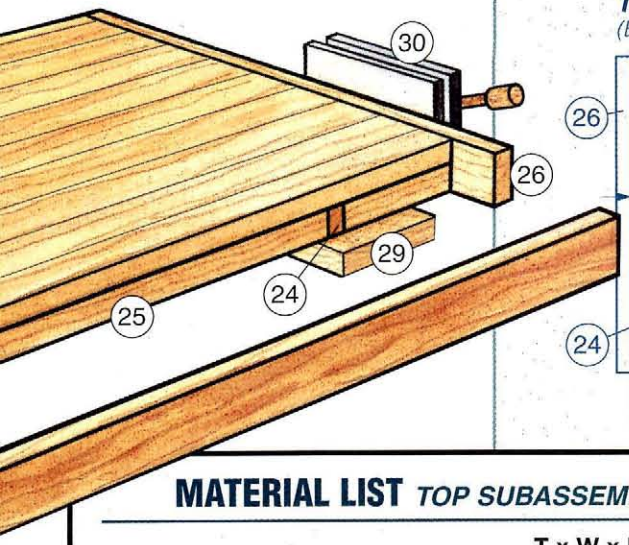
A well fettled plane is the best tool for removing the high areas of the workbench's top. Work diagonal to the grain for best results.

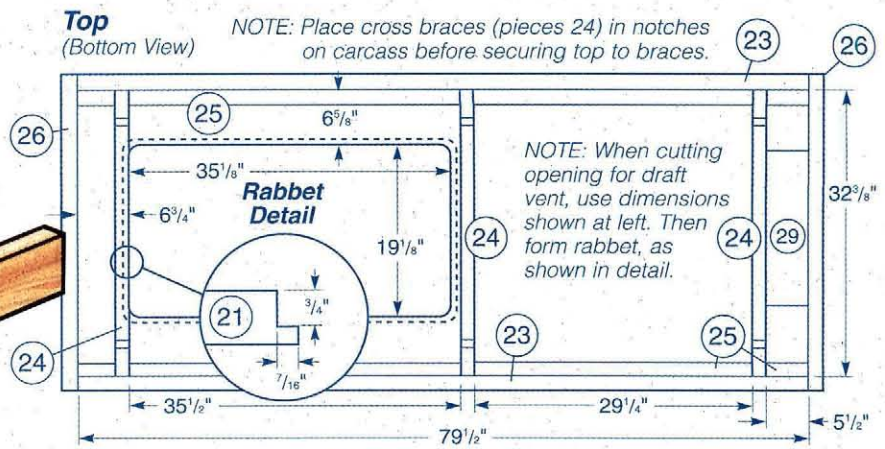
Another option is to use coarse grit paper and your belt sander to remove the high spots. Work in the pattern shown below.

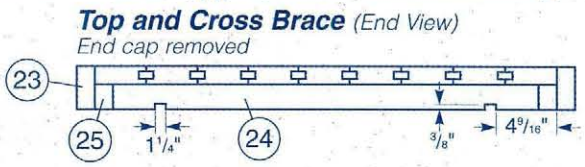


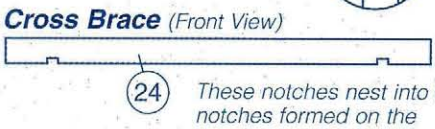
First mark the low areas in the glued up top. Next, with your plane or belt sander, remove the high areas as you work an opposing diagonal pattern. Again, using your straightedge, mark the low areas once more and repeat the pattern. Repeat this process until you flatten the top.

A dead flat work surface is an essential element in any workbench. Flattening a glued-up top is not too hard if you take it one step at a time. You can cart your glued-up top to a cabinet shop and have it surfaced by a large stationary belt sander, but if you choose to do it yourself, here's how to go about it.









MATERIAL LIST *TOP SUBASSEMBLY*

	T x W x L
21 Laminated Top Pieces (9)	1¼" x 3⅝" x 79½"
22 Splines (8)	1/2" x 1" x 79½"
23 Side Rails (2)	1¼" x 2⅞" x 79½"
24 Cross Braces (3)	1¼" x 1½" x 32⅜"
25 Long Cleats (2)	1¼" x 1½" x 79½"
26 End Caps (2)	1¼" x 2⅞" x 34⅞"
27 Draft Vent (1)	3/4" x 20" x 36"
28 Cover (1)	3/4" x 20" x 36"
29 Vise Block (1)	1¼" x 5½" x 15"
30 Vise (1)	Steel screw type

you will need to rout stopped grooves (I used a hand held router and a slot cutter for this task) to accept the tongues on the panels' edges. Glue and clamp up the four separate subassemblies, checking to be sure they are square as the glue cures. While you wait for the glue to dry, grab your plywood sheetstock and slice up the dividers and the bottom (pieces 10 and 11).

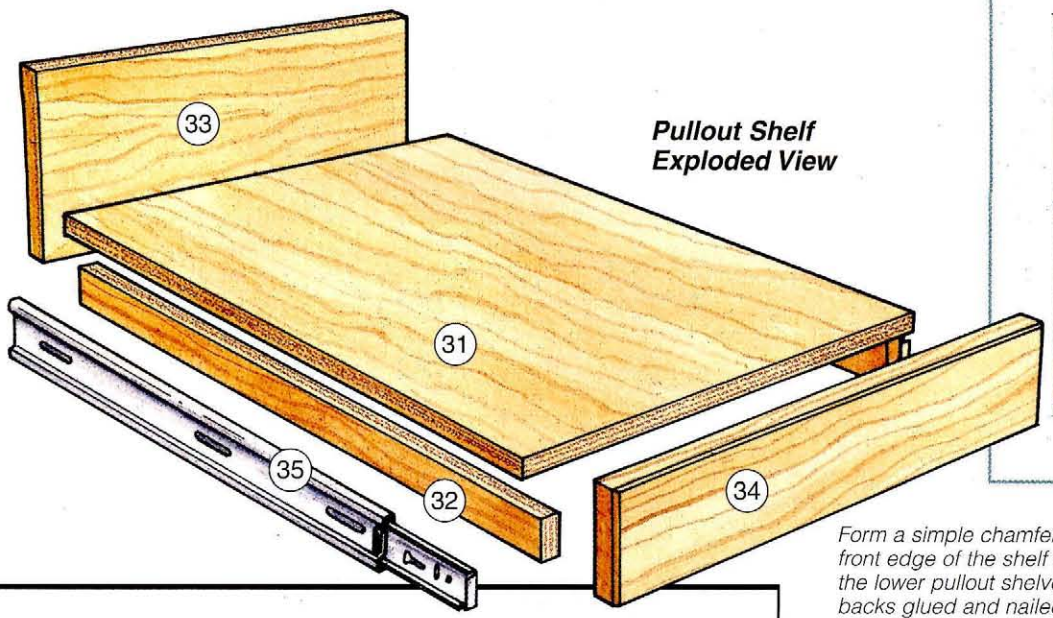
Grooves, Holes and Rabbets

Now that the subassemblies have cured, you need to do a little more machining to each of them. With a hand-held router and straight edge, plow matching grooves and dadoes for the bottom and dadoes for the dividers (there are dadoes in the bottom, too). Don't worry when the grooves and dadoes nip into the panels' tongue and groove joints ... it will work out fine. Using the same setup, form the rabbets at the edges of the front and back stiles (pieces 6).

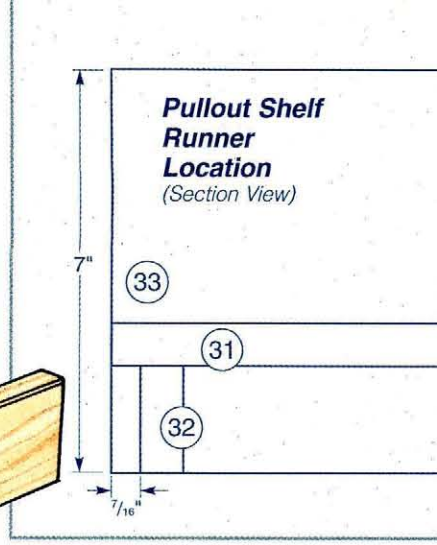
After a little experimentation, the author arrived at the perfect number of holes for the draft vent top, see the layout detail above left.

Put the router aside and grab your jig saw to cut the six notches on the top edges of the two long rails. These will serve to capture the notched cross braces later on. The last bit of machining before you put together the subassemblies is to drill the safety vent holes in the upper rails. (NOTE: If all the holes on the draft vent happened to get covered, these holes will prevent the motor from overheating.) These safety holes are best bored on the drill press, so you'll need either a buddy to help you hold up the frames as you drill, or a couple of roller stands.

Now predrill the counterbored screw holes though the front and back stiles and test fit the carcass together. (This is another process that a helper will make much easier.) Once everything fits together, assemble the carcass with glue, screws and clamps. While the carcass is clamped-up and the glue is curing, make the spacers, feet, cleats and dust shield (pieces 12, 13, 14 and 15). As shown in the *Elevations* on the previous pages, the feet have tapers on their inside faces and a rabbet on the opposing faces. When the carcass is out of its clamps, attach the feet, cleats and spacers with glue and screws. Plug all the exposed screw holes and sand them flush.



Pullout Shelf Exploded View



Pullout Shelf Runner Location *(Section View)*

Form a simple chamfer on the front edge of the shelf fronts. Only the lower pullout shelves have backs glued and nailed in place.

MATERIAL LIST *PULLOUT SHELVES*

	T x W x L
31 Shelves (4)	3/4" x 14¾" x 20½"
32 Shelf Runners (8)	3/4" x 1¾" x 20½"
33 Shelf Backs (2)	3/4" x 7" x 14¾"
34 Shelf Fronts (4)	3/4" x 3" x 14¾"
35 Drawer Slides (4 pairs)	Accuride 3832, 20"

Monster Moldings

The filters, sliding doors and spare insert are all held in place with molding. It's not hard to make, you just need to make a bunch of it. First rip enough stock to make the large and small molding (pieces 16 and 17), then get your table saw set up with a dado blade and a feather board. Plow the rabbet into the large molding stock as shown in the *Drawings*. Readjust the saw setup to make the small molding and create enough to make the two pieces required to hold the second sliding door. Now is also a good time to make the door cap and stop and sliding doors (pieces 18 through 20). The door stop and cap are simply sticked up hardwood, but one of the doors has a couple of rabbeted edges and both have finger holes to be machined. Look to the *Elevation Drawing* for these details. Again, predrill counterbored screw holes and mount the molding and assorted parts as shown in the *Exploded View* and *Elevation Drawings* — you are really making progress now. Plug the screw holes, sand them flush and get ready to do some laminating.

A Laminated Top

The glued up maple top on this bench is a good piece of work. The basic top is made of nine pieces of maple with splines to help align the glue-up (pieces 21 and 22). Take care to surface this wood to very close tolerances — it will help you in the long run. Once you glue up the top and trim it to size, you will need to determine how you will flatten it. See the sidebar on page 42 for some options and techniques that will help with this process.

When the top is flat, glue the side rails (piece 23) in place. Scrape the squeeze-out clear and install the cross braces (pieces 24). As mentioned earlier, the cross braces have notches cut into them that fit into the notches you formed earlier in the long rails (pieces 1). You'll need to rip the long cleats (pieces 25) from solid stock and then cut and fit them once the cross braces are in place. Gluing and clamping are sufficient to secure these cleats. Next, form the end caps (piece 26) boring the two-step holes for the lag bolts which attach the end caps to the top. Make the through holes for the bolts oversized to accommodate seasonal wood movement.

The Downdraft Opening

This is an admittedly disturbing task ... cutting a huge gaping hole in a perfectly good top, but you can't have a downdraft table without it. Use a straight bit in your hand held router and make a template (see the *Drawings* for the proper opening size) to guide the router to the dimension of the inside of the opening. Use several passes to cut through the top. Then switch to a rabbeting bit to reveal the rabbet on the upper aspect of the opening.

Make the draft vent and the cover (pieces 27 and 28) to fit your opening. Lay out the vent holes and use a sharp Forstner bit to bore them, as shown in the photo on page 43. Follow behind with your router and a roundover bit to soften the upper edges of the vent holes. Bore a single finger hole in the cover and roundover the top and bottom edge of that hole. If you choose to put an end vise on the top, install the vise block and vise (pieces 29 and 30), as shown in the *Drawings* on page 43.

Pullouts and Shelves

I wanted to be able to store tools in the bench, but I did not want to crawl into the bench to find them. To solve this problem, I built pullout shelves. The top ones serve as a little extra tabletop to place your in-use tools on and the bottom pullouts feature a high back to keep power tools in place.

Cut the shelves, runners, fronts and backs (pieces 31 through 34) to size and set up a "mini-assembly line" to build them. I used finish nails and glue to attach the runners and fronts to the shelves. Inset the runners 7/16" from the edge of the shelves to accommodate the drawer slides (pieces 35). On the two lower pullouts, glue and screw the backs in place. Mount the drawer slides in their proper places and you are ready to move on to the final details.

Now is as good a time as any to do a once-over sanding and surface preparation. I sealed my bench with a hard-drying oil finish. I wanted something that would seal the wood, but was also easy to retouch whenever I was moved to do so. (Don't use linseed or mineral oils ... they don't dry sufficiently to repel dust.)

Sanding Dogs

When using the downdraft table, I found these handy sanding dogs very useful. They fit into the vent holes and keep your stock from moving during sanding.

High-tech Hardware

The downdraft hardware and power strip are final touches that make this project sing (or at least hum). Look to the *Hard-to-Find Hardware* box for these items.

The hardware comes with its own set of instructions that I found straightforward and very easy to follow. I mounted the power strip over the pullout shelves and I actually recommend a second strip on the back side of the table as well. You can never have enough access to power. I wired the power strip through the ON/OFF switch of the downdraft unit so there would be a single power cord exiting the bench. It worked great.

Add-Ons and Personal Preferences

Workbenches should be made so they best suit the main user. Bench height is one area where people differ. Most woodworkers prefer the bench top to sit at half their height. (If you are 6' tall, the top should be 36".) Perhaps you would like bench dogs in your workbench ... this top is designed so that is an option. You can drill additional holes or you can use the sanding dogs (shown at left) along with your vise to secure longer stock or panels while machining.

Even though this project was just for me, I got over the guilt really fast ... let me know how you feel when you're done with yours!

