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See page 23

WOODWORKER'S JOURNAL



February 2002

Volume 26

Number 1

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**Hot new
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**Straight talk
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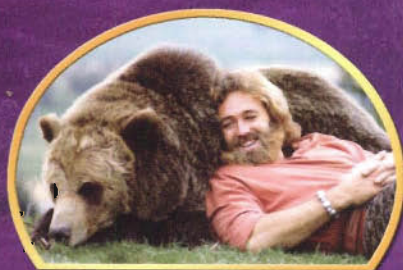
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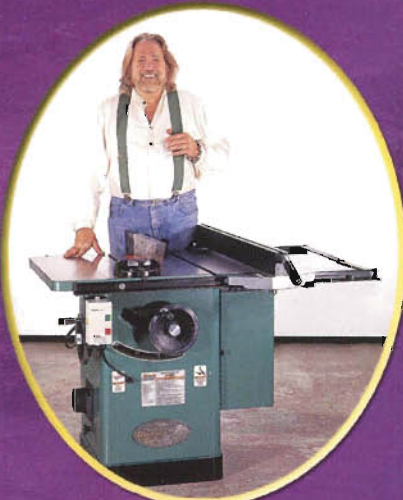
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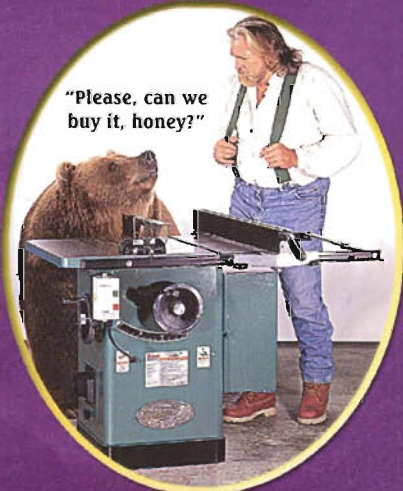


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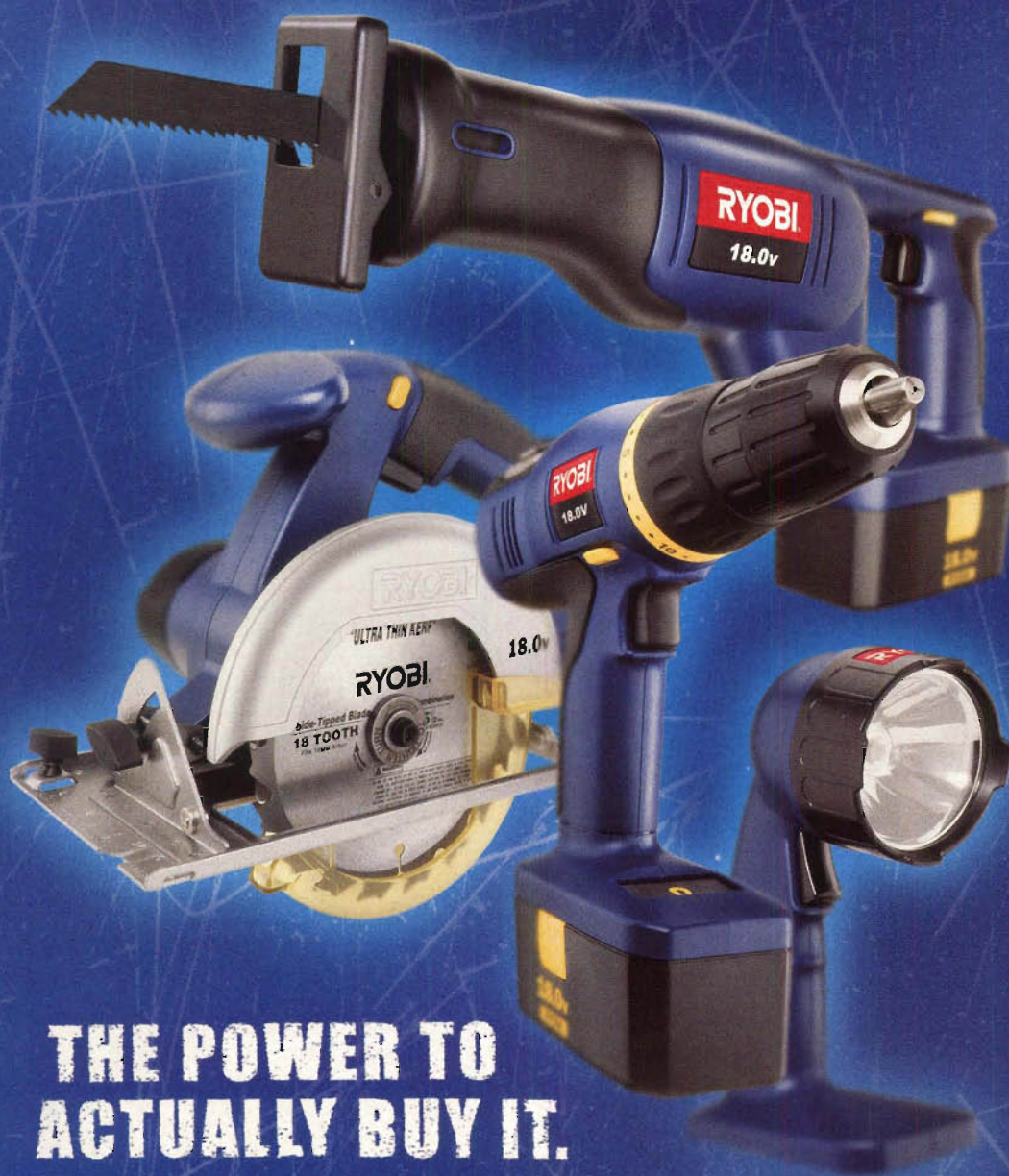
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Woodworker's Journal

Features

January/February 2002



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26 Hand Cutting Mortises and Tenons

By Ian Kirby

A master woodworker teaches you to cut perfect mortise and tenons by hand.



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32 Quebec Ladderback Chair

By Stephen Shepherd

Tapered legs and bent back rails give character to this rugged 19th century frontier reproduction.

41 Small Shop Clamp Cart

From the Woodworker's Journal Shop

The perfect answer to that New Year's Resolution to organize your shop, our mobile cart offers tons of storage for supplies and clamps of all types.

47 Arts & Crafts Side Table

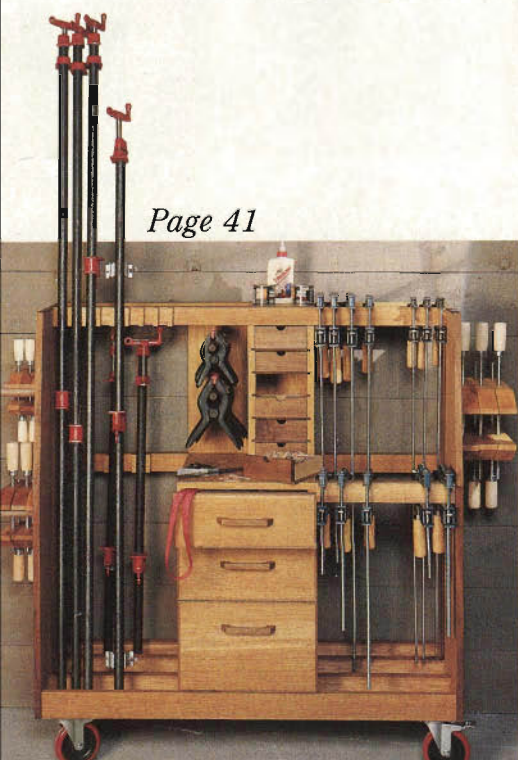
By Chris Marshall

Through mortise and tenons add stability to this side table, while breadboard ends keep the top flat.

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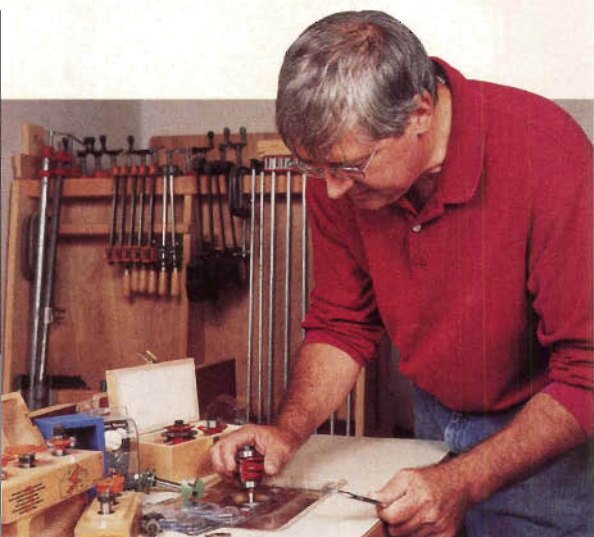


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Take a break in the shop ... the headlines aren't going away.

