

COMPARE **88** ROUTERS: THE ULTIMATE BUYER'S GUIDE

WOODWORKER'S JOURNAL

"America's leading woodworking authority"™

10

Super Cool Router Bits

You'll save time, effort and MONEY!

page 66

Power Waxing:

Do You Know the Secret?

page 106

Build a Rugged Entry Bench

Bonus — It's a Chair Table Too!
page 44

PLUS:

Classic Mission Chair

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December
2008

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Woodworker's Journal

Features

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By Ian Kirby

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The Southwest's iconic wood — is it good for lumber, or best left for smoking food on the grill?

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52 Modular Shelving System

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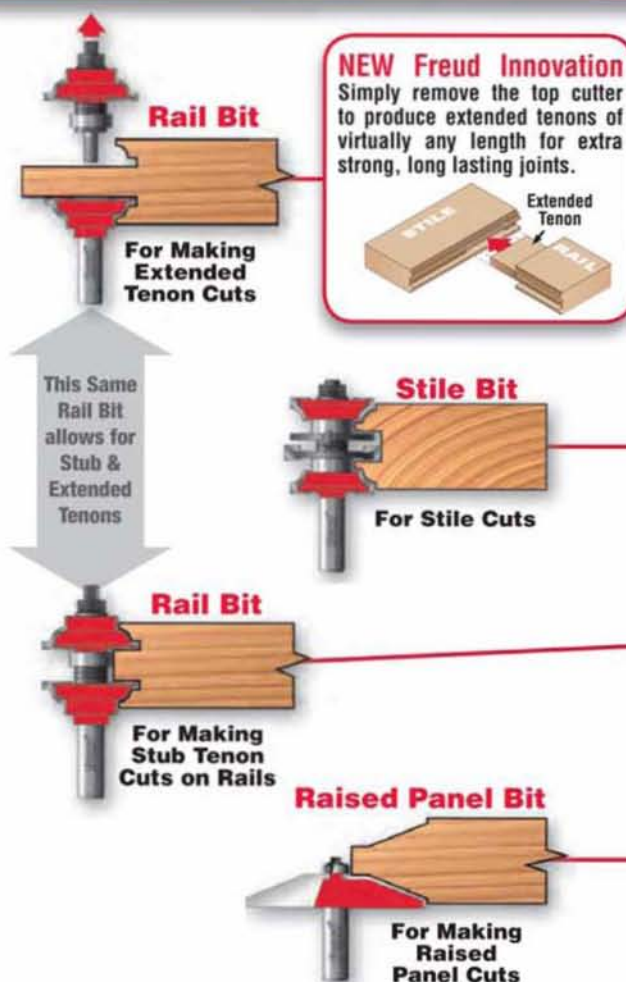
By Bruce Kieffer

This Mission-style chair, inspired by an original with Stickley ties, is currently found only in the Grand Canyon's historic El Tovar hotel. Next stop ... your dining room!

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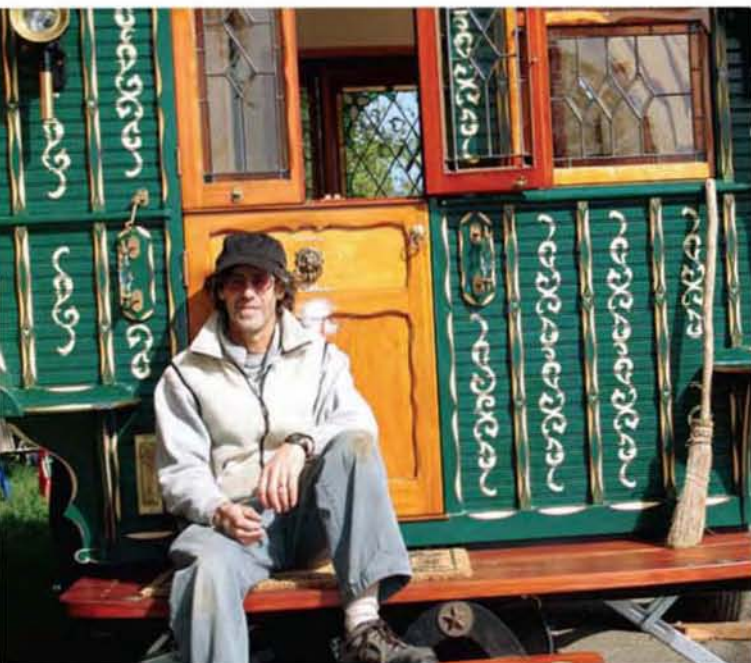
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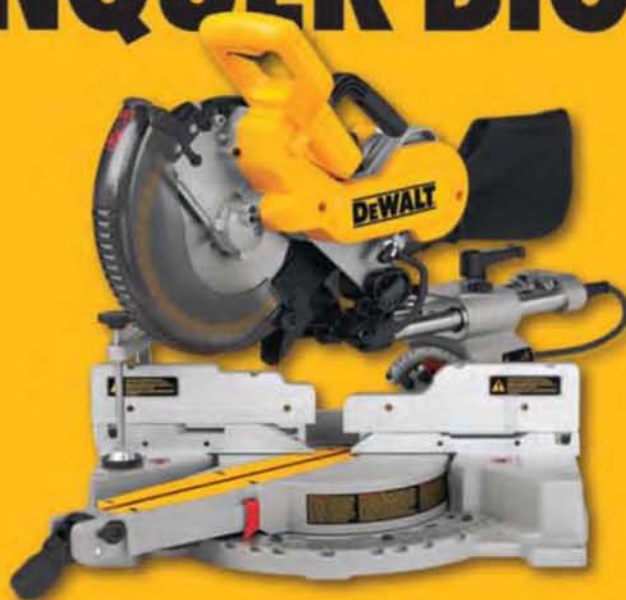
Field editor Chris Marshall has assembled the most comprehensive router guide you've ever seen.

100 What's In Store

News of the new Unisaw and more tools set to hit the shelves soon.



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Bosch	M1050S	\$249	Fixed	3.0	10,000	1/4", 1/2"	Yes	Variable speed	800-451-7000
DeWalt	DW745	\$249	Fixed	3.0	10,000	1/4", 1/2"	Yes	Variable speed	800-451-7000
Festool	OF 7300 E6	\$899	Fixed	3.0	10,000	1/4", 1/2"	Yes	Variable speed	800-451-7000
Festool	FT2000R	\$599	Fixed	2.0	10,000	1/4", 1/2"	Yes	Variable speed	800-451-7000
Festool	FT4000VC2	\$249	Fixed	2.0	10,000	1/4", 1/2"	Yes	Variable speed	800-451-7000
Hitachi	MR302	\$249	Fixed	3.0	10,000	1/4", 1/2"	Yes	Variable speed	800-451-7000
Hitachi	MR3502	\$249	Fixed	3.0	10,000	1/4", 1/2"	Yes	Variable speed	800-451-7000
Makita	TRAC	\$249	Fixed	3.0	10,000	1/4", 1/2"	Yes	Variable speed	800-451-7000
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Tolson	304001	\$249	Fixed	3.0	10,000	1/4", 1/2"	Yes	Variable speed	800-451-7000

Features Key: HP = Horsepower; WPM = Working Per Minute; Fixed = Fixed base; Variable = Variable speed; 1/4" = 1/4" collet; 1/2" = 1/2" collet; 1/4" = 1/4" collet; 1/2" = 1/2" collet.

Visit WJ online for our new router buyer's guide!

More on the Web ... Even if you already think Chris Marshall's roundup of routers in this print issue is something special, you ain't seen nothin' till you check it out on the web. Use our free, searchable buyer's guide to take the plunge into finding what you need in a router — you can search by base style, horsepower, collet size or many more features — and get the results right away. If you're in the market for a router, the searchable router database you'll find under the More on the Web tab at our homepage is just about the greatest thing since sliced bread (or at least Forstner bits).

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MORE ON THE WEB



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woodworkersjournal.com ... Woodworker's Journal is not just a print magazine anymore — we've gone digital. You can now find a preview of the digital issue, complete with video slide show, plus live links! Find the digital issue by going to the convenient link on our homepage at www.woodworkersjournal.com.



Premium eZine ... With the holiday season approaching, it's time to get busy in the shop! If you're looking for more great project ideas, check out the downloadable plans available to subscribers of the *Woodworker's Journal*

Premium eZine this November. Need to sign up for the eZine? Visit our homepage at woodworkersjournal.com.



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resourcedigest.com ... Don't forget to include the *Woodworker's Journal* Resource Digest in your web crawling: there's always the chance you might win a FREE tool for your workshop just by visiting!



Quik-Link ... What the heck happened to that wood? Some weird router bits, that's what. Track them down directly — along with the new products featured in this issue's *What's In Store* — on their manufacturers' web sites through the **Quik-Link** section of woodworkersjournal.com (after you've read all about the bits in *Today's Shop* on page 66 and the other tools in *What's In Store* on page 100, of course).

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QUIK-LINK

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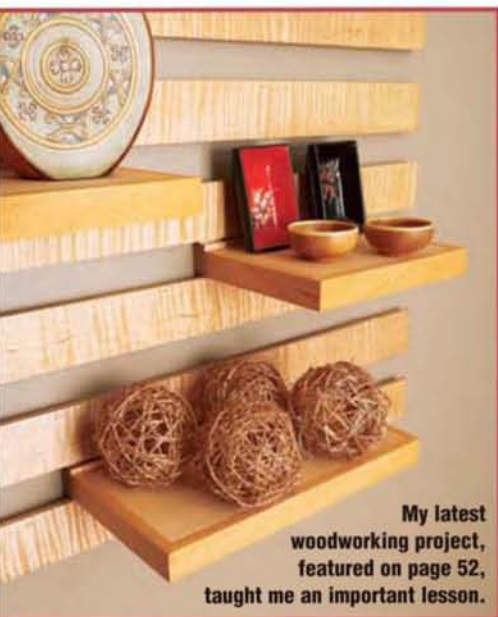
Patents Pending

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Life Lessons from the Shop

Lately I've been thinking about the lessons woodworking teaches us, and how those lessons extend to our lives beyond the shop. No matter your style or skill level, there is something to be learned every time you work in your woodshop. And when you emerge, and put the fruit of your labor on display for friends, family or clients to appreciate (or critique), you come away with a few more observations that have value well beyond the walls of your shop.

Some of those observations are practical ... others amusing: "If it doesn't fit, get a bigger hammer." (Or that saying's well-worn corollary: "If the only tool you own is a hammer, soon, all your problems begin to look like nails.")



My latest
woodworking project,
featured on page 52,
taught me an important lesson.

What else does woodworking teach? Warren Nelson, the foreman of my father's woodshop, was fond of saying to me: "In woodworking, it's never a mistake unless you can't fix it." I have heard Warren's voice in my head a thousand times and in a thousand different circumstances over the years. And his advice has helped me out of many a jam. More recently, the project featured on page 52 of this issue reminded me of another good lesson: "Listen to your wife and don't shop in hoity-toity catalogs." If that's not a life lesson, I don't know one when I see one.

In a more serious vein, I truly believe that there are valuable life lessons we all have learned in the woodshop. Here are a couple of mine, to help prime the pump: "A significant effort is required

if a quality outcome is to be achieved." And its partner: "A half-hearted effort will yield half-baked results almost every time." Field editor Chris Marshall offered up this lesson that I'll bet many of you have learned over the years as well: "In the shop, you are your own worst critic. The mistakes woodworkers fret over are almost always invisible to recipients of our work." And my publisher shared one of his with me as well: "Never tell any of your woodworking friends that you used bondo® body filler to fill a misplaced (and hidden) mortise." (After 18 years, he tells me, somebody will still reach for the bondo® whenever he enters the shop.)

I'm pretty sure that most of you reading this are the recipients of some hard-won woodshop life lessons — it just comes with the territory. Which makes me hope that you might want to share that woodshop wisdom with your fellow readers. What have you learned from woodworking: funny, serious or practical? Are there life lessons that you can share with fellow readers? Drop me a line with your woodworking maxims, and I'll feature them in our *Letters* department. Perhaps we all can benefit from your experiences.

Correction: In last issue's *Shop Test*, we incorrectly identified the Laguna Planer/Jointer Combo Machine in the story and its price. The correct information is:
Model: MJP0410-0175, **Cost:** \$2,495.

NOVEMBER/DECEMBER 2008

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Pining Away for Prettier Wood



Quartersawn longleaf pine was specified for this Arts & Crafts inspired bookcase.



A reader is unhappy with builder Frank Grant's recent choices of wood species for projects. In Frank's defense, editor Rob Johnstone selects species to ensure that readers learn about the characteristics of as many woods as possible.

A Matter of Taste

The bookcase on the front [of the *August 2008* issue] looked like it was made of pine. As I read through that issue, I noticed that several readers felt the same way as I did about the hideous bubinga table from a previous issue. It had a great top, a nice design and some really ugly legs.

Hmm, I thought, maybe I'm not crazy. So I got to the article about the bookcase and find that it was indeed pine, and it was built by Frank Grant, the table builder.

I like yellow pine. It is very strong and very cheap. I also use it for things where strength is needed but price is the key factor. It [also] makes for some fantastic painted kids' furniture.

I do not, however, find the grain pattern at all attractive. It is almost like a hideous American version of zebrawood. I am curious what my fellow readers think about this. Should we all chip in and send Frank some maple for the table and white oak for the bookcase? Or will there be a crowd digging through the 2 x 12s at the [store] next time I want to build some nice white painted furniture for my daughter?

Alex LaZella
Collinsville, Illinois

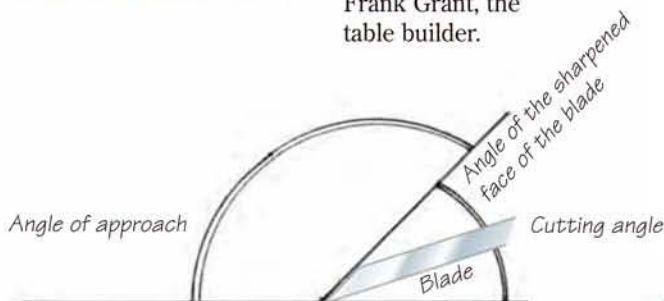
No Nomenclature

Curiously, we have no name for two angles — the angle at which the oncoming sharpened face of a plane blade, supported by the frog, meets the wood, and the angle of whatever is left to make up to 180° — handed down by respected woodworkers of the past. In the *August 2008* issue of *Woodworker's Journal*, on page 45 of an article called "Shoulder and Coachmaker's Rabbet Planes," between myself and the editors we managed to cause some confusion. To allay that confusion, here are the words I use for the two angles.

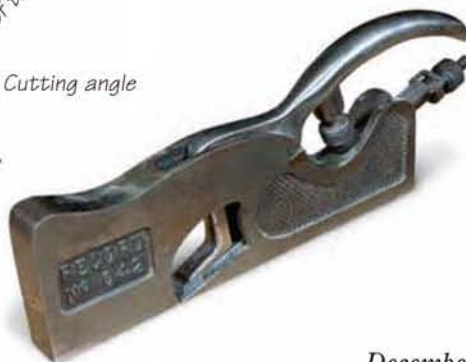
The angle of the sharpened face of the blade which is doing the cutting to the surface of the wood being cut is the *Cutting Angle*.

The angle forward of the sharpened cutting face of the blade (or cutting angle) is the *Angle of Approach*. I have seen this angle referred to as the Angle of Attack — which sounds too sinister for hand woodworking and planing!

— Ian Kirby



A bit of "plane speak" from master woodworker Ian Kirby.



Thin-skinned Turner?

I cannot help but reply to [Betty] Scarpino's reply to Dr. Higby's letter explaining the difference between a live

Continues on page 16 ...

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center and a dead center [Letters, August 2008].

Ms. Scarpino's thin skin must have prompted her sarcastic response. It is not "Tom's logic" — it is a statement of fact. Scarpino's sensitivity aside, the live center is indeed connected to the power source — I don't care if the connection is direct or by a belt.

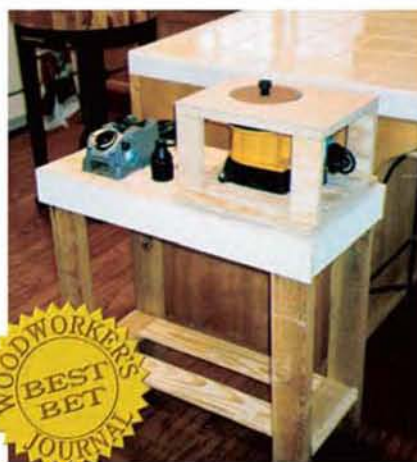
Please, Ms. Scarpino, spare me the emotional replies.

If you can't stand a man making a point, please get out of the workshop. Thick skin is a Y-linked recessive trait.

M.A. Eifrid
Plymouth, Indiana

Sharp Thinking

I read the excellent article "7 Power Sharpening Systems" [August 2008] by Bill Hylton



Ted Pietzrak agreed with our tool reviewer that the "Best Bet" Work Sharp needs a tool holder — so he built one. Find out how he did it by visiting our home page and clicking on the "More on the Web" icon.

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MORE ON THE WEB
For more about Ted Pietzrak's tool holder, go to woodworkersjournal.com and click on the icon above.

make some sort of tool holder." So I went ahead and did just that, and it

works perfectly to accurately sharpen all of my lathe chisels and all of my planes and even tools like knives and a hatchet. Here it is (see photo, above).

Ted Pietzrak
Auburn, California



Bob with the Domino

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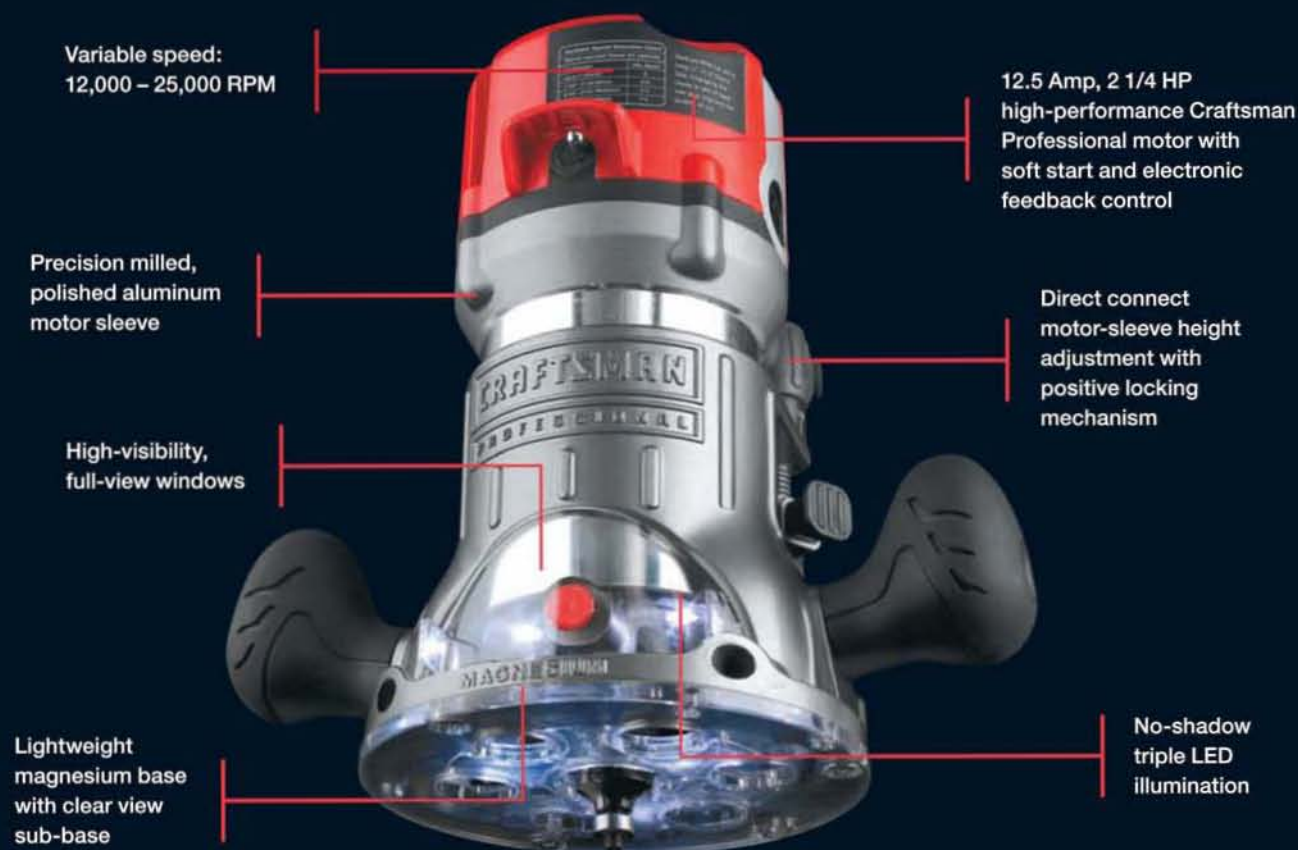


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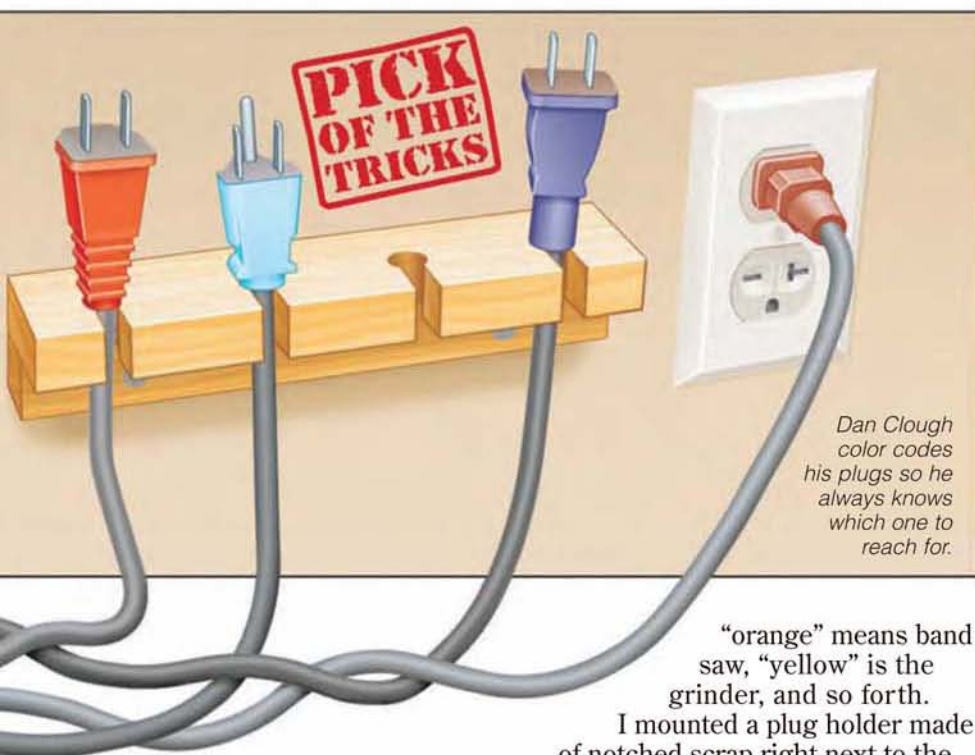
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Router features vary per model.

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Paint Your Plugs

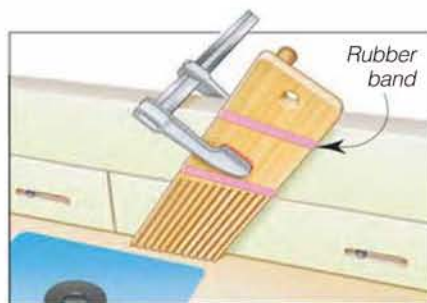
Since outlets are scarce in my shop, four machines have to share one outlet. I got tired of guessing which of the four identical black plugs was the right one for the machine I wanted to use, so I painted each plug a different color to match the machine color. Now, I know that



“orange” means band saw, “yellow” is the grinder, and so forth.

I mounted a plug holder made of notched scrap right next to the outlet so the plugs are ready when I need them.

*Dan Clough
Salem, Oregon*

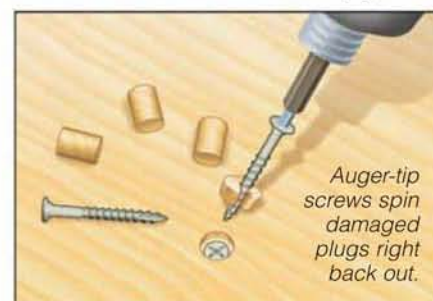


One-clamp Wonder

If your shop is a bit short on clamps, here's a way to mount small to medium-sized featherboards with one clamp instead of two. I wrap two rubber bands around my

featherboards, which gives them much better “grip” against fence facings. Space the rubber bands apart and place the clamp between them. Tighten the clamp and your featherboard will stay put. For long featherboards, I stick with two clamps.