Hard-to-Find Hardware

The following hard-to-find hardware items are available from ***Woodworker's Journal.***

Downdraft Fan/Motor Kit #38404*	*$199.99*
Power Strip #25377	*$18.99*
*20" Drawer Slides** #32508*	*$15.29*
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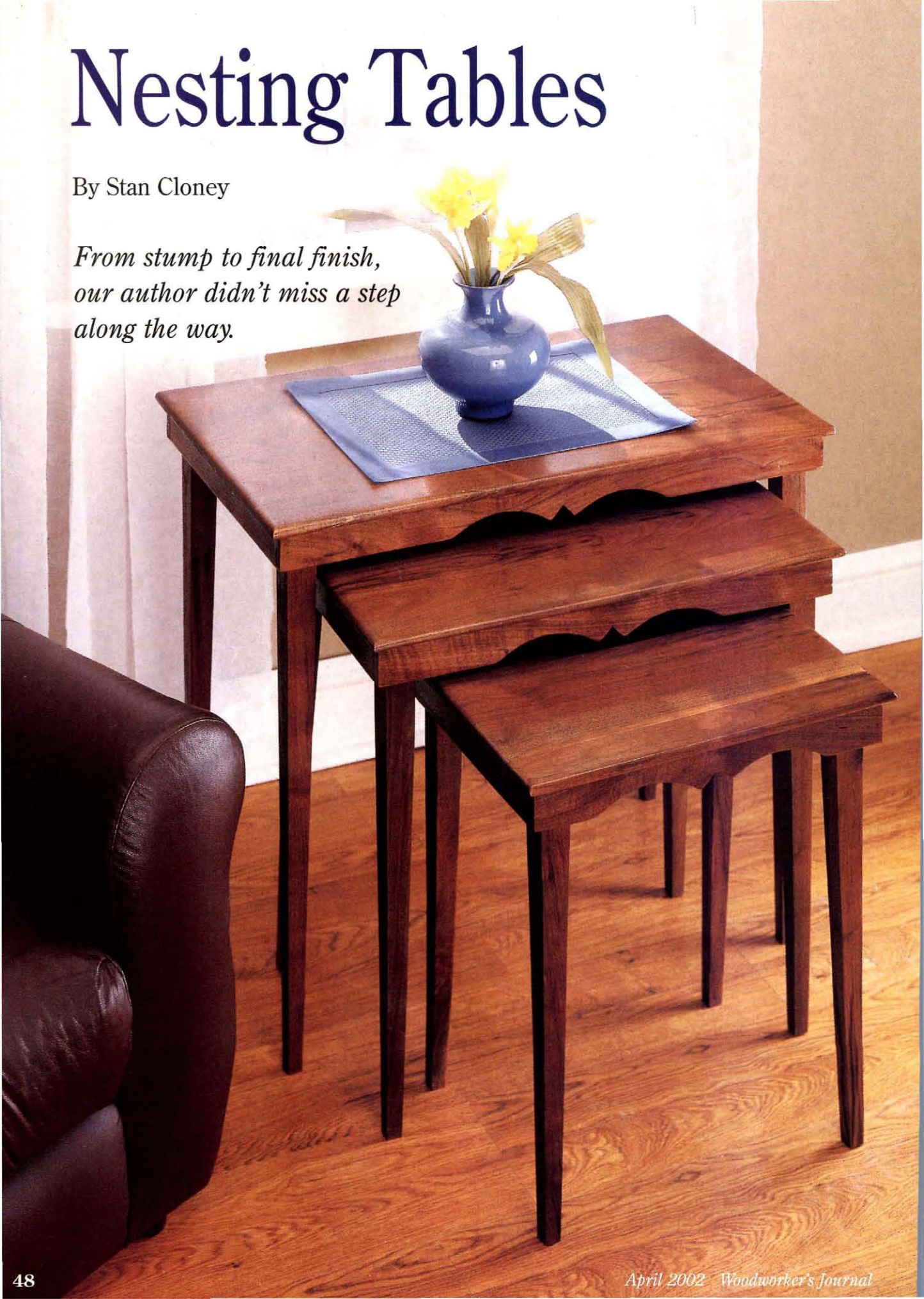
Nesting Tables

By Stan Cloney

From stump to final finish, our author didn't miss a step along the way.



A friend of the author offered him the chance to make good use of this 102-year-old black walnut tree. The opportunity proved to be more than he could resist. The nesting tables featured here are, presumably, the first of many black walnut projects in this woodworker's future.

Most of the time when I begin a new project, I find myself at a lumberyard of some sort. Not this time. A friend of mine was cutting down a large black walnut tree in northern California and asked me if I had any use for it. Like most of the woodworkers I've talked with, I have wondered about working on a project "from stump-to-finish," so I accepted my buddy's offer and had his tree milled into lumber. Working with rough-cut walnut has its challenges and rewards (and sure went a long way toward justifying the expense of my DeWalt planer). It all turned out great.

Making the Legs First

My son wanted a set of nesting tables, and I thought this homemade lumber would be a perfect fit for the project. I began by making the legs (pieces 1). I ripped and cut them to size and decided to add a bit of detail by tapering the two inside faces of each leg. As the lengths of the tables' legs vary, I made an adjustable tapering jig that worked well with the three different table heights (see the *sidebar* below). With all of the legs properly tapered, I notched the inside corner of each leg with a hand-held Japanese back saw, to accept the corner braces (pieces 2) later. With that step completed, I grabbed my belt sander and cleaned up the last traces of leftover saw marks.

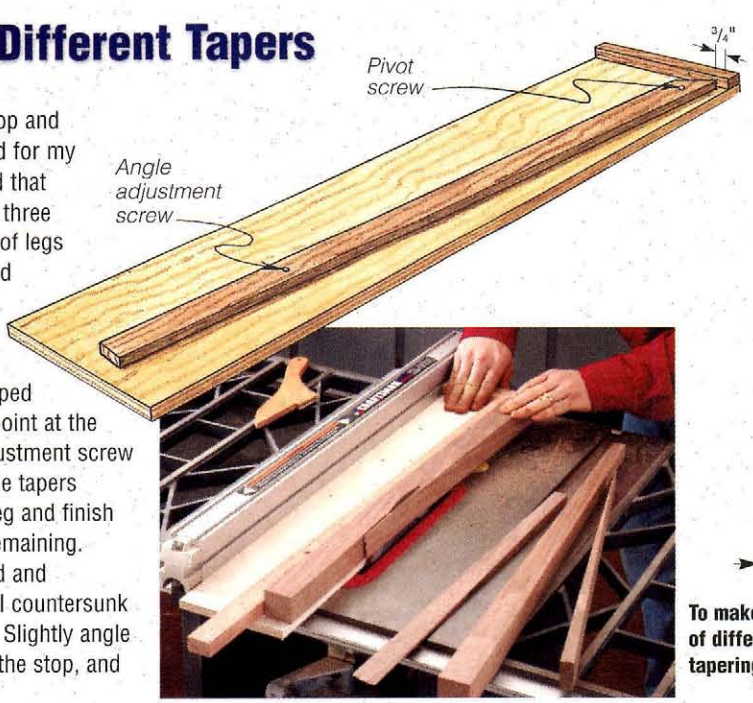
Moving on to the Aprons

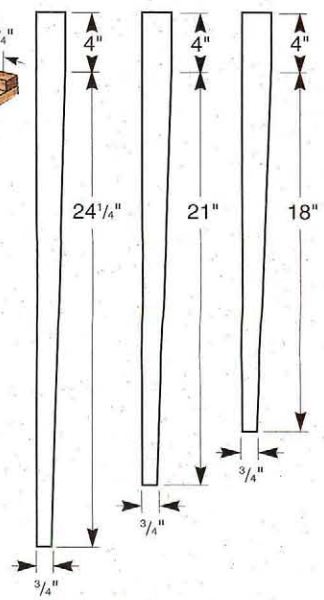
One of the great things about creating your own lumber is that you don't need to be constrained to the standard dimensions of lumberyard stock. I chose to make my aprons and even my tabletops 5/8" thick. It just seemed to be the right proportion. After surfacing the lumber, I ripped enough stock to make the 12 aprons (pieces 3 and 4). To give the tables a bit of style, I drew up a classic profile sized to work for all three tables. I had to determine the proper shape through trial and error, but you can use the *Scaled Drawing* on the following page and transfer the shape to your stock. With the shape drawn, I stacked and centered the three front rails and taped them together. Then I spray-mounted a paper pattern onto the top rail and formed the shape

One Jig: Three Different Tapers

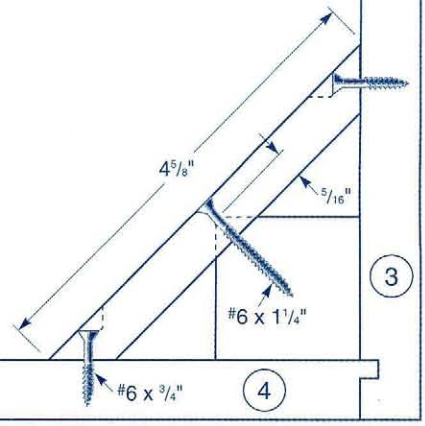
Once I had my wood in the shop and my design completed, I reached for my tapering jig, but quickly realized that I needed one jig that would cut three different tapers. The three sets of legs would be identical at the top and bottom, but would require a steeper angle as the tables got successively shorter.

To achieve this goal, I developed a simple taper jig with a pivot point at the bottom of the fence and an adjustment screw farther down its length. Start the tapers 4" down from the top of each leg and finish the cuts with 3/4" of material remaining. I used 1/2" plywood for the sled and hardwood for the fence. Predrill countersunk screw holes through the fence. Slightly angle the end of the fence closest to the stop, and you are ready to taper.



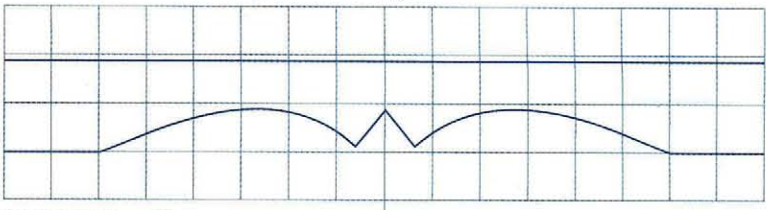


To make corresponding tapers on legs of differing lengths, try this simple tapering jig with an adjustable fence.



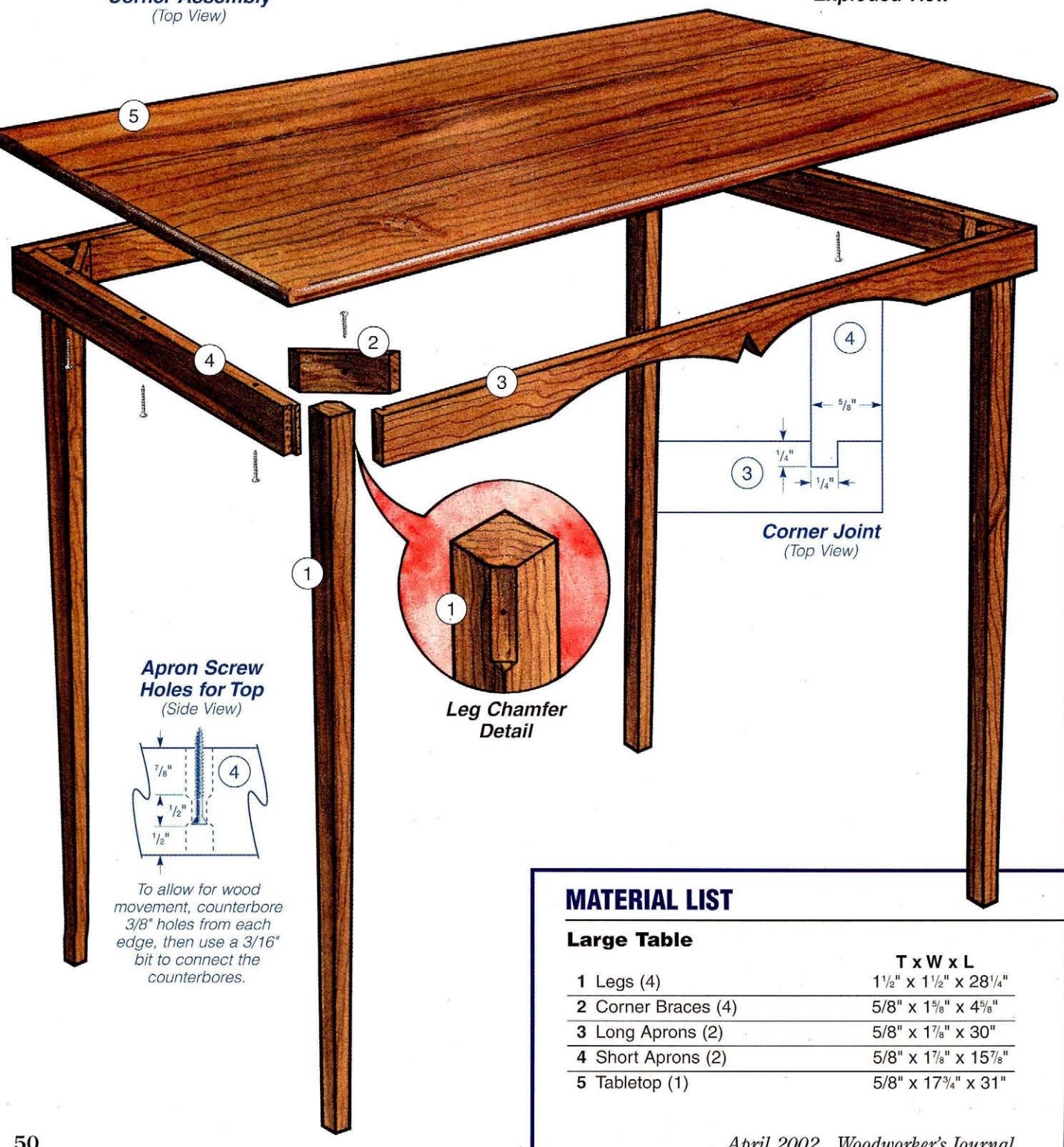
Corner Assembly
(Top View)

Front Apron Cutout *(Scale Drawing)*



Each square = 1"
(Note: The cutout is the same on all three front aprons.)

Table Exploded View



Corner Joint
(Top View)

Leg Chamfer Detail

Apron Screw Holes for Top
(Side View)

To allow for wood movement, counterbore 3/8" holes from each edge, then use a 3/16" bit to connect the counterbores.

MATERIAL LIST

Large Table

		T x W x L
1	Legs (4)	1½" x 1½" x 28¼"
2	Corner Braces (4)	5/8" x 1⅝" x 4⅝"
3	Long Aprons (2)	5/8" x 1⅞" x 30"
4	Short Aprons (2)	5/8" x 1⅞" x 15⅞"
5	Tabletop (1)	5/8" x 17¾" x 31"

carefully on the band saw, as shown at right. A bit of elbow grease and a very hard sanding block were then used to remove the fresh saw marks on the scrolled apron edges.