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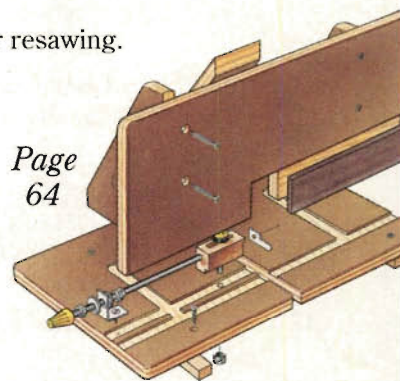
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Michael Dresdner on water-based finishes: how they work and how to make them look great.



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54 Dust Control in the Shop

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70 Tool Preview

Bill Hylton's expert impressions of the new router bits for 2002.

84 What's In Store

Shortcuts to smart cuts: tools that take you there.

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Pleasure as Usual

Like most Americans, I have a thing or two to say about the horrific events of and since September 11, 2001. Aside from sending my prayers to the victims and their families, it's clear to me that this magazine is not the appropriate forum to do so.

However, in the encouragement from our political leaders — that Americans hold their heads high and carry on with “business as usual,” — I find a truth that I believe is worth repeating. In fact, I would add that we carry on with the pleasures of America as well: including woodworking.

So, you won't find a marquetry flag project in this issue, and there's no bin Laden dartboard. It's going to be “pleasure as usual” from us, and I'm betting that's just fine with most of you.

“If ever the shop was meant to serve as a personal sanctuary, it's during times like these.”

If ever the shop was meant to serve as a personal sanctuary, it's during times like these. What better place to get away from the talking heads on TV for a few hours? Leave the headlines behind ... trust me, they'll be there when you emerge.



One of the projects from this issue, our own Clamp Storage Cart (page 41; behind the center spread), can help make your shop haven look a little better, too: it will neatly store all your clamps. The Arts and Crafts Side Table from Chris Marshall (page 47)

will add some elegance to your den, while Stephen Shepherd's Quebec Ladderback Chair (page 32) provides a chance to try some historical techniques that yesterday's woodworkers relied upon. Two regular contributors, Michael Dresdner and Bill Hylton, are back in this issue, with the latest on water-based finishes (page 78) and router bits (page 70), as is Ian Kirby, who walks you through hand cutting the venerable mortise and tenon joint (page 26).

AWARDS: Looks like some congratulations are in order. First, Sandor Nagyszalanczy's excellent book *Setting Up Shop* took first place in the “Books” category of the National Association of Home Workshop Writers' *Vaughan Golden Hammer Award*. Sandor's dust control article appears in this issue (page 54). A little closer to home, *Woodworker's Journal* won a *Publishing Excellence Award* in the “Regular Column” category from the Minnesota Magazine & Publications Association. The award recognizes the work of contributing editor Michael Dresdner for his *Finishing Thoughts* column.

Larry N. Stouken

JANUARY/FEBRUARY 2002

Volume 26, Number 1

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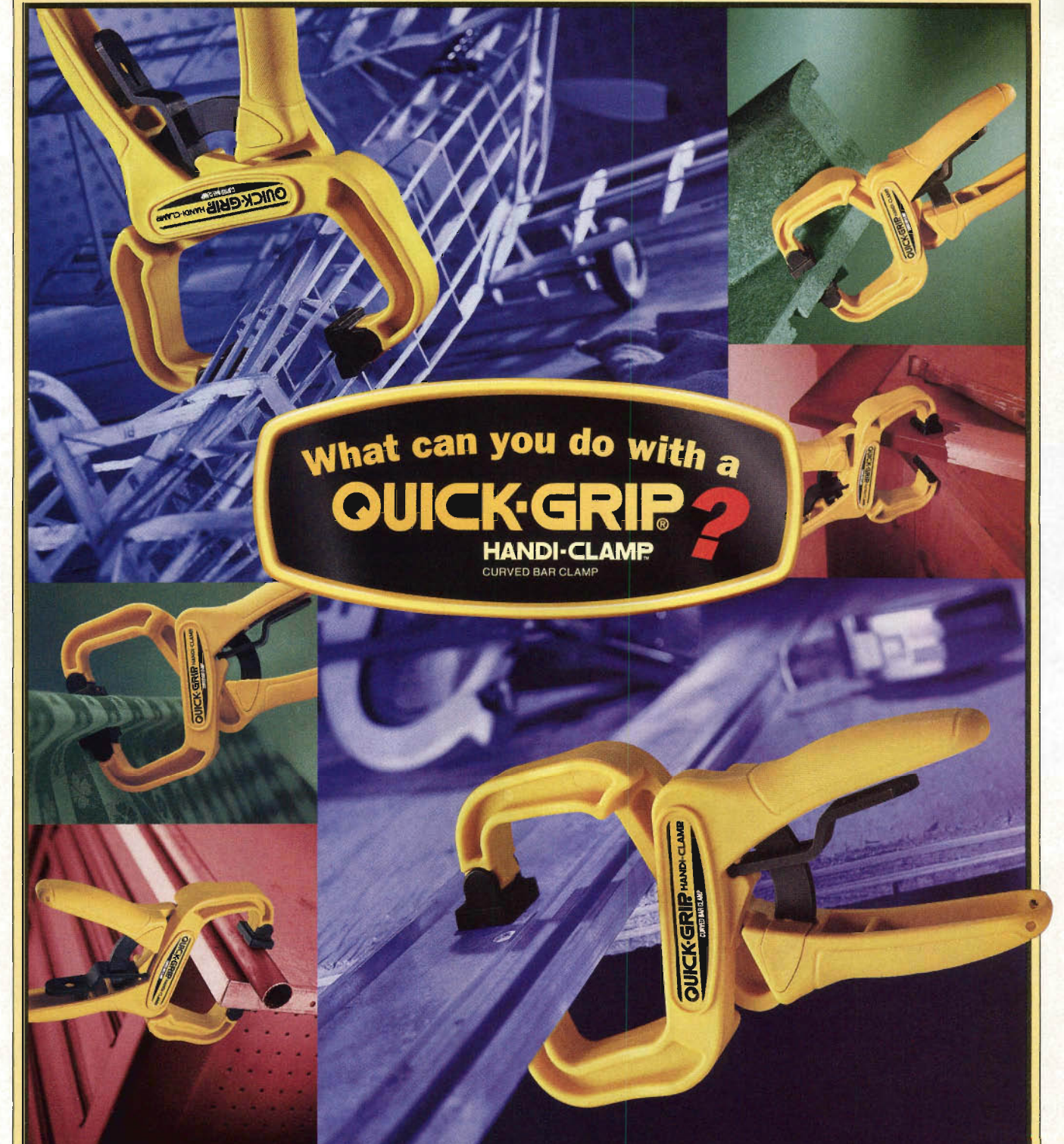
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Woodworking in 2056



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We ask that all letters, including e-mails, include a mailing address and phone number. We reserve the right to edit for length and clarity.

Porter-Cable Classic

I agree with Alfred Petersen, who said in your October 2001 issue that the Porter-Cable 503 belt sander would and should take first place in any belt sander line-up. I bought mine in 1946, and after 55 years it is still going strong.

I recently had it overhauled by the Porter-Cable Service Center at a cost of about \$218.00 (*It was accidentally plugged into a 230 volt outlet*). This included new field, armature, gears, bearings, seals, etc. Almost everything new but the case, and they polished that!

How many of today's sanders will be around in 2056? Current list price is about \$550. Let's see, that comes to \$10 per year. The 503 should have also been included in the "Premium Power Tool" list (also in the October 2001) issue). How many of those tools will still be around in the year 2056? Some — perhaps. The 503 is a real gem.

Bill Mikus
Yorkville, Illinois

One Rout to Happiness

Wonders will never cease! In my 77 years on this planet, I have never won a prize worth more than a five spot! I was surely surprised when I received the memo informing me that I had won a router for participating in your *Questions & Answers* department! Wow!

The Bosch 16123 AEVS router was delivered less than a week later! I have given it the "once-over," but have not used it as yet ... maybe I'll just build a display case for it, and put it in the front hall! In any case, thank you very much!

Lawrence E. Rook
Centerville, Massachusetts



Geezer-built Adirondacks

I'm a grey-haired, girthy, old grandfatherly (five times) geezer who is financially and follicle-ly challenged. Your October 2001 issue provided some great plans for a child's Adirondack chair using 3/4" redwood.

Being a frugal Scotsman, I decided to use inexpensive 3/4" x 6" x 6' dog-eared cedar fence board, which I can purchase locally for less than \$2 each. I can make a chair using only two boards. For strength, I simply glue two pieces together to make the legs and seat supports.