*Serge Duclos,
Delson, Quebec*



Unscrew Those Damaged Plugs

Here's a good way to draw a damaged wood plug out of its counter-bore, provided the glue is still wet. Drive an auger-tip wood screw into the center of the bad plug. When the tip of the extraction screw bottoms out on the head of the seated screw, keep turning it slowly and the threads will lift the plug out. Be sure to use an auger tip screw for this job — it will bore a pilot hole in the plug instead of expanding it and damaging the counter sunk hole.

*Mark King
Portland, Oregon*

Scanning for Shop Copies

I've started taking pages from your magazine and scanning them into my computer. The “PDF” file I create allows me to name the article so I can remember it for future ref-

CD Towers Become Dust-free Tape Storage

If you buy blank CDs or DVDs in bulk, don't throw away those empty plastic spindle towers. They're the perfect size for storing all sorts of shop tape so it stays clean and ready for use. Keep this storage box on your bench, or drive a couple of screws through the top cover to mount it under a cabinet.

*Barry Brown
Wellington, Florida*

erence. I can also print them out and tack them above my workbench instead of bringing my magazines into the shop and getting them dirty.

*Gary White
Irving, Texas*

Editor's Note: Scanning your print issues for personal use is OK, but distributing electronic versions without written permission is a definite "no-can-do" for copywritten publications like ours. You may want to check out the digital version of our magazine, now available at our web site. It's printable!



Try warming your PSA sanding disks before peeling them off.

Turning Up the Heat on PSA

I prefer to use pressure-sensitive adhesive (PSA) backed disks on my random-orbit sanders, but peeling off the old, stuck-on paper can be a real chore. Here's the easy way to do it: warm it briefly with a heat gun, and the paper will peel right off without leaving residue on the pad. Sure beats using solvents or a scraper to get the paper off!

*Ray Johnson,
Blue Ridge, Georgia*



WINNER!
In addition to our standard payment (below) Dan Clough of Salem, Oregon, will also

receive a **Stanley/Bostitch CPACK3 Combo Kit** 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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(Circle No. 3 on PRODUCT INFORMATION form)

Plunging into Breadboard Ends

THIS ISSUE'S EXPERTS

Frank Grant is a professional woodworker located in Minneapolis, Minnesota. He is a frequent contributor to *Woodworker's Journal*.

Bill Hylton is a Pennsylvania woodworker and author. He has several woodworking-related books on the market. He is a long-time contributor to *Woodworker's Journal*.

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:

QandA@woodworkersjournal.com

Please include your home
address, phone number and
e-mail address (if you have
one) with your question.

Q I have two questions regarding the tabletop board on Frank Grant's bookcase in the *August* issue of your fine magazine.

First, why use the split tenon/mortise design as opposed to a continuous tenon and mortise? Second, wouldn't gluing the tenon into the mortise in the way shown prevent normal contraction and expansion needed for the center board?

*Spike Runyon
Eagle Creek, Oregon*

A I've been making breadboard ends for the better part of 20 years. The configuration and methods I use are quite similar to those that were shown to me by my late friend and former associate, Paul Otis Lee, who was an alumnus of the North Bennet Street School in Boston, Massachusetts. Paul is the person who validated my split tenon technique that you are asking about. It is interesting to me that some

techniques — and breadboard ends are a perfect example of one of them — break all the rules of logical woodworking. With that said, however illogical they may be, breadboard ends have proved themselves practical again and again, and they've stood the test of time. On top of that, they look really good. So the answer to your first question is: because I learned it from a good friend and an excellent woodworker. Add to that I've done it that way for almost 20 years, and it works well.

The second question about glue and wood movement ... the answer is this: nothing prevents wood movement. You can slow it down, you

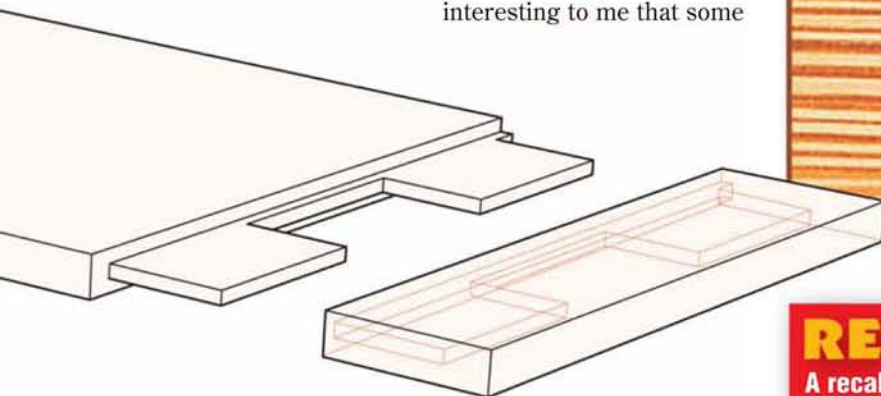
can limit its effects, but wood is a dynamic substance. That means it's going to move. For that reason, one rule I like to follow is this: "Don't skimp on the glue! Glue is your friend." Now, what I did for the top of the pine bookcase is arrange my joinery so that any noticeable movement — that inevitable seasonal expansion and contraction — would move toward the rear of the project, to avoid a noticeable projection at the front of the piece.

— Frank Grant

Q I am now the proud owner of a plunge router. How do I choose the right bits for it? I've checked



This photo shows the back view of the illustrated joint at left. The top's stub tenon is clearly shown.



Breadboard ends are a traditional joinery technique that defies the logic behind good woodworking. That small technicality has not kept them from extreme popularity.

RECALL NOTICE!

A recall is in effect involving model number 1191VSR Bosch Hammer Drills with serial numbers beginning with "7." The drill can continue to operate after the trigger has been released, posing a risk of injury. For more information, visit www.boschtools.com or call 877-472-0007.



Not all straight bits are created equal, at least when it comes to plunge cutting. Bill Hylton helps us identify proper plunge-cutting bits.

several displays at the home centers, and there are no clear divisions between "fixed" and "plunge" bits.

*Bob Enderle
White Lake, Michigan*

A Identify a plunge-cutting bit by looking for a cutting edge that crosses the tip. (See the photo above.) The carbide-cutting tips of the bit on the left jut above the steel body, which is flat on top. Plunge it and only the tips cut: when the steel hits the wood, it stalls the cut. It's not a plunge-cutting bit.

The bit on the right has an extra carbide-cutting tip crossing its tip. The maker identifies it as a plunge-cutting straight bit, and the extra carbide makes it more expensive than a more conventional straight bit of the same diameter.

The commonplace design for straight bits is seen in the middle. The steel body between the carbide tips is ground to form a ridge. It may not be particularly sharp, and it may not seem to be a cutting edge in the conventional sense, but the shape is sharp enough to enable the bit to plunge.

You can buy bearing-free profile bits that cut grooves, and these bits will plunge. A core-box bit is a coving bit without a pilot. A V-groover is a chamfering bit without a pilot. Shop around and you'll find pilot-free, plunge-cutting bits that form roundover and ogee profiles.

All of these bits have cutting edges extending across the bit's tip.

— Bill Hylton



WINNER! For simply sending in his question on breadboard ends, Spike Runyon of Eagle Creek, Oregon wins a **Steel City 5 Speed Mini-Lathe (Model 60170)**. Each issue we toss new questions into a hat and draw a winner.

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What would you like to make today?

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Winning Works

This year's 27th annual Design in Wood show, sponsored by the San Diego Fine Woodworkers Association, yielded beautiful designs and woodworking at its best.

Photos by Andrew Patterson and Lynn Rybarczyk

"Kingdom Keeper"
by Ewing Y. Mitchell IV

"Deco-Asian
Liquor Cabinet"
by Kory Zussman

---"Hollow Form"
by Jim E. Berger

"Table Lamp with Shade"
by Brian D. Jackson

"Canister Set"
by Mike Mahoney

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MORE ON THE WEB

For more great photos from the San Diego Woodworking show, go to woodworkersjournal.com and click on the icon at left.



The author carved the trillium flowers on this wagon's Port Orford cedar trim with knives and gouges — and built the rest of it, too.

Wagons, Ho!

Building a Living Past

In the winter of 1972, a wandering antiques dealer came by my shop in southern New Hampshire. He was hauling a rickety old shepherd's wagon fixed to the frame of a Model T truck to make it road-worthy. I was enchanted: I knew that I had to someday build such a magical, mobile space for myself.

A few years later, after research into traditional shepherd's wagons and wainwrighting (the craft of constructing wooden carts), I designed an all-wood structure for the bed of a 1940 flat-bed pickup. It was built mostly of pine tongue-and-groove boards screwed

to an oak frame to create walls and then enclosed with canvas "sailcloth" spread over steamed oak hoops.

I couldn't stop myself from building more shepherd-type travel trailers on the side. I studied the definitive book on the subject (*The English Gypsy Caravan* by Cyril Ward-Jackson and Denis Harvey) and ordered drawings of some vardos (what the Gypsies called their living wagons) published by John Thompson. It turns out that these "one-horse drawn, four-wheeled, one-room, chimneyed" vehicles were only produced for a relatively short period of time in England during the Victorian era. The Gypsies themselves rarely built their wagons —

Shop Talk continues on page 24 ...

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The author made the wagon roof from Egyptian treated canvas sailcloth laid over red cedar hoops, steam-bent over a form.

they relied on a handful of wainwright shops scattered throughout the countryside.

I built a number of these vardo-type wagons in the 1980s. Each was more refined structurally and more highly detailed in cabinetry, trim and carving work than its

cedar tongue-and-groove boards around a plywood torsion box. The woodworking in this wagon was, for me, the most fun of all: Except for machining the wood to dimension, I used hand planes to smooth all the surfaces; hand saws and chisels to create most of the joints;

predecessor. Last year, I completed a bow-top.

To ensure predictable performance and durability, I had the chassis professionally built of welded steel channel and fitted with a standard trailer undercarriage and tow-bar equipment. For windshear strength, I constructed the walls by sandwiching



The author uses marine woods (spruce, cedar, fir) in his wagon interiors for durability and longevity.

and drawknives and spokeshaves to create all the ornamentation. (No routers or power sanders were harmed in the creation of this project!)

For more details about my wagons, visit my web site at: www.jimtolpin.com or the Port Townsend School of Woodworking at www.ptwoodschoo.com.

—Jim Tolpin



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(Circle No. 82 on PRODUCT INFORMATION form)

The Rest of the Story

Parts ... Without the Parcel

I believe I recognize the "Stumper" in August 2008. The item involved is a device for repetitive cuts, though I've never used that particular function.

I bought the apparatus approximately 35 years ago in a flea market and don't think all the necessary parts were included.

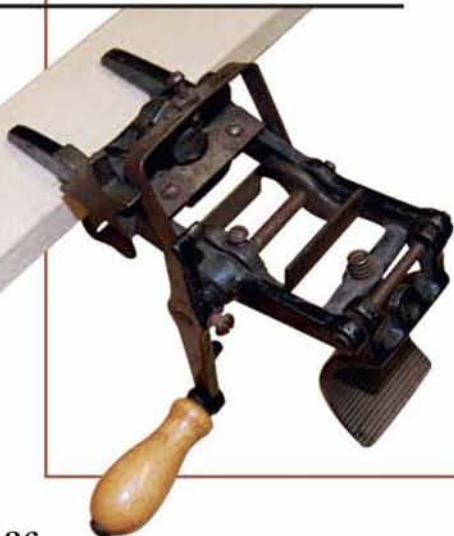
*James A. Murra
Napa, California*

Shop Drawer Paraphernalia

James is correct about the mystery tool components belonging to Russ

What's This?

Arthur Hinners of Brenham, Texas, wants to know what this tool is. He already knows turning the handle counterclockwise makes the "cutters" cut, and there are some faded words on the tool. **Do you know more?** Send in your answer for a chance to win a prize!



Hauser of Tavares, Florida, which were featured in our August issue. It sounds like other readers were a little luckier in gathering all the pieces of the tool together, though — at least for the most part.

As **Bob Lizardo** of Niagara Falls, New York, explained, "The two tools are actually accessories. They are part of the Stanley Mitre Box." **Gerald Fritz** of Lincoln, Nebraska, continued, "Two 1/4" rods could be extended

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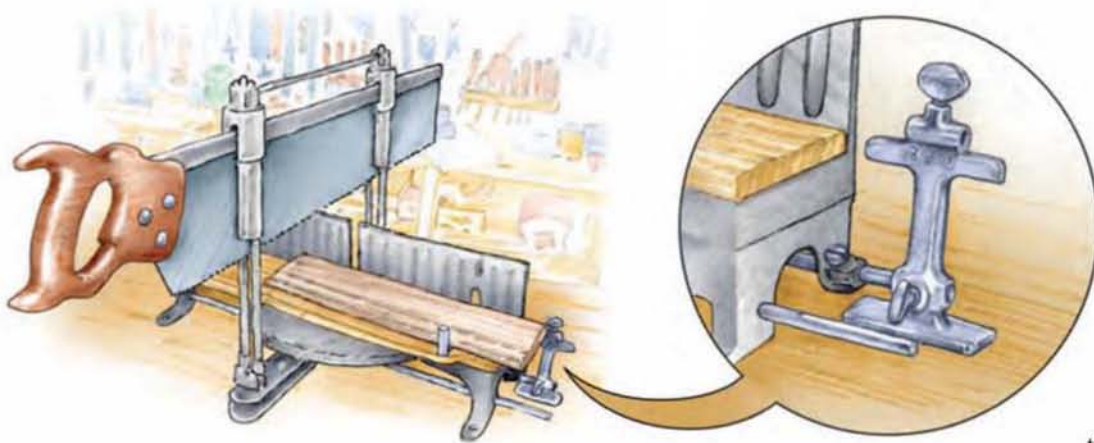
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Tom Hamilton of Houston, Texas, knew the mystery "tool rods" were part of a miter box set — since that's how he uses his.

from each side, and the parts in the picture, turned flat-side-up, help hold the wood being cut."

"When not being used for repeat cuts, they were stored out of the way on rods going under the frame of the mitre box," said **Robert H. Ingelson** of Holland, Michigan.

Dr. J. Courtland Robinson of Stevenson, Maryland, had an even more detailed explanation of the rods: "With the supplied directions, they are used to provide a stop for repeated crosscuts or to hold moulding at an angle so as to get repeated cuts with a compound angle. The numbers are there to help follow the directions."

Court now has a chop saw that he says is "faster but more dangerous, and possibly less versatile."

He also has some insight into why the tools may have become a mystery — and, just possibly, why James didn't get all the parts with his flea market purchase. According to Court, "I can understand why Mr. Hauser did not know, as lacking the miter saw they would be a mystery — and the sort of item that would be dropped in a drawer even if one had the saw."

—Joanna Werch Takes

If you have the answer to this issue's mystery tool, send it to Stumpers, c/o *Woodworker's Journal*, P.O. Box 261, Medina, Minnesota 55340. Or send an e-mail: stumpers@woodworkersjournal.com

WINNER!

Paul Gomoll of Hampshire, Illinois, wins a **Porter-Cable 371K Compact Belt Sander**. We toss all the *Stumpers* letters into a hat to select a winner.



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Coming-of-Age Opener

By Betty Scarpino

Nicely grained wood and a couple of pieces of hardware combine to make a quick, easy and infinitely customizable gift.

My son Dan will turn 21 years old soon. I'm not going to buy him that Honda Ridgeline he'd like, so I decided to do the next best thing: make him his very own bottle opener in his college team colors. What more could a young man want?!

Supplies You Will Need

This bottle opener project can be created in less than a day, but first it requires the purchase of a metal bottle opener gadget. These can be obtained from Craft Supplies' Woodturners Catalog (800-551-8876 or at www.woodturnerscatalog.com). If you don't already have one, you will also need a 7/32" drill bit, available from this same catalog.

Wood Selection

Select a solid piece of hardwood, with strength to the grain and preferably with a nice grain pattern. I hereby give you permission to shop for lumber! For Dan's opener, I used a chunk of ash, 6" long by 2" square (see the full-page sidebar on page 34 for the finishing technique I used). The maple handle, also shown in the photo on page 32, is shorter in length but about the same diameter. The walnut opener, shown in the



images for the turning process, is about 7" long by 1½" square.

Of course, the handle of these bottle openers can be made in any size and length you want. A few years ago, I made a 14"-long one for a friend. I was defying him to not lose it! (I also drilled a hole in the end and looped a length of leather through it so he could hang it near his refrigerator.)

Drill the Hole

Before you turn the body of the handle, drill a hole in one end. In order to ensure that the brass part fits at 90° to the handle, make sure your stock is square so that it sits at 90° on the table of your drill press. Draw an "X" on each end, and punch a hole in each center with an awl.

The hole needs to be 7/32" diameter and at least 1" deep. I usually drill somewhat deeper, just to make sure I end up with enough depth after the object is turned. Use a wood clamp to hold the wood securely and horizontally while drilling.

Another way of drilling the hole would be to put the 7/32" bit into a Jacobs chuck that is mounted in your lathe's tailstock. Put the wood blank into a four-jaw scroll chuck, attached to the headstock. Drill the hole by advancing the tailstock while the lathe is running at a slow speed. (Of course, you could turn the entire handle mounted this way after the hole is drilled. Just make sure you have a long enough length to allow for holding it in the chuck.)

Woodturning continues on page 32 ...



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Before mounting the handle on the lathe, drill a 7/32" diameter hole in the center of the blank. This hole will accept the hardware after turning.



The author parts the walnut handle off the lathe while it is still running. This leaves just a small nub to be removed and smoothed (right) before final finishing.

Mounting on the Lathe

Now that the hole is drilled, mount the wood blank between centers on your lathe. To make sure the hole was centered on my lathe, I drew a small circle, centered around the hole and positioned the rim of my safety drive onto that circle.

Turn whatever form you desire, but leave a bit of wood on the butt

end of the opener so that you can clean up that area after you've finished turning.

Your method and equipment may vary from what's shown in the photos. If you use a spur center, you must deal with the prongs, at least with one end of the wood. It's probably best, then, if you mount the wood with the drilled hole at the



This shapely little project will provide service — and a memory of the maker — for years to come.

tailstock. It would be helpful if you had a cone center for your tailstock. A cone center allows you to center the hole, which, in turn, centers the stock. Leave a small amount of wood at the headstock, spur-center-end, then cut it off with a small hand saw when you've finished turning.

I parted the walnut handle off the lathe while the lathe was running, and I left only a small nub on the butt end. This I cleaned up with my skew chisel and sanded quickly with a sanding pad in my drill press.

Finishing

I usually apply finish before I attach the metal opener. For the walnut handle, I used several coats of oil. The maple handle received several coats of lacquer. (See page 34 for the stained-ash finish.)

Attach the metal opener to the handle by gently screwing the tang into the hole. It should be a snug fit with the threads cutting into the wood. For a more permanent connection, use a small amount of epoxy.

Appropriate Use of the Project

I happened to have a bottle of IBC root beer in my refrigerator. Of course, I'm sure Dan will be enjoying his own brand of brew on his birthday in an appropriately adult fashion.

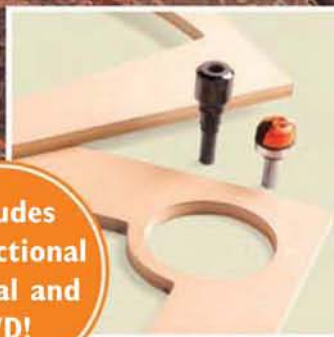
Betty Scarpino is a professional woodturner from Indianapolis.



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Dye and Liming Wax: An Over-the-Top Finishing Technique

I often use this stain and liming-wax finishing technique on ash because it takes advantage of its bold grain pattern and makes for a very dramatic look.

You will need some type of ring-porous wood. Ash and oak work the best, with ash being my favorite. It gives consistently good results. The more curves you use in your project, the more the grain shows up!

Supplies: some sort of wood dye, spray finish, liming wax and #0000 steel wool. I used Solar-Lux™ brand (made by Behlens), blood-red colored, alcohol-based dye. Make sure you use a dye, not a stain — a stain won't work for this type of finishing process. You could also use leather dye or India ink or a waterbased dye.

For the spray finish, I used Deft® brand semi-gloss lacquer.

The liming wax is a white wax that comes in a can. The Woodturners Catalog (see page 30) carries a brand made by Liberon. For Dan's bottle opener, I used gold powder mixed into the white liming wax. You can also experiment with using shoe polish or acrylic paint instead of liming wax. I've had mixed results with those items, but others have had dramatic success with acrylic paint.



Saturate your project's wood with a dye for a deep color. Let the piece dry several hours — the author usually lets hers sit overnight.

For whatever project you are making, sand the wood down to at least 200-grit abrasive. Everyone has discovered the hard way that



Spray finish seals the wood but leaves pores open. If the finish runs in one spot, use a pin to prick open the pore holes. Sand with steel wool after finish dries.



sanding scratches show up far too vividly when dye or stain is applied!

Apply the dye. I saturate the wood for a deep color. Let the dye dry for several hours.

Sand slightly with #0000 steel wool. This leaves the surface smooth and reduces the sanding that's required later. Gently wipe the surface to clean off dust and steel-wool debris.

Spray the object. I generally apply two medium coats of spray finish. The objective is to seal the wood but still leave the open pores open.

After the finish is dry, sand very lightly with #0000 steel wool. Take care not to rub hard, so you don't break through the lacquer. Apply the liming wax, rubbing it gently into the pores. Before the wax dries too much, wipe the excess off with a soft cloth or paper towel; don't rub hard. Again, use #0000 steel wool to gently remove the remaining residue of liming wax. The liming wax will remain imbedded in the open pores, yet will be removed from the surface of the rest of the wood.

This finishing technique has been around for many years. The only drawback I've discovered is that it's somewhat difficult to refinish a scratched piece. Dye, finish and wax can create an unlimited variety of color combinations. It works best for smaller projects or those that won't be subjected to a lot of wear. I challenge you to try it on your next project!

—Betty Scarpino



The author wears gloves to apply liming wax, a petroleum-based product that can penetrate the skin. Steel wool removes wax residue.