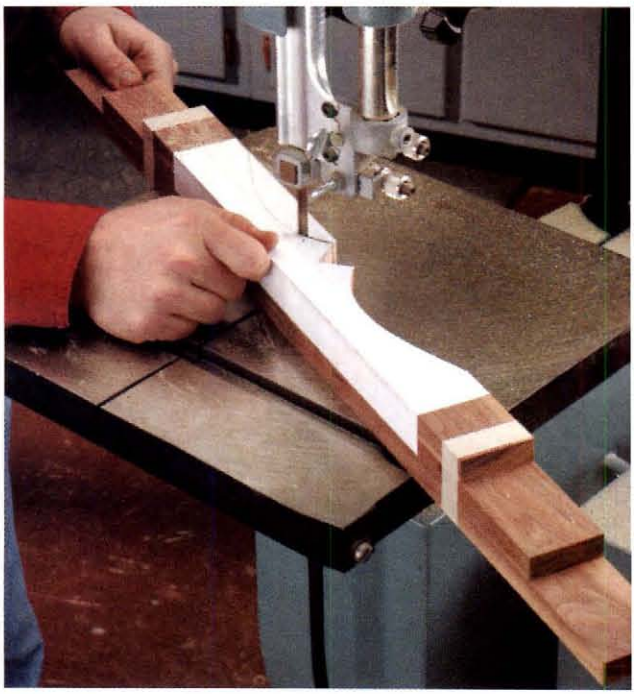
To hold the apron's corners perfectly during glue-up, I made a slick little notch-joint. I cut these on the table saw using my miter gauge and a 1/4" dado head, as shown in the bottom photo at right. This two-step process was easy to do and provided some additional mechanical strength to the corner joint as well. Now you are ready to move on to making the tabletops.

Making the Tabletops

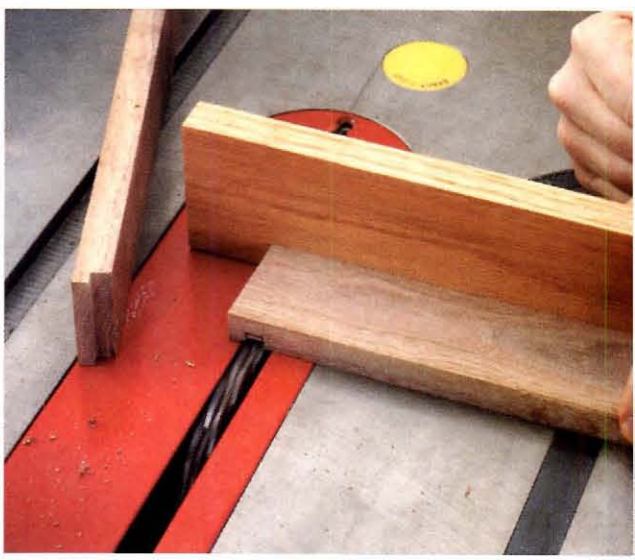
Creating the tabletops (pieces 5) really gave my portable planer all the work it could handle. As I live in sunny California, I was able to do this extensive (and noisy) task outdoors, thus keeping the huge volume of walnut shavings out of my shop. I sure hope walnut mulch is good for plant bedding, because it is all around my yard now!

Once the tabletop lumber was planed to its proper thickness, I jointed and ripped it to usable widths. I cross cut pieces for the three different tops to length (with a little extra for trim after the tops were glued up), taking time to match grain and figure as best I could. When I laminate solid wood panels, I like to alternate the orientation of the annual growth rings as a hedge against warping. I know folks will argue about whether this is effective or not, but it works for me. Along those lines, yellow glue is my choice for this sort of work. It is easy to work with, forgiving during clamp-up and durable over time. I scrape the squeeze-out from the joints right away, but like to let the glued-up panels sit for a couple of days before I sand them smooth, to avoid joint sink. I also prefer to sand through a few grits before I trim the panels to their final size, which helps me avoid an otherwise hidden flaw in the wood.

After I trimmed the tabletops to their final dimensions, I bullnosed all four edges of each top on my router table. It gave me an old-fashioned detail that matched the natural walnut finish I had envisioned. I found the tabletops needed some hand sanding where the bullnose shape blended into the top. With that completed, I set them aside and prepared to assemble the trio of tables.



Cutting the profile found on these nesting tables is best done with the apron pieces stacked and taped together. Even though these three aprons are different lengths, the profile (which is centered on each front apron) is the same size.



The simple, two-step notched corner joint used in these tables was formed on the table saw with a 1/4" dado head. The joint adds a little extra glue area to each corner, increasing strength.

Medium Table

	T x W x L
1 Legs (4)	1½" x 1½" x 25"
2 Corner Braces (4)	5/8" x 1⅝" x 4⅝"
3 Long Aprons (2)	5/8" x 1⅞" x 24"
4 Short Aprons (2)	5/8" x 1⅞" x 14"
5 Tabletop (1)	5/8" x 15½" x 25"

Small Table

	T x W x L
1 Legs (4)	1½" x 1½" x 22"
2 Corner Braces (4)	5/8" x 1⅝" x 4⅝"
3 Long Aprons (2)	5/8" x 1⅞" x 18"
4 Short Aprons (2)	5/8" x 1⅞" x 12½"
5 Tabletop (1)	5/8" x 14¼" x 19"

But first, the last fabrication step was to make the corner braces that help keep everything aligned. I predrilled all the screw holes and mitered their ends in preparation for final assembly.

Assembling the Tables

The first major assembly task was to glue and clamp the aprons together. Again, yellow glue and pipe clamps worked fine; just be sure the aprons are dead square as they cure. Once the glue dried, I took the apron subassemblies over to my drill press and bored three stepped holes into each short apron, as shown in the *Exploded View* on page 50. Since these aprons run across the tops' grain, these holes need to be designed to allow for movement (see *Elevation Drawing, page 50*). This simple approach allows the screws to move as the tops expand and contract with seasonal changes.

Now, it was time to attach the legs to the apron. First I glued and screwed the corner braces into the corners. Don't allow this step to move your aprons out of square. As I looked at the long, slender, tapered table legs, I became concerned that I might have trouble aligning them properly during assembly. I solved this problem with a jig that held the legs firmly while they were being attached to the aprons. (See the *sidebar* at right.) Once the legs were securely positioned, I screwed them in place through the corner braces.

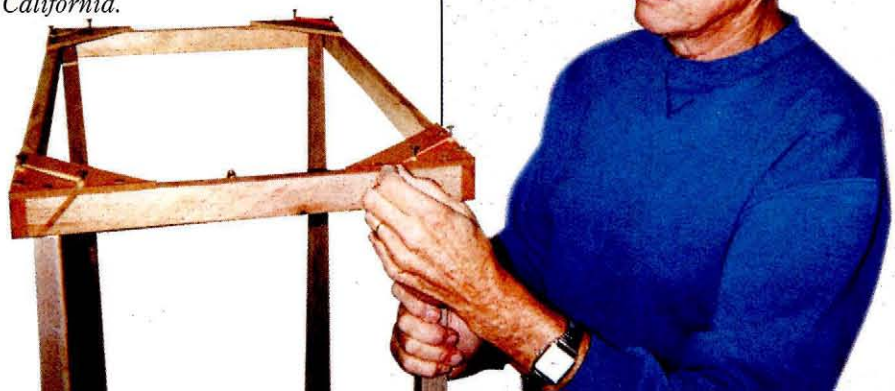
Keep in mind, I also attached the corresponding tabletop while the legs were still in the jig. I simply placed the whole kit and caboodle on the underside of a tabletop and drove the screws home with my battery-powered drill driver. When you attach your aprons to the tabletops, make certain that the screws that go in the elongated screw holes are centered within their openings. That's it for assembly; a bit of final sanding and it's on to finishing.

A Fitting Finish

Natural walnut has a wonderful look that you just can't get with any other wood. Still, I like to help it along by using a mixture of linseed oil thinned with turpentine to get the figure to pop. I let that coat cure for about a week and then (after a quick rub-down with 0000 steel wool), I applied three coats of water-based polyurethane, with a light sanding before the last coat. I sealed both faces of the tabletops to avoid any unpleasant wood movement surprises down the line.

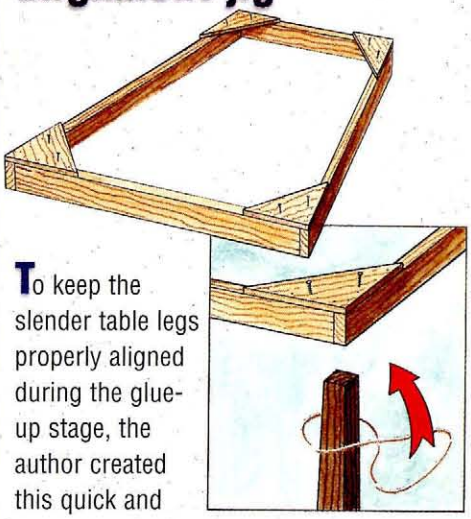
After all was said and done, I have to say that my "stump-to-finish" experience was completely satisfying. I'd recommend it to anyone who has a hankering to "do it all."

A retired pharmacist with seven children (one of whom is now the proud owner of this set of tables), subscriber Stan Cloney and his wife live in the beautiful mountain community of Mt. Shasta, California.



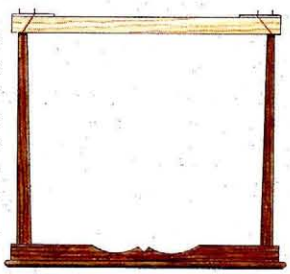
The author keeps the long slender legs of his nesting table square during glue-up with this simple alignment jig.

Try this simple alignment jig



To keep the slender table legs properly aligned during the glue-up stage, the author created this quick and easy-to-make jig.

To make your own, start with a plywood frame the exact dimension of the apron frame. Add a cleat with a couple of screws left proud to each corner, as shown above. After you place the legs into the openings formed by the apron and corner braces (but before you drive in the screws), place the jig over the bottom of the legs, as shown below. Then, using a large rubber band with a figure eight twist, secure the leg into the corner of the jig.



Don't drive the corner brace screws into the legs until you've positioned the alignment jig over the bottom of the legs.

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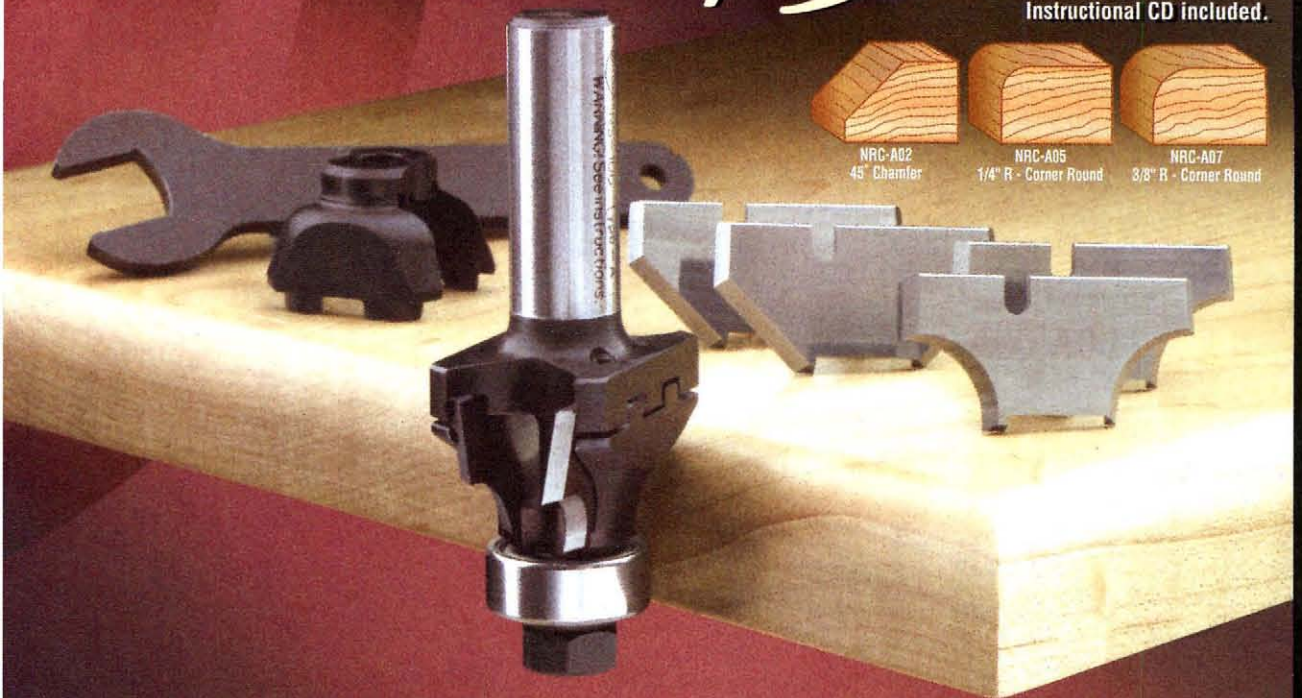

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What's the Difference Between Saw Blades?

By Bill Hylton

Do you know what a raker is, or a hook angle? Our Sultan of Saw Blades reveals the science and theory behind getting those sweet, smooth saw cuts.

Not long after you got your table saw, you probably started thinking about buying a better blade for it. You were hoping you could get smoother, cleaner cuts from the saw if you had just the right blade.

Then, after peering at the blades hanging on the store's rack and scanning your favorite tool catalogs, you began, perhaps, to think about needing more than one good blade. After all, can one blade really do it all? If it can, which one is it? If there is no such blade, then which ones, you asked yourself, do I need?

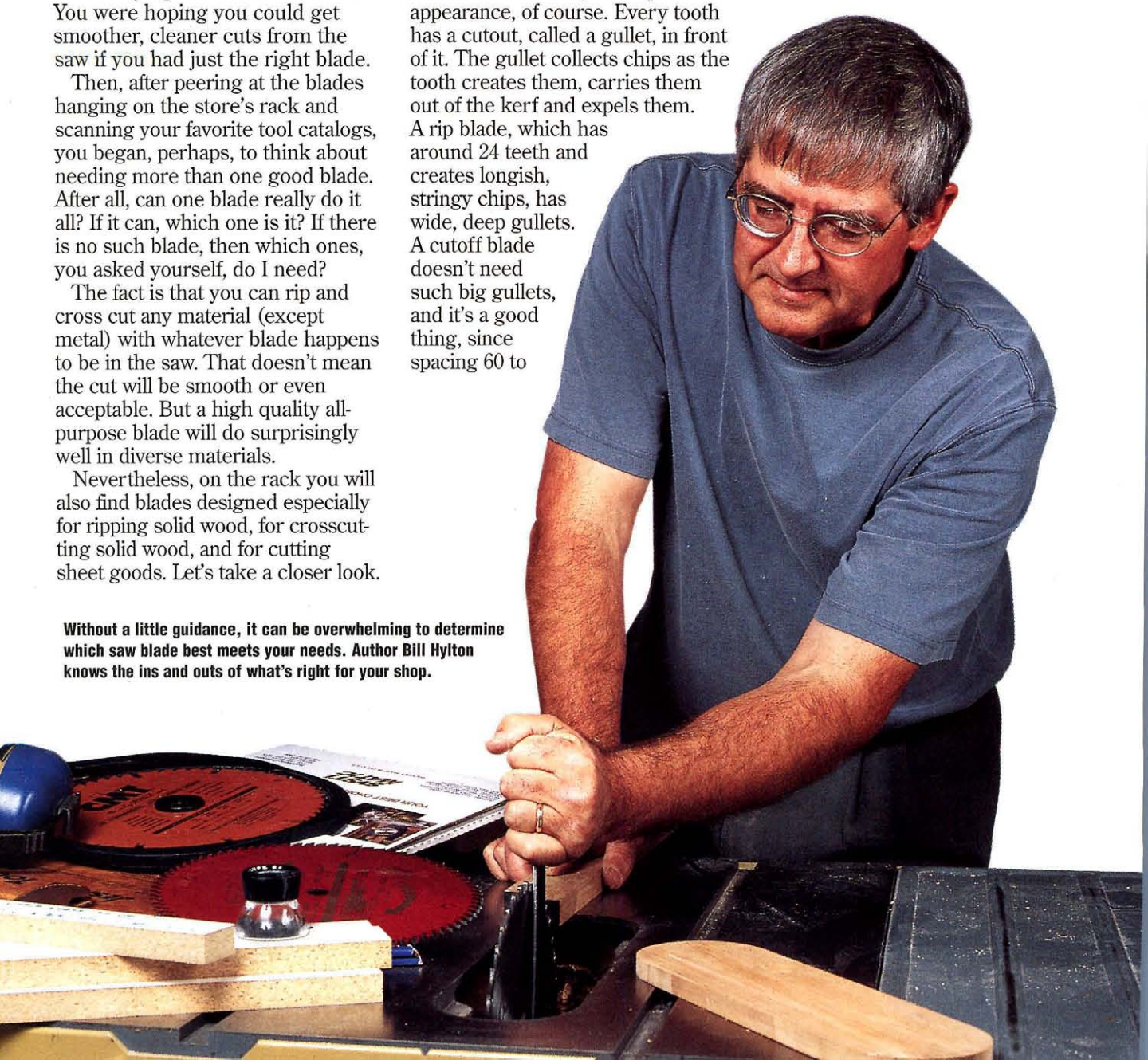
The fact is that you can rip and cross cut any material (except metal) with whatever blade happens to be in the saw. That doesn't mean the cut will be smooth or even acceptable. But a high quality all-purpose blade will do surprisingly well in diverse materials.