John P. Cardie
Bloomfield, Colorado

Laser Sights

Letter writer Todd Surman wanted to know about a laser for the DeWalt DW708. I own a DeWalt DW705 and I located a manufacturer that offers a laser sight for that saw. It fastens to the arbor, and they offer a 60-tooth blade as well. The company is: **Bladepoint Corporation** of Quincy, Massachusetts. Their phone number is 617-770-4575 and their url is bladepoint.com.

James M. Greer
Lawrenceville, Georgia

I read your review of the Craftsman Laser Trac miter saw with a lot of interest and a little nostalgia. Way back in the dark ages of 1975, I had a trick up my sleeve that accomplished the same thing on my radial arm saw. I just kept a plastic spray bottle, filled with water, near the saw. When I needed to see where the blade would track on my stock, I just gave a squirt to the proper side of the (running) blade and, lo and behold, a crisp, clear line would appear that was exactly aligned with the future cut regardless of the blade's angle or size.

Mike Rogerson
Cupertino, California

I purchased a laser to mount on my Makita LS1211 12" sliding compound miter saw. The instructions suggested mounting on the guard, which I tried but abandoned, due to the unsteady and slick surface. I found two unused holes in the upper frame of the saw, which fit those in the bracket perfectly. In addition, they allowed me to

securely tighten all screws. To date this mounting has functioned as expected.

If Mr. Surman's saw doesn't have similar holes there should be room to drill them. This laser is an excellent product, and is reasonably priced.

As your readers know, Sears has come out with a laser-guided miter saw with the laser mounted close to the shaft. The saw must be on to activate the laser. This seems unsafe, since line-up must be done under a moving blade.

*Henry J. Boesch, Jr.
Bolingbrook, Illinois*

Correction

The contact information for the Record RPM75 benchtop mortiser in the December 2001 issue was incorrect. The correct telephone number is 800-933-1562; web site recordpower-usa.com.

Salvaging Sanding Belts

I read Peter Williams' letter in the October issue and have a solution for salvaging old sanding belts. I came by my solution while trying to make belts to fit a knife sander/sharpening machine. It uses 25" by 1½" belts. A search failed to turn up belts in that size.

I decided the solution was to make my own from larger sized belts. The problem was in coming up with a means of joining the ends of the belts. Trial and error led

me to two items that made the joining both possible and long-lasting: A close weave Fiberglas™ cloth and a glue called *Brush-On* made by **Pacer Technology** of Ranch Cucamonga, California.

This fix has worked so well that I have worn the grit off of one belt and the joint is still strong. I recommend cutting the Fiberglas larger than the belt width but keeping the length the same as the old connecting material. The excess can be trimmed off after the glue sets.

*Ted R. Jambon
Baton Rouge, Louisiana*



Fresh Coat of Paint

I recently wrote to ask your advice on the proper paint finish for a wooden pedal car I was building. Enclosed is a picture of the finished product. I think it came out rather well, and my granddaughter pedals it all over her patio.

*Dr. Jim Naeve
Coon Rapids, Minnesota*

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

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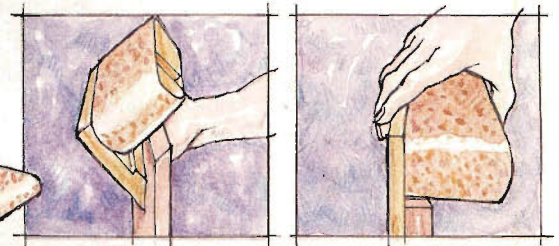
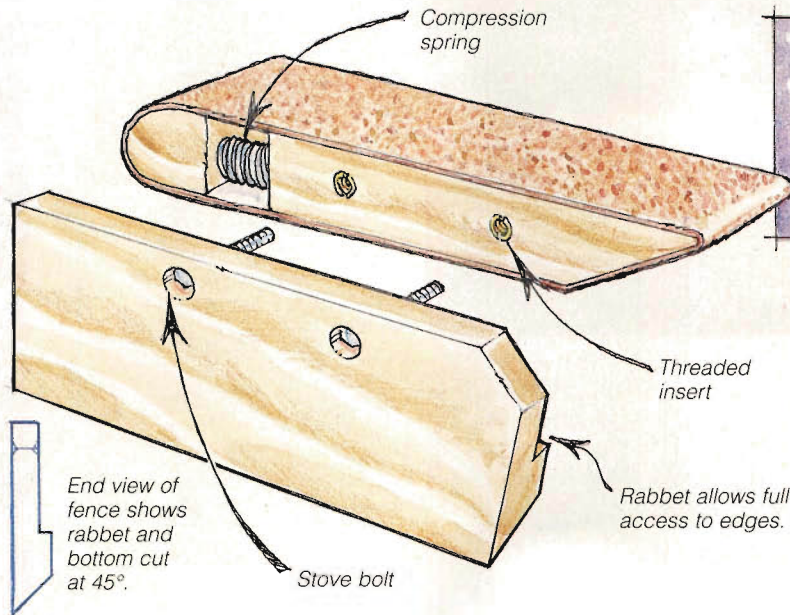
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Edgy Woodworking Jigs



Robert Dye's jig works for edge sanding both mitered and square edges.

Shop-made Edge Sander

I made the spring-loaded block sander some time ago but recently modified it to sand edges at either 90° or 45°. The "modification" is merely a rabbeted 1 x 4 so I can sand right up to an edge. The belt is easily rotated to expose a new sanding surface.

Robert Dye
St. Louis, Missouri

Caulk-saver

Over the years, I've heard numerous suggestions on keeping partially used tubes of caulk fresh. My solution is to use a large-size wire nut made for underground use and wet areas. These nuts have silicone inside, which seals the nozzle and prevents the contents from curing prematurely.

William Britt
Cambridge Springs, Pennsylvania

Mating Holes

When drilling dowel holes in facing surfaces I use steel ball bearings to match the hole locations. At each spot where I want to place a dowel, I dimple the surface with a center punch and place a small ball bearing in each dimple. Then I position the mating piece exactly and give it a whack with a mallet. This makes matching dimples in the second surface. For small assemblies, I use a vise or clamp instead of the mallet.

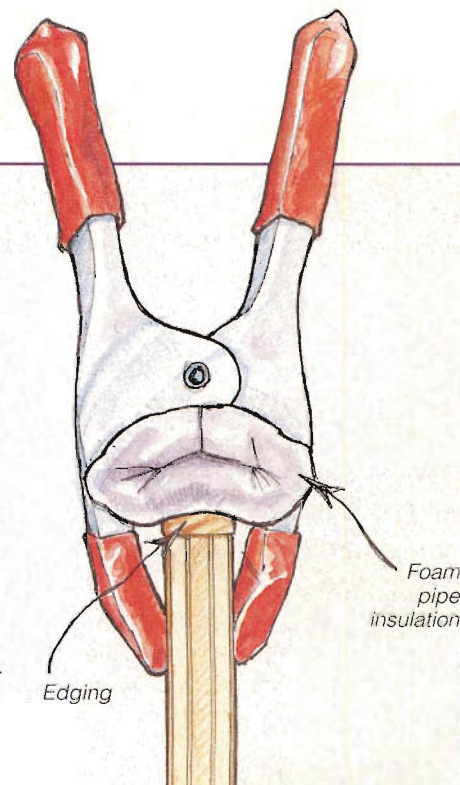
Donald Moffat
Corvallis, Oregon



Poor Man's Edge Clamp

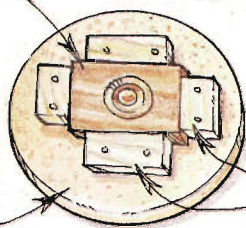
When applying edge banding, there's no need to buy specialty clamps. Large, spring-jaw clamps do an excellent job. The trick is to use a piece of foam pipe insulation to distribute the clamping pressure along the edging. You'll find that a 1/2" foam tube — made for insulating copper pipe — fits snugly against the hinge of a 4" spring clamp. Press the clamp inward against the foam to compress it slightly, and add more clamps along the edge as necessary. This technique works well even when the edge has an irregular contour.

Dan Humburg
Brookings, South Dakota





Drawer front



Particle board

Stop blocks

Recessed Drawer Pulls

For small drawers, recessed pulls are practical and look good. Rather than mount the stock directly on a face plate — and have to fill the screw holes — I made the jig shown in the sketch. I cut out a disc of 3/4" particle board and screwed it to a face plate. The drawer front fits snugly between the stops and a strip of double-sided carpet tape keeps it in place until I've finished the turning.

Greg Paige
St. Joseph, Missouri

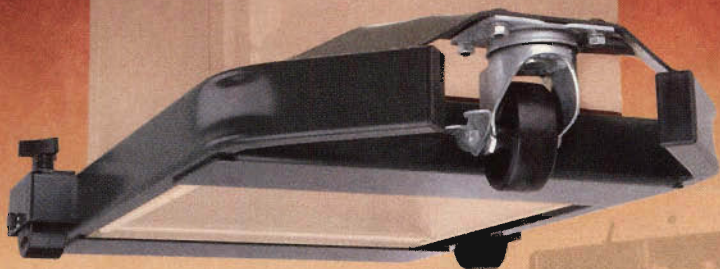


WINNER!