Making Spirits Bright

Great Gift Ideas for the Woodworker

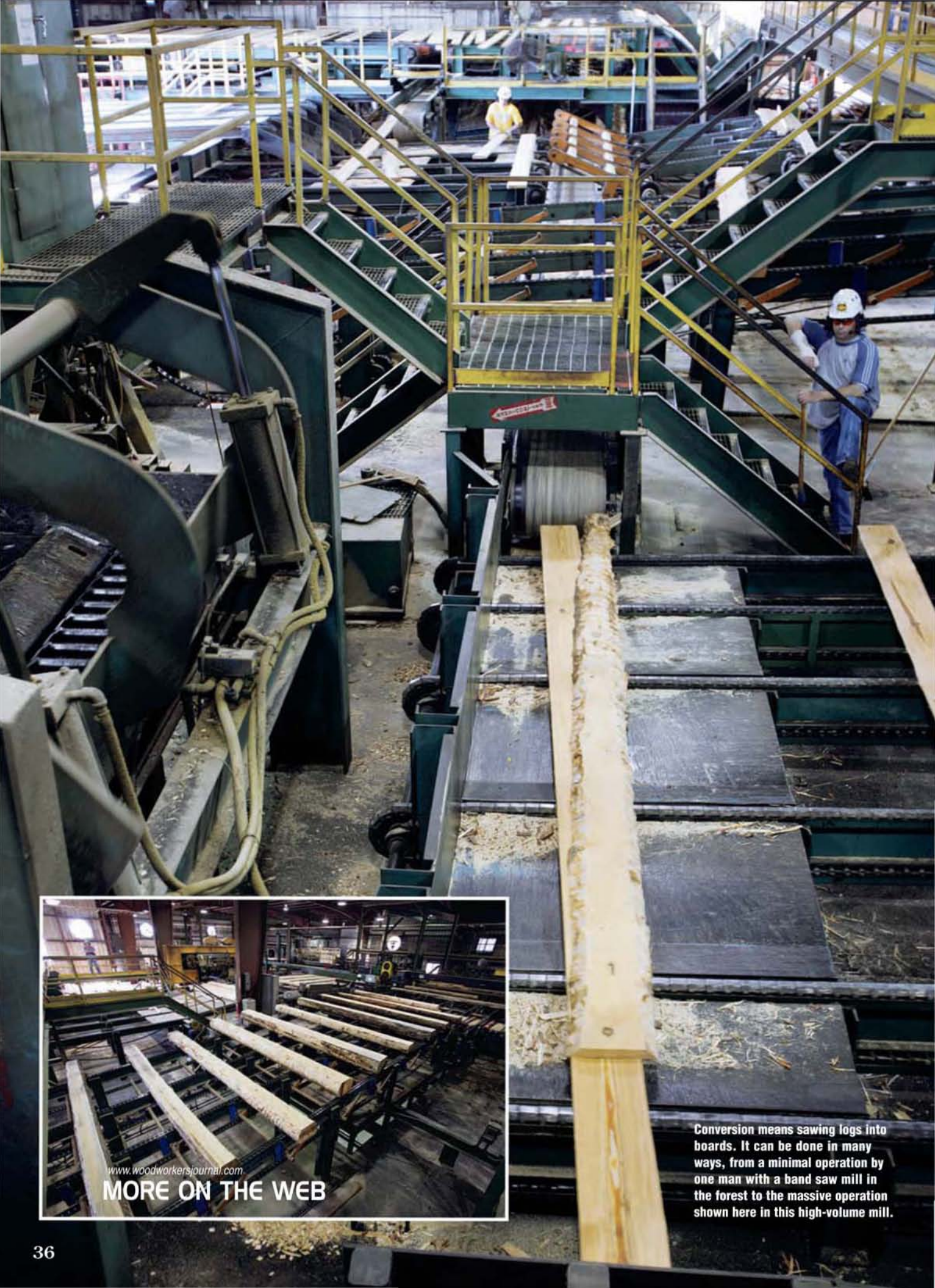


1. 4" Double Square 24N08.01 2. Hacking Knife 28K02.60 3. Precision Oiler Pen 25K70.02 4. Magnetic Paintbrush Holder 67K74.02
 5. Lumber Gauge 50K63.01 6. Japanese Nail Set 44K13.01 7. Digital Height Gauge 88N90.01 8. Lanyard Level 36N35.15 9. Woodworker's Knife 06D07.10 10. Blindman's Fractional Electronic Caliper 88N62.60 11. Plane Screwdriver 50K39.01 12. Microtip Screwdriver 17K01.95
 13. Pocket Scraper 97K52.10 14. Finger Wrench 25K11.03 15. Folding Dozuki 60T56.01 16. Lifetime Knife Sharpener 70M46.50
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MORE ON THE WEB

Conversion means sawing logs into boards. It can be done in many ways, from a minimal operation by one man with a band saw mill in the forest to the massive operation shown here in this high-volume mill.

MAKING WOOD USABLE

By Ian Kirby

Converting logs to boards suitable for furnituremaking.

In our September/October issue, Ian described how wood is formed in a living tree. He also gave us a vocabulary to name the structural components of wood. The sum of those components is the whole of a piece of wood. But for wood to become lumber, it must be cut from a log. Then it must be processed to be suitable for use. In this article, Ian explains how and why that processing occurs. Why does one board twist or cup, and another remains flat? Read on.

— The Editors

A truck loaded with newly felled logs destined for a sawmill to be converted into boards ready for drying could just as aptly be called a water tanker as a logging truck. That's because practically half the weight of each log could be due to water. We call this its *moisture content* (MC). Since the properties of timber depend a great deal on the amount of moisture it contains, knowing what that amount is allows us to dry and use it to the best advantage.

Determining Moisture Content

MC is a variable and its weight is expressed as a percentage of a constant, which is the oven-dry weight of the wood.

$$\frac{\text{Weight of water} \times 100}{\text{Dry weight of wood}} = \%MC$$

If you have a scale or balance accurate to about half a gram, the *oven-dry method* of determining MC is simple. Take a sample from a board, weigh it wet, dry it, weigh it dry, and do the math.

$$\frac{\text{Initial weight of sample} - \text{dry weight of sample} \times 100}{\text{Dry weight of sample}}$$

This was the simplest method of determining MC prior to the advent of moisture meters. All that is required now to get fast results is to follow the manufacturer's instructions. Although I don't consider meters absolutely



The three moisture meters above perform the same task using slightly different methods. The Lignomat meters use pins of different lengths to test the moisture content. The Merlin meter uses radio waves and has no pins.

essential, they are nonetheless very desirable, for they provide a real indication of whether the wood will perform as expected.

Depending upon whether it is softwood or hardwood, there can be a considerable range of MC in a newly-felled tree. As well, the sapwood will contain more moisture than the heartwood. The average MC is about 75%, but it can exceed 200% in some species! The desirable MC for furniture-making is 8% to 10%, so clearly a lot of moisture must be removed.



If you remove moisture from wood, you reduce its weight. This fact is at the bottom of the original and simplest way to calculate moisture content (prior to moisture meters). Weigh it wet, dry it, weigh it dry, then do the math.



“ A truck loaded with newly felled logs destined for a sawmill to be converted into boards ready for drying could just as aptly be called a water tanker as a logging truck. ”

Options for Removing Moisture

Two ways of removing moisture are *air drying* and *kiln drying*. Done correctly, both methods will deliver wood that is sound, flat and without stain mark from stickers. Done incorrectly, both will deliver distorted, split and/or case-hardened material best suited for firewood. Although the two drying methods employ different procedures, the underlying principle is the same for both. To better understand the problem of drying wood, imagine the microscopic vessels in the board magnified to the size of drinking straws. These straws, however, differ from ordinary drinking straws in that they are all shapes and sizes. Some have open ends, some have pointed ends; some have thick walls and narrow cavities while others have thin walls and wide cavities; some are large and some are small. A more consequential difference is that not only is the vessel cavity full of moisture but the vessel wall is also saturated. No wonder, then, that the MC in a newly-felled tree can range from 75% to more than 200%. Moisture in the cavity of the newly-felled log is called *free water* and moisture in the cell wall is called *bound water*.

Drying Wood

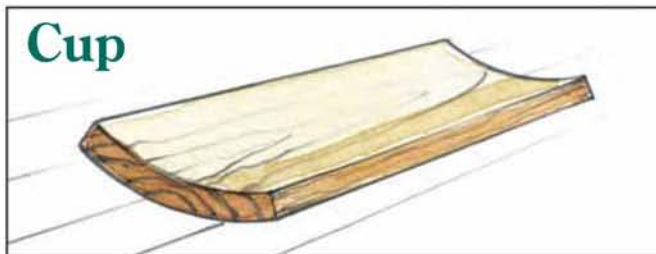
Drying wood is a slow process. It dries from the outside, where the evaporated moisture is continuously replaced by moisture migrating from the inside. If the board is dried too rapidly, the outer layers shrink while the interior is still saturated. The result is a complication called *case hardening*. The key to success is balancing the rate of surface evaporation with the migration of moisture from the inside.

Three factors control drying: humidity, rate of air circulation and air temperature. Temperature, however, plays a dual role. It influences *relative humidity* (RH), which affects the rate of evaporation from the wood surface, which in turn governs the rate of migration of moisture outward.

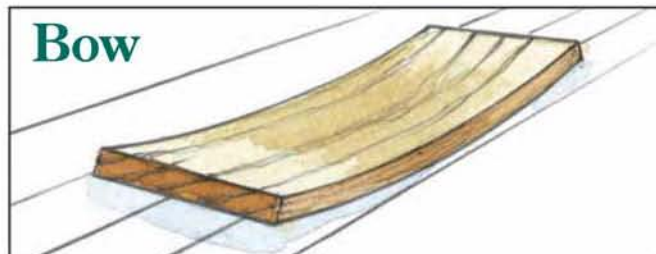
The free water in the vessel cavities dries out first, like emptying a bottle. When all the free water has been removed — this is a theoretical rather than an absolute condition — the wood will have a MC of about 30%. This is called the *fiber saturation point*. Up to this stage, no change in the shape or dimension of the wood has occurred — no shrinkage, no distortion.

What is distortion?

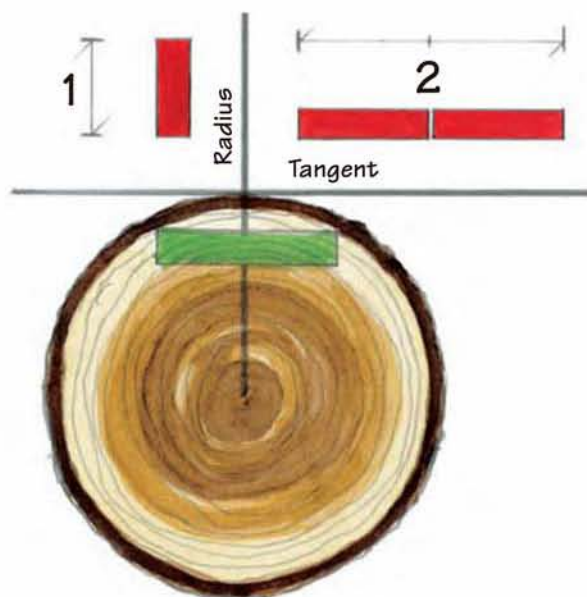
A distorted board is almost always a sawn board from a sawmill. The distortion, which occurs during drying, may take any of the four forms demonstrated in the images below. The longer and wider the board, the more obvious any distortion, but when cut into furniture parts, the distortion can usually be overcome during the stock preparation stage. A twisted board usually presents the worst salvage problem. Provided MC is in the 8% to 10% range, if you leave the sawn parts to stabilize in a dry shop for a couple of weeks before preparation, they will normally remain flat after preparation.



Cup: the board remains flat in length and on edge but curves across its width, away from the heart.



Bow: the board remains flat in width and on edge but curves in length, like a straight road descending a hill.



Differential Shrinkage. A section through a tree is essentially circular: it has a radius and a tangent. If a board is cut from the log so the faces are tangential, the adjacent edges are radial. The shrinkage in the tangential direction is on average twice that in the radial direction.



Flatsawn Board. There is more tangential exposure on the top half than the bottom half of this board. Therefore, the tissue on the top half will shrink more than the bottom half and the board will cup.

Shrinkage Flatsawn board

The next drying stage is the removal of bound water from the vessel walls, and it's here that changes begin. As drying continues, the board shrinks in width and thickness but not in length. If shrinkage were to occur equally on both faces and both edges, the board would remain as flat as it came from the saw. However, shrinkage is unequal: it shrinks about twice as much in the tangential plane as it does in the radial plane. This is called *differential shrinkage*.

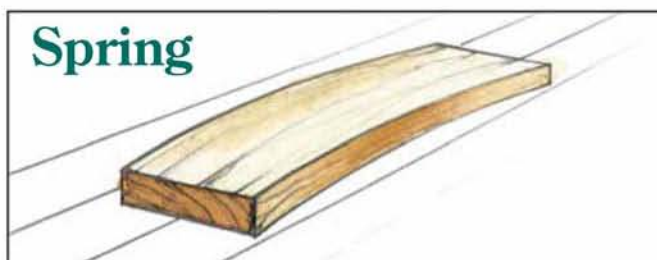
Differential shrinkage is the sole reason that wood distorts. A flat board can distort in four ways: cup, bow, spring and twist. Various splits or shakes may also occur. These distortions are further complicated by the fact that trees grow in a spiral fashion. The amount of spiralling varies from hardly perceptible to the highly visible, such as may be seen in the splits or cracks in a wooden utility pole.



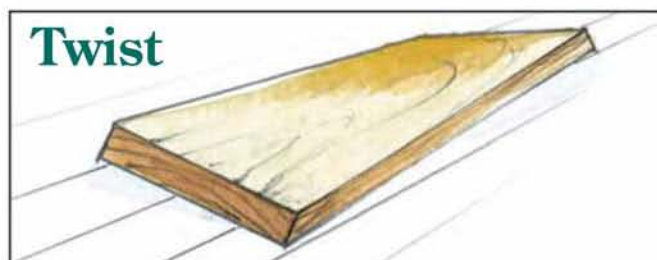
In this flatsawn board example, the outcome of shrinkage differential is a cupped board.

What is a “warped” board?

The term “warped” is a nonspecific term that denotes a misshapen board. The glossary from *The Collins Complete Woodworker* reads: “Any defect in lumber that deforms a board’s shape.” And while that may be an accurate definition, it is the term itself that is not useful. By using the terms cup, bow, spring and twist, a woodworker can accurately describe the specific distortion of a board. This is much more useful information than “warped.” “Spring” or “sprung” board has local variations, the most common being a “crooked” board.

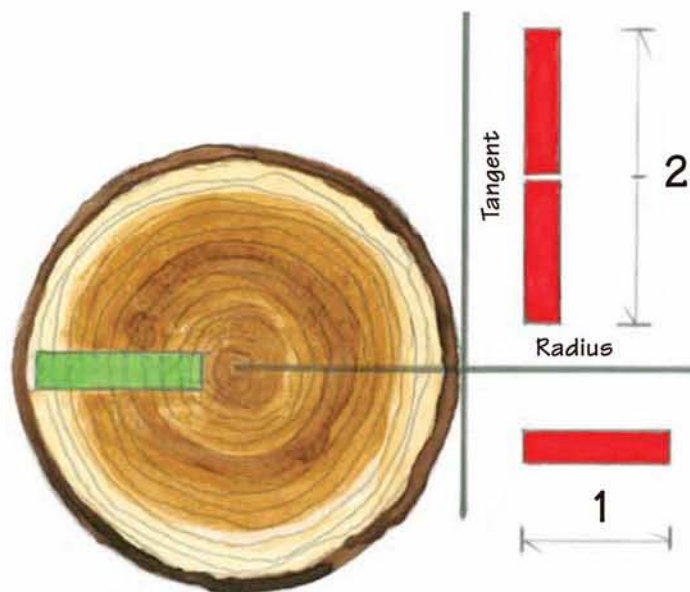


Spring: the board remains flat in width but curves in length, like a river going around a bend.

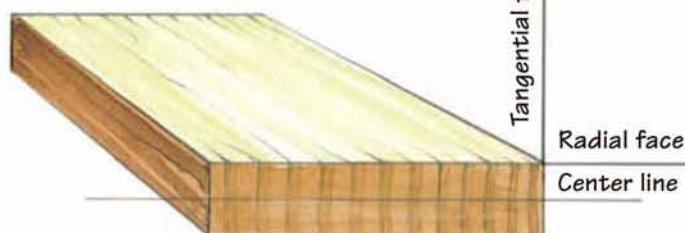


Twist: the board curves in length and width like a propeller.

Shrinkage Quartersawn board



Quartersawn Board. Because the tangential tissue is symmetrical relative to each side of the center line through the board, shrinkage is balanced on each face and the board will tend to remain flat.



Wood is Hygroscopic

Generally speaking, if you buy or own a board of distorted wood, it will be cut up into selected parts for the job at hand. It is inevitable although often surprising how much distortion is minimized as the parts are cut into smaller pieces. The next task is planing to thickness and size (see "Marking Up for Success: Prepare the Stock" at www.woodworkersjournal.com), which entirely removes all distortion. However, wood is *hygroscopic*: it loses or gains moisture (shrinks or expands) until its MC reaches equilibrium with the humidity of the air. This point is called *equilibrium moisture content* (EMC).

Woodworkers long ago learned to cope with wood's nature to shrink and expand. For example, one of the earliest and ingenious solid wood furniture designs is the frame-and-panel, which allows a panel to change size within a dimensionally stable frame.

Dimensional changes occur on a short-term, or daily, basis and over a long-term, or seasonal, basis. Both are gradual, but short-term changes tend to affect only the surface tissue as in the case of a board that cups slightly when left overnight on a bench top. Turn it over, and it gradually returns to flat.

Neither daily nor seasonal changes in moisture content can be prevented by the application of a finish.

Air-drying lumber is a time-honored method which, properly done, is effective. It normally takes about one year to dry each inch of thickness. Kiln-drying speeds the process by strict control of the three factors that cause drying: air movement, temperature and humidity, all of which, when air drying, are subject to the vagaries of weather.



“ Differential shrinkage is the sole reason why wood distorts. ”

A finish may retard the rate of change, and one finish, or the number of applications, may be temporarily more effective than another, but if humidity and temperature changes in the atmosphere persist, wood movement is unavoidable.

Kilns Regulate Drying Variables

Kiln operators have a vested interest in minimizing any sort of degrade to the charge of wood being dried. They strive to avoid distortion, splits and case hardening. The early days of kiln drying often produced batches of less than satisfactory quality. As operators learned how to better regulate the three drying variables, they developed and applied a rigorous series of adjustments over given periods of time. Operators now follow a kiln schedule for every species of commercial lumber. More than one species may have the same kiln schedule so they can be dried together. Kiln operations today are so well understood that results are predictable. The outcome is that we have better and more consistent lumber products to work with than our predecessors. Kiln drying has become a science; air drying is still an art.



Computer technology is central to Lignomat meter systems. Shown here, a wireless transmitter with probes passes MC readings onto a receiver connected to a personal computer that displays the data. Wireless probes can also measure temperature and EMC values.

What's In a Name?

For easy reference, this glossary contains a list of italicized words in the text. In some cases, the definitions are expanded.

Air Drying: a method of stacking wood outdoors to dry. Boards are separated by stickers arranged one above the other and close enough together to prevent sagging of the drying boards. Dimension of the stickers controls the rate of airflow through the stack. Ends are usually coated to prevent over-rapid moisture loss. Typically, a cover protects the stack from direct sun and rain and an open shed wall deflects strong winds.

Bound Water: the water in the cell walls. The way water is held in and between the fibrils that comprise the cell wall is complex. Consequently, removing it is a complex and relatively slow process which, if done incorrectly, can spoil the usefulness of the wood.

Case Hardening: when the outer layers have shrunk due to over-rapid drying and the core is not yet dry, the outer shell goes into tension. As the core dries, the shell, which is set in a permanently expanded condition, prevents normal shrinkage of the core. When the core eventually dries, it goes into tension and the shell goes into compression.

Differential Shrinkage: the nature of wood to shrink about twice as much in the tangential direction as in the radial direction in a cut board or billet; the sole reason why wood distorts while drying.

Equilibrium Moisture Content: the moisture content at which the wood is neither gaining nor losing moisture; a dynamic equilibrium that changes with relative humidity and temperature.

Fiber Saturation Point: a theoretical state at which all the free water has been dried from a sample of wood and all the bound water remains. The MC at this state is about 30%.

Free Water: the water in the cell cavities.

Hygroscopic: the property of exchanging (absorbing/releasing) moisture with the atmosphere.

Kiln Drying: the drying of wood in a closed container where an operator with the aid of computer program controls the air circulation, humidity and temperature. In a modern kiln, each species is dried according to a schedule — the cycle according to which the three variables are regulated to speed drying with a minimum of degrade as shrinkage occurs while reducing MC to about 8%.

Moisture Content (MC): the weight of water in a sample of wood expressed as a percentage of the dry weight of the sample.

Oven-dry Method (to determine MC): a wood sample is weighed, then dried in an oven at about 215°. Weigh it every four hours. When the last two readings are the same, the sample is dry. Its initial weight minus its dry weight is the weight of water. Its MC is determined by the standard formula (see p. 37).

Relative Humidity: at every temperature there is a proscribed maximum amount of water vapor the air can hold. Relative humidity is the actual amount of water vapor present, expressed as a percentage of the maximum possible for that temperature. At maximum, the air is saturated.

Ian Kirby is a wood scientist, designer and master woodworker. In addition to his frequent contributions to Woodworker's Journal, he is the author of many books.

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MORE ON THE WEB

Visit our home page at www.woodworkersjournal.com and click on this icon to see Ian Kirby's article "Marking Up for Success: Prepare the Stock."

The Best Little Timber in Texas

By Rob Johnstone, with Tim Knight

*Gnarled and twisted by the dry climate and harsh elements of the Southwest, **mesquite** is a lumber that may not be familiar to many woodworkers.*

I have to admit that, previous to my decision to build a magazine project with this species, my most intimate experience with mesquite was pulling its nasty little spikes out of various and sundry sections of my anatomy while bird hunting. Beyond that, it was most familiar to me as a complement to the barbecue briquettes over which I prepared the fruits of my outdoor labor. In fact, I held an opinion very close to a fellow who e-mailed me his notion of the wood, after hearing about my decision to build with mesquite.

"Mesquite is a small bush that grows out in west Texas where there are no trees. Since those folks have never seen a real tree, they actually think a 3" stem is saw timber. To call a mesquite board 'lumber' is an elastic statement (as in, a real stretch)."

But then I found out about Tumacacori Mesquite Sawmill (www.mesquitedesign.com) in Arizona. There, owner Art Flores has a stock of mesquite lumber that is quite impressive. Mesquite, as it turns out, has a beautiful color and stunning figure. The color, when finished with a clear topcoat like shellac or polyurethane, is a warm brown-orange and red

Paul A. Mistretta, USDA Forest Service, Bugwood.org



Perfectly suited to its environment, mesquite provides not only lumber, but also shade and food from its seed pods (photo above). Its characteristic shape is easy to see in the tree (photo at left) and on the chainsaw lumber rig (photo below).





Frank Grant's entry bench (page 44) is made from velvet mesquite.

hue with amber flecking. It is common to have black knot and limb-wood incursions into the lumber. Most people who work with mesquite use those "flaws" as beauty marks to add to its distinctive look. If you look at the *photo* of the tree on the opposite page, you can easily see how those waney edges and incursion flaws are impossible to avoid in this special lumber. For that reason, Art takes extra care when cutting his stock to keep flitches in order and to be able to sell those pieces in such a way that builders can take advantage of the unique grain, figure and incursion patterns.



Each tree of velvet mesquite — shown stuck up in flitches in the Arizona sunshine — produces beautiful one-of-a-kind lumber. You would do well to keep individual stock pieces' shape in mind during a project.

Art calls his lumber "velvet mesquite," and as you can see in the *photo* above, he has a significant supply available. Frank Grant, who built our entry bench, has worked with it several times before. It is a favorite wood of his, as it both challenges and rewards a builder's creativity. While this lumber is not for everyone, it is a beautiful option for woodworkers who like to work with unique stock from time to time.



Prosopis glandulosa

The USDA recognizes 35 species and varieties of mesquite in the United States, some introduced from North Africa. The most widespread is honey mesquite, a native species. It occurs from Kansas down through west Oklahoma, most of Texas, and into northern Mexico. A variety is found west as far as southern California.

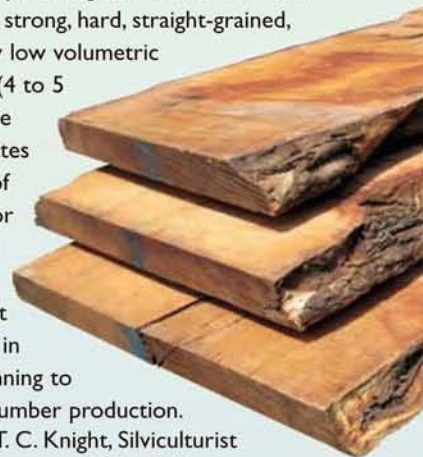
Mesquite is more widespread now than in the 19th century. The introduction of European cattle to the Southwest led to overgrazing of the rangeland, which eliminated the range fires that held mesquite in check. The cattle also widely distributed undigested seed. Interestingly, its range into Oklahoma and Kansas, as well as east to Shreveport, Louisiana, is generally along the trails used for the late 19th century cattle drives out of Texas. It soon took over rangelands under these conditions, eliminating native grass stands. According to records from lands near Las Cruces, New Mexico, mesquite was found on 26% of sites studied in 1858. By 1963, it occupied 70% of those sites.

Native Americans used honey mesquite for fuel wood. They commonly used the bean-like fruit, ground into flour, for making a type of bread which was the main staple of their diet. The pods were also used to make drinks. The bean pods are a very important food source for numerous species of birds, mammals and livestock.

Under ideal conditions, honey mesquite can grow up to 40 feet tall. It can survive in extremely dry areas, but then occurs as a scrubby bush. The oldest recorded specimens ranged from 172 to 217 years old, but it more commonly lives for 30 to 40 years.

Mesquite is used chiefly for fuel wood. It is often the only fuel wood available in regions where it occurs. Tall, straight-stemmed trees, found mostly along damp drainages, are the form most used for lumber. The wood is strong, hard, straight-grained, warp-resistant, and has a very low volumetric shrinkage from green to dry (4 to 5 percent). Tall, straight trees are not common. Research indicates that the current rate of use of straight-stemmed mesquite for lumber cannot be maintained without the introduction of good silvicultural management practices. Hence, landowners in some parts of Texas are beginning to manage mesquite stands for lumber production.