Nevertheless, on the rack you will also find blades designed especially for ripping solid wood, for crosscutting solid wood, and for cutting sheet goods. Let's take a closer look.

A Closer Look at Saw Blade Plates

Blades do not all look alike. The number of teeth impacts a plate's appearance, of course. Every tooth has a cutout, called a gullet, in front of it. The gullet collects chips as the tooth creates them, carries them out of the kerf and expels them. A rip blade, which has around 24 teeth and creates longish, stringy chips, has wide, deep gullets. A cutoff blade doesn't need such big gullets, and it's a good thing, since spacing 60 to 80 teeth around the rim doesn't leave much room for gullets.

Most blades also have cuts in the rim called expansion slots. These are designed to prevent heat build-up from warping the blade. Some blades also have additional slots intended to dampen vibration and thus decrease blade noise.



Without a little guidance, it can be overwhelming to determine which saw blade best meets your needs. Author Bill Hylton knows the ins and outs of what's right for your shop.

All these cutouts and slots, even the arbor hole, are cut into the blade's plate (or body) with a laser. After being cut, the plate is hardened and tempered, milled, tensioned, then milled again. At each stage, the plate is checked and rechecked to ensure it's dead flat.

Teflon® coatings and chrome plating adorn some blades. The coatings reduce friction, thereby reducing the buildup of pitch and gum. And when they do get gummed up, they are easier to clean.

Saw Blade Teeth

Look even closer and you come to the teeth. On one blade, the teeth may seem rather blunt. On another, they are decidedly pointy.

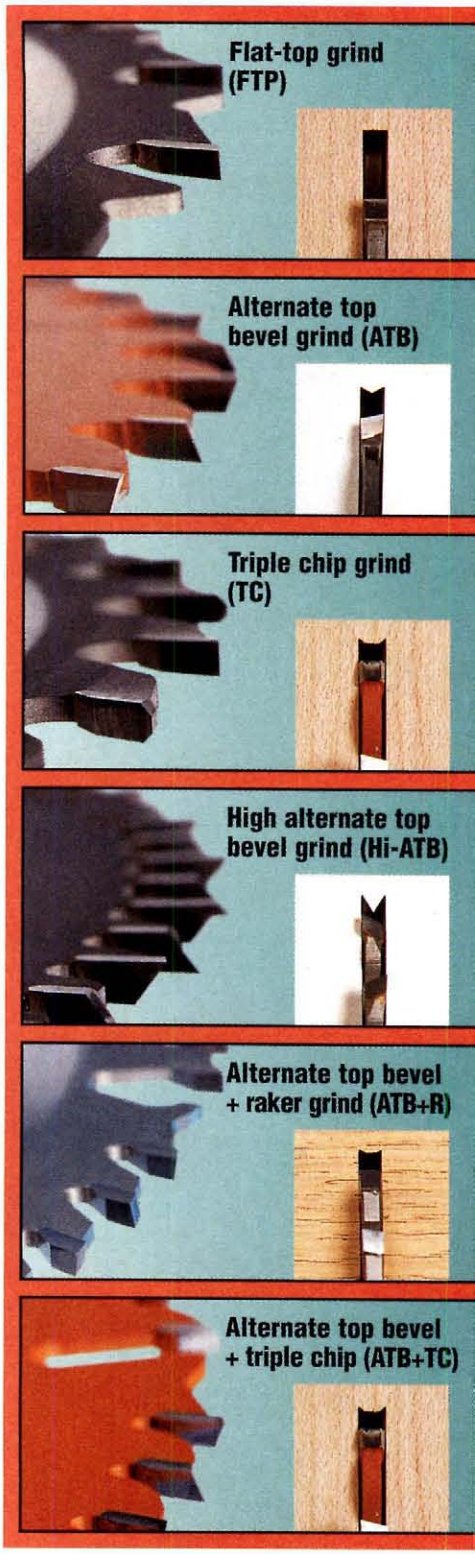
Regardless of appearances, every tooth on every blade is a tiny bit of tungsten-carbide, brazed or silver soldered to the blade's steel disk.

You may have heard that C4 is the hardest grade of carbide, and you may have been warned to "make sure you get a blade with tips made of C4 carbide." The complicated truth is that the C1 to C4 scale used to grade carbide hardness has a whole lot more than four classifications. The design engineer has a lot of choices, and selects a carbide that best suits the particular cutting application.

The teeth are distributed evenly around the plate. In general, the more teeth a blade has, the smoother its cuts will be. But there are tradeoffs. When you have lots of teeth, more force is required to feed the workpiece through the cut, and the cutting speed is low. In addition, more teeth are in the kerf throughout the cut, generating more heat, and dulling the blade more quickly.

Lowering the number of teeth on the blade reduces the force

The well-equipped woodshop might have three basic table saw blades. The primary blade will be either an all-purpose blade or a combination blade. Dedicated rip and crosscut (or cutoff) blades round out the set.



Tooth configurations take into account grind, bevel and hook. Knowing the effects of these parameters helps you sort out the tradeoffs and home in on the blade that does what you want. The illustrations above indicate the type of kerf produced by the three basic tooth shapes used in the six common configurations.

Tool Preview continues on page 56 ...

Hook angle impacts feed effort, cutting speed and splintering. Blades with high hook cut — and splinter — aggressively. For delicate materials, you want a blade with low hook.

Tensioning a blade usually leaves a visible ring on the plate. Sometimes it is milled or polished away or obscured by a coating.

required and increases the cutting speed. It also reduces the number of teeth in the kerf during the cut, thus yielding a cooler cut and extending the life of the blade. The tradeoff is a rougher cut.

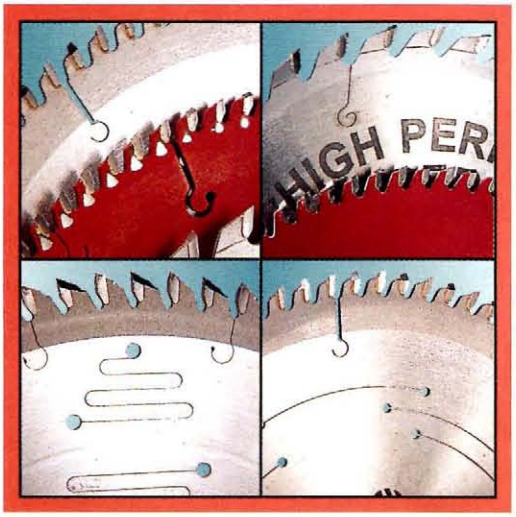
Tooth Grinds

Beyond the numbers of teeth, there are correlations between their shape and orientation and the cut effort, speed and quality. Three basic tooth shapes are used in six different configurations. By tooth shape I mean, primarily, the shape of the cutting edge.

The flat-top tooth (usually abbreviated FT) has a square cutting edge, like a chisel. A flat-top grind blade cuts like a chisel, plowing nicely with the grain, but splintering its way roughly across the grain. By itself, the flat-top tooth grind is used primarily on rip blades. Teamed with other grinds, the flat-top tooth is called a raker.

Teeth in the alternate top bevel grind (commonly referred to as ATB) have cutting edges that angle from side to side. From tooth to tooth around the blade, the bevel angle alternates left and right. The bevel angle varies according to design intent, ranging from 5° to as much as 40°. Once the angle exceeds 20°, it is often referred to as High ATB.

The pointed corner of the ATB tooth slices through wood fibers like a knife, creating a crisp edge to the kerf, while the beveled portion pares the waste. It seems to cut equally well with the grain and across it. It even cuts chip-prone laminates cleanly. The steeper the bevel angle, the cleaner the slice. On the other hand, the steeper the angle, the less durable the edge.



Expansion slots (top left) allow the plate to expand without warping when friction heats it. The most common contour is a fishhook. Teflon® (top right) keeps pitch from sticking to the blade. To combat the blades' high-pitched singing, blademakers laser cut slots and arcs designed to reduce vibration (bottom photos).

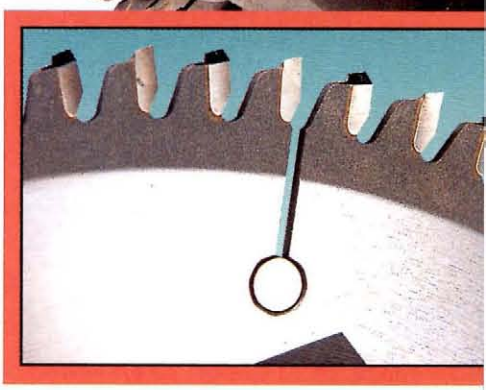
ATB is surely the most widely used grind. By itself, it is used on all-purpose and cutoff blades. In the high ATB configuration, it's used on cutoff blades and so-called "melamine" blades. Teamed with teeth of other grinds, it's used on combination and all-purpose blades.

The third basic shape is the triple chip. Here the corners of a flat-top tooth are chamfered at 45°. In the triple-chip grind, or TC, the characteristic tooth is alternated with a flat-top tooth (called a raker in this application) that's set a few thousandths lower.

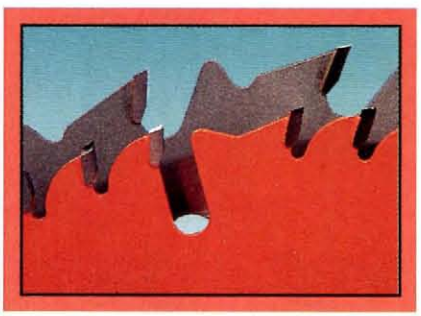
The triple-chip tooth cuts a narrow groove that the following raker widens. This grind is favored for various sheet goods, including melamine.

The most common example of teaming teeth with different grinds is the combination blade, which

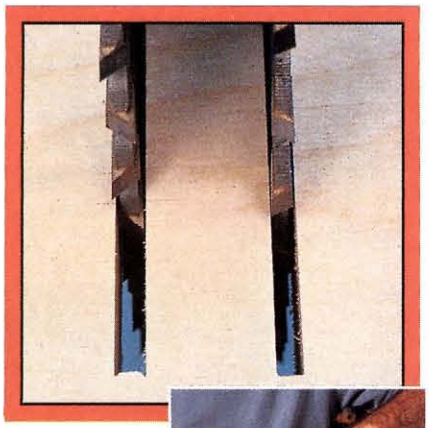
Tool Preview continues on page 58 ...



One blademaker inserts copper plugs to dampen vibration and noise: the ear-splitting singing. Proof of the effectiveness of such measures is in the ears of the listeners.



To compensate for their aggressive cutting, many rip blades have anti-kickback spurs incorporated into the rim contour to limit each tooth's bite.



A typical table saw blade produces a 1/8" kerf, while a thin-kerf's blade makes a 3/32" cut (above right). A benchtop table saw needs a thin-kerf blade: compared to a floorstander, the benchtop is low-powered and bogs down easily when driving a regular-kerf blade in hard wood.

has what's called an ATB+R grind. This blade has groupings of five teeth: four ATB teeth and one raker. The ATB teeth score the stock and the raker, with its extra deep gullet, clears dust and chips. The raker tooth is ground about .01" lower than the ATB teeth.

The last bit of geometry in a saw tooth is the hook. This is the angle between the front of the tooth and a line extended from the blade center to the cutting-edge tip. It can range from 20° or slightly more down to negative numbers. A high hook angle gives you an aggressive cutter, but one that creates a lot of tearout on the underside of the work. Low hook translates into a clean but sluggish cut. More feed pressure is required.

In practice, rip blades have high hook angles, cutoff blades have low hook angles.

The Payoff

The blades are hanging on a rack at your local tool emporium. What do we have?

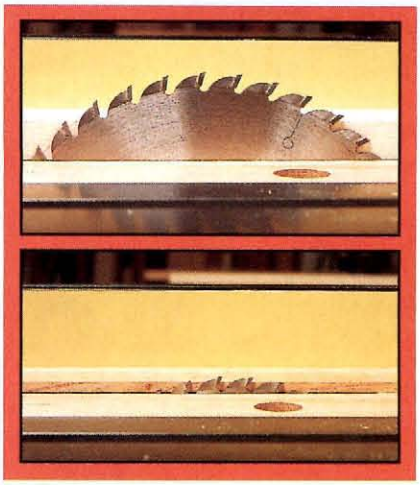
Rip blade: Immediately characterized by its big, uniform gullets, the rip blade typically has 24 flat-top teeth and 15° to 18° of hook. Variants include speed rippers with 18 to 20 teeth and 20° or more of hook, and glue-line rippers, with 30 teeth (sometimes with a triple-chip or ATB grind). The fewer teeth a blade has, remember, the faster it will cut, and the more teeth it has the smoother it will cut.

Cutoff blade: Teeth, and lots of 'em, characterize the cutoff (or crosscut) blade. The quintessential cutoff blade has 60 to 80 ATB teeth and 10° of hook. The ATB grind slices cleanly across the grain, and all those teeth ensure a smooth cut.

There's a lot of variation in bevel angles and hook. One blade has a 15° hook angle, and you know it sacrifices a skosh of smoothness to reduce feed effort and accelerate cutting. Another has High ATB teeth (with a 40° bevel angle) and only 5° of hook. Smoothness takes priority over cut speed here.

Melamine blade: This is essentially a subset of the cutoff blades. It works well on all sorts of sheet goods, but is designed primarily to make clean, chip-free cuts in melamine. Like a cutoff blade, it has 80 teeth, but in either triple chip or High ATB grind and with a shallow — or even a negative — hook angle.