In addition to our standard payment (below) Dan Humburg of Brookings, South Dakota

will also receive a **Delta 22-580 portable two-speed finishing planner** 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 e-mail us: tricks@woodworkersjournal.com

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Men of the Cloth Turn to Wood

Monks Find New Niche:

Casket Making Business

"Elegant but simple" is how Sam Mulgrew describes his company's product. Mulgrew is general manager at Trappist Caskets, a business operated by the monks of New Melleray Abbey, a 152-year-old monastery situated not far from Dubuque, Iowa.

New Melleray is getting a new lease on its economic life by sticking with the basics: harvesting timber and turning it into wooden caskets. Trappist Caskets offers shaped or straight line caskets in a variety of species, including white ash, red oak, pine, maple and the best seller, black walnut.

"These products have a lot of personality," Mulgrew said. "People are impressed by the dignity of funerals featuring a wooden casket." There is a demand for the caskets from members of religious orders who are looking for simplicity, but it is the beauty of the wood that makes people notice a Trappist Casket, Mulgrew said. "They seem to appeal to Baby Boomers who want to express their own personalities," he said.



The monks at Father Brendan's Benedictine abbey near Dubuque, Iowa, have found making caskets to be a way to support themselves while living a prayerful life.

It can't hurt that they are contemplating a final resting place that has been carefully constructed by gentle men whose lives are spent in prayer.

Even if Trappist Caskets is on the Internet at www.trappistcaskets.com (or call 888-433-6934), they are never far from the Benedictine Rule grounded in the contemplative life. As a reminder, callers to Trappist Caskets who are put on hold hear the monks' prayerful chanting.

New Melleray Abbey is home to Iowa's second largest privately owned forest, a massive reserve of hardwood that had never been aggressively logged, until November of 1999.

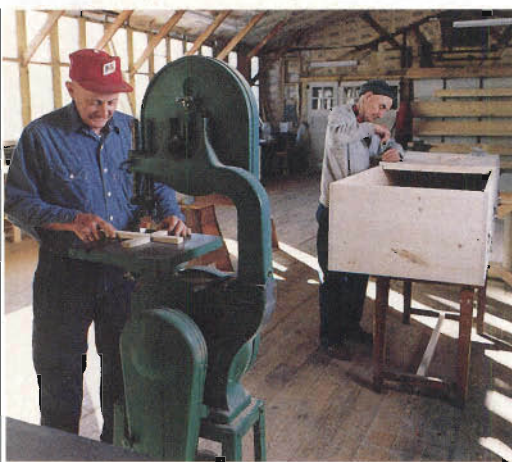
That was when the monks agreed to take over a casket making company that Mulgrew started in 1996, on his farm about 30 miles away. A dwindling agricultural economy had taken its toll on the abbey's income, one that since its founding has depended upon farm-

related practices. The object was for the monks to sustain themselves by the work of their own hands.

At the same time, it had to be work that allowed them to be reflective, never compromising their need to work in an atmosphere of prayer, Mulgrew explained.

There was a desire to recycle as many of the monastery's outbuildings as possible, outbuildings that included a wood shop. There was some thought of making furniture, but that would have required a huge investment. Besides, furniture products lacked the spiritual quality the monks wanted to incorporate.

One look at Mulgrew's finely-honed caskets and it must have seemed to be a match made in heaven. A self-taught casket maker, "with a steep learning curve," Mulgrew said it was a long process for him to arrive at an heirloom quality casket. "I wanted fine



Brother Placid (at band saw) and Brother Felix are two of the monks who build caskets from start to finish — from milling logs to stuffing upholstery with homegrown straw.

woodworking joinery and I didn't want to make up for poor joinery by finishing," he said.

Once New Melleray and Mulgrew joined forces, there was an eight-month training period. Now, Mulgrew says it's to the place where the monks are training others and his main duties involve marketing and office work. "They are a fine group of guys to work around," Mulgrew said, noting with a smile that it is the first bunch of workers he has been with who don't cuss. The monks live a highly scheduled life, arising each morning at 3 a.m., and going to bed at 8 p.m.

While that may sound like a long work day, it is actually a long prayer day, with work on the caskets going on only from 9 - 11:35 a.m. and 2 - 4:30 p.m., six days a week. "They understand that making money is not the highest purpose in life," Mulgrew said.

The abbey employs a forester who works with the monks to select the trees used in their operation and sees to it that the forest is maintained. For every tree harvested, 100 are planted.

From forest cut to packing the coffins for shipping, every step of the production is handled by the monks. Mulgrew attributes the caskets' strength to raised panel joinery that bears up to 500 pounds. The caskets are sold directly to the public at prices ranging from \$575 to \$1,485.

While the monks produce caskets of such striking beauty, they themselves will never have a use for them. In the Benedictine tradition, at death, their bodies will be placed on a shallow bier and lowered into the grave, without benefit of cover.

— Mary Rae Bragg



San Francisco Giants player Barry Bonds hit 73 home runs to break the single-season record in 2001 — while using a maple bat.

A Better Bat?

Maple Out "Runs" Ash

In 1996, out of work carpenter Sam Holman was sitting in an Ottawa, Ontario pub when his buddy — a pro baseball scout — bemoaned the fact that players had broken so many bats at a recent spring training. "You're a carpenter," he told Sam, "why don't you make a bat?"

That day, Sam read up on bats and hitting. "I knew I wasn't going to build a better ash bat," Sam said. What he noticed in an engineering table, though, is that the density of maple and ash are very close, with maple offering about 10 percent more strength and four to five times more hardness. "It looked like a very attractive choice," he said.

So Sam went home, picked up some maple left over from a renovation project, and made a prototype. Major League Baseball began allowing the use of the maple Sam Bat the following year. "What I know now is, in skilled hands, maple is a phenomenal material for batting," Sam said.

"With an ash bat, the first time it's used it starts flaking."

The most prominent Major League user has been Barry Bonds, who used his maple Sam Bat in pursuit of Mark McGwire's home run record. The relationship between Bonds and Sam Bat has helped in the expansion of Sam Bat — it's now moving out of the 17½ foot shop in Sam Holman's home. "One thing I will say about maple is, it's beauty that works," Sam said. *More info: 613-233-0192 or www.sambat.com.*



Swedish instructor Wille Sundquist (right) is one of the teachers at Country Workshops.

Back to Shop Class

Woodworking School Roundup

Aside from brief exposure during high school shop classes, most woodworkers these days are self-taught. Spending a week, or even a long day, with one of the masters at the following list of schools can have a huge impact on your methods in the shop. Coursework typically includes techniques and tool use, with a smattering of woodworking philosophy. (Note: you can visit www.woodworkersjournal.ezine/currentissue.cfm for more details.)

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Shop Talk continues on page 16 ...

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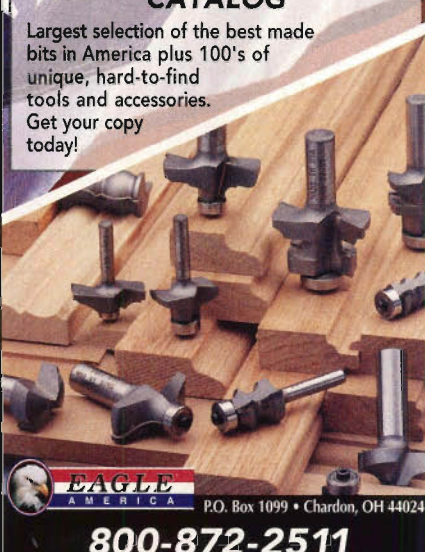
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Center For Furniture Craftmanship

Director Peter Korn's school on the Maine coast offers workshops on furnituremaking, design, and related skills.

Contact: 207-594-5611
or www.woodschooll.com

Country Workshops

Founded by master craftsman Drew Langsner, this North Carolina school's focus is on traditional craftsmanship with hand tools.

Contact: 828-656-2280
or www.countryworkshops.org

Heartwood School

Established to teach classes on building an energy-efficient house, this Massachusetts school has expanded into timber framing, cabinetmaking and furnituremaking.

Contact: 413-623-6677
or www.heartwoodschool.com

Homestead Woodworking School

Based in rural New Hampshire, this school offers a variety of classes for novice, intermediate, and advanced woodworkers.

Contact: 888-659-2345
or www.woodschoollnh.com

JD Lohr School

This Pennsylvania-based school offers Saturday and extended weekend woodworking and furnituremaking workshops.

Contact: 610-287-7802
or www.jdlohrwood.com

Marc Adams School of Woodworking

Based in Indiana, this is one of the largest woodworking schools around — over 9,000 square feet of space.