— T. C. Knight, Silviculturist
Oden, Arkansas



SOUTHWESTERN ENTRY BENCH

By Frank Grant

Although its elements and material are derived from the Southwestern United States, this entry bench/chair-table will be at home in virtually any locale.



When I learned that Bruce Kieffer was building a replica chair from the El Tovar Hotel (page 56), my thoughts immediately raced across the road to a building called Hopi House. Designed by Mary Colter in 1905, it was her first of several commissions that have since become icons of American Southwestern architecture, greatly influenced by the living history of the region and the many ancient dwelling sites that have stood for thousands of years in the American Southwest.

Having had the privilege of walking amongst some of these places, I found it easy to see why Ms. Colter was so enamored. I've had an affinity for all things Southwestern since my earliest days as a woodworker. Whatever your discipline, the landscape, the light, the nature and the people of this vast area are sure to inspire anyone with an eye and a mind toward creative pursuits.

This "chair-table" style of furniture seemed to really catch on in Spanish Colonial times, and examples can be seen in photographs of some of the buildings that Mary Colter designed. When editor Rob Johnstone chose mesquite lumber for this bench, I couldn't have been happier. Mesquite, a tree native to the Southwest and known for its dark, grainy and tough wood, is perfect for this style. Mesquite art and furniture can be found in fine craft galleries from Santa Fe to Scottsdale.



With a unique selection of velvet mesquite in hand, author Frank Grant began the challenging process of harvesting bench pieces from this special lumber. While it's not a difficult species to work, the checks, flaws and limb incursions present challenges not found in your run-of-the-mill lumberyard stock.



Built Solidly . . .

When the wood arrived from Art Flores's sawmill (*see story, page 42*), the first thing I did was spread all the planks out on the floor of the shop and carefully study what lay before me. Two of the planks were thicker than the rest; these would become the post and rail components. The rest would be divvied up for the panels, stiles and top. I chose some leftover longleaf pine for the floor of the chest simply to conserve the precious mesquite and give the project a nice pine aroma inside.

Mesquite is gnarly wood containing many cracks, voids, waney bark edges with streaks of sapwood and a distinct interlocking

grain. To help map it all out, I took some scrap 1/4" MDF and luan plywood, cut them to rough component size and laid them out on the planks to determine grain direction and optimal visual interest while avoiding the largest of the natural defects in the wood. I then traced around these with a black marker before harvesting the parts. I used a combination of circular saw, reciprocating saw and ultimately the band saw, to break the exceptionally heavy planks down to a manageable size for hoisting around in the shop.

After a quick visit to the chiropractor, I proceeded to size and square all the components, using the jointer and thickness planer.

I then made "story" sticks out of the aforementioned templates, for

posterity, and to keep as a reference in case I need to build more benches in the future. (I do this with nearly everything I make: hey, you never know, and they look so cool hanging in the shop.) These story sticks are exact profiles of the components, with markings to transfer joinery details to the set-off components. (Set-off means squared, sized and cut to length.)

I laid out all the joinery at this point, then set the tenon components aside to focus on the mortising. I always do the mortising first: it's easier to make tenons fit mortises than vice versa. I bored holes with the drill press using 1 1/8" and 3/8" Forstner bits, the latter for getting closer into the corners.

I proceeded to chop these roughed-out mortises square with a selection of sharp chisels, mostly a 1" and a 1/2" paring chisel and a 3/8" mortising chisel for the tougher corners. Once the holes were more refined, I went in with my 1" chisel again, carefully paring the walls and making sure everything was nice and straight, to help eliminate hang-ups during assembly.



Harvesting the parts

Determining where specific parts of a project will be cut from a piece of wood is known as "harvesting" the parts. It is a very important task in any project — but it becomes critical when you're working with lumber that has extreme characteristics like mesquite.



... to Last a Lifetime

Cutting Tenons, Raising Panels

Now for the tenons. I occasionally cut tenons on the band saw, especially if there are not too many of them. I use the same setting on the marking gauge for the tenons and the mortises, and the same philosophy as if I were cutting them with a hand saw. I split the line with the saw blade and go nice and slow. Take your time on this, and follow your line with as much surgical precision as you can muster. (Do some test cuts in scrap.) Oh, and this may seem odd, but I choose not to use the fence; I do a better job freehand.

If you work nice and slow, you'll end up with accurate cuts. Pat yourself on the back before cutting the shoulders on the table saw. You could also make the shoulder cuts first, before revealing your samurai skills on the band saw. Either way works well, in my opinion.

At this point, I put a 1/4" straight bit in the router table and cut all the housings (dados) for the box floor, as well as for what I find to be among the most harrowing of woodworking operations: panel raising!

To raise the panels, I used a large profile cutter — one that cuts above and below the material. The smaller of the two profiles appears on the outside faces of the panels, adding a nice visual detail to the heavy-looking post-and-rail assemblies.

I don't have a 7½-hp, 3-phase shaper in the shop, but I do have a 2hp router with a 1/2" collet that will accept the large, scary panel bit. Knowing this is an underpowered

arrangement, I took the time to build a new fence out of some glued-up 3/4" MDF and screwed it to the table in a semi-permanent fashion. This made it virtually incapable of shifting, in the event my bit would kick back like an ornery mule in the desert. I then routed a slot in the tabletop to accept the miter gauge from my table saw, furthering my intention to keep all my fingers in place for the next project. After a number of test cuts in various woods, including our precious mesquite, and a prayer for additional reinforcement, I started in carefully, moving VERY slowly.



The prayers, the planning ... everything worked out well. I'm using the same two fingers to type this story as all the others I've written, and yes, I feel grateful. Before final fitting and surfacing, I cut the saddles into the front legs for the rails that will support the top in the "down" position. I then formed a radius on the back legs where the rails and top will pivot, which turns this entry bench into a "chair-table."



Using the same methodology as he would use with hand tools, the author turned to the band saw to cut out the various tenons required for the entry bench.

Preparing for Assembly

Smoothing the Surfaces

I'm luckier than I am smart, so I was able to hand plane a fair amount of the exposed surfaces, including all the panels, posts and stile assemblies. The long rails were the toughest, but I managed to get the machine marks out before finishing with fine sandpaper.



When chopping out the mortises on a drill press, the author used different diameters of Forstner bits to hog out the waste.

I like hand planing because it's less noisy, less hazardous (little or no dust), and it's a good upper-body workout. Mesquite works surprisingly well with hand tools in spite of its idiosyncrasies.

After the finish surfacing, I whittled the edges of all the components using a small drawknife, a technique I learned from my days as a cabin carpenter in the far reaches

of northern Minnesota. I think it's a wonderful rustic touch that adds texture and visual interest.

I had glued and clamped the pine floor together a day earlier, and at this point I broke it out. After re-sharpening my #5 bench plane, I hand-planed the floor smooth (easy sailing!) before cutting a 1/4" tongue all around on the table saw. The tongue allows plenty of room for wood movement inside the chest. I left this wood bare, hoping to coax out some of that good pine scent for the inside of the case.

Before final assembly, I gave everything a coat of wax-free shellac, as is my style. I'm a big fan of shellac: it may be the most beautiful natural finish out there, and it's nontoxic to boot.

A couple of humid and ultimately rainy days caused things to swell up on me a bit, so I had to re-fit all the joints before final assembly. The way I figure, bringing lumber from a place that sees less rain in 10 years than we might get in Minnesota in a good month, this is to be expected. Just don't try to force it; mesquite isn't forgiving like that. If you don't break the wood, you'll break your hammer beating on it or throw out your shoulder in the effort.

Beginning the Assembly

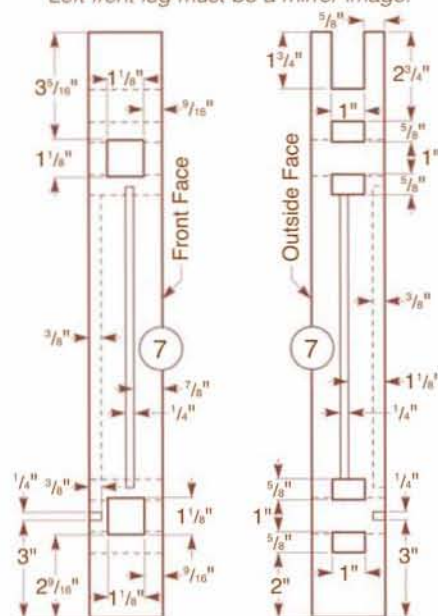
First, I assembled the ends of the case, then I drilled and chopped the mortises to accept the long front and back assemblies. By doing it this way, I eliminated some of the tearout you could get from drilling and chopping through existing holes in the posts.

After all this horsing around, I assembled the long sides, added the floor and brought all the assemblies

Right Front Leg

(Inside and Back Views)

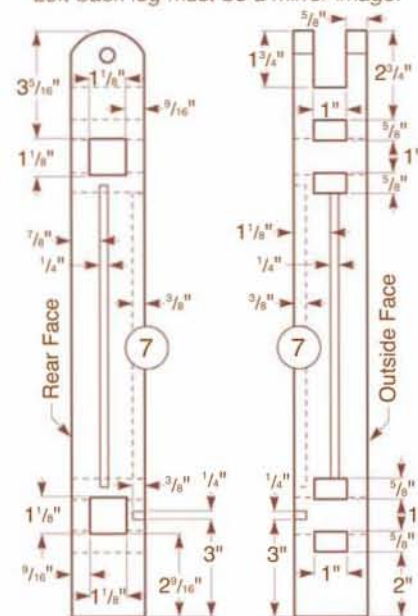
Left front leg must be a mirror image.



Right Back Legs

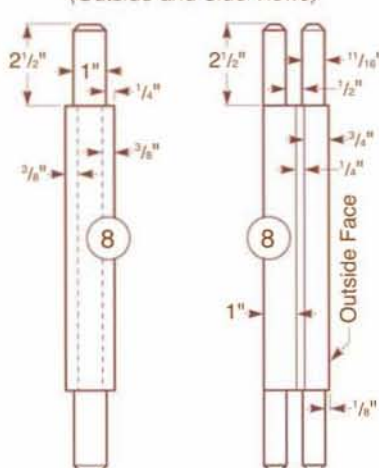
(Inside and Front Views)

Left back leg must be a mirror image.

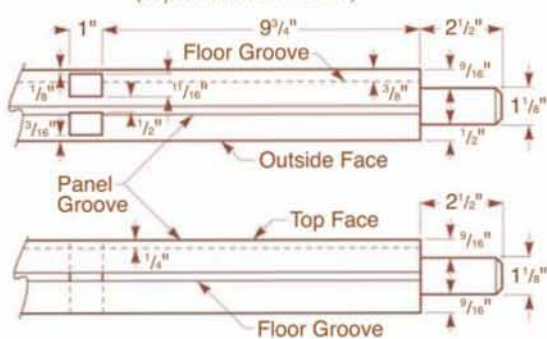


Stiles

(Outside and Side Views)

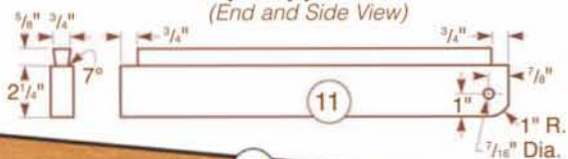


Bottom Long Rail (Top and Inside Views)

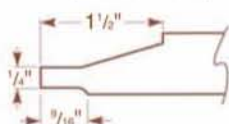


Note: Some hidden lines on the leg and stile and rail drawings are not shown to avoid the confusion of overlapping mortises and tenons.

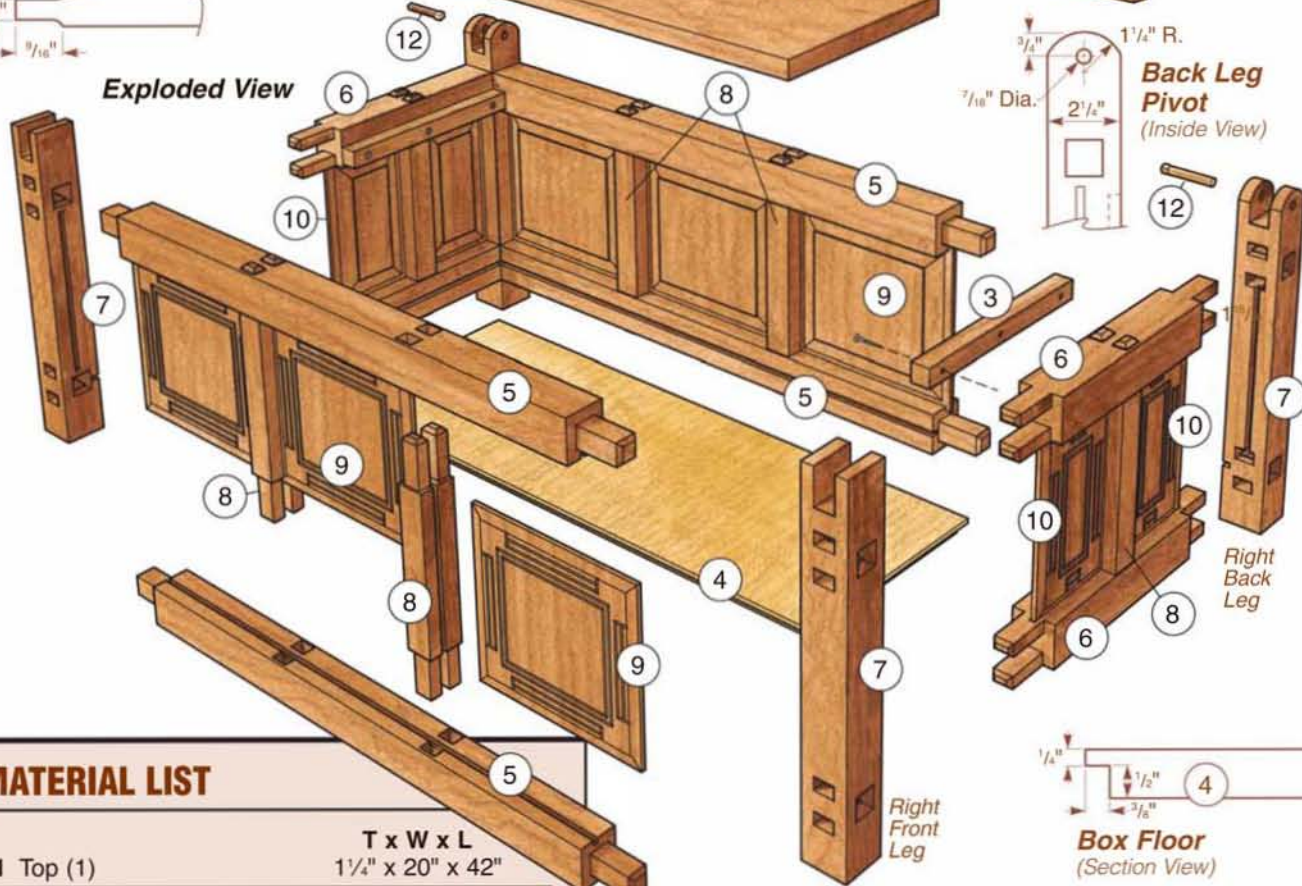
Top Support Rail (End and Side View)



Panel Edge Profile (Section View)



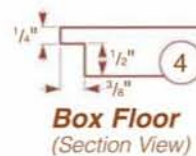
Exploded View



Back Leg Pivot (Inside View)



Right Back Leg

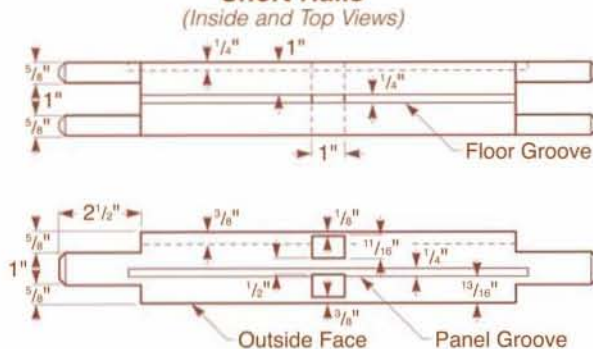


Box Floor (Section View)

MATERIAL LIST

	T x W x L
1 Top (1)	1 1/4" x 20" x 42"
2 Box Lid (1)	1" x 11 3/8" x 31 3/8"
3 Lid Support Cleats (2)	1" x 1" x 11 1/2"
4 Box Floor (1)	3/4" x 32" x 12"
5 Long Rails (4)	2 3/16" x 2 1/4" x 36 1/2"
6 Short Rails (4)	2 3/16" x 2 1/4" x 16 1/2"
7 Legs (4)	2 1/4" x 2 1/4" x 18"
8 Stiles (6)	1 1/2" x 2" x 13 3/4"
9 Large Panels (6)	3/4" x 9 1/4" x 10"
10 Small Panels (4)	3/4" x 5 1/2" x 9 1/4"
11 Top Support Rails (2)	1" x 3" x 17"
12 Pivot Pegs (2) (carve to fit)	3/8" x 3/8" x 2 1/2"

Short Rails (Inside and Top Views)





Nothing beats a sharp chisel when it comes to cleaning up and paring a mortise square. Form the mortises first, then the tenons.

together, using customary and prodigious amounts of glue. After getting it all clamped up real good, I turned on the air conditioner to hopefully lessen the effects of the steamy summer humidity we were experiencing here in “tropical” Minnesota. I let the project sit overnight, to give the glue plenty of time to set up and cure.

The next morning, I removed the clamps, which revealed a sturdy little piece of furniture. I added a ledge of two 1" x 3/4" x 1 3/8" mesquite cleats to support the box lid, which is simply a straight, thick mesquite board, planed and drawknifed at the edges.

Routing Sliding Dovetails in the Top

With the carcass completed, it was time to make the top. I set aside two planks early on for this component.

The Final Details

After surfacing a straight, square mating edge on each, I chose two more boards to serve as the top support rails. These sit within the saddles cut into the legs. They have a pivot point at the back, drilled through and pinned to the legs with a couple of simple whittled pegs.

I attached the top support boards to the top planks, 2 1/2" shy of the leading and trailing edges of the top, using a simple sliding dovetail arrangement (see the *Drawings*). After laying out my system on the underside of the top, I clamped the two planks together nice and flat before adding a straight board to use as a fence to guide my plunge router. Then I took three deepening passes with a 1/2" straight bit until I reached a depth of 5/8". I switched to a dovetail bit to shape both sides of the housings, taking one pass for each cheek. To cut the mating dovetails into the top edges of the top supports, I chucked the same dovetail bit into a router table (see photo at right, next page) and made a few passes on scrap wood to dial in the fit. Once everything was set, I routed the two supports.

Here's how I assembled the top: I fitted the rails onto one plank before sliding the other plank into place. I glued only the edge joint between the top boards. (It should slide on the dovetailed supports as needed to allow for wood movement.) Once the glue cured, I scraped off the excess and took my drawknife to the edges. A light scuff sanding with 220-grit cleaned up the surfaces, followed by a topcoat of shellac.

Carving Out the Details

At this point, I decided a bit of relief carving might be in order. After much head-scratching and a number of studies in scrap wood, I made up a simple design to carve into the panels. Whenever I carve, I always do lots of studies in scrap to determine exactly what I'm trying to accomplish with the design before committing to the “money” wood.

I used MDF story sticks to transfer reference marks to the chest panels. It took just two tools — a #41 swan-neck V-gouge and a mallet — to cut the cross-grain and then long-grain relief lines.

The chips flew during the panel-raising process. The author anchored a shop-made fence to the router table with screws. The large diameter panel-raising bit had a back cutter that formed a clean shadow line around the face of the panels.



Mesquite carves surprisingly well and holds nice, crisp details. Just be careful in those cross-grain areas that are close together, to avoid a potential chip of wood breaking free. If this happens (and you can find the chip), simply glue it back in place, like a real woodcarver would do. Go nice and slow with the gouge and



The lid supports have a dovetailed edge, which is captured by the two sections of the top assembly. See the *Drawings* for details.

mallet; you'll maintain lots of control that way. As you go along, make minute adjustments to the angle of your gouge, in order to maintain appropriate depth without digging too deeply or cutting so shallow that you lose your cut. Carving simple lines like these effectively should only require one pass, but if you need to make another one to refine certain areas, read the grain and "work" each side of the cut to avoid unsightly tearout.

A few swipes of shellac in the carving lines completed the project. There you have it. Feel free to sit, stand, jump or park a tank on top of this bench. You won't find a much sturdier piece of furniture or a tougher wood from which to build it. It's gorgeous, too, just like the great American Southwest.

Frank Grant is a professional woodworker and a frequent contributor to Woodworker's Journal.



To Carve or Not ...

We understand that carving is not something every woodworker would choose to do. It is, however, a traditional element in this type of Southwestern furniture. Carving also is one of Frank Grant's signature design motifs, so it just made sense to include it in our design. But if carving is just not your cup of tea, don't let that keep you from making this fun and practical project. To prove the point, we asked Frank to make a second entry bench out of mesquite, identical to the first, but without the carving. As you can see in the photo above, the beauty of the wood and the construction elements of the bench are sufficient to make this a beautiful project without the carving. Even so, simple relief carving is within reach of most woodworkers. If you try it out, it just may show up in your work on a regular basis.

— The Editors







Modular Shelf System

By Rob Johnstone

Three moldings (easily made on the router table) are at the heart of this shelving system. Our editor modeled it after a pricey wall unit he saw in a trendy catalog, saving some cash and upgrading the quality.

Continues on page 54



Production Approach Saves Time

My wife was looking at a bare expanse of dining room wall and then back at a catalog with an unnerving intensity. At about the same time, my discretionary income early warning system started buzzing, and I knew it was time to ask her what she was thinking.

"I was thinking if this would look nice on our wall," she said, pointing to a catalog picture. Surprisingly, I agreed, until I saw the poor quality wood and the high-test price.

"I might be able to build something even nicer, and for a lot less money," I said, concerned that I've said that before without living up to the promise. Thankfully, this time, it worked out just fine.



The wall shelf system project began with a mock-up to establish the proper dimensional relationships between the various moldings.

Fine Wood and Simple Lines

This is a really stripped-down piece of woodworking, but it's pleasing to look at because of the striking fiddleback maple I used for the wall moldings. I enhanced its natural color with a first coat of linseed oil, followed by several coats of dewaxed shellac. The intensely textured figure of the wood highlighted by the project's repetitive lines is quite pleasing to look at.

Three moldings which were formed on my router table make up the majority of this project. I decided to construct most of the shelves with a mitered frame and plywood top and bottom, because it makes the most frugal use of wood — in both quantity of stock and the number of dollars spent. I also made a solid wood shelf plate molding, featuring a plate groove, shown in the photo at left.

Mock-Up Test

To be certain that everything would work properly, I made a mock-up version of the wall molding and the shelf cleat molding, mounted to a faux wall, before I started. It helped me determine the critical distance between the wall molding pieces. If you follow the dimensions of the moldings shown at right in the *Material List*, the space between the moldings will be exactly 2". (See *Drawings* at right.) By using the mock-up and adjusting the various molding dimensions and configurations, I was able to set up my router table and test the fit of each molding as I machined it.