To change a blade, trap it against a scrap of wood so you can loosen the arbor nut. I select a scrap from the off-cuts box. Hold the blade with your right hand and loosen the nut with the wrench in your left.



A good general rule in dialing in a setting is to follow tearout with the blade height: raise the blade to eliminate splintering on the top; lower to eliminate splintering on the bottom. The top image shows an "all-purpose" setting for an all-purpose blade; the lower image shows a setting for thin stock.

Combination blade: The "traditional" general-purpose blade is this familiar 50-tooth ATB+R unit. For years, this has been the "jack-of-all-cuts" blade, capable of crisp crosscuts and acceptably fast rips. It cuts plywood and other sheet goods with a minimum of splintering. The versatility stems from its mixture of ATB and FT teeth on one body. The teeth are grouped in fives, with four in the ATB grind and one a flat-top raker. The raker is, of course, ground slightly lower than the ATB teeth. The ATB teeth are mounted in front of shallow gullets (referred to as the primary gullets), while the raker has a deep gullet in front of it. The deep gullets visually separate the groups of teeth. Often, the last shoulder in each group, the one opposite the raker, has an anti-kickback spur.

CMT makes a combination blade in this pattern, but the raker is in the triple-chip grind.

All-purpose blades: This is the reigning favorite do-all saw blade. The prototype is the 40-tooth ATB blade, but some versions have only 30 teeth. A number of manufacturers offer ATB+R versions.

Tool Preview continues on page 60 ...

(Circle No. 31 on PRODUCT INFORMATION form)

(Circle No. 139 on PRODUCT INFORMATION form)

(Circle No. 78 on PRODUCT INFORMATION form)

Getting the Best From Your Blades

Having now sprung for a new blade (or two or three), make sure you get the best cuts possible from it. There's more than simply removing the old blade and installing the new.

First, make sure your table saw is accurately aligned. Both the blade and the rip fence must be parallel to the miter gauge slots milled into the saw table. Misalignments do more than degrade cut quality; they lead to kickback.

Next, make and use a zero-clearance insert. By backing up the workpiece on either side of the blade, this type of insert can minimize tearout and chipping on the bottom of your workpieces. By all means use a good guard and splitter. These will help you get safer cuts, and safer cuts are better cuts.

Finally, set the blade to the optimum height for whatever material you are cutting. The conventional wisdom is to set it just 1/4" above the material being cut. This minimizes your exposure to the blade throughout a cut, and it may actually be the optimum setting for a man-made sheet like plywood or melamine. But for several reasons, it may be too low.

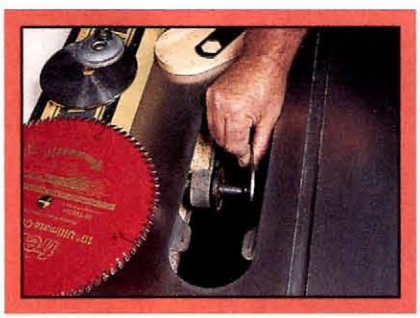
When you have more than one blade, you need blade storage. Provide each blade with its own space so you don't crash them into each other; protect those teeth.

Pitch, gum and resin buildup will make the plate run hot, promoting further buildup and causing dulling. These blades need cleaning.

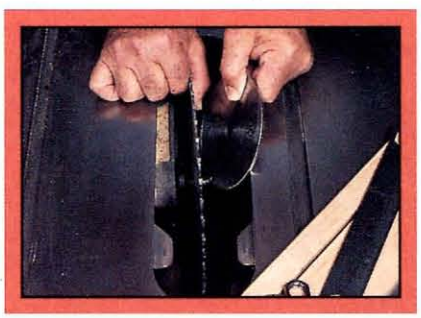
Soak the blade in cleaner; scrub with a nylon or brass brush. To prevent rust, dry the blade (use a hair dryer) and use a spritz of WD-40.

Most blades can be resharpened several times. A competent sharpening service can even replace a missing carbide tip.

Look at the cutting tips with a magnifier. If the cutting edges shine in reflected glass, they're rounded over. Time to resharpen.



Fit one stabilizer on the saw's arbor, followed by the blade and the second stabilizer. Secure them with the flange washer and arbor nut.



Forrest advocates using a single stabilizer. If you don't use the first stabilizer, you will still be able to use the measuring scale on your fence.

Three aspects to this are cut quality, safety, and blade wear. Let's consider them in reverse order.

Setting the blade high reduces wear on the teeth, because each tooth remains in the cut a shorter time and doesn't heat up as much. In addition, you can feed a board faster when there are fewer teeth in the cut, and that shortens the duration of the cut, again yielding a cooler operation.

From a safety viewpoint, a lowered blade is pushing back at you rather than pushing the board down against the table. The potential for kickback therefore is increased. If you use your saw's guard and splitter, you can raise that blade without increasing your exposure.

Finally, there's the matter of cut quality. The optimum blade height for a smooth, clean cut is influenced by the number of teeth, the tooth geometry, and, of course, the material. More often than not, test cuts are in order to establish the best setting for the quality of cut you want.

Bill Hylton is the author of several woodworking books including Chests of Drawers, *forthcoming from Taunton Books.*

WOODWORKER'S JOURNAL | MARCH/APRIL 2002

15 ROUNDS – WORLD HEAVYWEIGHT CHAMPIONSHIP – 15 ROUNDS

"I AM THE GREATEST"

SHAPER

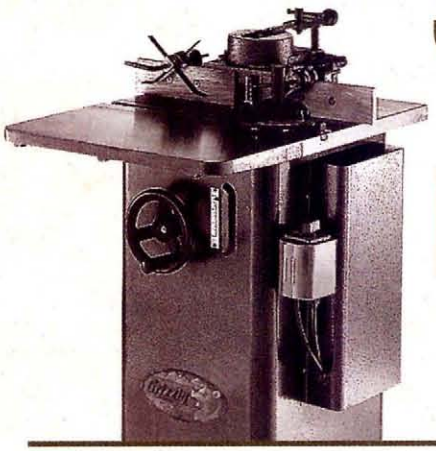
CHAMPION

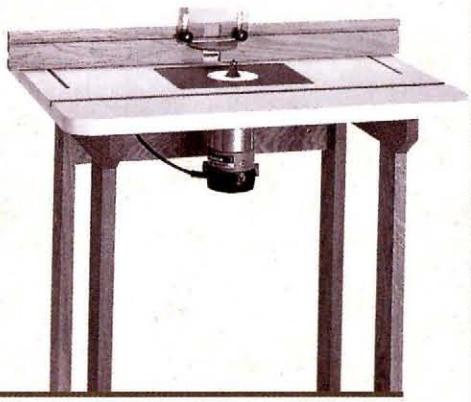
– VS –

– LIGHTNIN FAST –

ROUTER TABLE

CHALLENGER





BY CHARLES SELF

Which is the right woodworking tool for the home shop, the shaper or the router table? Which unit will come out on top in this no-holds-barred cage-match? Think the comparison is a simple one? The answer just might surprise you.

It really does appear there's a possibility of a knockdown-drag-out contest here, with small shapers vying for the utility title over router tables equipped with 3 or 3¼ HP routers.

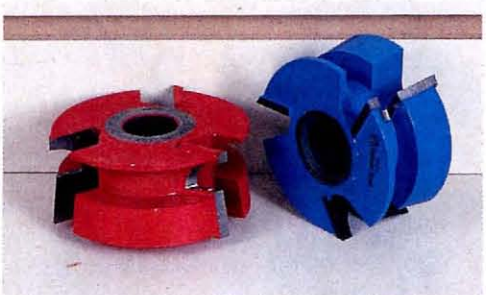
What actually happens is a lesson in symbiosis. The tools are different enough that having one of each, assuming a need for their specific features, may not be a bad idea at all.

For this bout, I compared a Rockler router table, using a Hitachi M12V, to a Grizzly 1½ HP shaper (model G1035). Both run on 120 volt, 20 ampere circuits.

Poor Man's Shaper

The router table has long been called a poor man's shaper ...'tain't necessarily so. While the Rockler table is lower priced than many, it's still not cheap: around $160 for the table and fence, plus another $70 for a pine leg set ($110 for oak). Add $190 for the M12V, and you're kicking $420 in the teeth, plus shipping. The Grizzly G1035 sells for $425, usually with less than $50 shipping.

It was just about a wash on price, then, when I compared two pretty much equal machines. You can argue until the dawning of the Apocalypse about the lower power figure for the shaper, but the fact is, these motors are pretty close to equal, with an edge going to the lower rated machine. The low-down grunt and go power of the shaper motor wins every time, even though it turns the spindle at about half speed when compared to the router.



These top-of-the-line shaper cutters from Freud and Amana demonstrate the massive nature of the shaper knives and heavy-duty thickness of their carbide inserts.

Grizzly's G1035 has two speeds, 7,000 and 10,000 rpm, and uses a 16 ampere reversible 3,450 rpm single phase motor to get to and hold those speeds. The G1035 motor is also a totally enclosed fan cooled (TEFC) type. It has an induction motor, and provides plenty of speed and power for shaper cutters, though its rotational speed is nothing

like that of the Hitachi's universal motor. It is far more durable under heavy loads than a universal motor.

The Hitachi M12V reaches 20,000 rpm, reducible to 8,000 for use with large bits. It draws 15 amperes. Both need a 20 amp circuit, though the Grizzly motor is convertible to 220 volts, dropping amperage loading to 10. The variable electronic speed router has a soft start so there's no torque kickback, which is far more important for hand-held operations than it is when table mounted. But then, one of the router's advantages is that it can be dismounted from the table and used hand-held.

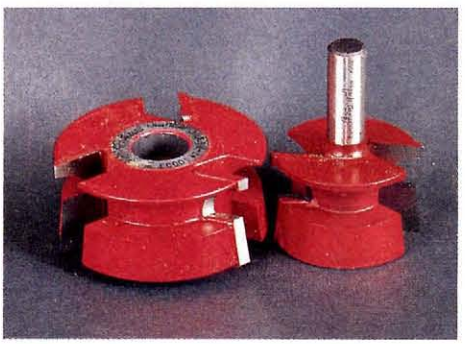
Bit and Cutter Comparisons

It is common for router bits to have two cutting edges, while the shaper's cutters have three. In addition to the extra cutting edge, which in effect increases cuts per rpm to 30,000 with small cutters and 21,000 with large, the shaper cutters have much more mass. This means they tend to run more smoothly than do lighter router bits. In this test, I ran several Freud cutters and several from Amana. Both brands proved excellent and gave nearly glass smooth cuts on MDF, ash, oak and cherry. Bits for the router came from Amana, Freud and Jesada,

These two bits do the same task, cutting stile and rail joints. Note the difference in size: the router bit (top) is much smaller.

and again, all proved well made, and gave very good to excellent cuts with the test woods.

The primary differences between cutters and bits are weight and amount of carbide (size of the actual carbide tips). The more massive shaper cutters, with their larger carbide inserts, tend to wear longer, sharpen more times, and thus offer greater life for those who do a considerable amount of shaping. In other words, if you're going to raise 10 to 15 panels for kitchen cabinets, the router table is king, because the lower cost bits are also easier to insert and lock in place. For those doing 20 or more (up to hundreds), the shaper rules, because those cutters will hold their edges longer (larger edges, plus more of them, mean longer life, all else being equal).



A key difference between these cutting tools is that a shaper has three knives on each cutter (left), versus two on most router bits.

There is a considerable difference in cost between router bits and cutters, though. To use an example from Grizzly, a stile and rail set for the router is about $100, available in four profiles. Reversible stile and rail sets for a shaper, for 3/4" material, run from $180 to $240, depending on the cutter diameter. There are five profiles. From there, the shaper sets get complex, prices rise a bit, and frames being cut are probably passage door types, instead of cabinet door. Grizzly alone lists 19

stile and rail sets for their shaper, something you will not see in a router bit catalog.

In general, shaper cutters cost as much as 150% more than router bits for similar uses, but choice is wider, and the cutters are far more durable than the bits.

To make the comparison a little muddier, many smaller shapers offer an accessory router collet spindle, which allows the use of router bits with the shaper. Again, a generality may be presented: router bits, with only two cutting edges, are intended for high speed use, so when they are used on most shapers, the results are not as good as when the same bit is used in a router.

Shaper cutters come in a remarkable variety of sizes and shapes. This Amana panel raising bit is a very large cutter. In fact, it's just a bit too large for this setup, complicating your choice.

Performance

For the most part, a router table is still handy if you have a small shaper. The shaper will do everything the router table will do, including (with the optional router collet spindle) blind work. Going in the other direction, if you've never used a shaper, and don't do a lot of raised panel work, or molding production, you'll probably never miss it. Once you get one, you'll never want to work without one.

Pluses for router tables include lower cost for bits. The cost to set up is about the same, so there's no pro or con there. The high speed (some routers hit 25,000 and more rpm) of routers gives a much better cut finish with two cutter bits. The cost of the router table can be mitigated by buying it a bit at a time — router; table; legs; fence, or by building your own (which allows for constructing a top, legs, cabinetry that are optimum for your personal needs and desires). Many router table inserts can be modified with P-C style guide bushings to allow template work.

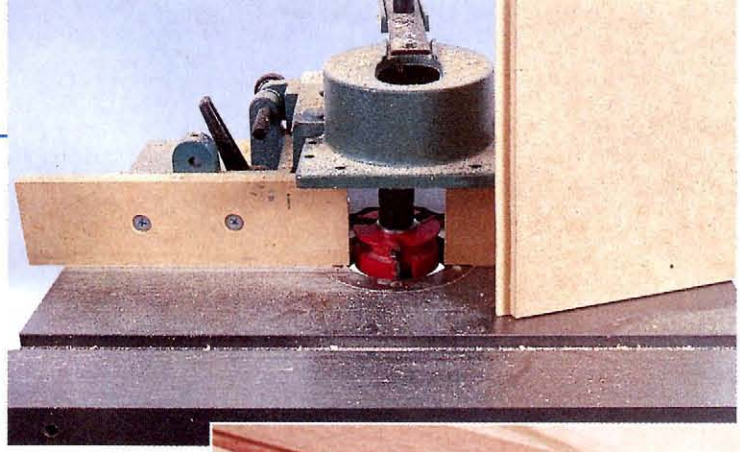


Table-mounted routers and shapers are both in the business of shaping wood. Which tool is best is, to some degree, an open question. Cost, project selection, level and frequency of use are points to examine as you resolve this issue.

Shaper Advantages

Pluses for shapers start with the heavy-duty motor that provides lower rotational speeds, but much greater grunt, meaning, usually, a longer lasting machine. Induction motors, as on shapers, are much, much quieter than the shrieking universal motors on routers. Magnetic switches used on most small shapers are safer than the switches on most router tables should there be a power loss. Cutters last longer than bits, which is an overall shaper advantage, even though the cutters usually cost considerably more. Changing, and adjusting, a cutter is easier than changing a router bit, as is getting it set for height. A Router Raizer will eliminate this advantage, but at a cost of an additional $90 or so. Shapers have cast iron tables, which are flatter (at least in theory) than the laminate tops used for router tables. Highly polished cast iron tables are easier to work on than a laminate surface, and, in essence, do not wear out. The shaper fence is standard, has guards, guides, and, often, a decent dust collection attachment setup (Grizzly's is a modest $14.95 option). The reversing switch on shapers allows more complex work, including feeding backwards into a reversed cutter to achieve varied profiles.