Contact: 317-535-4013
or www.marcadams.com/index.html

The Masterpiece School of Furniture

A California-based traditional woodworking program offering the



Jeffry Lohr, front, is the founder of JD Lohr School in Schwenksville, Pennsylvania.

philosophy and classic form of 17th and 18th century furnituremaking.

Contact: 707-964-8798
or www.masterpieceschool.com

North Bennet Street School

This full-time college in Boston also offers a series of short-term courses in woodworking to strengthen techniques and develop skills.

Contact: 617-227-0155
or www.nbss.org/workshops/index.html

North House Folk School

This traditional crafts school on the Minnesota shores of Lake Superior offers a wide variety of courses for every skill level.

Contact: 218-387-9762
or www.northhousefolkschool.com

Northwest Woodworking Studio

This school's goal is to offer "a traditional crafts approach for building functional pieces of work that will last for generations." They also offer a Mastery Program in Woodworking, with lectures and one-on-one study in the student's shop.

Contact: 503-284-1644
or <http://nitwit.com/nws/about.html>

The Windsor Institute

At the end of this class, each student leaves New Hampshire packing a Windsor chair, and knows how to make that chair in a home workshop.

Contact: 603-929-9801
or www.thewindsorinstitute.com

The Woodworking School

Founded by finishing expert Michael Dresdner and tool safety authority Roger Goad, this new school is offering hands-on classes in the Sumner, Washington area.

Contact: 253-862-6571
or www.thewoodworkingschool.com



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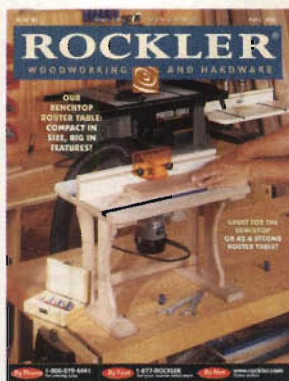
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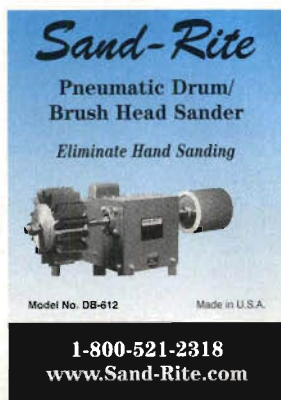
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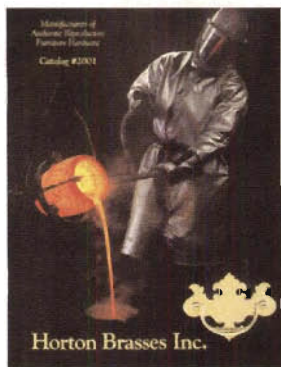
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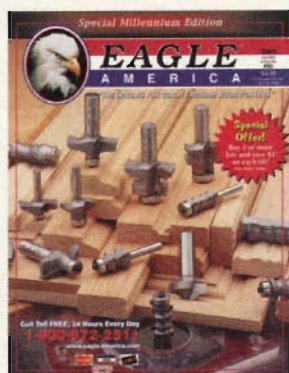
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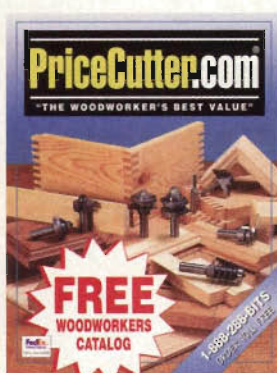
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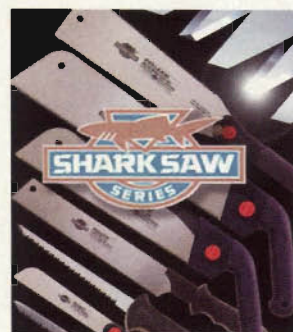
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Some Fancy Finishing

Q I repair violins and other string instruments. For varnish, I usually use Propolis or Italian spirit varnish with aniline powdered dyes, an approach recommended to me by a more experienced technician. I never quite mastered this medium and wondered if you had any suggestions for me. How does one handle this kind of varnish? What are the dos and don'ts of this medium?

*Zing Koh
Sugar Land, Texas*

A The slow drying, relatively soft varnishes we use for violins tend to be a bit more difficult to brush out than furniture varnish. Traditionalists try to overcome the tacky, hard-to-apply nature by using a stiffer, shorter bristle brush, such as a 1" badger.

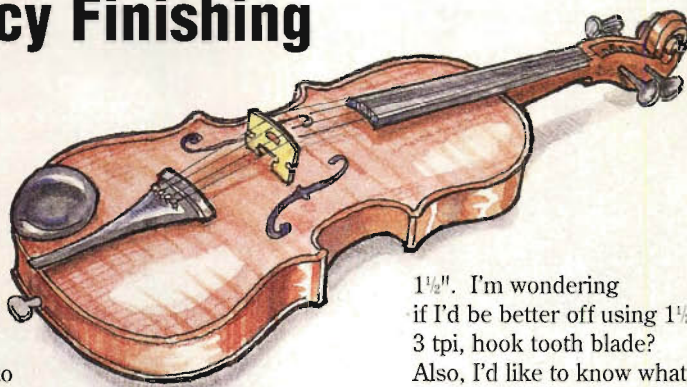
Recall Notice!

A "recall to repair" is in effect involving some 7" circular saws from Ryobi. The models in question have lower blade guards that get stuck in the open position.

For more information point your browser to www.cpsc.gov or contact the manufacturer.

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— WJ Editors



They use short strokes and rely on the long cure and flow time to minimize the brush marks, but still expect to put time in smoothing the surface between coats.

Generally, I find that you can make these varnishes handle better using the same tricks you would for any varnish — thin the material with solvent and apply thinner coats. That will mean more coats to get the same build, but you'll find the ease of use compensates for the added time. Use a quick drying solvent such as naphtha, and keep the coating thin, so that you don't get sags when you hang the instrument to dry. I hang violins in a dust-free chamber heated to about 90 degrees to get faster cure with less dust settling in the finish, but at best it is a long, slow process.

— Michael Dresdner

Q In most of the articles I have read about resawing, the recommended blade is a 3/4", 3 tpi, hook tooth blade. I believe they recommend this because most people resaw with a 14" band saw and a 3/4" blade is the max it will take. I have the JET 18" band saw and my max blade width is

1 1/2". I'm wondering if I'd be better off using 1 1/2", 3 tpi, hook tooth blade? Also, I'd like to know what blade configuration is best for resawing given my set up? Does it matter what thickness I'm trying to achieve?

*Chuck Steger
Bossier City, Louisiana*

A The idea is to use as wide a blade as possible because a wider blade has more "beam strength" which resists deflection. However, it is not always practical. A 1/2" 3 tpi is wide enough to resist deflection, and at .025" thickness it tolerates bending around a 14" wheel. It is also easier for the saw to tension a small blade adequately. Three tpi is aggressive enough to resaw and still cut 3/4" material.

Using a similar rationale, I would use a 3 tpi 3/4" or 1" blade on your 18" saw. You may have to special order.

— Mark Duginske



continues on page 22 ...