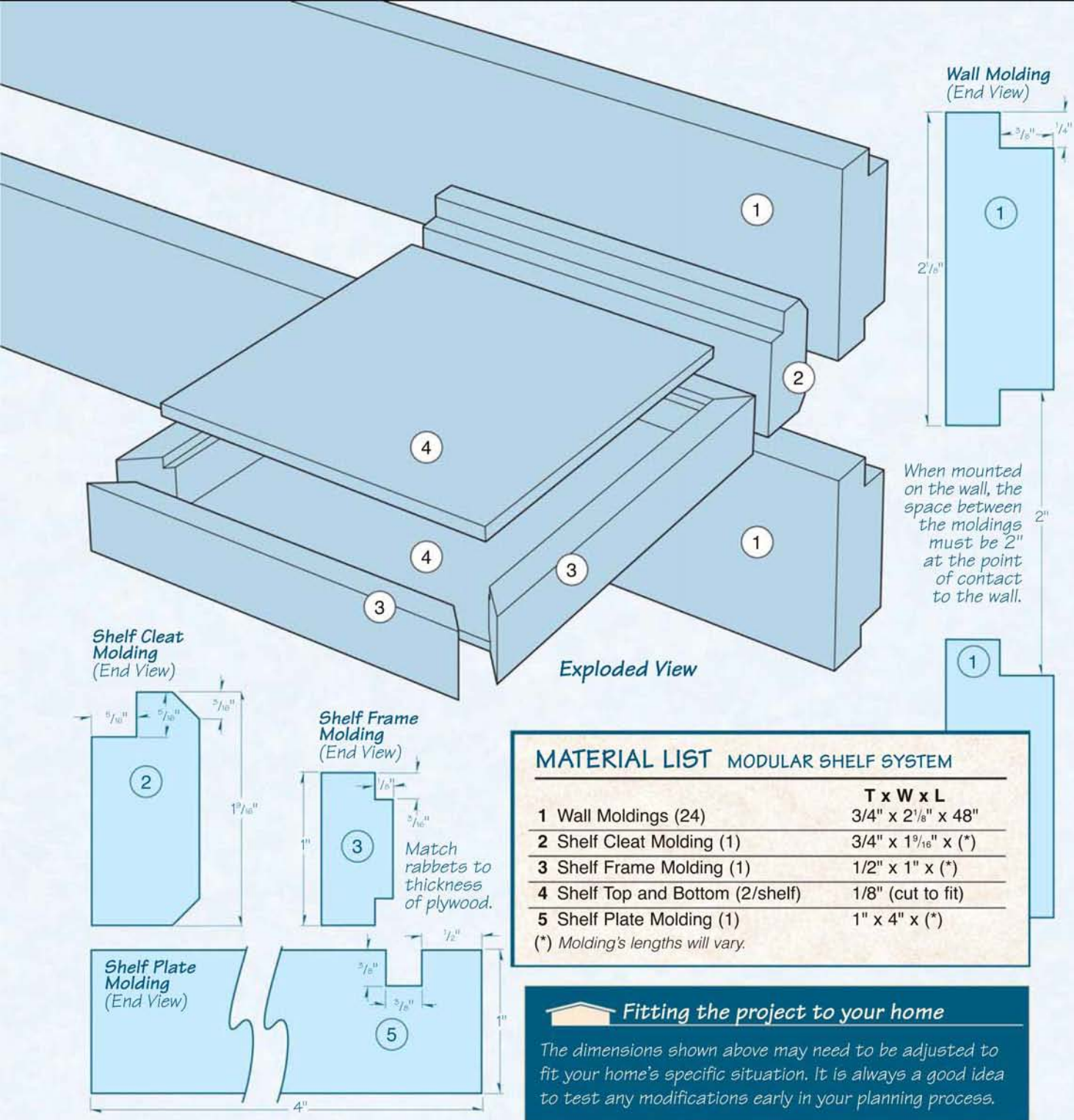


The shelf frames were pinned together at their mitered corners. Then, the plywood tops and bottoms were cut to fit the frames.

Because the maple I used presented such a curly grain, routing it was touchy — it really wanted to tear out on me. After a couple of sketchy cuts with a regular straight bit, I tried a compression bit made by Freud. It has two separate cutting edges machined on spirals, moving in opposite directions around the bit. It sounds kind of crazy, but it worked great to keep tearout to a minimum.

All three moldings were formed using a router table. The fiddleback curly maple was a challenge to rout ... the grain wanted to tear out. The author used a compression bit (inset photo, left) made by Freud to tame the wild grain.





Once all the moldings were formed, it was time to cut and assemble the shelves. Mitering the shelf frame moldings, I made all the shelves 4" deep but in lengths of 8" and 12". I pinned the mitered corners but glued the plywood to the frames. The cleat moldings were cut to length and glued to the shelves. My last step was to finish the shelves with three coats of linseed oil — no shellac. It's very easy to retouch if required.

Mounting the Wall Moldings

While you'll modify the measurements of this system to suit your needs, please consider that your wall moldings should be created in multiples of 16" lengths. This will match the 16" on-center studs in your walls. My wall moldings are 48" long, so they crossed three adjacent studs per molding. I secured them with 2" finish nails. Starting with the lowest rail, I used a full-length spacer in the

molding's rabbet to properly locate the next molding up. If you want even more strength, it is OK to use construction adhesive, too.

Now our wall is nicely decorated, and our bowls and knickknacks have a home. And this time out I built a much nicer unit, for considerably less than the catalog version! Whew.

Rob Johnstone is editor in chief of Woodworker's Journal.

Grand Canyon El Tovar Hotel Chair

By Bruce Kieffer

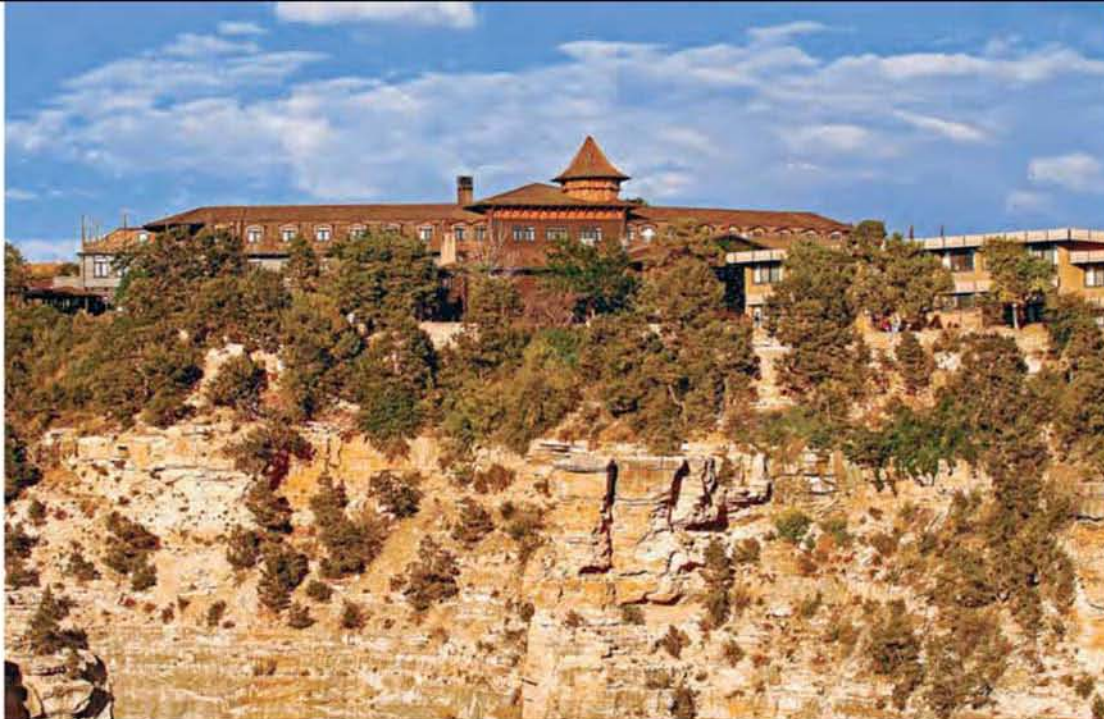
Build your own historic Stickley Brothers inspired dining chair using sturdy dowel-joint construction.

My wife and I have visited the Grand Canyon South Rim many times in the past decade. We luckily booked a room in the El Tovar Hotel on our first trip. It's a fantastic, quaint, bustling historic building set on the edge of the most incredible naturally formed canyon in the world. I'm in awe every time I go there.

Our first night's dinner was in the hotel's dining room. I noted dark log walls, an unusual serving buffet, large Hopi Indian murals and blasé chairs. A few years later while at the hotel again, I noticed the chairs were newly built in the

Mission style. I investigated and found they had been recently reproduced from photos and an original chair. There were notable differences between the reproductions and the white oak originals. The new chairs were red oak, they were shorter and slightly wider, the backs were more angled and the seat cushions were thicker and set on the seat frame rather than inside. Also, the reproduction chairs in the main dining room had arms; none of the originals did. I later learned the reason the original chairs had no arms was so women with large dresses, which were popular at the turn of the 20th century, could get in and out more easily.

I really liked the chairs, and I wanted to make some for myself. Running short of time, I made arrangements to get the chair details by phone at a later date. When I reached my hotel contact, he told me he found out that one of



Photography by: Scott Johnson Photography, Inc.

the wait staff owned an original chair. I was elated! I knew that if I could make it happen, I could measure the original chair and make an exact duplicate.

My wife and I planned another trip to the Grand Canyon in late 2005. I made arrangements to meet the staff to learn the history of the chair and measure the original. I went armed with my computer, tape measure and protractor. They put the original chair and me in the private dining room and closed the doors. Four hours later, I emerged with the chair completely drawn in 3D on my computer. I was ready to build my chairs, but a series of life events put a pause to that goal. They are done now, and I will show you how I built my El Tovar chairs. But first, here's a little history lesson about them.

History of the El Tovar Hotel and Dining Room Chairs

The hotel was built in 1905 and is described as "a cross between a Swiss Chalet and Norway Villa." It was the first luxury hotel built on the Grand Canyon South Rim and the destination for the newly laid Topeka and Santa Fe Railway line that ran from Williams, Arizona, to Grand Canyon Village on the South Rim. It was named in honor of Spanish explorer Don Pedro de Tobar (translated to Tovar) who reported the existence of the Grand Canyon to fellow explorers in 1540.

The railway company commissioned architect Charles Whittlesey to design the hotel. At the time, designers of national park and other lodges along the railroad lines were attempting to define new styles incorporating natural and local materials to create comfort and luxury. Whittlesey's design followed that idea by using mainly local stone and Douglas fir trees shipped in from Oregon. The hotel cost \$250,000 to build and opened January 14,

1905. It originally had 95 rooms, but a subsequent renovation shrunk that number to 78 to allow for private bathrooms in all the guest rooms.

The Fred Harvey Company, which had been building and operating facilities along the Santa Fe route for years, was hired to run the new hotel. They met Albert and John George Stickley, Stickley Brothers Co. furniture makers, at the 1904 St. Louis World's Fair. Fred Harvey commissioned the Stickley Brothers to make all the furniture for the El Tovar Hotel. The dining room chairs were built as part of that commission. Those chairs were used until the 1950s, and then they were unfortunately replaced with a set of nondescript chairs.



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The Stickley Brothers Company was commissioned to build all the furniture in the El Tovar Hotel (above), including the original dining chairs shown at right. They were used until the 1950s.



Little Tweaks for a Bolder Look

Construction Notes

I could have made my chairs exact duplicates of the originals, but I chose to make a few cosmetic changes to enhance the “Mission” look. There were different sized rounded-over edges used throughout on the original. Some were intentional, but others seemed either worn that way or added to hide some wear during a possible refinishing. Either way, I felt none enhanced the look of the chair, so I left them all off. The results make a bolder looking chair, in my opinion.

I liked the scale, proportions and comfort of the original white oak chair, so I didn’t change anything there. I’m almost sure (that’s a 100 percent maybe) that the original’s joinery was all mortise and tenon. I used dowels instead. I devised a simple angled block setup to use with my self-centering doweling jig so I could drill the dowel holes in the ends of the angled side rails.

The original chair seats were leather. The reproductions are vinyl. I bought upholstery-grade leather from a seller on eBay by searching for “upholstery leather.” You can upholster your seat using the instructions on page 62 or simply hire an upholsterer. Either way, I’ve got to tell you, leather

is more expensive and harder to work with than a high-grade upholstery vinyl. OK ... let’s build a chair!

Shaping the Legs with a Template

The rear legs are shaped using a template, jig and router. Start by making a rear leg template of the shape shown in the *Drawing* on page 61 from 1/2" Baltic birch plywood. Trace the rear leg shapes to the rear leg blanks (pieces 1). Rough-cut the rear legs leaving about 1/16" extra on the sides to be routed away later, and leave the ends an extra 1 1/2" long. The extra “tang” on the ends are used to screw the leg to the routing jig. The rear legs are mirror images of each other when the dowel holes are drilled, so don’t forget to flip one over when you trace the shapes.

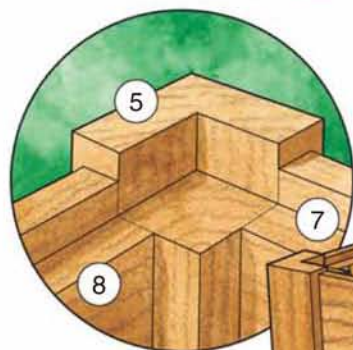
The author used a template to mill the rear legs to shape. A pair of long built-up supports, fastened to a base on both sides of the template and leg blank, stabilize this routing operation.



Mark the centerpoints of the slat dowel holes in the crest and seat back rails using a curved template clamped to the workpiece.

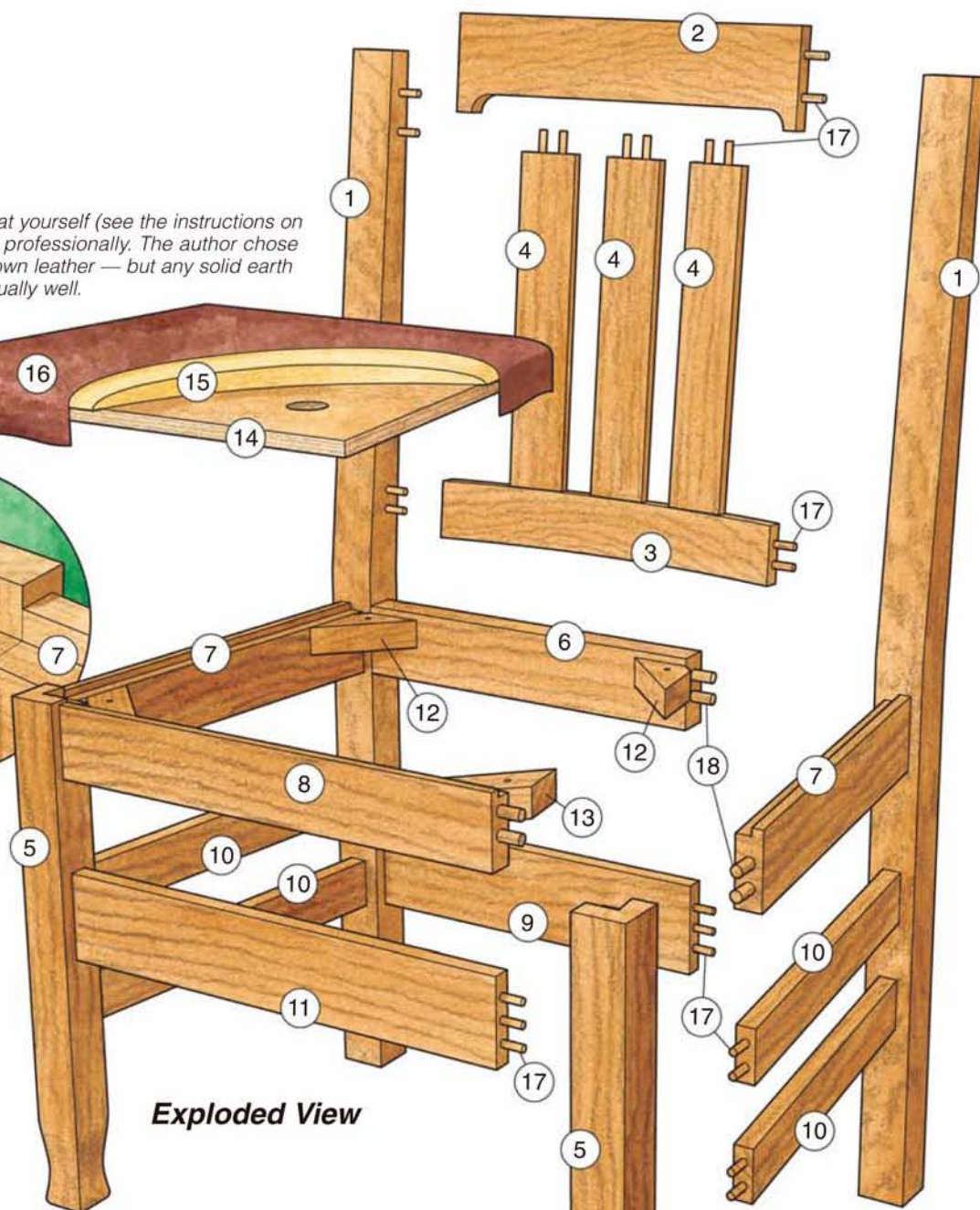
In 2003, the hotel’s food and beverage department decided to replace the then worn-out dining room chairs. They hired the Schafer Commercial Seating Co. of Denver, Colorado, to make a prototype chair based on photos of the original Stickley Brothers chair. Thomas Ratz, a waiter at the hotel, saw the prototype chair and felt “it didn’t look or sit well.” By coincidence, Thomas owned an original chair, which he bought at an antique store in Scottsdale, Arizona. Thomas’s chair was sent to Colorado and another prototype was made. The results were a “near match” according to Thomas, but the food and beverage department felt some changes needed to be made so the chairs would be more comfortable. That’s why there are differences, as I have noted, between the original chairs and the reproduction chairs.

You may upholster the seat yourself (see the instructions on page 62) or have it done professionally. The author chose a historically accurate brown leather — but any solid earth tone color would work equally well.



Front Leg Corner Notch Detail

See page 63 for a photographic detail of the corner notch.



Exploded View

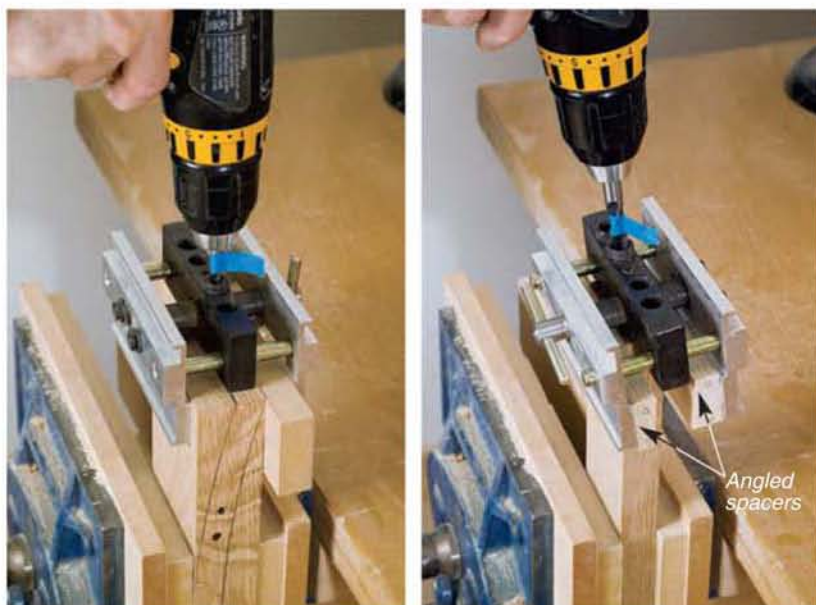
Dowel joinery is a time-honored technique when building chairs. The author suspects that the original chairs were constructed with mortise and tenon joints. This chair would accommodate mortise and tenon joinery, but the Material List would need to be changed significantly to allow for additional tenon lengths.

MATERIAL LIST

	T x W x L
1 Rear Leg Blank (2)	1 ⁵ / ₈ " x 3 ¹ / ₂ " x 40"
2 Crest Rail (1)	1 ¹ / ₂ " x 3 ¹ / ₄ " x 12 ³ / ₄ "
3 Seat Back Rail (1)	1 ¹ / ₂ " x 2" x 12 ³ / ₄ "
4 Slat (3)	3/8" x 2" x 11 ³ / ₈ "
5 Front Leg (2)	1 ⁵ / ₈ " x 1 ⁵ / ₈ " x 18"
6 Rear Seat Rail (1)	1 ¹ / ₁₆ " x 2 ¹ / ₂ " x 12 ³ / ₄ "
7 Side Seat Rail (2)	7/8" x 2 ¹ / ₂ " x 13 ¹⁹ / ₃₂ "
8 Front Seat Rail (1)	7/8" x 2 ¹ / ₂ " x 16 ¹ / ₄ "
9 Rear Rail (1)	5/8" x 3 ¹ / ₄ " x 12 ³ / ₄ "

	T x W x L
10 Side Rail (4)	5/8" x 1 ³ / ₄ " x 13 ⁹ / ₁₆ "
11 Front Rail (1)	5/8" x 3" x 16 ¹ / ₄ "
12 Rear Corner Block (2)	1" x 1 ³ / ₈ " x 3 ¹³ / ₁₆ "
13 Front Corner Block (2)	1" x 1 ³ / ₈ " x 3 ⁹ / ₁₆ "
14 Seat Plywood (1)	1/2" x 14 ¹ / ₄ " x 18 ¹ / ₄ "
15 Seat Foam (1)	1" x 15 ¹ / ₄ " x 19 ¹ / ₄ "
16 Leather or Vinyl (1)	20" x 24"
17 Dowel Pin (48)	1/4" Dia. x 1 ¹ / ₂ "
18 Dowel Pin (16)	3/8" Dia. x 1 ¹ / ₂ "

Jig-guided Dowel Joinery



Use a self-centering doweling jig and a 3/4"-thick spacer to drill dowel holes in the ends of the crest and seat back rails (left photo). Angled spacers taped inside the doweling jig tilt it for drilling the holes in the ends of the side rails (right photo).

Make the leg routing jig shown in the top photo on page 58. Use a 3/4" x 12" x 45" piece of scrap particle-board as the platform and stacked-up 1 5/8"-thick wood and 1/2" Baltic birch for the outer router base supports. Screw the leg blank, inside face up, to the platform going through the end tangs. Attach the template to your leg blank using 1 1/4"-long screws, located in the four hidden areas where the rails will be.

Rout the leg shape with a top-bearing flush-trim router bit. If your bit is not long enough to cut the entire 1 5/8" thickness, then remove the leg from the jig, remove the template, flip the leg over, and trim away the remaining waste with a bottom bearing flush-trim router bit. Cut away the leg end tangs, and sand the edges smooth.

Cut the front legs (pieces 5) to size. Shaping the feet is a two-step process. Draw the foot shapes on the fronts and backs of the front legs. Use a band saw to cut the shapes and use a spindle sander to smooth the sawn edges. Draw, cut and smooth the foot shapes on the other two sides of the front legs.

Lay out the notches on the front leg tops where the seat cushion will rest. Using a dovetail saw, cut a kerf 3/8" down from the top on the inside corner of each leg. Doing this now greatly simplifies clearing the notches later, after the chair is assembled.

Drilling the Dowel Holes

Drill all the dowel holes now except those in the rear legs for the crest and seat back rails. Now cut the rest of the chair parts to size (pieces 2, 3, 4 and 6 through 13). Cut the ends of the side rails (pieces 7 and 10) to 82.5° as shown in the *Drawings* at right. Mill rabbets on the inside edges of the side and front seat rails.

Make the curved template for the crest and seat back rails. Lay out the slats and dowel holes on the template. Drill a small hole through the template, centered in each

slat dowel hole location. Clamp the template to the crest and seat back rail pieces, trace the shape, and use an awl to mark the centers of the slat dowels.

Drill the 1/4"-diameter slat dowel holes in the crest and seat back rails. Drill the crest rail slat dowel holes 17/16" deep so that they will end up 13/16" deep later, after the corbel shape is cut. Drill the seat back slat dowel holes 13/16" deep.

Use a self-centering doweling jig to drill the 1/4"-diameter dowel holes in the ends of the crest and seat back rails. Place a

3/4"-thick spacer on the front side of those rails, clamp the doweling jig in place, and drill the holes 9/16" deep. Drill the 13/16"- deep dowel holes in the ends of the slats (pieces 4).

You'll need to make two angled spacers for your doweling jig to drill the dowel holes in the ends of the side rails (pieces 7 and 10). Take a 1 1/4" x 1 1/4" x 16" piece of wood and rip it with your table saw blade set at 7.5° and the rip fence set at 9/16" (see *Drawing*). Cut 5" lengths off the ripped strips. Label the ends as shown in the *Drawing*. Adhere the angled spacers to the inside faces of your doweling jig with double-stick tape. Have the B and D edges up and the angled faces inward (see top right photo). Drill the dowel holes in the ends of the side rails, and then remove the angled spacers.

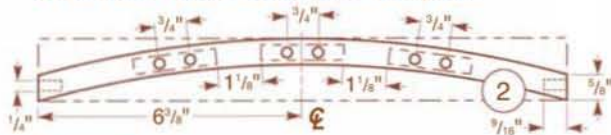
Drill the dowel holes in the ends of the remaining rails (pieces 6, 8, 9 and 11) and in the legs for all the rails except the crest and seat back rails.



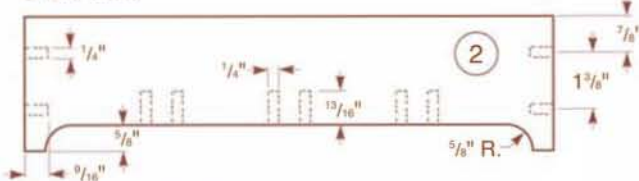
Sand the inside faces of the crest and seat back rail with a curved wooden sanding block.