A huge advantage for the shaper is the number of stock cutters available, even for small 3/4" spindle machines. There are also shaper cutters that hold individual cutting knives that can be ground to any shape desired at modest cost

Shaper cutters are exceptionally easy to install, since the spindle is right up in front of the user. Height adjustments are just as easy.

(anyone with a little time to practice can produce their own profiles using a grinder). Or buy already cut shapes. Molding heads typically cost about $60 for a 3/4" knife or a bit more, while blank 2" knives are around $25 a pair. Already shaped two-knife sets range from $50 to $60 or so, depending on complexity of the molding, manufacturer, and so on. This flexibility is simply not available for router bits.

All that may sound as if the shaper is the ideal tool, even for the hobbyist woodworker. Unfortunately, the cost of that great variety of cutters keeps it from being as big an advantage as it might seem.

To make the comparison a little muddier, many small shapers offer an accessory which allows you to use router bits in the shaper.

Final Judgment

Any woodworker deciding between getting a shaper or a router table needs to take into consideration (after the age-old question of affordability of the basic machine), how great a variety of profiles they expect to cut over the years, and how large some of these profiles will be. If the primary construction unit is boxes, and box joints are a near daily use while raised panels only come along a couple times a year, the router table, with the advantage of the removable router, is the certain choice. The shaper would be overkill, and the small, straight bits used with box joint jigs will not cut as cleanly at lower speeds on the shaper as they will at higher speeds on the router table.

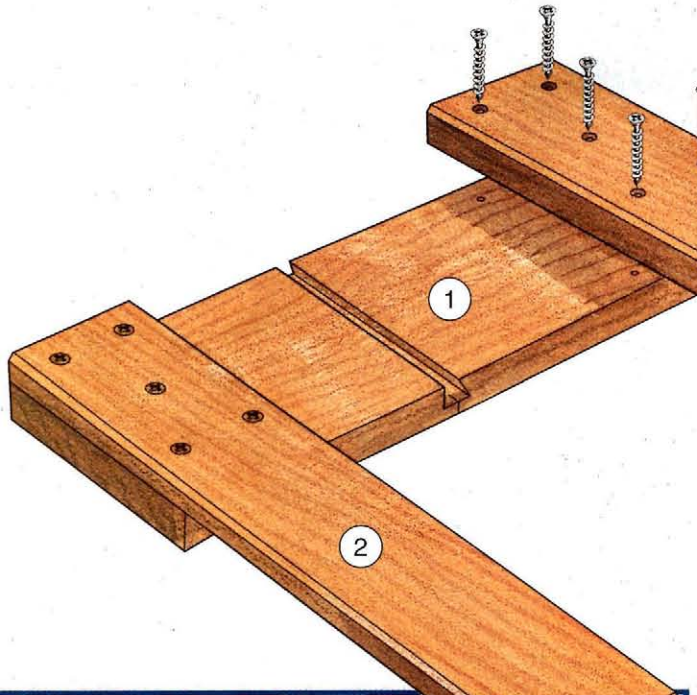
If things go the other way, and the hobbyist is determined to outfit the entire neighborhood with arched raised panels for kitchen and bath and rec room use, then the shaper is the way to go, as long as you're willing to accept the higher cost of the cutters.

For the average woodworker who has space and money for only a single tool, I'd suggest most consideration be given to the router table. For the advanced woodworker who expects to produce lots of raised panels, stile and rail doors, and large moldings, the small shaper is the sensible starting point. And I'm defining small shaper here as at least 1½ HP with an overall style similar to Grizzly's G1035. With all that said ... contestants ... to your corners!

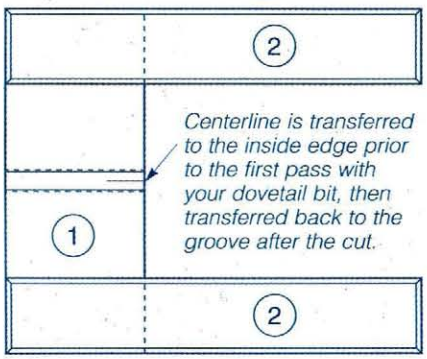
Charles Self is an award-winning author who regularly reviews tools and woodworking products for Woodworker's Journal.

Sliding Dovetail System

By Jack Gray



Groove Jig
(Top View)



In use, the author's sliding dovetail jigs are a study in simplicity — appropriate in light of his years at the Stickley furniture manufacturing facility. Here the groove is being plowed in one pass.

Working in the sample shop of a high-end furniture manufacturer was a challenge. Designers would come in with a blueprint of a new piece of case goods (where all the cross rails had sliding dovetails) and say: "I need this built by the end of the week." Early on I devised a two-jig system for sliding dovetails that would handle the tails and grooves without calculations. I relied on this system for the next 11 years. Sometimes I even made the groove jig long enough to be used for fixed shelves. Our rails and shelves were always 13/16" thick, so my preferred bit was a 3/4" dovetail on a 1/2" shank. I needed this heavy bit since all the cuts were made in one pass.

Making the First Jig

To use these jigs, you'll need to replace your router's base plate with a 6" square piece of 1/4" Lexan or other sheet plastic. The hole in the center should be 3/4" diameter to minimize the throat. For the groove jig itself, use a piece of stock 3/4" thick, about 4" wide, and at least a foot long for the base (piece 1). Lap join one arm (piece 2) perpendicular to the base, as shown above. Place your router (with its new plate) on the base, position the second arm parallel to the first and clamp it in position. Slide the router back and forth in an even, smooth action and adjust the arm as needed. Secure the second arm the same as the first.

Chuck a V-groove bit in the router to project ever so slightly from its base. Score the base with this setup to create a centerline on the jig. Transfer the scoreline onto the front edge of the jig with a square and knife. Now chuck your dovetail bit into the router and set the depth of cut to 3/8". Rout fully across the base of your jig and extend the centerline with a knife inside this cut. That's it ... the first jig is ready.

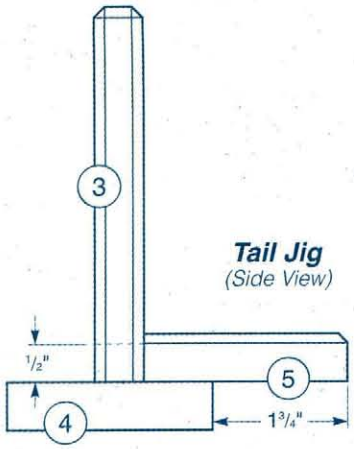
Using The Groove Jig

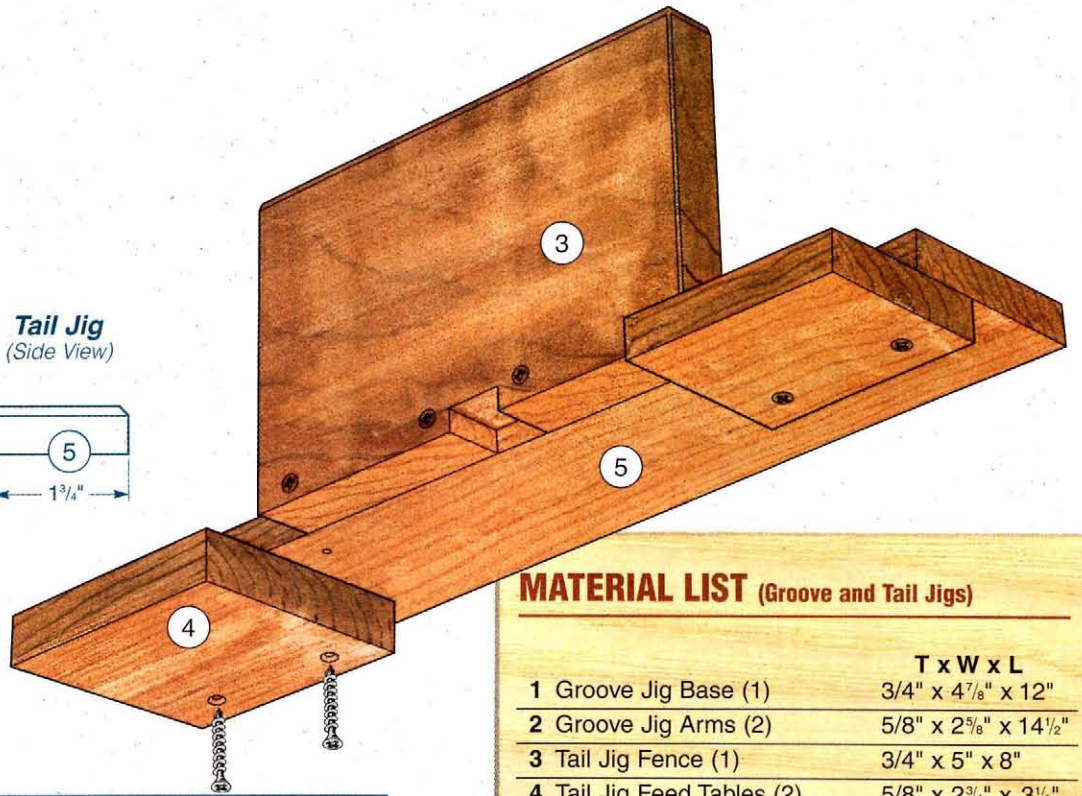
Position your jig so its centerline is perfectly lined up with the layout line of your desired dovetail. Clamp the jig, stock and bench together and you're ready to plow your first groove. You can use this jig when you're forming rails, fixed shelves, toeboards and shelf supports.

Making the Second Jig

Don't change that dial!

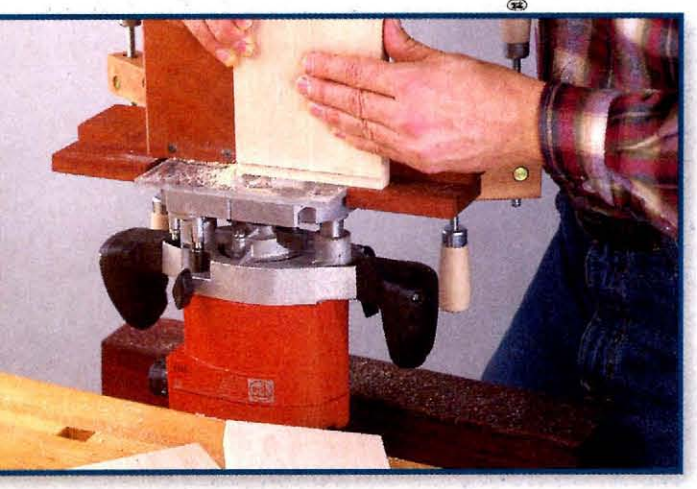
The beauty of this sliding dovetail system is that by using the same router, setting and base plate to form both the groove and tail, you can virtually eliminate errors. As you can see from the *Drawings* above, the tail jig is equally simple to make: just





MATERIAL LIST (Groove and Tail Jigs)

	T x W x L
1 Groove Jig Base (1)	3/4" x 4 7/8" x 12"
2 Groove Jig Arms (2)	5/8" x 2 5/8" x 14 1/2"
3 Tail Jig Fence (1)	3/4" x 5" x 8"
4 Tail Jig Feed Tables (2)	5/8" x 2 3/4" x 3 1/2"
5 Tail Jig Base (1)	5/8" x 2 3/4" x 14"



Unlike any dovetail jig we've ever seen, the author's tail jig is clamped directly to the router base. With the router secure in a vise, the operation is smooth. Switching back to the groove jig only takes a moment.

a tall fence (piece 3) with small infeed and outfeed tables (pieces 4) all screwed to a base (piece 5). Cut a small notch into the center of the fence to fit the bit, then assemble the pieces with glue and screws. It's all clamped to the router's new 6" square plastic base plate. Rail stock will be run vertically across the face of this jig, another advantage of the new base plate — you get a nice smooth surface with a small throat.

Using the Tail Jig

Clamp your router in the inverted position. I used to just clamp mine in the tail vise of my bench, but now I use another jig to hold it more efficiently. Clamp the jig to the router base with the bit projecting just past the edge of the fence.

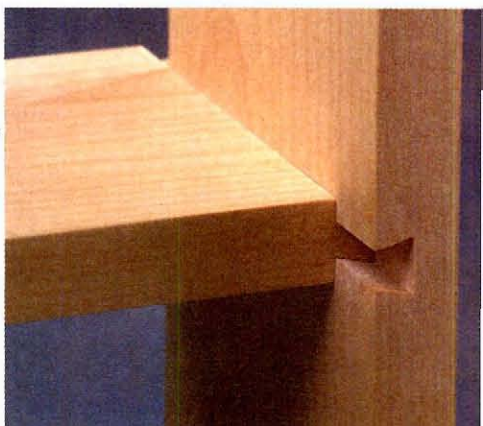
The only trial-and-error adjustment in this whole system is arriving at the width of your dovetail. By using a few pieces of scrap stock, you can easily establish the proper size by adjusting the position of the jig and testing the fit in the groove. Once you get it right, all of your cuts will be correct because you have not changed the depth of the cut.

While this system will guarantee you perfect sliding dovetails when used correctly, it also demands control and organization on your part. All of your pieces must be cut to length and sized before you start. And remember, once you set your router depth it cannot be changed until all of the cutting is completed.

Case Good Tips From an Old Pro

When assembling case goods, it's helpful to use clamps to hold the sides and pull them together, in case there is any bow in them. Also, it doesn't hurt to clamp the sides at each rail until the glue dries. And speaking of glue — polyurethane glue in a sliding dovetail is like grease. It doesn't swell the wood like carpenter's glue, and it's not tacky either. Sliding a fixed shelf into position with any other glue is an absolute nightmare. Just trust me on that.

Jack Gray is retired from L. & J.G. Stickley, Inc., founded by Gustav Stickley's brothers. While there, he created these jigs to aid in making sliding dovetails — found on all Stickley case goods — for prototypes and special orders.



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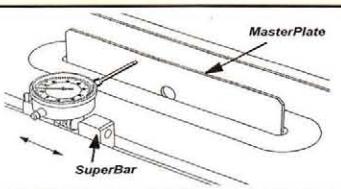

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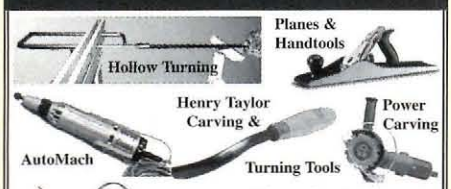

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Craftsman 27511 Plunge Router

By Rick White

A star performer of our February 2000 *Monster Plunge Router Shop Test*, the Craftsman 27511, found its way into contributing editor Rick White's shop, where it soon became a favorite whenever power and accuracy were needed. Its smooth operation and dependability over the long haul have led the Craftsman 27511 plunge router to the spotlight as one of *Woodworker's Journal's* "Tools that Endure."