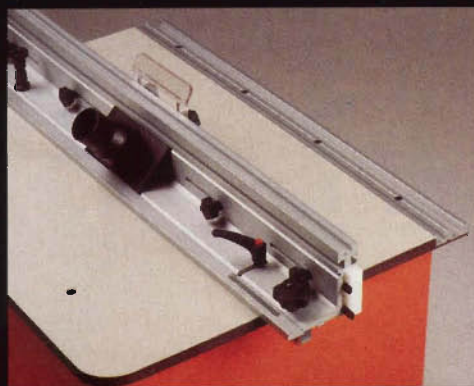
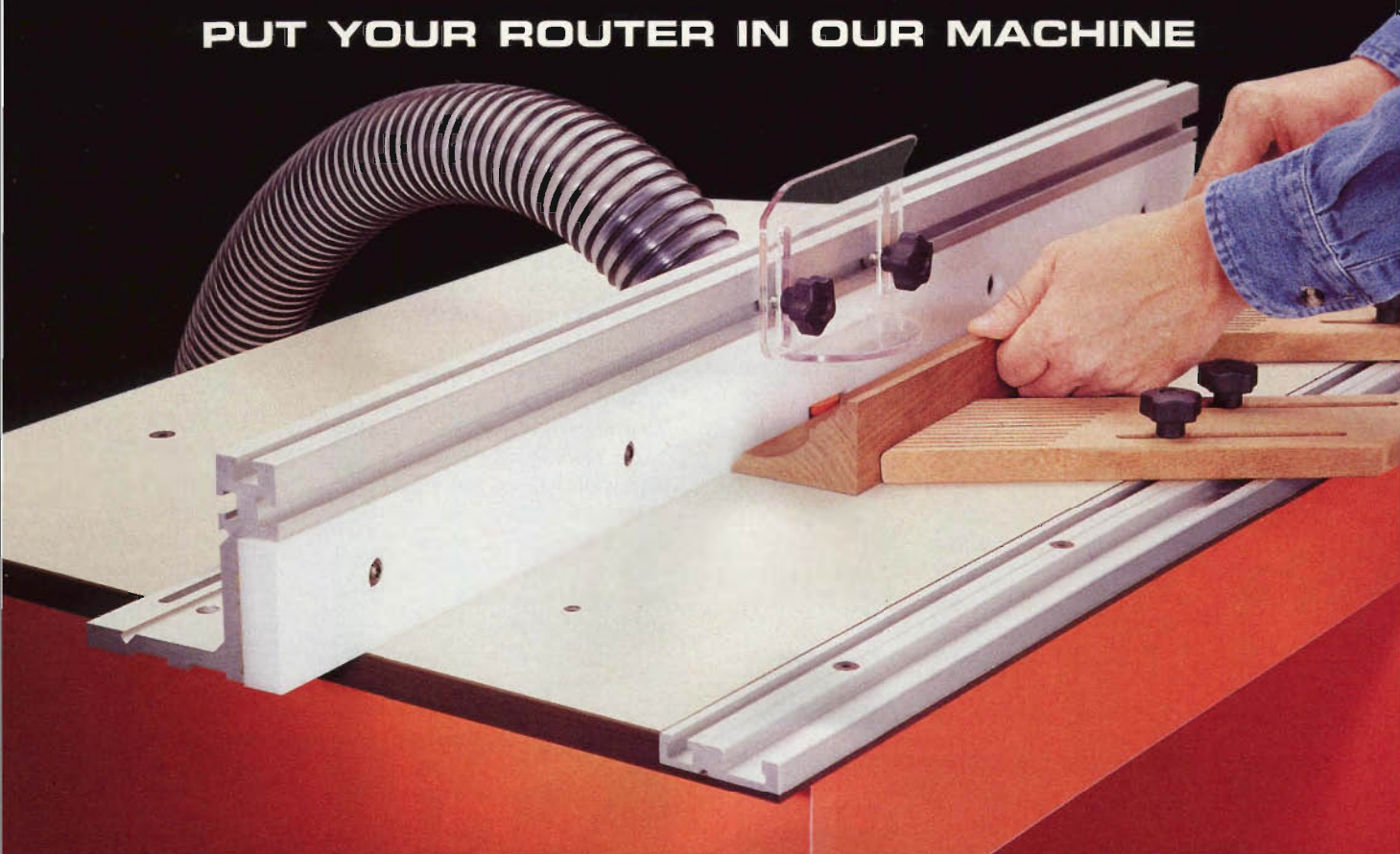
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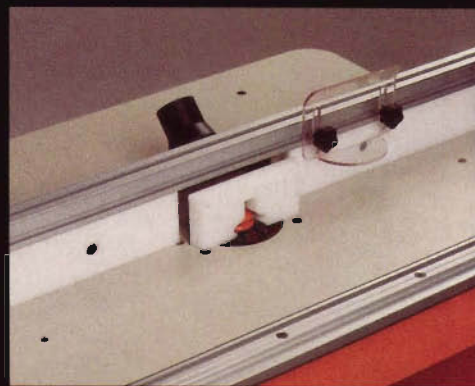
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QUESTIONS & ANSWERS

THIS ISSUE'S EXPERTS

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

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

Mark Duginske is the author of *Band Saw Workshop Bench Reference* from Sterling Publishing Company.



As my need for a drill press becomes more imminent, I am confused about the articulating head feature. I think the versatility would be better than that of a tilting table. I can only purchase one drill press and prefer a floor model. Can I combine all of my needs and find a model to accommodate them?

*David Runte
Houston, Texas*



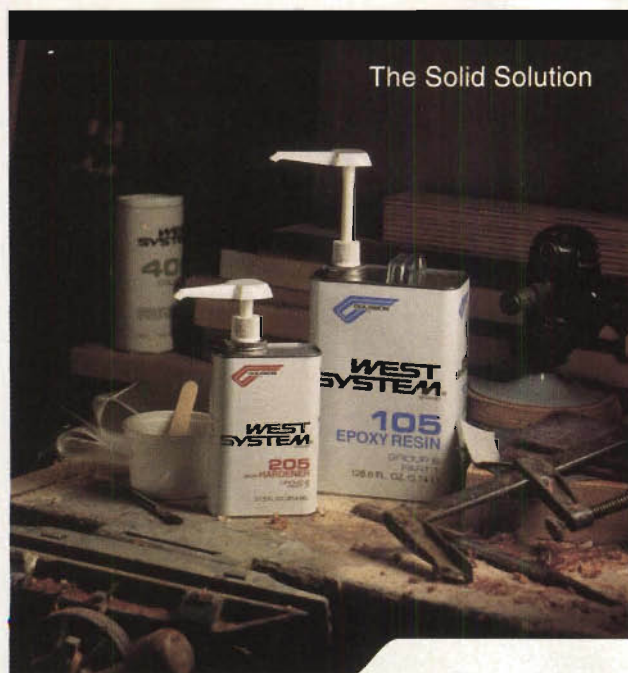
Many small shops find that a 15" drill press with a 1/2 HP or 3/4 HP motor is adequate for the vast majority of their needs. Get one with at least a 1/2" chuck and 4 inches of quill

travel. Some drill presses offer multiple spindle speeds. In my opinion, as long as you have a low speed in the 300 rpm range, a four-speed step pulley system is perfectly adequate. Tilting tables and table raising mechanisms are of debatable value. When you need to drill at an angle, there's usually a simple jig you can make to hold your work. To drill to the center of larger pieces, or for regular angled drilling, consider one of the radial drill presses on the market. They cost a bit more, but they are very versatile for odd angles and long reaches.

— Ellis Walentine



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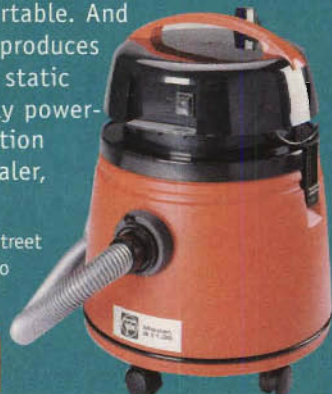
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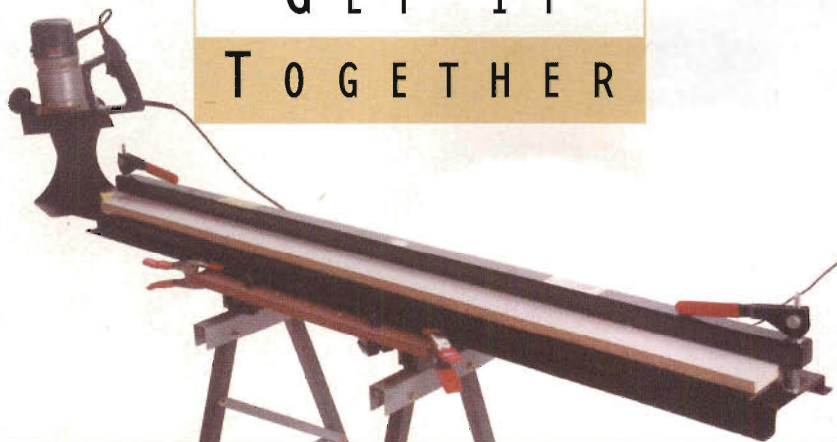
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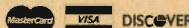
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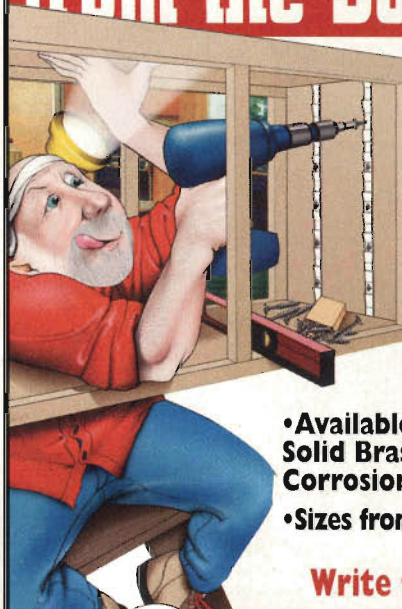