El Tovar Chair Elevation Drawings

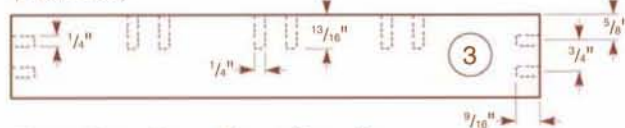
Crest and Seat Back Rail Template



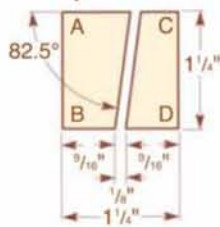
Crest Rail (Front View)



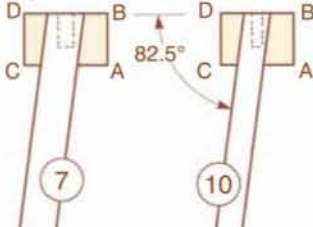
Seat Back Rail (Front View)



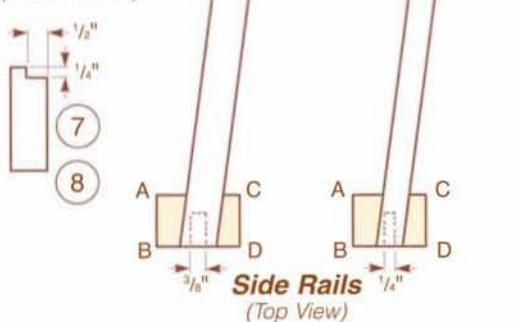
Doweling Jig Spacers



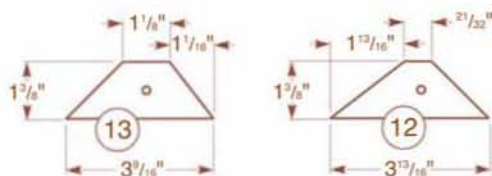
Doweling Jig Spacer Orientation



Seat Rail Rabbets (Section View)



Side Rails (Top View)

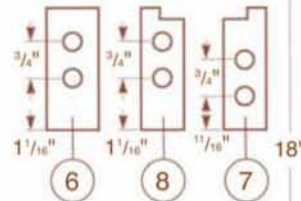


Corner Blocks (Top Views)

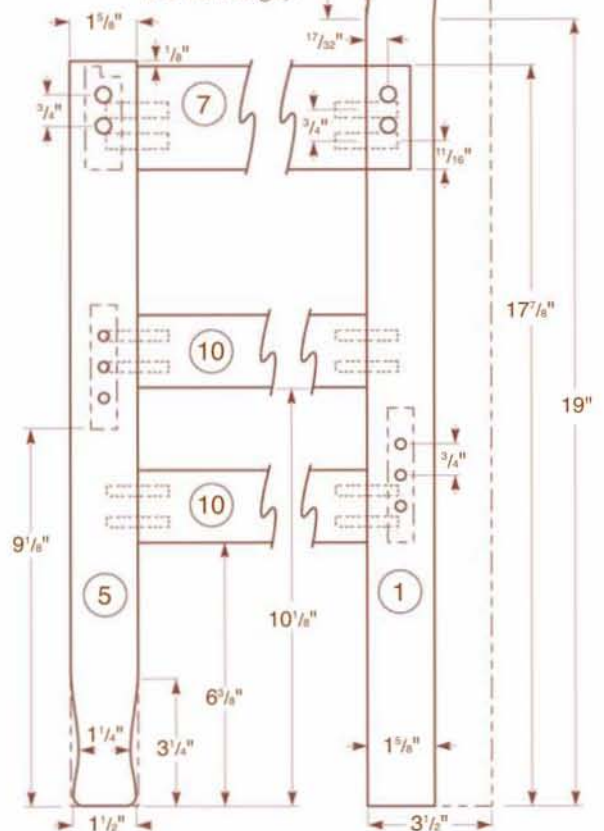
Chair Assembly (Side View)

Rail Dowel Locations (End Views)

The seat rail dowel pins (pieces 18) are offset to miss each other.



The majority of the dowel holes are centered on the legs. The exception is the holes bored for the rear seat rail, piece 6 (set back 17/32" from the front edge).



Dry-fitting the Chair Back

Use a band saw to cut the inside curves of the crest and seat back rails. Make a wooden sanding block to match the curve radius, and sand the sawn curve faces smooth. Now cut the outside curves and sand them smooth. Cut the corbel shape on the bottom edge of the crest rail, and sand it smooth.

Finish-sand the seat back parts and ease any exposed

edges. Dry-assemble the seat back. Insert 1/4" dowel centers in the rail dowel holes. Align the seat back to each rear leg, press it down to mark the dowel holes, and then drill the holes.

Glue and clamp the slats to the crest and seat back rails. Dry-fit the rear legs and rear rail (piece 9) to the seat back to ensure all is aligned properly.



Wrapping Up the Seat

There's no sewing required for the seat cushion — it's just a simple "wrap." This upholstery isn't hard to do, but it can be fussy getting it to look good. Practice with scrap materials before you do your final seat cushion.

Start by fitting the seat plywood (piece 14) in the chair opening and allowing space for the leather. The final fit should be just slightly loose. Check the fit by placing scraps of your leather in all the corners between the frame and plywood. Round the plywood corners to a 1/8" radius, and aggressively ease the top and bottom edges with coarse sandpaper. Drill 1"-diameter air relief holes in the plywood about 5" in from each corner.

Trace the seat plywood pattern to the seat foam (piece 15) and the leather (piece 16). Cut the foam leaving an extra 1/2" all around, and cut the leather leaving about 3" extra all around. Adhere the foam to the seat plywood top with spray adhesive.

Set the plywood and foam on the leather and start "wrapping." Set your stapler to light pressure so you can "baste" the staples, which means setting them shallow so they are easy to remove. Tack the front edge down in the middle. Pull the rear edge tight, and tack it down in the middle. Remove the front edge staples, pull the front edge tight, and tack it again in the middle. Now do the same with the sides. Increase the tension of the leather on all four sides until it looks good on top.

Set your stapler pressure for full depth. Pull the leather tight, and staple toward and into the corners. Pinch the leather in the corners, and use a knife or scissors to trim away the waste. Hammer the leather in the corners down to flatten it, and then add a few more staples. Trim away any excess leather from around the seat cushion.

Set the upholstered cushion in the chair. It should fit tight. If you find any odd bunching areas on the cushion edges, you can lightly hammer them down to flatten them out. Fasten the seat cushion to the chair, driving screws up through the corner blocks.

Upholstery by the Numbers

Photo 1: Staple the leather to the seat front. Pull the leather tight, and staple the back.

Photo 2: Pull the leather tight and staple the sides.

Photo 3: Pinch the corner leather and trim it off with a knife or scissors.

Photo 4: Add staples to finish the corner.





Use dowel centers to mark the seat back dowel hole locations on the rear legs. Drill these holes and assemble the seat back. The legs are set in place without glue for alignment. Carry out a full dry-assembly before opening your glue bottle.

Assembling the Chair

Finish-sand the unassembled chair parts, and ease all the exposed edges. Glue and clamp the rear legs, seat back, rear seat rail and rear rail together. Glue and clamp the front legs, front seat rail and front rail together. Now glue and clamp the front, back, side seat rails and side rails together to assemble the chair. Check the chair for square by measuring the diagonal lengths from seat corner to seat corner, as shown below. When equal, the chair is square.

Using a chisel, chop the notches for the seat cushions on the front leg tops. Use a band saw and stationary sander to shape and fit the corner blocks (pieces 12 and 13), and then attach them with screws.



Notch the tops of the front legs to accept the seat cushion. Note the thin saw-kerf at the bottom of the notch. This was cut earlier in the process.

Finishing Up

Apply your choice of stain and finish. I applied one staining coat of DeftOil Black Walnut Danish Oil Finish; I let that dry for three days, and then I top-coated that with three coats of clear Natural DeftOil finish. For a lighter color, try one of the other DeftOil walnut colors for the stain coat instead.

Bruce Kieffer is a professional woodworker and a frequent contributor to Woodworker's Journal.

Check the chair's squareness by measuring the corner-to-corner diagonals between the legs. Readjust the clamps, if necessary, until these measurements are equal.



Credits: This story would not have been possible without gracious help from the following people: Thomas Ratz, El Tovar Hotel waiter; Eli Murphy, El Tovar Hotel bellman; Mona Mesereau, Mesereau Public Relations; and Jon Streit, Xanterra South Rim Executive Director of Operations. Thanks to all.

— Bruce Kieffer

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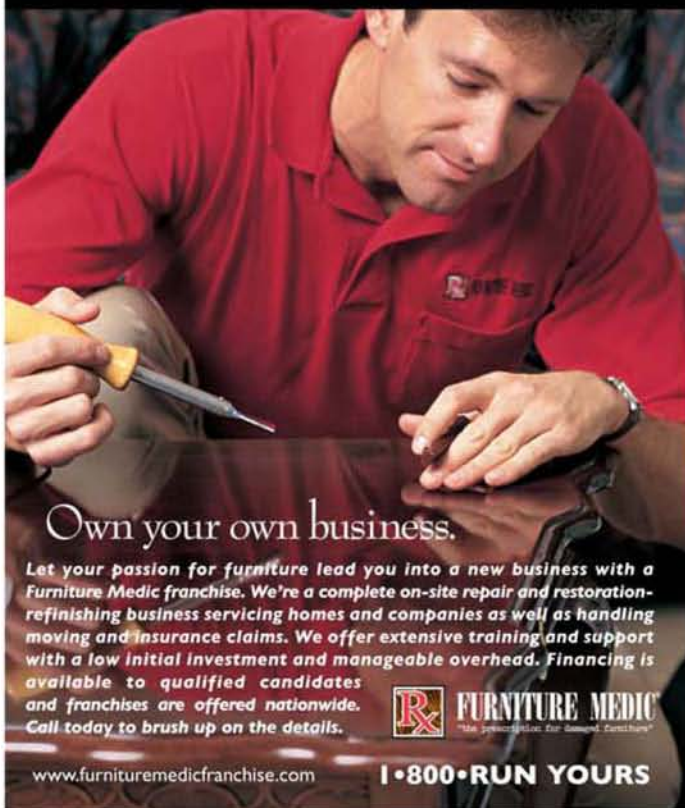
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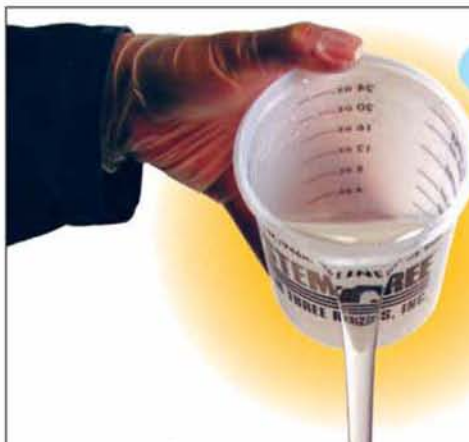
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(Amana)



Instile and Rail System
(Amana)



Finger Joint Bit
(Sommerfeld
Tools)

Router Bits You've Never Heard Of

... but you'll really want to try!

By Bill Hylton

Here is a gathering of **10** router bits (including sets of router bits that work together) that will make your life easier in the shop. Some of them are really clever!

So much is going on in the router realm that it's difficult to stay current. Routers don't fundamentally change from year to year, of course, and neither do router bits. But each year introduces a few novel and occasionally revolutionary bits. And if you aren't paying close attention, you simply don't hear about them.

A couple of years back, a buddy of mine was holding the floor at a meeting of the local woodworker's guild, explaining how to calculate bevel angles and set up the table saw for making sides of hexagonal and octagonal boxes. Partway into his talk, someone shouted, "Aw, you just use a bird's-mouth bit!"

To save you a similar embarrassment, here's my list of 10 great bits (including bit sets) that you ought to know about. Just in case you don't already ...

The Cast of Characters

Screw Slot Bits

Making slots for screws — rather than simply drilling around pilot holes — is sometimes essential to

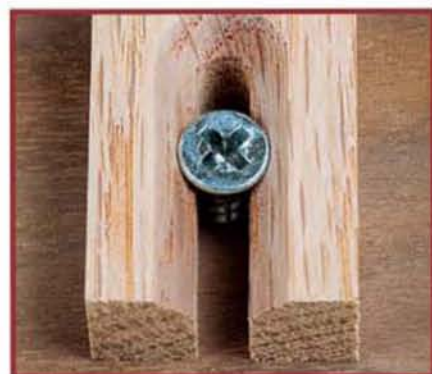


Screw Slot Bits
MLCS

allow for wood movement or for adjustability. But making those slots can be really putzy.

Did you know you can get a router bit to cut those slots? Two, in fact: one to make a slot with a countersink for a flathead screw, another for a counterbored slot for a round-head screw. Both are proportioned for #8 screws.

Use the bit in a plunge router (or in a table-mounted router) to cut a slot in one quick operation.



Clean slots for #8 screws are a job for the router, not the drill press. One bit cuts the slot and a countersink (top); the other makes a slot with counterbore. Use a plunge router to make blind slots.

Today's Shop continues on page 68 ...



Tongue and Groove
Edge Banding Set
(Infinity)



Box Joint Bit
(Infinity)



Edge Banding Set
(Eagle America)

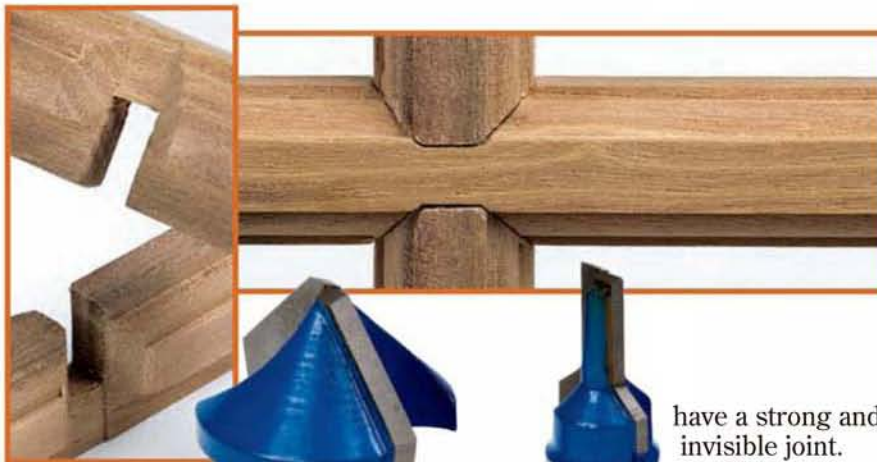


Grill Cutter Set
(Woodline USA)



Reversible Drawer
Lock Glue Joint Bit
(Eagle America)





A cross-lap joint is traditional for joining horizontal sash bars, called muntins, and vertical sash bars, called mullions. The joint is strong, it positively aligns the bars, and it looks sharp.



Window Grill Cutter Set
Woodline USA

have a strong and invisible joint.

When you are making a grid of more than four lights, you do have to lay out the cross-laps precisely. Your router table setup must enable you to locate the

cuts precisely from piece to piece. Cut the cross-lap joints before routing the profile and the rabbet for the glass. The profiling cuts parallel to the grain, so it'll clean up cross-grain blowout from the joinery cuts.

Window Grill Cutter Set

A number of bit vendors have specialized bit sets for constructing divided light doors and for making window sashes. A finicky aspect of any divided light construction is the sash-bar joinery. Do you cut tiny mortises and tenons for each joint or depend on the strength of a simple cope-and-stick joint? A cross-lap joint is traditional and strong, but it's tedious to cut accurately.

Not anymore! Unbeknownst to us poor woodworkers, bit makers have come up with a pair of cutters that make this cross-lap doable. And easily doable, too! One bit is a 1/4" straight bit, the other a V-groover with the point clipped off. It cuts a V-groove with a 1/4"-wide flat bottom.

Here's how the system works. Cut a 1/4"-wide dado across the top edge of one sash bar and across the bottom edge of its mate. The depth of the dados is half the stock thickness. Next, use the modified V-groover to cut across both sides of both sash bars. Center this cut on the two previous cuts, and set the cut depth to leave a 1/4" of wood between them.

When the cuts are done, the two bars should slide together. You

Finger Joint Bit

You've seen paint-grade moldings at the home center — the stuff made up of those short pieces joined end-to-end with finger joints. Have you ever thought how great it would be to "stretch" a board like that? Did you know you can cut that joint on your router table?

The finger joint is a positive-negative interlock, in which tapered projections (the fingers) on one piece fit into tapered grooves in the other. It expands the glue area threefold, but more importantly, it exposes long grain surfaces for gluing. That's why it works for end-to-end joinery.

Miters glue poorly because you're bonding end grain to end grain. Mill the ends with a finger-joint bit to create nesting long-grain surfaces, and the miters will glue up tight and strong.

It works great for miter joints as well as for joining plywood panels to each other and to edge banding. The bit that cuts the joint is not cheap, and when you see it, you understand why. The Sommerfeld bit comprises a stack of four-wing finger cutters and a thicker shoulder cutter, along with a ball bearing guide on a 1/2"-shank arbor. The full assembly is impressive, though at just over 1 1/2" in diameter, it can be run at full speed in a 1 1/2 HP router.

Out of the box, the bit has five finger cutters stacked atop the bearing and capped with the shoulder cutter. You must reorder the stack according to the stock thickness. For example, you use only two finger cutters and the shoulder cutter to mill stock that's 5/8" to 13/16" thick.

Today's Shop continues on page 70 ...

Finger Joint Bit
Sommerfeld Tools



Best known for end-to-end joinery, the finger joint also reinforces miter joints, joins plywood pieces edge-to-edge and attaches edge-banding to sheet goods.



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Instile and Rail System™
Amana Tool



have a definite shortcoming. They're 1/4"-wide. That's too wide for conventional 1/4" plywood, which is on the order of 7/32" thick, and too narrow for 1/2" plywood, which is thinner than its nominal thickness, too.

Several years ago, the tooling engineers at Amana came up with cope-and-stick bits incorporating adjustable slotters for the panel groove. The two-piece slotter can be shimmed to expand it from 3/16" to 9/32" for thin ply. For thicker plywood, you add a third element to the slotter. Using the shims, you can expand its basic 7/16" cut to 17/32" for 1/2" plywood.

Edge-banding Bits:

A lot of woodworkers can't accept a plain old glue joint for edge-banding plywood. They just don't believe that glue spread on the plywood's edge will secure a thin strip of solid wood to the plywood. So, here are a couple of profiles designed specifically for edge-banding.

I like these V-groove-based edging approaches. You chuck the "ply-

wood" bit in your table-mounted router and just center the cut on the plywood edge. Given the shapes of the cutters and the odd number of plies in veneer-core plywood, it's surprisingly easy to do. When you switch bits, you use a sample of the cut plywood to adjust the height of the edging bit.

The profiles give you a positive fit; you won't find the edging squirming out of alignment as you apply clamping pressure. Moreover, you get some long-grain to long-grain gluing surfaces, yielding a stronger bond than the long-grain to end-grain match you get with conventional glue-ups.



Edge-band bits that mill both the plywood and the edging produce stronger-than-the-glue joints that align positively. Easy and effective.

The edging has enough substance to allow tight miters at corners. And you can trim the edging very, very close to the plywood veneers without fearing the edging will delaminate from the plywood.

Today's Shop continues on page 72 ...

Instile and Rail System™

Flat-panel doors are practical and attractive. And making the panels from plywood is economical and labor-saving. No need to plane down stock, glue up narrow boards, then rip and crosscut individual door panels, and finally back-cut their edges. You can cut the panels for a dozen doors from a sheet of plywood in minutes. In addition, because plywood is stable, you can glue it into the frame to reinforce the door.

But the panel grooves cut by conventional cope-and-stick cutters

Edge Banding Bit Set Infinity Tool/Eagle America



Eagle America



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Box Joint Bit Infinity Tool

Box Joint Bit

This is a bit for cutting box joints in thin, narrow stock for tiny boxes and drawers. One pass cuts all the notches and tabs in the end of a piece $1\frac{9}{16}$ " wide. Two passes (and a bit adjustment) are needed to form the joinery on anything wider — up to a maximum of $3\frac{7}{8}$ " wide.

There's nothing to take apart, switch around or shim for a proper fit. Chuck the bit in your table-mounted router, adjust the bit height carefully, and rout away.

Make yourself a pusher to support the parts on-edge and back up the cuts. It'll also allow you to clamp the



parts so they don't get pulled in by the cutter. The width of your stock is critical. Perhaps the easiest approach is to rip your pieces as close to $1\frac{9}{16}$ " as you can. Then cut the joints, assemble them and hand-plane the top and bottom edges of the boxes to make all the edges flush.

For making shallow boxes and drawers from thin stock, Infinity's box joint bit is a good choice.



Close-up of box joint in a small cedar box.

Today's Shop continues on page 74 ...

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Bead-and-Cove Bits Rockler



Bead-and-Cove Bits

A handsome canoe is always pictured with the catalog blurb about this bit. Since you don't really know a bit until you've tried it, I tried one. It's unlikely I'll ever make a canoe, but the bits are truly useful.

Any coopered or staved construction is simplified with this style of bit. There's no need to calculate the angle between adjoining strips in a particular construction. You just rout an adjustable flute-and-bead joint. One edge of each strip is fluted (or coved, if you prefer), and the other gets a matching bead. Put two strips together, edge-to-edge, and you have a tight joint that can be adjusted almost 45° in either direction.

This is a good way to assemble wooden hot tubs, planters, barrels, coopered doors or bowed tops for chests.

Usually you see two-bit sets for this application, and in just one size that forms a 1/8"-radius flute/bead. While you can mill stock about 1/2" thick with those sets — producing a kind of tongue-and-groove edge joint — the radius limits you to 1/4"-thick stock for real staved constructions.

The essence of staved construction is joining narrow slats into curved forms using flute-and-bead joints. The nosed edge of one stave seats tightly into the concave flute of its neighbor.

Rockler's innovation is to put both the flute and bead profiles on one shank. To switch from one profile to the other, you only have to raise or lower the bit, not change from one bit to another. In addition, four different sizes are available.

Lonnie Bird Tambour Door Bit Set

For the first time I can remember, I want to make something with tambour doors. All it's taken to revamp my woodworking desires was about 90 minutes with this nifty three-bit set. Revolutionary, if you ask me.

The set originated in the mind of Lonnie Bird, who I know as one of the gurus of reproducing 18th-cen-



Lonnie Bird Tambour Door Bit Set Amana Tool

tury American furniture. While I can't picture Queen Anne or Chippendale pieces with tambour, Bird has nonetheless designed a great system. The literature and DVD that accompany the set explain it clearly and provide step-by-step directions for making a tambour-door breadbox.

The singular feature is the interlock of the slats. No need to glue the strips to canvas. Each has an integral bead along one edge and a slot in the other. A slat's bead slides into the slot in its neighbor. Make as many slats as you need, slide them together, and your tambour is done.

Slats created with the Lonnie Bird Tambour Bits have a wood-to-wood connection: the bead along the edge of one slat is captured in the groove of another slat.



Making the slats is remarkably easy. Rip 1/2"-thick stock into 1 15/16"-wide strips. Each strip will yield two tambour slats. Four passes across the shaping bit transform the strip into two ungrooved slats linked at their beads. Rough out each groove with a pass over the table saw blade, then complete its shape with a pass over the ball-head groover, the second of the set's bits. Rip the slats apart on the table saw, and they're ready for the sanding and finishing.

The set's third bit, a 1/8" round-over, is used only to ease the edges of the end slat.

Reversible Drawer Lock Glue Joint Bit

Most woodworkers know of glue-joint bits and drawer-lock bits. But there's a form of the glue-joint bit that's scaled for thin stock. And it will cut joinery for assembling drawer boxes.

You ought to get to know this little cutter. Use it to mill adjoining edges of 1/2" stock when making drawer boxes. The advantage in this is that the joint — so long as it is properly cut — forces the faces of adjoining boards to come flush as you clamp them.



Reversible Drawer Lock Glue Joint Bit Eagle America



Assembling a drawer with a lipped front takes two setups — one for the front cuts, a different one for the sides.

Today's Shop continues on page 76 ...



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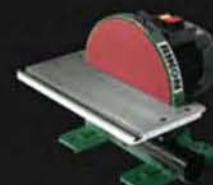
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Beyond that, use the bit to cut a drawer-lock joint that I believe is stronger than the conventional routed drawer lock. In addition to the interlocking tabs of the conventional joint, this one has an extra shoulder or two that can give the joint just a little extra resistance to racking stress.