In our February 2000 roundup of seven *Monster Plunge Routers* (machines claiming at least 3 HP), Rick Christopherson cited the Craftsman as having the best plunge lock, a conveniently placed trigger switch and a handy variable control switch — all strong features if, like me, you use plunge routers mostly for hand-held jobs.

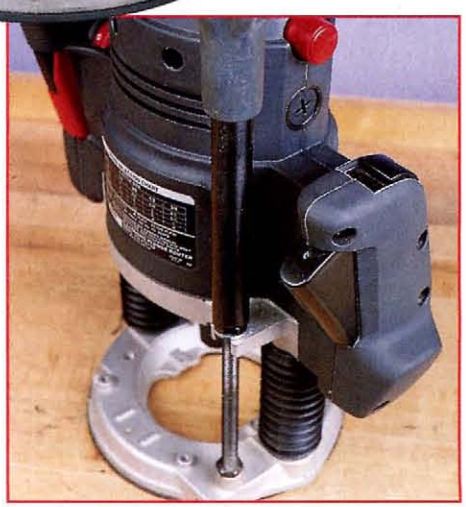
Although power is very important when evaluating the capabilities of any production quality router, for me accuracy is really the key measure of quality. And when you are talking plunge routers, smoothness of operation is one of the most important contributors to accuracy.

In my opinion, smoothness is not just how well a plunge router slides up and down on its plunge posts. It also includes: speed control operation, power switch location and ease of use, as well as depth stops and plunge locks (some plunge router's stops are just a joke!).

Trial By Fire

About the time I read Rick's evaluation, I decided to create a bedroom set (an ash and walnut queen-size bed and bowfront bureau that later showed up in *Woodworker's Journal*). These projects were large and required some heavy-duty router work. Always willing to help, I was more than happy to say yes when editor Rob Johnstone asked me to do an extended durability test of the Craftsman plunge router. (I figured ...why not burn up a test router instead of my own?)

I used the Craftsman 27511 for over 18 months, and I really put it through its paces. Everything from shaping with large diameter raised panel bits (I used to use a router table for these cuts) to one-pass routing of 3/4" wide by 3/8" deep dadoes through hardwood, to cutting angles off the end of 3/4" hardwood plywood with a straight bit. Regardless of the task, the Craftsman did the job accurately and without complaint. To my surprise, the real strong point of this tool was its toughness.



The major controls of this router are well placed and easy to operate. The plunge lock is controlled by the trigger on the router's left handle.

WOODWORKER'S TOOLS THAT ENDURE JOURNAL

Woodworker's Journal's "Tools that Endure" have undergone serious hard use in the shop and have stood the test of time. We congratulate winners of this award for producing tools of superior quality and lasting craftsmanship.

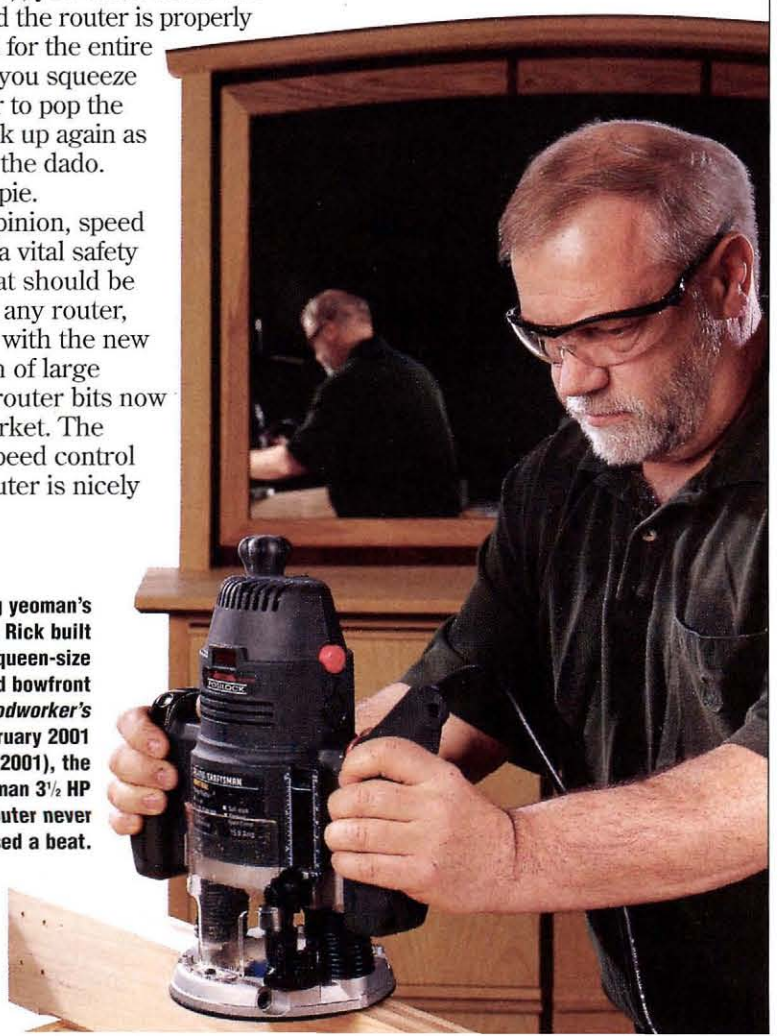
Great Features

It is one thing to have a bunch of great features, but it is even better for those features to be easy to access and use.

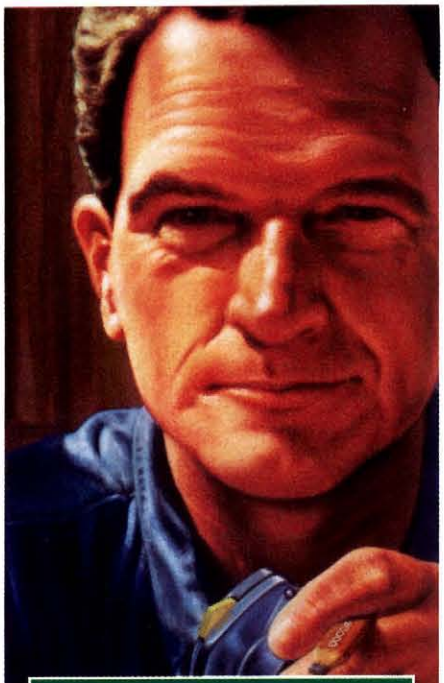
Like the original tester, I particularly liked the plunge lock control being on the left handle. This is a common sense feature that adds significantly to the ease of operation. For example, as you begin to plow a dado with the router, this simple control allows you to engage the cutter into the workpiece until it reaches the proper cutting load (we all know what that sounds like); you then release the trigger and the router is properly positioned for the entire cut. Then you squeeze the trigger to pop the router back up again as you finish the dado. Simple as pie.

In my opinion, speed control is a vital safety feature that should be a must on any router, especially with the new generation of large diameter router bits now on the market. The variable speed control on this router is nicely placed for ease of use (under your thumb as you hold the router). And while I find this router is at its best as a hand-held unit, it is a real workhorse when mounted in a router table.

Tough, powerful, well-designed and easy to use. For these reasons and many more (like an easy and safe to use spindle lock), I heartily recommended that *Woodworker's Journal* select the Craftsman 27511 plunge router as a "Tool that Endures."



Doing yeoman's duty as Rick built a matching queen-size bed and bowfront bureau (*Woodworker's Journal* February 2001 and August 2001), the Craftsman 3½ HP plunge router never missed a beat.



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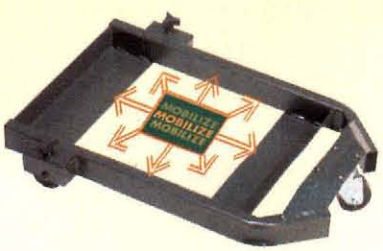

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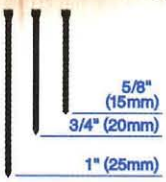

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Rubbing Out a Satin Finish

By Michael Dresdner

Would you like to know the secret to a smooth professional finish that cries out to be touched? It's rubbing out, a simple process that you'll want to do on every piece that you finish. Whether you brush or spray, it seems that no matter what you do to avoid it, you'll always get some bits of dust, air bubbles, brush marks or orange peel in the last coat. A good rub-out is the solution.

What is Rubbing Out?

Rubbing out, or simply "rubbing," is the process of smoothing the surface of a finish after the last coat has dried. Done right, it leaves the surface looking uniform, but more important, it imparts a smoothness that is a delight to the touch. Rubbing can remove small nibs or bits of dust, smooth overspray, reduce orange peel or brush marks, or even up irregularities in sheen — the measure of how shiny or dull the surface looks. This process is most important on surfaces that are easily seen or touched, like the tops of tables, desks, or sideboards, but you can rub any and all areas of a piece if you like.

Technically speaking, you can change the sheen by rubbing, but it is not a good idea. You can take a gloss surface and rub it down to satin, and you can rub a matte surface up to satin, but it is a whole lot easier to start with a satin finish if that is what you want the final rub to be.

Which Finishes Get Rubbed

Contrary to popular belief, any type of finish can be rubbed, including shellac, lacquer, oil varnish, polyurethane, conversion varnish, and waterbased coatings. Some may take more "elbow grease" and some are easier, but all are candidates. What's important is to wait until the finish is cured before you rub. For example, you can usually rub shellac or lacquer to satin just a couple of days after the last coat has dried, but oil varnish may need a week or more to get hard. You can even rub very thin coatings, like oil finishes or very thin wipe-on varnishes, but it takes a lighter hand so that you don't wear through the finish.

While you can rub too soon, there is no limit in the other direction. For example, you could rub the finish on an old tabletop to bring back its original sheen, feel, and beauty. Simply clean off any dirt, wax or grease on the surface with a TSP solution or mineral spirits, then rub just as you would a new finish. The only limitations are that the finish must be thick enough so that you don't wear through, and in good shape with no areas that are peeling or lifting. After all, rubbing is an abrasive process, and as such it can dislodge any loose finish.

Rubbing to Satin

The object in a satin rub is to leave a uniform set of fine scratches on the surface of the finish — something like the look of "brushed brass." Let the coating

continues on page 78 ...

With just a few basic supplies you can rub a finish to a smooth satin sheen which is silky to touch.

The first step in "rubbing" is gently sanding the cured finish. The author recommends using either the gray/white or gold self-lubricating 400 grit sandpaper.

cure at least two days for fast drying finishes like shellac and lacquer and at least a week (longer if you can wait) for oil varnish and polyurethane. Waterbased finishes vary, but I'd play it safe and wait three weeks or longer. Some waterbased finishes are sensitive to the solvents found in paste wax, and lit may take weeks for them to fully cure. There are just four simple steps to a satin rub and, like most finishing, the first one involves sanding.

Start by Sanding

Use 400 grit or P800 grit stearated (self-lubricating) sandpaper to rid the surface of any raised nibs or rough spots. Don't sand any more aggressively than you must — the point is simply to remove any rough areas and dust nibs. In many cases, it will take only seconds to remove the stray nibs, but surfaces with slight orange peel or brush marks will need a bit more attention. Fold the paper in thirds and use just the weight of your hand to lightly scuff sand the finish. Be very careful near the sharp edges of the furniture to avoid sanding through.

Steel Wool and Wax

Take a pad of 0000 steel wool and dip it into some paste wax (any brand will do). The wax will help lubricate the rubbing pad and make the fine scratches more uniform. Hold both hands flat, one atop the other, on top of the pad. Press down and rub the surface with the grain. On an inlaid or parquet top, simply choose one direction to rub, usually along the

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length. Start by carefully rubbing the ends, but hold your hand flat and fingers straight so you don't roll over any sharp edges. It's easy to miss the very end when you do the primary rub, so hitting them separately first makes sense. Now go back and, with substantial pressure on the pad, rub back and forth with the grain. Rub in a perfectly straight line and avoid "Chinese bridges." Make long, even strokes from one side of the panel or top to the other. Overlap slightly on the next stroke, just as you would when brushing or spraying finish. When you have made your way going side to side from the front edge to the back edge, continue rubbing and head back the other way. When you return to your starting edge, you'll have made one full pass. I do six full passes, adding extra paste wax if the pad gets too dry. Don't worry about applying too much wax — we'll be removing it directly.

Wiping Off the Bulk of the Wax

With a soft cloth, or some of those ubiquitous blue Scott shop towels, wipe off all the wax you can as soon as you are finished rubbing. Don't wait to let the wax dry or you will have to buff it off, and that will make the surface shiny. Our objective here is to keep it satin. Get off as much as you can wipe immediately. Now take your thumb and, pressing firmly, swipe it across any part of the rubbed top. Chances are, it will leave a smear, indicating that in spite of our best efforts, there is still too much wax left on the surface. A smeary top is not what we are after, so the last step is designed to remove all the excess wax.

> "It's best to think of rubbing not as a way of changing sheen, but of adding uniformity and a good tactile sensation."

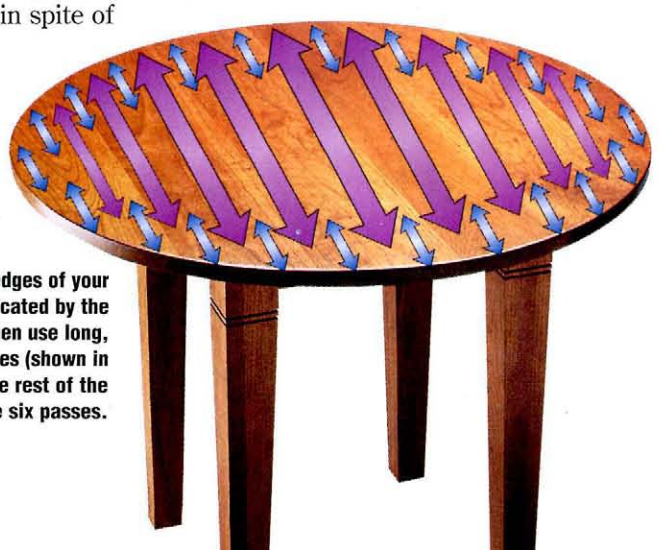
Removing Excess Wax

Sprinkle a bit of cold water over the entire surface, or mist some on with a pump sprayer. Take a new 0000 steel wool pad and, using no more pressure than just the weight of your hand, go back and carefully repeat your rub pattern one more time. Go side to side from the edge nearest you to the farthest edge. Now stop, flip the pad to the clean side, and continue this gentle rub back to your starting edge. You'll notice that the pad has picked up quite a bit of wax. That's because the cold water helped congeal the wax so that the steel wool could cut it off rather than continue to smear it around. While most will be removed, a very thin coating — just enough, in fact — will be left on the surface. It should be enough to make the surface feel good, but not enough to smear. Now wipe off the water with some clean towels and feel the surface. It should be smooth as silk with a uniform satin sheen.