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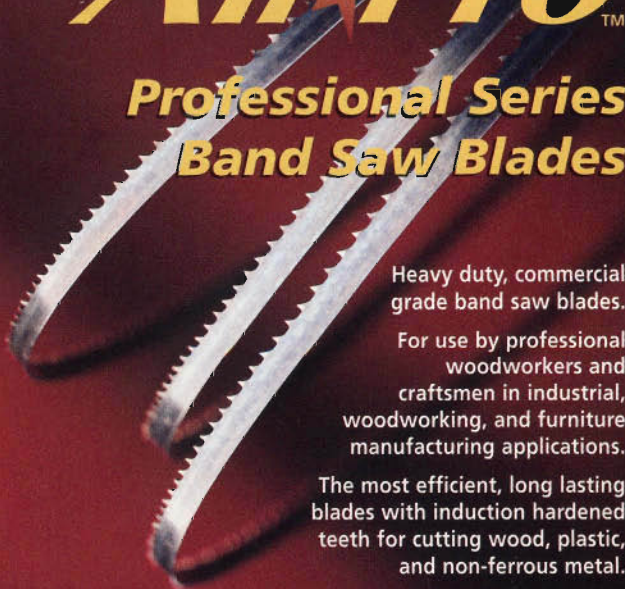
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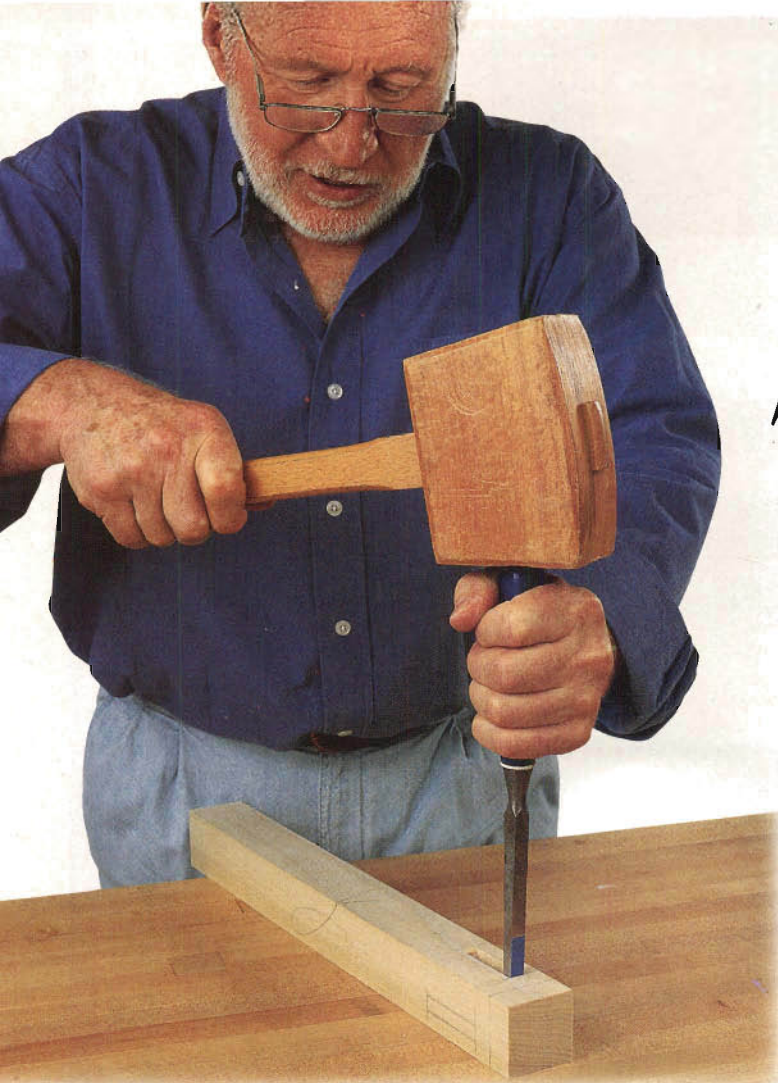
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Hand Cutting Mortise and Tenons

By Ian Kirby

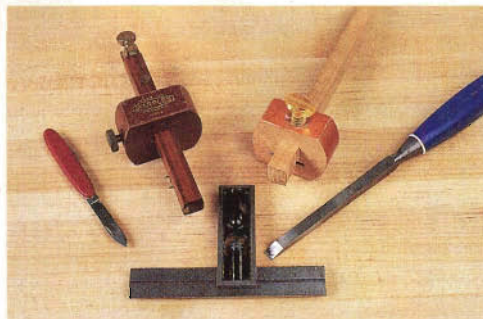
Learn to form an age-old joint like a master. Join Ian as he walks you through the fine details of cutting perfect mortise and tenon joints by hand.

Making a mortise and tenon joint by hand is normal, everyday woodworking. No special tools are needed other than a mortise chisel. You must pay special attention, however, to cutting each part in the right order.

Mortise Chisel

The mortise chisel is robustly made to withstand mallet blows and lever out waste without breaking. Manufacturers' design details vary, but *the one essential characteristic is that the flat back face must be at right angles to the sides*. These square corners cut the wood as the waste is scooped out. A non-square chisel will twist as you drive it. You cannot stop the twist! Levering out waste with a twisted chisel will make a mortise wider than the chisel.

In addition to a mortise chisel and marking tools shown above, you



A good mortise and tenon joint starts with the right marking out tools. The author recommends, from left to right, marking knife, mortise gauge, cutting gauge, mortise chisel, and try square.



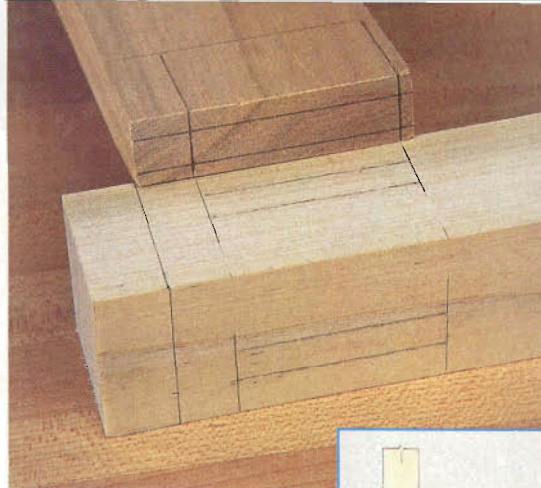
One of your first steps is to set the tips of the mortise gauge spurs to the width of your mortise chisel.

need a mallet, a tenon saw, a bench hook, and 3/4" bevel-edge chisel. Obviously, hand tools cost much less than a mortising machine. As for speed — that depends on how skilled you become — but after making a few, it's not slow. For a one-off project, hand-made can be quicker than machine-made. As for the pleasure derived from a well-executed hand-made joint, well, you won't know until you've tried it.

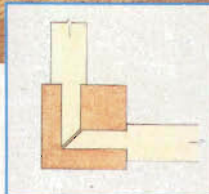
In *Marking Tools for Exacting Joints* (August, 2001), I explained how to use marking tools. Then, in *Mortise and Tenon Primer* (October, 2001), I described the principles behind designing and making a mortise and tenon joint. (Editor's note: To find electronic versions of both previous articles mentioned, visit our web site at www.woodworkersjournal.com) This time I will walk you through all the steps for a specific joint.

"Knowing the hows and whys of hand work provides a solid foundation for quick and precise machine work"

"Marking Tools for Exacting Joints"
Woodworker's Journal, August 2001
— Ian Kirby



A well marked-out joint is the first step toward a successful hand cut mortise and tenon. The last step will be to miter the tenons.



Before You Start Cutting

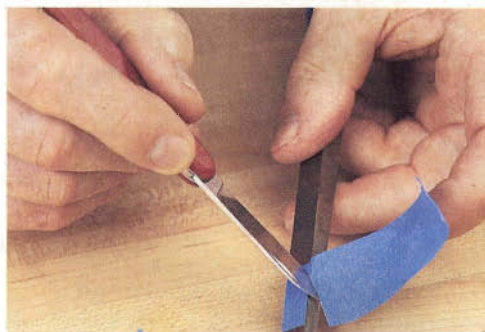
Begin by marking face sides and face edges on all the pieces. Face sides go inside, face edges go down.

Knife the horn. The horn helps prevent the mortise from splitting once glue is applied to an already tight joint. You cut the horn off after the glue is cured.

Knife all round the shoulders of the tenon. Then, using the marking gauge, mark the top and bottom edges of the tenon. You can now transfer these distances to the leg to mark the top and bottom edges of the mortise.

Set the tips of the mortise gauge spurs to the width of the mortise chisel. The importance of this setting will be discussed later. Two fence settings are needed: one for the mortise in the leg and one to scribe the tenon width onto the rail. Mark both parts and your joints should look like those in the photo at top right. After you chop the mortise, you'll have to saw the tenon: how close you saw to the gauge line will be decided later.

To know how deeply you are driving the chisel into the mortise, make a simple depth gauge using a piece of blue masking tape stuck to the back of the chisel and trimmed flush with the edges. Don't wrap the tape around the chisel because it will crush and tear as you get to



Apply masking tape to the back side of the chisel to establish your cutting depth. Tape wrapped around the chisel will crush and tear as you reach full depth.



Position the chisel with two hands, as shown above. Then tap firmly with the mallet to set the edge of the chisel (inset).