Bird's-Mouth (aka Multi-angle) Bits

The wrens that set up housekeeping outside my office window each spring owe their little house to the bird's-mouth bit. These bits — there are three different ones in the set — enable you to mill one edge of boards and assemble them into hexagonal, octagonal and other-agonal forms.



Close-up of the joint in the wren house.



Bird's-Mouth Bits
Lee Valley

If you're looking for a good way to construct multi-sided boxes, here it is. You don't have to calculate bevel angles. You just decide how many sides your construction will have, chuck the appropriate bit in your table-mounted router, and start routing. When you're done, the routed bird's-mouth is self-aligning.

I first tried the bits several years ago, making multi-sided tubes. I made an eight-sided form from thin strips of Spanish cedar, then transformed it into a kind of cigar humidor by adding rabbeted disks for a bottom and top.

The six-sided form made of Western red cedar strips began my wren's house, simply by mounting it to a board hung on a nail in a deck post. Maybe there's something extra in the bird's-mouth joinery. Every year, Mamma and Poppa Wren show up, push the old nest out onto the ground, then recycle the twigs and strings and other debris into a new nest.



Western red cedar wren house made with a bird's-mouth bit.

Bill Hylton is a woodworker, author and a frequent contributor to Woodworker's Journal.

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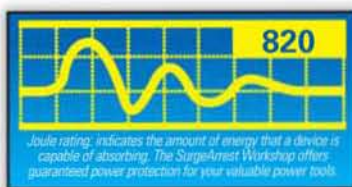
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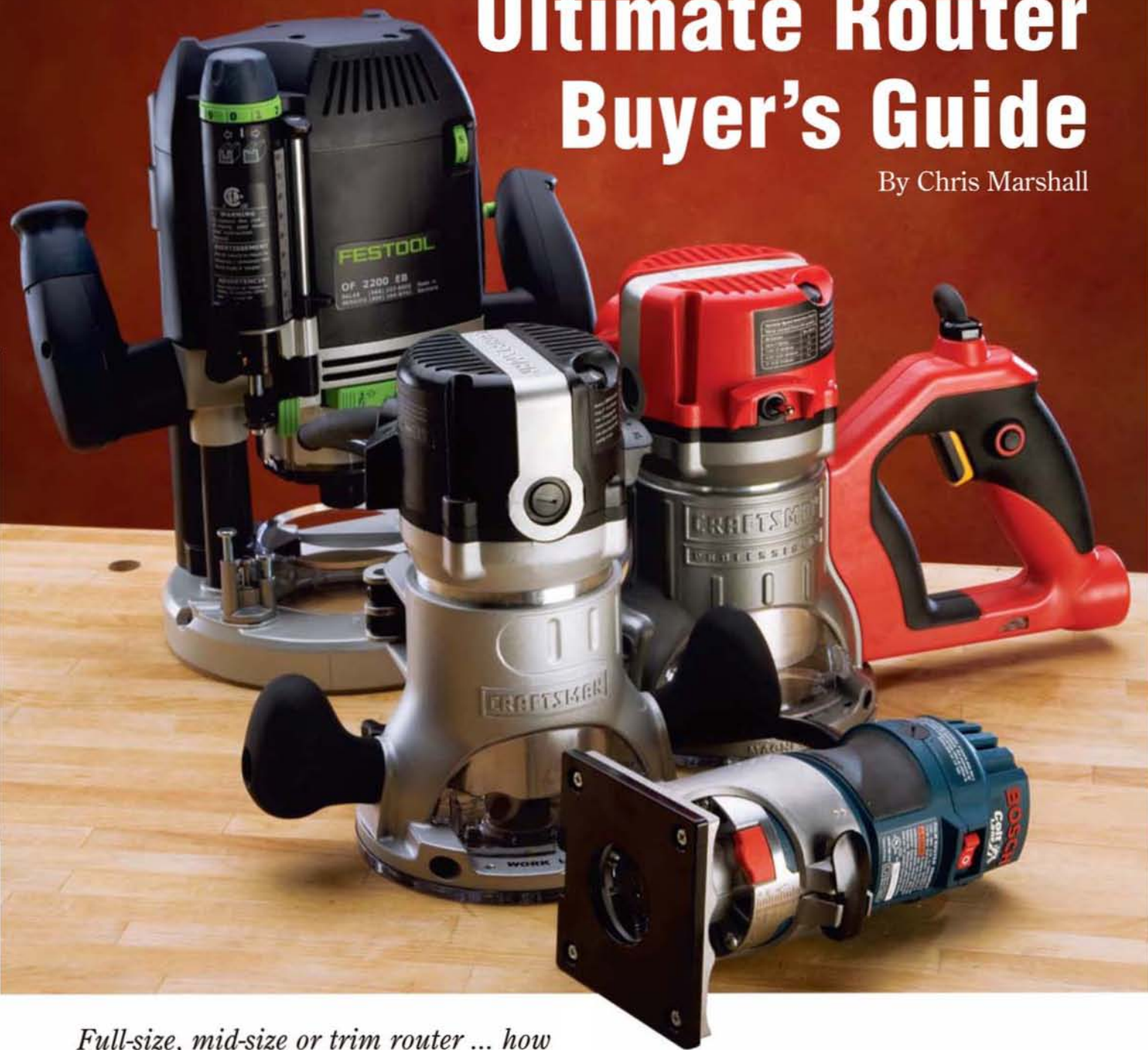
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Ultimate Router Buyer's Guide

By Chris Marshall



Full-size, mid-size or trim router ... how do you choose? Use the charts in this article as a guide, or try our online database to find the perfect fit.

If you've got visions of spiffy new routers dancing in your head this holiday season, you're going to need a good shopping guide to help pluck the perfect sugarplum. These days, there are more routers on the market than even Santa can keep up with — 88 different

machines or packaging options and counting! That's why we've put together this *Tool Preview* article. It's NOT a head-to-head tool test; instead, we're dedicating this space for our first-ever, comprehensive router shopping guide. It includes every major-brand router currently

on the market, with the critical stats you'll need to make that buying decision a lot easier. We've grouped them into four primary categories: trim routers, mid-sized routers, combination fixed/plunge base kits and full-size routers. You can certainly use these printed charts as stand-

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Matching a Router to Your Needs

If this will be your very first router or you're just getting started in the hobby, choosing the "best" machine can be bewildering, but it doesn't have to be. Before you get lost in the sea of router sizes, prices and features, step back and consider what you want your new router to do. In other words, focus on function, and try to be realistic about your skills and needs. If a router will basically be a means for you to soft-

Tool Preview continues on page 82 ...

Trim Routers: Tiny but Tough as Nails

Manufacturer	Model	Price	Base Style	HP / Amps	RPM	Collets	Dust Port	Other Features	Contacts
Bosch	PR10E	\$99.68	Fixed	1HP / 5.6 Amp	35,000	1/4	No	EFC, SS, SL, CC	www.boschtools.com 877-267-2499
Bosch	PR20EVSK	\$119.75	Fixed	1HP / 5.6 Amp	16,000-35,000	1/4	No	VS, EFC, SS, SL, EG, CC	www.boschtools.com 877-267-2499
Bosch	PR20EVSND	\$202.68	Fixed	1HP / 5.6 Amp	16,000-35,000	1/4	No	VS, EFC, SS, SL, EG, 2AB, CC	www.boschtools.com 877-267-2499
Craftsman	Professional 28212	\$109.99	Fixed	1.25HP / 6.5 Amp	18,000-25,000	1/4	No	VS, SS, SL, CC, WL, 1AB	www.sears.com 800-349-4358
DeWalt	D26670	\$99	Fixed	5.6 Amp	30,000	1/4	No	SL	www.dewalt.com 800-433-9258
DeWalt	D26670K	\$179	Fixed	5.6 Amp	30,000	1/4	No	SL, CC, 2AB	www.dewalt.com 800-433-9258
Festool	MFK 700 EQ	\$510	Fixed	6 Amp	10,000-26,000	1/4, 8mm	Yes	VS, EFC, SS, EG, CC, 2AB	www.festoolusa.com 888-337-8600
Freud	FT750T	\$99	Fixed	1HP / 6.5 Amp	27,000	1/4	No		www.freudtools.com 800-334-4107
Grizzly	H7790	\$45	Fixed	5/8HP / 2.1 Amp	30,000	1/4	No	EG	www.grizzly.com 800-523-4777
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Makita	3707FC	\$159	Fixed	4.4 Amp	26,000	1/4	No	EG, WL	www.makita.com 800-462-5482
Makita	3709	\$119	Fixed	4 Amp	30,000	1/4	No	EG	www.makita.com 800-462-5482
Porter-Cable	7310	\$89	Fixed	5.6 Amp	30,000	1/4	No	SL	www.deltaportercable.com 888-848-5175
Porter-Cable	97310	\$199	Fixed	5.6 Amp	30,000	1/4	No	SL, EG, CC, 2AB	www.deltaportercable.com 888-848-5175
Porter-Cable	97311	\$219	Fixed	5.6 Amp	30,000	1/4	No	SL, EG, CC, 3AB, Solid carbide bit	www.deltaportercable.com 888-848-5175
Ridgid	R2400	\$99	Fixed	6 Amp	20,000-30,000	1/4	No	VS, EFC, SS, EG, CC, Flush trim bit	www.ridgid.com 800-474-3443
Ryobi	TR45K	\$79.97	Fixed	4.5 Amp	25,000	1/4	No	CC, 1AB, Flush trim bit	www.ryobitools.com 800-525-2579
Ryobi	P600	\$49.97	Fixed	18 Volt	26,000	1/4	No	SL; Battery & charger sold separately	www.ryobitools.com 800-525-2579

Features Key: AB = One or more accessory bases included; ATA = Above table adjustment; CC = Carry case; DSL = Dual switch locations; EFC = Electronic feedback circuitry; EG = Edge guide; SL = Spindle lock; SS = Soft start; VS = Variable speed; WL = Worklight

Trim routers will handle your most delicate routing operations, but they're also up to task for profiling, template routing and milling joinery.



en sharp edges or cut an occasional small profile, a trim router may be all the machine you need. Today's trim routers are compact, nicely appointed and affordable. They're small enough to stand on the edge of a board for trimming off edge banding or laminate, yet powerful enough to handle most smaller profiling bits. You can grip a trim router easily in one hand, and the compact size won't feel intimidating to control. Trim routers are also ideal for cutting hinge mortises, small dadoes and even fine joinery, so it will continue to be a useful tool as your skills grow. For many jobs, I actually prefer a trim router over larger machines. They're tiny but remarkably potent.

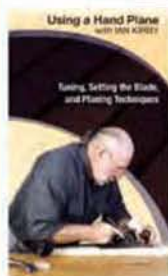
Stepping Up

Of course, a mid-sized router will cover more bases than a trim router will. Here, we're talking about a 1.75- to 2.25-hp machine that requires two-handed operation with either a fixed- or plunge-style base. If you want just one router to do most every kind of routing task, including moderate to large profiling cuts, dovetailing and mortising, definitely set your sights on a mid-sized machine. For all-around woodworking, a mid-sized router is the workhorse of both serious hobbyists and professional shops.

Within this middle category of routers, you have two base style options to choose from: fixed and plunge. A fixed-based router can be set to a full range of cutting depths, and the handles are positioned near the bottom of the base, so it has a pleasantly low center of gravity

Tool Preview continues on page 84 ...

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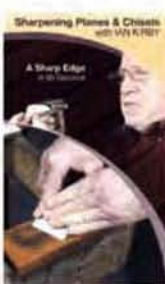
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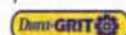
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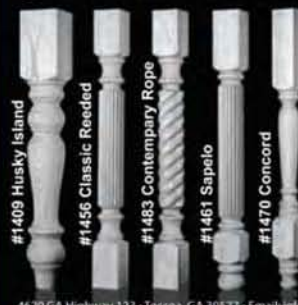
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Totally re-designed, feature-packed pinner; making it the most popular headless pinner in the market.



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 $\frac{3}{8}$ " ~ $1\frac{3}{8}$ "

August 2006

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Increased fastening capability and an optional anti-dry firing feature to follow the popular Grex P635.



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2" fastening capability and with everything else you expect from a Grex Headless Pinner.



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"the Grex P635 is the Lexus of pinners"
Wood Magazine, September 2005

Grex P635
Voted BEST BET of headless pinners
Woodworkers' Journal, April 2007

Grex P635
Voted BEST NEW TOOL in 2005
Popular Woodworking, December 2005

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Popular Woodworking, December 2005

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when feeding the tool along. However, a fixed base won't allow you to plunge the bit into the wood. You'll need to turn off the router and reset the motor in the base to change the cutting depth. Fixed-base routers can be used for general profiling or other cutting operations, provided you can feed the bit into the edge of the wood.

They're also the usual choice for router table applications.

Plunge bases are different animals. Here, the motor is mounted between two spring-loaded posts on the base. You can vary your cutting depth instantly and without turning the tool off by simply unlocking a lever or knob and rais-



If one machine needs to cover the whole gamut of routing for your shop, choose a mid-size plunge router. While it may not be the ideal solution for every operation, you'll find it to be amply powered and feature-packed. It's made for moderate to heavy-duty work.

ing or lowering the motor housing. Plunge routers are equipped with a depth stop system so you can step off a series of cuts to create a deep mortise or cutout. The depth stop can also help you reset the tool to the same cutting depth without measuring — it's ideal for repetitive cutting situations.

For all practical purposes, a plunge router can do everything a fixed-base router can do, but the handles and motor are mounted higher up on the base to facilitate the plunging motion. The higher center of gravity can feel a bit unstable, especially when you're milling small or narrow stock. I tend to use my

plunge router for mortising or hogging out waste on an inside cutout, but I reach for a fixed-base machine for nearly everything else.

Do You Need a Full-size Router?

When it comes to routing, bigger isn't always better, especially if you

Tool Preview continues on page 86 ...

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Wood Gear Clock Kit

Create this fabulous working work of art with Woodline's Wooden Gear Clock Kit with Pin router attachment. The kit comes with full size gear templates, hardware kit, spiral bit, and full instructions on CD and DVD. The included wood kit includes 6 pieces of specialty gear plywood in your choice of walnut or cherry. You supply the other wood needed from your scrap box. Includes the Woodline Pin Router Table Attachment perfect for many different projects. Additional gear plywood and hardware kits available. Grandfather style design with pendulum and weights.

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WL-WCK-DPC : Cherry Kit
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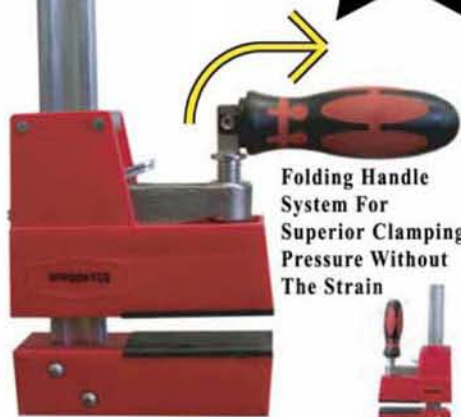
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When choosing a new router, focus on function and be realistic about your needs.

plan to use your router more as a handheld tool than under a table. Although useful, unless you plan to use really large profiling bits or raise panels for cabinet doors, a full-sized router is more machine than you'll need for ordinary profiling and joint-making. That extra weight, size and power can even work against you on smaller or delicate

work. Still, if your budget will allow it, a 3- or 3.25-hp router will give your router table the gumption only exceeded by a shaper. It's an investment that can easily wait for a while until you get serious about the heavy-duty jobs. With that said, once you step up to a big router, there are many good fixed-base or plunge models to choose from.

Combo Kits ... Best of Both Worlds
Twenty years ago or so, routers were only made with dedicated bases. Fixed-base or plunge-base ... the twains just never met. Not anymore. If you can't decide between buying one or the other, a combination kit may be the perfect solution. Here, you get a motor pack that mounts in either a fixed or plunge

Mid-size Routers: Workaday Machines of Most Shops

Manufacturer	Model	Price	Base Style	HP / Amps	RPM	Collets	Dust Port	Other Features	Contacts
Black & Decker	RP250	\$59.99	Plunge	2HP / 10 Amp	8,000-27,000	1/4	Yes	VS, SS, SL, EG	www.blackanddecker.com 800-544-6986
Bosch	1617	\$166.69	Fixed	2HP / 11 Amp	25,000	1/4, 1/2	No	ATA	www.boschtools.com 877-267-2499
Bosch	1617EVS	\$184.46	Fixed	2.25HP / 12 Amp	8,000-25,000	1/4, 1/2	No	VS, EFC, SS, ATA	www.boschtools.com 877-267-2499
Bosch	1618EVS	\$217.49	D-handle	2.25HP / 12 Amp	8,000-25,000	1/4, 1/2	No	VS, EFC, SS	www.boschtools.com 877-267-2499
Bosch	1613AEVS	\$210	Plunge	2.25HP / 12 Amp	11,000-22,000	1/4, 1/2	Yes	VS, EFC, SS, SL	www.boschtools.com 877-267-2499
Craftsman	17517	\$149.99	Plunge	2HP / 10 Amp	15,000-25,000	1/4, 1/2	Yes	VS, SL, Digital display	www.sears.com 800-349-4358
Craftsman	17540	\$89.99	Plunge	1.75HP / 9.5 Amp	25,000	1/4, 1/2	Yes	SS, SL, WL	www.sears.com 800-349-4358
Craftsman	17541	\$79.99	Fixed	1.75HP / 9.5 Amp	25,000	1/4, 1/2	Yes	SS, SL, WL	www.sears.com 800-349-4358
Craftsman	17542	\$89.99	Fixed	2HP / 11 Amp	12,000-25,000	1/4, 1/2	Yes	VS, EFC, SS, SL, EG, CC, WL	www.sears.com 800-349-4358
Craftsman	Professional 28190	\$129	Fixed	2.25HP / 12.5 Amp	12,000-25,000	1/4, 1/2	Yes	VS, EFC, SS, SL, EG, CC, WL	www.sears.com 800-349-4358
DeWalt	DW616	\$139	Fixed	1.75HP / 11 Amp	24,500	1/4, 1/2	No		www.dewalt.com 800-433-9258
DeWalt	DW618	\$169	Fixed	2.25HP / 12 Amp	8,000-24,000	1/4, 1/2	No	VS, EFC, SS, SL, CC	www.dewalt.com 800-433-9258
DeWalt	DW618D	\$199	D-handle	2.25HP / 12 Amp	8,000-24,000	1/4, 1/2	No	VS, EFC, SS, SL	www.dewalt.com 800-433-9258
DeWalt	DW621	\$219	Plunge	2HP / 10 Amp	8,000-24,000	1/4, 1/2	Yes	VS, EFC, SS, SL, EG, CC	www.dewalt.com 800-433-9258
Festool	OF 1010 EQ	\$360	Plunge	8.5 Amp	10,000-23,000	1/4, 8mm	Yes	VS, EFC, SS, CC	www.festoolusa.com 888-337-8600
Festool	OF 1400 EQ	\$450	Plunge	11.7 Amp	10,000-22,500	1/4, 8mm, 1/2	Yes	VS, EFC, SS, SL, CC	www.festoolusa.com 888-337-8600
Freud	FT1700VCEK	\$189	Fixed	2.25HP / 13 Amp	10,000-23,000	1/4, 1/2	Yes	VS, EFC, SS, SL, ATA, CC	www.freudtools.com 800-334-4107
Hitachi	M12VC	\$129	Fixed	2.25HP / 11 Amp	8,000-24,000	1/4, 1/2	No	VS, EFC, SL	www.hitachipowertools.com 800-829-4752
Makita	3606	\$129	Fixed	1HP / 7 Amp	30,000	1/4	No		www.makita.com 800-462-5482

**Black & Decker's
RP250 mid-sized
plunge router**



Tool Preview continues on page 88

base — both are included. The bases are fully featured and capable of doing the same precise work as a dedicated fixed or plunge router. The added advantage of a combo kit is that you can mount one base in a router table and use the other for handheld routing. Then, just swap out the motor to power whichever base you happen to

need. A combo kit is an excellent way to maximize your initial investment, and it costs less than buying two separate routers, with no appreciable compromise in quality. It's the routing equivalent of a marriage made in heaven, so it's easy to understand why both the number and variety of combo kits continues to grow.

Manufacturer	Model	Price	Base Style	HP / Amps	RPM	Collets	Dust Port	Other Features	Contacts
Makita	RF1101	\$209	Fixed	2.25HP / 11 Amp	8,000-24,000	1/4, 1/2	No	VS, EFC, SS	www.makita.com 800-462-5482
Makita	RD1101	\$239	D-handle	2.25HP / 11 Amp	8,000-24,000	1/4, 1/2	No	VS, EFC, SS	www.makita.com 800-462-5482
Milwaukee	5615-21 Bodygrip	\$169	Fixed	1.75HP / 11 Amp	24,000	1/4, 1/2	No	ATA, CC	www.milwaukeetool.com 800-729-3878
Milwaukee	5616-21 EVS Bodygrip	\$199	Fixed	2.25HP / 13 Amp	10,000-24,000	1/4, 1/2	No	VS, EFC, SS, ATA, CC	www.milwaukeetool.com 800-729-3878
Milwaukee	5619-20	\$169	D-handle	1.75HP / 11 Amp	24,000	1/4, 1/2	No	ATA	www.milwaukeetool.com 800-729-3878
Porter-Cable	690LR	\$149	Fixed	1.75HP / 11 Amp	27,500	1/4, 1/2	No		www.deltaportercable.com 888-848-5175
Porter-Cable	9690LR	\$149	Fixed	1.75HP / 11 Amp	27,500	1/4, 1/2	No	CC	www.deltaportercable.com 888-848-5175
Porter-Cable	690LRVS	\$159	Fixed	1.75HP / 11 Amp	10,000-27,500	1/4, 1/2	No	VS, SS	www.deltaportercable.com 888-848-5175
Porter-Cable	691	\$175	D-handle	1.75HP / 11 Amp	27,500	1/4, 1/2	No		www.deltaportercable.com 888-848-5175
Porter-Cable	891	\$229	Gripvac	2.25HP / 12 Amp	10,000-23,000	1/4, 1/2	Yes	VS, EFC, SS, SL ATA, CC, DSL	www.deltaportercable.com 888-848-5175
Porter-Cable	892	\$189	Fixed	2.25HP / 12 Amp	10,000-23,000	1/4, 1/2	No	VS, EFC, SS, SL ATA, CC, DSL	www.deltaportercable.com 888-848-5175
Ridgid	R2400	\$99	Fixed	6 Amp	20,000-30,000	1/4	No	VS, EFC, SS, EG, CC, Flush trim bit	www.ridgid.com 888-474-3443
Ryobi	R163K	\$59.97	Fixed	1.5HP / 8.5 Amp	25,000	1/4	No	SL, ATA, CC, WL	www.ryobitools.com 800-525-2579
Ryobi	RE180PL	\$99	Plunge	2HP / 10 Amp	15,000-23,000	1/4, 1/2	No	VS, SS, SL	www.ryobitools.com 800-525-2579
Skil	1810	\$64.99	Fixed	1.75HP / 9 Amp	25,000	1/4	No	SL	www.skiltools.com 877-754-5999
Skil	1815	\$79.99	Fixed	2HP / 10 Amp	25,000	1/4	No	SL, CC, WL	www.skiltools.com 877-754-5999
Skil	1820	\$85.99	Plunge	2HP / 10 Amp	25,000	1/4	No	SL, CC, WL	www.skiltools.com 877-754-5999
Triton	MOF001C	\$209.95	Plunge	2.25HP / 13 Amp	8,000-21,000	1/4, 1/2	Yes	VS, EFC, SS, SL, EG, ATA, CC	www.tritonwoodworking.com 888-874-8661

Features Key: AB = One or more accessory bases included; ATA = Above table adjustment; CC = Carry case; DSL = Dual switch locations; EFC = Electronic feedback circuitry; EG = Edge guide; SL = Spindle lock; SS = Soft start; VS = Variable speed; WL = Worklight

**Bosch's 1619EVS
full-size router**



Gotta-have Features

Compared with today's laptops, cell phones or hybrid cars, a router seems like a pretty simple machine: it's basically a motor with two handles that spins a really sharp bit. Yet, that simplicity is what makes it so impressively versatile. A router can create elaborate profiles, cut a workpiece in two, duplicate shapes, soften edges, drill holes, trim veneer or laminate, make a wide variety of joints, carve letters ... and much more. And the right features on your router can help you squeeze every bit of value and versatility out of it. Here are the best bells and whistles to look for in your next router:

Variable speed: Most mid- to full-size routers are equipped with variable speed control, and it really does help if you use the same router for all your bit sizes. Small bits cut most cleanly at mid to high speeds; large bits need to be dialed down to slower speeds to be used safely. With variable speed, just twist the dial one way or the other and you're covered, no matter what bit you need to use.