Rubbing Wipe On Finishes

This rubbing method works great for any finish, provided it is thick enough to withstand all that steel wool work. After all, even 0000 steel wool removes finish, albeit slowly. But you can get the same nice look and feel over very thin coatings, and even wipe-on finishes. Oil finishes sometimes come out smooth and dust-free all by themselves. But if you use shellac or polyurethane gel as a fast build wipe-on coating, you can wax it and smooth it in one quick step.

As before, sand VERY lightly with 400 grit or finer sandpaper, just to remove any dust nibs or rough spots. Once again, dip a 0000 steel wool pad into paste wax — use plenty — and rub, using only moderate pressure with the grain of the wood. Do only one pass in one direction, then wipe off all the wax aggressively with clean towels as soon as you finish. That's it. The wax will add a smooth feel and even appearance to the thin coating, and your furniture will still retain that "woody, natural" appearance typical of very thin finishes.



Rub the very edges of your piece first, as indicated by the blue arrows. Then use long, straight strokes (shown in purple) to rub the rest of the piece. Complete six passes.

Contributing Editor Michael Dresdner is an expert woodworker and finisher. Look for his newest book, Build Like a Pro: Painting and Finishing, *from Taunton Press in April 2002.*

(Circle No. 3 on PRODUCT INFORMATION form)

(Circle No. 128 on PRODUCT INFORMATION form)

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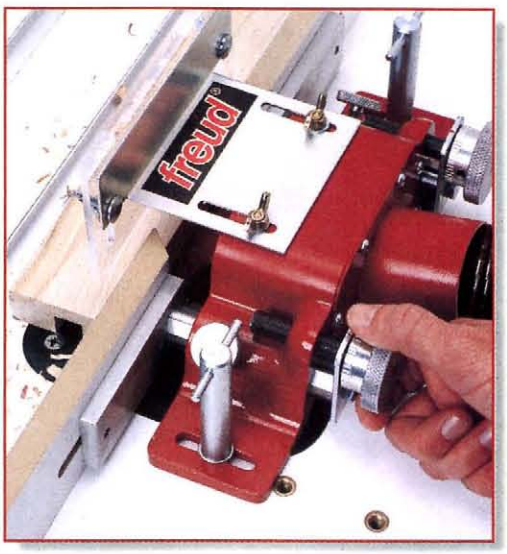
Tools That Make It Look Easy

Freud's New Split Router Table Fence



Freud, Inc.'s new SH-5 Professional Router Table Fence is split. The SH-5 gives your router table the control and precision of a high-end shaper machine.

Twin micro-adjusting knobs are infinitely adjustable, with indicator marks graduated by .001". Infeed and outfeed fences adjust separately and have a 7/8" range for jointer use or other applications. Russell Kohl, vice president of marketing and sales, thinks woodworkers will like the SH-5. "They can create their own unique router table for the fence, customizing it to their preferences, such as height, size and materials," he said.

The SH-5 sells for a street price of $99.99. *For more information, call 800-334-4107 or visit* www.FreudInc.com.

A Totally Modular Shop System

Tool Dock™ is "an innovative system of modular, mobile, multi-functional workstations." What that means is that the company has designed cabinets and workbenches around just about every bench top power tool.

For tool setup and change-over, attach a standard tool-mounting insert to the bottom of each machine, then use the same base for numerous machines. Store your tools when not in use, and when you're ready to go to work, just drop the tool in place and lock it down. The system accommodates different body sizes and "brings tools to a common, manageable work height, allowing the user to customize their workshop to their own specifications." It features steel cabinet construction, 1¼" thick tops, plenty of dust collection ports, adjustable height, casters, leveling feet, drawers and shelves. Prices range from $122 for a tool crib to $257 for a shop bench. *For more information, you can call 866-866-5362 or visit* www.tooldock.com.

Cutting For One

A one-person shop can be a problem when you need to cut large panels of wood. The PanelPro® panel saw from Safety Speed Cut Manufacturing aims to be your solution. Your wood is supported on a soon-to-be-patented vertical frame made of 16-gauge steel, while the 12 amp Bosch saw motor operates from behind the panel. The PanelPro has a vertical crosscut capacity of 50" and — with one person — a horizontal ripcut capacity of eight feet. (With a helper, you can rip longer boards.) The saw head easily rotates 90° to facilitate switching between these applications.

To ensure accurate cuts, the entire PanelPro system is aligned to 1/32" tolerance. Computer-located mounting holes for the lower fence and custom-produced steel guide tubes maintain this accuracy. The PanelPro also features graphite-impregnated nylon bearings, which ride smoothly on the guide tubes and automatically expel sawdust when the saw is in use. The PanelPro sells for $699.

For more info, call 800-599-1655 or visit www.panelpro.org.

continues on page 86 ...

Make Your Own Floating Tenon Stock

A few years back, beadLOCK™ made it possible for woodworkers of any skill level to create floating mortise and tenon joinery, using the company's jig and a standard drill. You just drilled both mortises, then cut off a piece of their patented hardwood tenon stock and glued it into the mortises. Now, the company has gone a step further: they're offering router bits that let you make the tenon stock yourself instead of ordering it pre-cut from the factory.

beadLOCK's new Tenon Stock bits are carbide-tipped and available in both 3/8" and 1/2" sizes, to match the mortises made by their jig. With safety in mind, the router bits are only "intended for use on stationary router tables." Your table should be equipped with a fence, and the stock must be milled in several passes.

One big advantage to the new bits is that woodworkers can make their own tenon stock in any wood species desired, so now you can even experiment with exposed, decorative tenons in matching or contrasting species. The bits come with a 1/2" shank and according to company spokesperson Lora Benway, "they will retail for $80 each." *For more information, call 920-485-0350, or visit them at* www.beadlock.com.

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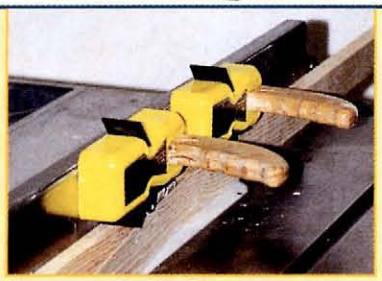

Get a Grip!

Mesa Vista's two new Grip-Tite systems use abrasive rollers to keep the work tight against the fence and prevent kickback on any saw. A 14-gauge metal plate attaches to the fence on your tool, giving the magnets a solid base to grab. According to a company spokeswoman, the "rollers are installed at an angle, so a single operator can run large sheet goods through the saw without help." The GT 2000 sells for $39.95 (A retrofit is available). *For more info, call 800-475-0293 or visit* www.grip-tite.com.

First in Its Field

Bosch's 1678 is the first top-handle worm drive circular saw. They say it's a way to give consumers accuracy, durability and power. A 3 HP, 15 amp motor is useful for a broad range of applications, while a 32-bar commutator provides efficient transmission of electricity. The largest armature and field combination found among circular saws helps the 1678 dissipate heat and deliver more power. Taller and deeper gear teeth (800 percent more contact area than in sidewinder gears) maximize the contact area and, again, provide a higher load capacity. A steel drive gear and bronze-aluminum alloy output gear expand at different rates to prevent gear binding. To increase accuracy, the blade was designed for less axial "play," and for a less obstructed view of the cut line, the blade was positioned on the left side. Finally, five ball bearings (four is standard) provide additional stability and strength for the motor and gears, with an advanced oil lubrication system maintaining higher viscosity for longer gear life. Street price is $199.99. *For more information, you can call 877-267-2499 or visit* www.boschtools.com.

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1 Panel Bit
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2 Slot Cutters
1 "V" Groove
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- Straight Bits= 3/4"R, 1/2"R, 1/4"R
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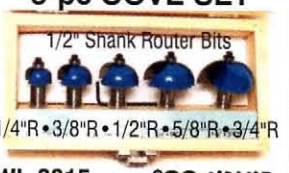

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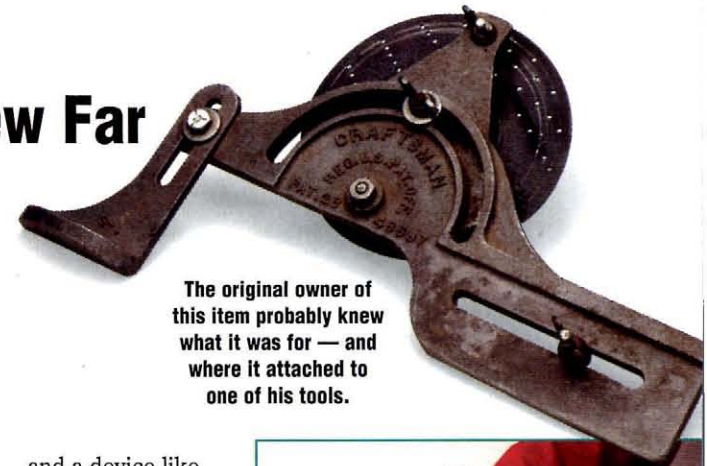
Sew Close, Yet Sew Far



The original owner of this item probably knew what it was for — and where it attached to one of his tools.

It's funny how you can grow attached to something — even if you don't know what it is. That's the case for **G. F. "Fin" Lackey, Sr.** of Boaz, Alabama, and his "tool," at right. "This attachment was given to me by a great friend who made his living in woodworking and could do anything — and even he did not know what its purpose is," Fin told us.

Let's hope *Woodworker's Journal* readers can clue Fin in to the true purpose of his attachment: Clues: the name is Craftsman; the patent number is 2646697.

Sew, meanwhile, let's look back at **Bill Clough's** tool. The Pennsylvania man's tool was originally featured in our October 2001 issue, and we reprinted it in the February issue because we had received so few responses. That second showing caused a few of you to brush up on your German. **Don Scott** of Lubbock, Texas, even thinks that "12 years spent in Germany while in the Army might be paying off."

Here's his mini-German lesson for us all: "The tool is from the firm Strobel Sons. From the inscription you describe, they manufactured (Fabrik = fabricated) Spezial (Special) Sewing machines (Näh = sewing). Maschinen means machines. The company was founded (gegrundet) in 1883. The rest of the data is the address; 70 Heimran Street, München."

Hildegard Lombardo of Grapevine, Texas says that's in Munich: "The correct spelling in German is Muenchen or München." She saw a similar item for sale on the German version of eBay, which was identified as a hand stitcher with pattern tracer.

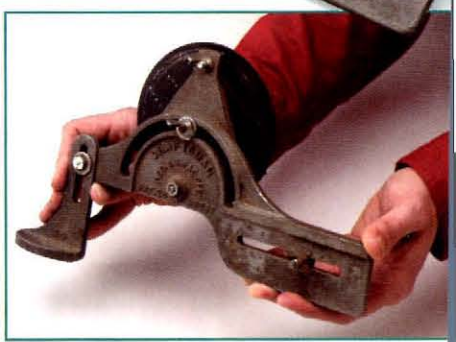
Almost everybody agrees that the tool relates to sewing. It's still not clear, though, exactly what the relationship is. An incarnation of the Strobel company is still in business, but, judging from their responses to our e-mails, they must not know what it is either.

A marvel of German engineering: a special sewing device that does ... something.

Shannon Miller of Kirtland, Ohio, echoes the tracing wheel theory. "A crude tracing wheel is still used by some home seamstresses. Manufacturers would need a more precise tool."

"The way it was described to me," says **John Reed** of Delano, California, "was that a washable carbon type paper would be placed between the pattern and the material and the tool would be run over the pattern, while the little spur wheel would leave dots on the material for the seamstress."

Bill McGraw of Neosho, Missouri, says his wife called it a hem stitcher. "She recalls her mother taking tablespreads, handkerchiefs, pillowcases and other flat goods to a laundry and a device like this was used to put a hem on them." Bill's wife thinks it was actually an attachment for a sewing machine. The spike wheel made an opening in the fabric weave and held it open while the needle did the stitching. The reason for this, she adds, was to make a series of evenly spaced holes to provide a starting place on the cloth edge for the stitcher's crocheting.



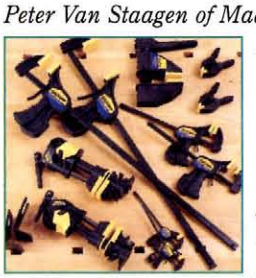
Our latest mystery tool is 13" long, 6¾" high, with an adjustable foot on one end which can be adjusted for a total unit height of 8½".

Robert Everett of Denton, Texas, talked to some older German friends, who told him the tool was a handheld sewing machine: "It's held like a pistol with your thumb on the top of the upper bar," he said. "A plunging action moves the needle found on the front of the tool."

The leather stitching theory was put forth by several readers. "The star-shaped piece seems to be a stitch marking wheel, used for premarking leather to be stitched," says **Daniel J. Hinojosa** of Glendora, California.

Finally, **Edward Funk** of Terre Haute, Indiana, offered a good summary: "It is a very old sewing tool. I have looked at the picture closely, and can't see how it would be used to sew... but then I can't sew anyway!"

WINNER! *For taking the time to respond to Stumpers, Peter Van Staagen of Madison, Alabama wins a collection of*



American Tool's Quick Grip clamps. We toss all the Stumpers letters into a hat to select a winner. Send your question or answer to Stumpers Dept., Woodworker's Journal, P.O. Box 261, Medina, Minnesota 55340. Or e-mail: jtakes@woodworkersjournal.com

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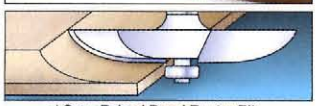

*Cove Raised Panel Router Bit

*Ogee Combination Rail & Stile Bit

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1 Round Over (3/8"),
1 Roman Ogee (5/32")
1 14° Dovetail (1/2"),
1 Rabbeting (3/8")
1 Panel Pilot
1 45° Chamfer,
1 Flush Trim (1/2"),
1 Hinge Mortising (1/2"),
1 Round Nose (1/4")
1 V-Groove (3/8")
1 allen wrench and
1 bearing to convert Round Over into Beading bit.

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6 Round Over (1/8", 3/16", 1/4", 5/16", 3/8", 1/2")
5 Straight (1/4", 5/16", 3/8", 1/2", 3/4")
1 Chamfer (45°),
1 Slot Cutter (1/4"),
1 Rabbeting (3/8")
1 V-Groove (1/2"),
1 Bevel (25°)
1 Panel Pilot (3/8")
3 Round Nose (1/4", 3/8", 1/2"),
3 Dovetail (14°-1/2", 5/8" & 9°-3/8")
2 Roman Ogee (5/32", 1/4")
1 Allen Wrench and 1 bearing to convert Round Over into Beading bit.

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1 Point Cutting Round Over (1/2"),
1 Flat Bottom Round Over (1/4" r),
1 Multi Bead/Reed Bit (1/8" r),
1 Double Round Over (5/32" r),
1 Cove Sign Lettering (5/8" 60°),
Chamfer (30°, 22.5°, 15°),
4 bearings & allen wrench

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- **Round Over & Ogee Door Lip** (1-1/4")

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SET #1452

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16 Piece Forstner Bit Set

Includes these sizes:
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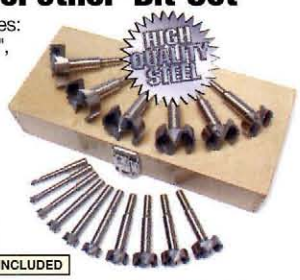

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