Electronic feedback circuitry: which goes by several different trade names, essentially means the router's circuitry monitors the load placed on the motor and adjusts the torque output to match. So,

during a heavy cut, the motor won't labor or stall. Power output feels the same. Here's a feature you won't truly appreciate unless you've used an older router without this sophisticated circuitry. With EFC,

Tool Preview continues on page 90 ...

Full-size Routers: Big Guns for Heavy-duty Jobs

Manufacturer	Model	Price	Base Style	HP / Amps	RPM	Collets	Dust Port	Other Features	Contacts
Bosch	1619EVS	\$323.38	Plunge	3.25HP / 15 Amp	8,000-21,000	1/4, 1/2	Yes	VS, EFC, SS, SL, ATA	www.boschtools.com 877-267-2499
DeWalt	DW625	\$259	Plunge	3HP / 15 Amp	8,000-22,000	1/4, 1/2	No	VS, EFC, SS, SL	www.dewalt.com 800-433-9258
Festool	OF 2200 EB	\$800	Plunge	15 Amp	10,000-22,000	1/4*, 8mm*, 1/2	Yes	VS, EFC, SS, SL, CC, 5AB	www.festoolusa.com 800-337-8600
Freud	FT2200EP	\$199	Plunge	3.25HP / 15 Amp	10,000-22,500	1/4, 1/2	Yes	VS, EFC, SS, SL, EG	www.freudtools.com 800-334-4107
Freud	FT3000VCE	\$349	Plunge	3.25HP / 15 Amp	8,000-21,000	1/4, 1/2	Yes	VS, EFC, SS, SL, ATA	www.freudtools.com 800-334-4107
Hitachi	M12V2	\$219	Plunge	3.25HP / 15 Amp	8,000-22,000	1/4, 1/2	Yes	VS, EFC, SL, EG, SS	www.hitachipower tools.com 800-829-4752
Hitachi	M12SA2	\$199	Plunge	3.25HP / 15 Amp	22,000	1/4, 1/2	Yes	EFC, EG, SL, SS	www.hitachipower tools.com 800-829-4752
Makita	3612C	\$299	Plunge	3.25HP / 15 Amp	9,000-23,000	1/4, 1/2	No	VS, EFC, SS, SL	www.makita.com 800-462-5482
Milwaukee	5625-20	\$319	Fixed	3.5HP / 15 Amp	10,000-22,000	1/2	No	VS, EFC, SS	www.milwaukee tool.com 800-729-3878
Porter-Cable	7518	\$349	Fixed	3.25HP / 15 Amp	10,000-21,000	1/2	No	VS, EFC, SS, Overload protection	www.deltaportercable.com 888-848-5175
Porter-Cable	7519	\$329	Fixed	3.25HP / 15 Amp	21,000	1/2	No	SS, Overload protection	www.deltaportercable.com 888-848-5175
Porter-Cable	7538	\$349	Plunge	3.25HP / 15 Amp	21,000	1/2	No	SS, Overload protection	www.deltaportercable.com 888-848-5175
Porter-Cable	7539	\$369	Plunge	3.25HP / 15 Amp	10,000-21,000	1/2	No	VS, EFC, SS, Overload protection	www.deltaportercable.com 888-848-5175
Triton	TRA001	\$269.95	Plunge	3.25HP / 15 Amp	8,000-20,000	1/4, 1/2	Yes	VS, EFC, SS, SL, EG, ATA, CC	www.tritonwoodworking.com 888-874-8661

Features Key: AB = One or more accessory bases included; ATA = Above table adjustment; CC = Carry case; DSL = Dual switch locations; EFC = Electronic feedback circuitry; EG = Edge guide; SL = Spindle lock; SS = Soft start; VS = Variable speed; WL = Worklight; * = Collets sold separately

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you can really focus your attention on the technique and how your cut is progressing and let the router keep pace with you.

Soft start: Without soft start, a router will blast up to full speed the second you turn it on. The noise can be startling, and that surge of power might even make the router jerk in your hands, especially with a big bit in the chuck. It's not a pleasant way to ease into a tricky cut or



Freud's FT1702VCEK combination router kit

Combination Kits: Exceptional Versatility for a Value Price

Manufacturer	Model	Price	Base Style	HP / Amps	RPM	Collets	Dust Port	Other Features	Contacts
Bosch	1617PK	\$216.35	Fixed, Plunge	2HP / 11 Amp	25,000	1/4, 1/2	No	ATA, CC	www.boschtools.com 877-267-2499
Bosch	1617EVSPK	\$233.42	Fixed, Plunge	2.25HP / 12 Amp	8,000-25,000	1/4, 1/2	No	VS, EFC, SS, ATA, CC	www.boschtools.com 877-267-2499
Craftsman	Professional 28084	\$219.99	Fixed, Plunge, D-handle	2.25HP / 12.5 Amp	12,000-25,000	1/4, 1/2	Yes	VS, EFC, SS, SL, CC, WL	www.sears.com 800-349-4358
Craftsman	17543	\$119.99	Fixed, Plunge	2HP / 11 Amp	12,000-25,000	1/4, 1/2	Yes	VS, EFC, SS, SL, CC, WL	www.sears.com 800-349-4358
DeWalt	DW616PK	\$199	Fixed, Plunge	1.75HP / 11 Amp	24,500	1/4, 1/2	Yes	CC	www.dewalt.com 800-433-9258
DeWalt	DW618PK	\$219	Fixed, Plunge	2.25HP / 12 Amp	8,000-24,000	1/4, 1/2	Yes	VS, EFC, SS, SL, CC	www.dewalt.com 800-433-9258
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Features Key: AB = One or more accessory bases included; ATA = Above table adjustment; CC = Carry case; DSL = Dual switch locations; EFC = Electronic feedback circuitry; EG = Edge guide; SL = Spindle lock; SS = Soft start; VS = Variable speed; WL = Worklight

Top-dog Features on Today's New Routers

get over your trepidations about routing in general. With soft start, you'll experience a moment of pause after powering it up, and then the router gently accelerates to the preset speed. Soft start comes standard with most new routers that have electronic feedback circuitry. It's a subtle but pleasant feature to have on a handheld router.

Spindle lock: Many routers require two wrenches for making bit changes. One wrench holds the motor shaft, and the other wrench loosens or tightens the collet. With spindle lock, you push a spring-loaded pin or engage a locking collar to hold the motor shaft in place, so the only wrench you need is the one for the collet. This is a particularly handy detail on dedicated plunge routers where you can't remove the motor to get better access to the bit. It's not a do-or-die feature, but it does take a little hassle and knuckle-busting out of the bit changing equation.

Above the table adjustment: If you are like most woodworkers, sooner or later one of your routers will spend its days hanging under a router table. Two relatively new features can make table routing more precise and convenient. First, buy a router that allows you to adjust cutting height from above the table

with a handle, crank or knob. It sure beats stooping over to tweak the depth setting from underneath. Second, look for a router designed to extend the collet above the table so you can change bits without lift-

ing out the machine. Machines with ATA will generally include both of these great enhancements.

Chris Marshall is Woodworker's Journal's field editor.



Try Before You Buy to Find that Perfect Fit

Most people would never buy a set of golf clubs without taking a few swings or a pair of shoes without trying them on for size. Follow that same practice when shopping for a router.

You'll find that routers come with a variety of handle styles, shapes and sizes. Switch and control layouts vary, too. Your router should fit your hands comfortably, and the On/Off switch and plunge controls should be easy to reach. Make sure the depth stop system on your plunge router is simple to understand so you'll have an easy time using it when necessary. Have a look at the sub-bases that come with the tool. Make sure one of them will accept rub collars. Combination kits are designed to be interchangeable. Try out the motor removal mechanism. It should work smoothly and lock the motor securely in both bases. All in all, buy a router that makes sense to you and feels really comfortable to use, even if it costs a little more than other similar models. If you're like most of us, you'll power it up for nearly every project you build, so why not enjoy the ride?



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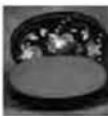
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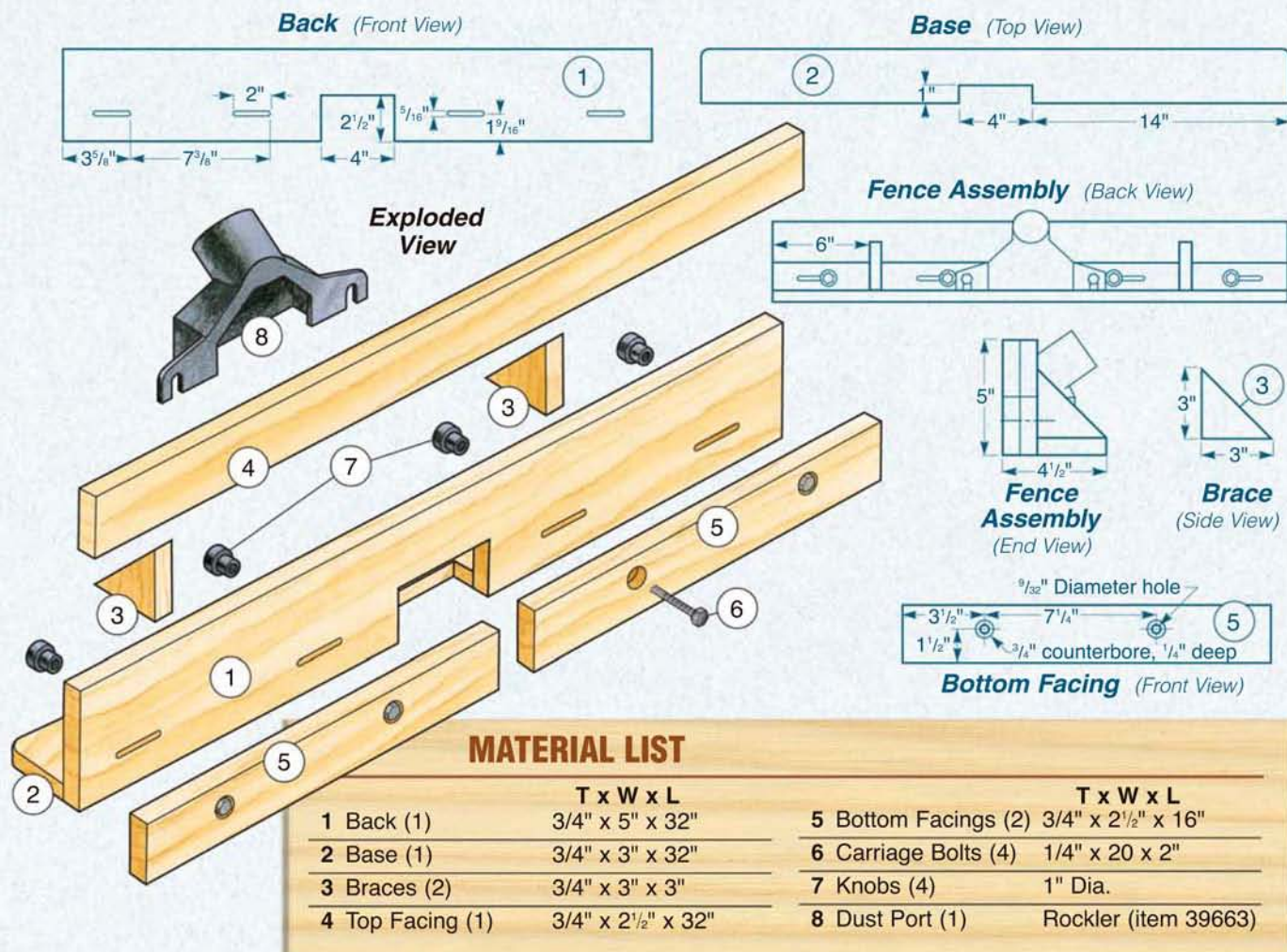
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Wide-body Router Table Fence

By Chris Marshall



Store-bought router table fences do their job reasonably well. But, despite their strengths, I think many fence designs still come up short — literally. Two or three inches of height just doesn't provide enough vertical support for tall work.

Here's where this shop-made fence really shines. It's a full five inches tall — and that extra real estate is a big help if you raise panels vertically or stand workpieces on edge for other milling. The fence's fixed top facing (piece 4) makes it easy to mount featherboards or



The author used a slotting jig, rub collar and straight bit to mill four slots in the fence back for the through bolts. Two rails under the jig made for easy alignment and clamping.

a guard over the bit. The bottom facings slide open 3 1/2", which will accommodate most bits, even large horizontal panel raisers.

At 32" long, my fence will fit any standard-sized router table. Just clamp it in place or drill holes or cut slots through the base to match your table's current fence-bolt spacing.

Assembling the Base and Back

Cut the back (piece 1) to width and several inches longer than necessary. I used the extra length to help support a simple slot-cutting jig when routing the

Here's a fence that's tailor-made for vertical panel-raising or whenever you need to stand tall workpieces up for routing. It's simple to build, sturdy and sized to fit most router tables.

endmost bolt slots (see photo, previous page, and the *Drawings*). My router jig was a quick "one-off" that consisted of a piece of 1/2" MDF with a 3/4"-wide through slot for guiding a plunge router equipped with a 3/4" O.D. rub collar. A pair of scrap rails tacked under the jig base allowed it to straddle the workpiece and provided a couple of "ears" for clamping. Fashion your jig so the router will cut 2"-long slots, and use a 5/16"-diameter straight bit to machine them.

Next, cut out the large router bit opening in the back panel. Trim the back to final length, then refer to the *Drawings* to make the base (piece 2). Ease the base's top edges. Glue and tack the back to the base. Before the glue dries, miter-cut a pair of triangular braces (pieces 3), and install them behind the fence back with glue and brads. Make sure the braces hold the fence back at 90° to the base. Reinforce all these joints with 1 1/2" countersunk flathead wood screws.

Adding the Facings and Dust Port

Now, cut the top and bottom facings (pieces 4 and 5) to size. Glue and screw the top facing flush with the top edge of the fence back. Joint the bottom facings about 1/32" narrower to create a sliver of clearance below the top facing. That way, they'll still slide easily when the fence is locked down on the table. Now, set the fence face-down on your bench, slip the bottom facings into position, and mark the through-bolt hole locations. (The bolts should nearly touch the "inside" ends of the slots when the facings are closed.) I used a 5/16"-diameter brad-point bit as a punch, which gave me perfect centerpoints for drilling the 9/32"-diameter bolt holes. Bore 3/4"-diameter countersinks, 1/4" deep, into the facings to recess the carriage bolt heads (pieces 6). Thread knobs (pieces 7) onto the bolts to mount the facings on the fence.

Wrap up this handy project by installing the dust port with a pair of short lag screws and washers. Before you screw it in place, squeeze a bead of caulk around its inside rim to help improve the vacuum seal. Add a couple of coats of wipe-on finish, and this custom fence is ready for duty!

Chris Marshall is Woodworker's Journal's field editor.



Use glue and pin nails or brads to assemble the fence back, base and braces. Check to make sure the back and base form a 90° angle, then reinforce the glue joints with countersunk screws.



Squirt a bead of caulk around the contact surfaces of the dust port before mounting it to the fence back with short lag screws.



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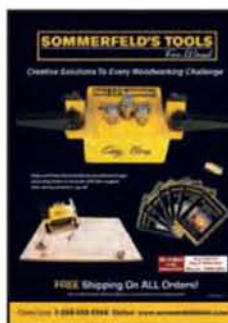
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Continues on page 102 ...



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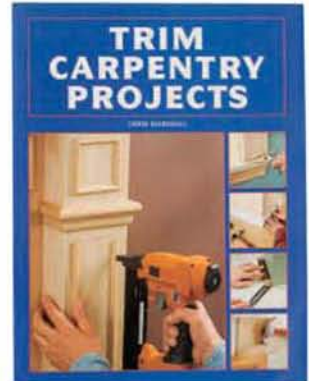
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combines a utility knife and a wire stripper. Serrated cutting surfaces on the blade are patented. It's also a wire cutter and crimper. The tool sells for under \$25.



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Trim Carpentry Projects by Chris Marshall, *Woodworker's Journal* field editor, takes you through all the steps, from pre-planning to finish staining, for molding, baseboard and more projects. Published by Sterling Publishing Co., ISBN 1-58159-363-5, it is priced at \$14.95.



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The Perils of Poly over Paint

By Michael Dresdner

ABOUT MICHAEL DRESDNER

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

When not writing about woodworking, he is an active community theater participant.



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Please include your home

address, phone number and

e-mail address (if you have one)

with your question.

Q Like a good majority of suburbia, I have standard contractor MDF white finished cabinets. The cabinets are 10 years old and have weathered well, with the exception of the cabinets below the sink at the center island. Due to water, the frames need refinishing, though there is no wood damage, thankful to say. I tried to dry sand, add a new coat of semi-gloss white latex and then add three coats of polyurethane. The polyurethane gave the surface an obvious yellow tone in comparison to the other 22 doors and face frames in the room. What should I use to provide the necessary moisture protection to the surface in this area?

— Phil Grimmer
Collierville, Tennessee

Michael Responds: It's a little late now, but the problem that you can see was caused by putting oil-based polyurethane, which happens to be amber, over white paint. The problem you do not see, and which may or may not show up in the near future, is that you did not follow good protocol in adding finish atop an existing coating. I'll tell you what you should have done, and you can decide whether you want to go back and remove what you have on there and start again, or take a chance and simply go on top of what you already applied. It should come as no surprise that the former option is less risky.

You can add finish atop an existing coating provided it is in good condition with no cracking or peeling evident, and provided you follow a good preparation protocol. Start by scrubbing the surface with either mineral spirits or TSP using a nylon abrasive pad to

remove skin oils and airborne grease, which, by the way, abounds in kitchens. Lightly sand, then apply a coat of primer.

After the primer, add whatever color topcoat you prefer. If you choose the paint wisely, opting for one of those kitchen paints noted for endurance and the ability to be scrubbed repeatedly, there is no need for any clear sealer over it. In fact, some of the kitchen paints available today are even more durable than some furniture polyurethane.

For the record, even though I don't advise it in this case, I will tell you that if you want to go over water-based paint with a clear coat and do not want color change, use waterbased polyurethane. Most, though not all, go on clear and do not yellow over time. Granted, it is not as durable in kitchens as oil-based polyurethane, but that is just one more reason to go with a durable kitchen paint.



Some of the kitchen paints available today are even more durable than some furniture polyurethanes.



It matters little to the stain if a varnish is wipe-on or brush-on.

Q I have seen several articles on oil-based wiping varnish and would like to know if this can be used over oil-based stain, waterbased stain or both?
— *Eston Doyle*
Salisbury, North Carolina

Michael Responds: Both. As we discussed in the *Skill Builder* section of the *September/October* issue, wiping varnishes are little different from brushing varnishes. In fact, any var-

nish that you can brush on can be wiped on. And any stain that you can use brush-on varnish with, you can use with the wipe-on variety.



WINNER! For simply sending in his question on wiping varnish, *Eston Doyle of Salisbury, North Carolina*, wins **UGL's ZAR Wood Finishing Kit**. Each issue we toss the new questions into a hat and draw a winner.

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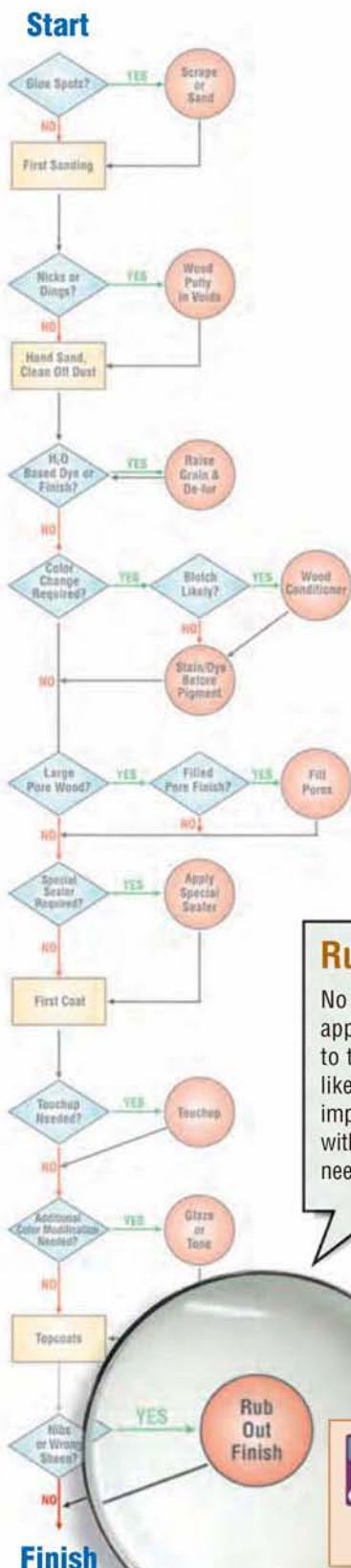
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Finishing a Fantastic Finish

A SLICK SOLUTION



A white nylon abrasive pad, paste wax and paper shop towels are key components in what Michael Dresdner likes to call power waxing. It works no matter what choice of topcoat or application method you use.

Sadly, many woodworkers stop short of the final step of rubbing out their finish, and it harms them in two ways. It deprives them of that silky feel and uniform sheen that the finest finishes exhibit, and it makes them believe that they are somehow inadequate finishers

because they can't get that elusive perfect surface when applying their last coat.

The truth is that whether you brush, spray or even wipe a finish, odds are good that no matter how you try, your last coat will contain subtle brush, spray or rag marks along with

tiny random nibs, usually caused by dust settling into the still-wet surface. The simple solution is to rub out the finish.

A full-blown rub-out schedule, described in "More on the Web" (see box below), requires a finish with some thickness,

usually three or more good coats. However, even finishes done with multiple coats of wipe-on polyurethane or Danish oil can benefit from a gentle type of rub that I call power waxing.

Wait until the finish is dry and cured, usually several days, and feel for dust nibs. If there are any, remove them by wiping the surface lightly with 600-grit or finer sandpaper. One light pass will remove the nibs.

Dip a white nylon abrasive pad, the finest made, into some paste wax, and rub the surface smooth. For large areas, clamp the pad to your jitterbug sander, or stick it onto the hook-and-loop head of your random-orbit sander and use it to work the wax onto the surface. As soon as you are done, wipe off the wax aggressively with paper shop towels. Don't wait until the wax dries or it will only come off with very aggressive buffing, leaving a surface that is too shiny.

—Michael Dresdner

Rub-out

No matter how you've applied your finish up to the last coat, you're likely to have small imperfections. To end up with a great finish, you'll need to rub it out.

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Shorter Open Time	✓	✓
Doesn't Stain Skin	✓	✓
Bonds Most Materials	✓	
Bonds Oily / Exotic Woods	✓	
Lower Cost - Better Value	✓	
Longer Usable Shelf Life	✓	

Titebond III
ULTIMATE Wood Glue
Waterproof - Superior Strength
Outperforms All Other Wood Glues
Longer Open Assembly Time
NET 8 FL. OZ. (237 mL)

As the leader in wood glues, we want you to know the truth about polyurethane glue and woodworking. A straightforward comparison between Titebond® III Ultimate Wood Glue and polyurethane glue tells the story.

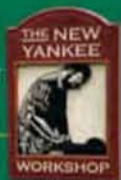
Titebond® III is THE ultimate choice for bonding wood to wood. Period.

For more information and a detailed comparison, please visit www.titebond.com/TBIIIvsPolyurethane

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Making
the cut
from every
angle.

You don't have to
be big to make a
huge impression.



Faster cut alignments with
dual laser marking system



Easy and precise bevel angle
setting with fine adjustment



Designed to capture
91% of saw dust



Cuts up to 6 1/2" crown molding
in special cutting position



Compact, lightweight
design for portability

KAPEX KS 120 EB **Sliding Compound Miter Saw**

Faster The Kapex KS 120 EB lets you get more work done in less time with faster cut alignments, rapid miter settings, and rapid FastFix blade changes.

Easier The innovative MiterFast angle transfer device eliminates complex angle calculations. An easy bevel angle setting provides fine adjustment, and a unique rail-forward design allows you to work in tight spaces.

Smarter The Kapex boasts a 12" miter saw capacity in a revolutionary 10" miter saw design. It's also the first miter saw with variable speed, giving you perfect cuts every time.

For more information on our saws and the entire line of Festool products, contact us at 888-337-8600 or visit us online at www.festoolusa.com. **It's not a tool...it's a Festool.**



Add the CT 22 for near-total dust
extraction and optimal jobsite performance.

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