Remove the chisel by pushing away from you for the first four cuts, as shown above. The inset photo at left shows how the chisel leaves a space the same shape as its end.

the final depth of the mortise and lever out the waste. For our purposes here, the tape also tells you which way the chisel is facing as you look at the photos of chopping the mortise.

Do your chopping at the end of the bench, away from the vise. Place the workpiece over the legs because that's where the benchtop is most solid. Brush the bench clean of mortise chips as you work. If chips get trapped under the work, you will have to steam out the dents. The chips can also tilt the workpiece, making it difficult to drive the chisel straight.

Joiner's Mallet

Chop with a joiner's mallet. A cylindrical carver's mallet is not designed to deliver the heavy blows required for chopping mortises. Plus, a glancing blow off the chisel handle could hurt your wrist. Also avoid a dead blow hammer. Because it deadens the chisel's response to the hammer blow, you won't know when the chisel has been driven solid and can't be driven further.

Chopping is a three stage cycle, repeated over and over. First you position and set the chisel, then you drive the chisel, and then you lever out the waste.

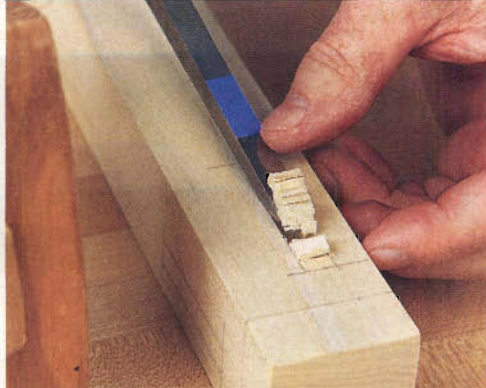
Use two hands to position the chisel exactly between the gauge lines that mark the side walls and

parallel to the knife lines that mark the end walls. It's difficult to locate the chisel accurately with a mallet in one hand. Next tap the chisel to set the edge into the workpiece. The importance of how the chisel width is measured should now be apparent. By using a top-of-the-spurs setting, the gauge line reflects the actual chisel width and makes it easier to position the chisel. A bottom-of-the-spurs setting makes the gauge lines wider than the chisel, making it difficult to repeatedly position the chisel in the right place.

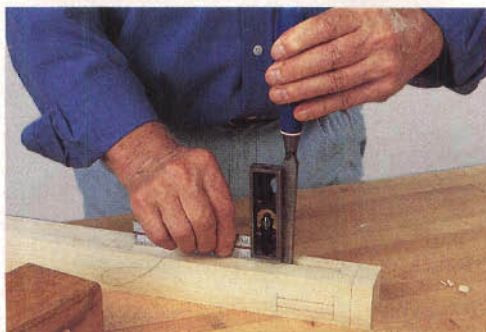
Drive the chisel with a full arm swing blow. It may twist if not hit squarely. If so, hold the workpiece to the bench with one hand and twist it back into alignment. If you can't correct the twist, lift the chisel out and re-position it to take a new, small bite.

Remove the waste by levering the chisel towards you. Remember to always keep both hands behind the sharp edge.

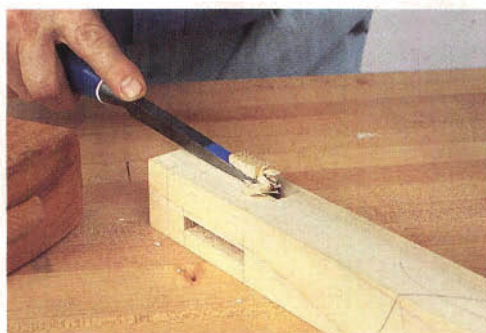
To hold the chisel vertically, stand at a comfortable arm's length directly behind it (see the photo on page 24). You determine the chisel is vertical by simply sighting it — there are no effective assists.



Using the layered method of waste removal you can lever out the first chip with five chisel cuts.



Here the author checks his mortise for square using his try square and chisel.



If you choose the full-depth method you can lever out a big chip from the center of the mortise after the second drive of the chisel.

There are two ways to chop out the mortise. I call them the layered method and the full-depth method (see *sidebar*, below). Using the layered method, you remove the waste in layers by cutting the mortise end-to-end at half the depth, then removing a second layer to the full depth.

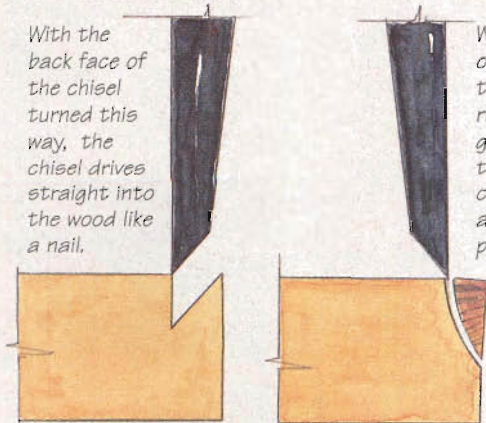
When using the full-depth method, you remove a portion of the center of the mortise to the full depth, then advance incrementally to each end, going to full depth with each bite.

Both methods rely on the fact that the mortise chisel cuts the wood with the square corners of the back face and scoops out the waste by riding on the grinding bevel. To see how it works, get a block of wood — a 2 x 4 will do. Stand facing the end grain and position the chisel 1/4" from the near end, with the back face away from you. Drive the chisel into the wood with a hard blow, like driving a nail. Now turn the chisel around and repeat the procedure. This time the chisel scoops out a chip as it rides on the grinding bevel. You just completed the essential steps for chopping a controlled square

The key to accurate mortise and tenon joints is paying

How the mortise chisel cuts

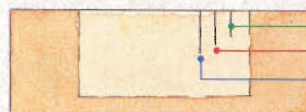
With the back face of the chisel turned this way, the chisel drives straight into the wood like a nail.



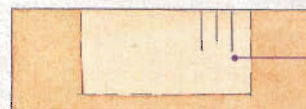
Scooping out the mortise waste depends on the proper orientation of the chisel.

With the back face of the chisel turned this way, the chisel rides on the grinding bevel and the sharp square corners scoop out a chip, leaving parallel side walls.

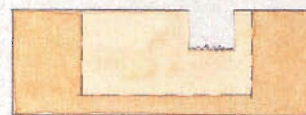
Layered method for chopping mortises



Cut 1
Cut 2
Cut 3



Cut 4 deepens Cut 1 to equal Cut 3.



Cut 5 lets you begin scooping out the waste.

The layered method requires five cuts to remove the waste.

hole with a mortise chisel: you first made a space and then you scooped out the waste. I'll now describe how to make that space for each of the chopping out methods.

Chopping the Mortise — Layered Method

The layered method takes five chisel cuts to get the first waste out.

Cut 1 — Start by standing behind the work. Position the chisel, flat side away from you, about 3/16" from the far end of the mortise. Tap lightly to set the chisel, then hit it hard. If you hit as hard as I do, three blows will usually drive it as far as it will go. A dull *clunk* is the tell-tale sound of a chisel driven solid. Put the mallet down. To remove the chisel, lever the handle *away* from you; it's easier to withdraw that way. What remains is a space the same shape as the end of the chisel.

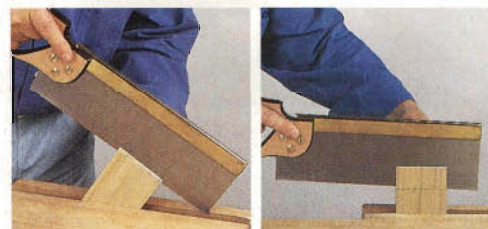
Cut 2 — Position the chisel about 3/16" towards you. Tap lightly to set it, followed by three hard blows. The difference between Cut 1 and Cut 2 is that the second went a bit deeper because of the space created by the first.



The author places the laid out tenon on the mortise to determine how close to saw to the line (left). For Cut 1 (above) he starts at the far edge and makes a kerf parallel to the end.



Cut 2: Saw down the line nearest you, right down to the shoulder line. Be sure you keep the saw edge in the end kerf at all times during this cut.



Cut 3: Reverse the workpiece (left) and saw down to the shoulder line again. **Cut 4:** Clamp upright and saw the center triangle down to both shoulder lines.

Cut 3 — Remove the chisel and position it another 3/16" towards you for Cut 3, which will go deeper yet.

Cut 4 — Position the chisel in Cut 1 and hit it hard to drive it to the same depth as Cut 3.

Cut 5 — Finally, position the chisel, back face away from you, another 3/16" behind Cut 4. You are now over half an inch from the start. Drive the chisel, place the mallet down, and lever the chisel handle *toward* you — keeping it carefully aligned with the mortise sides — and scoop out the first waste. Repeat Cut 5 until you have removed the first layer. To remove the second layer, repeat Cuts 1 - 5 and then finish the job with Cut 5.

Chopping the Mortise — Full-Depth Method

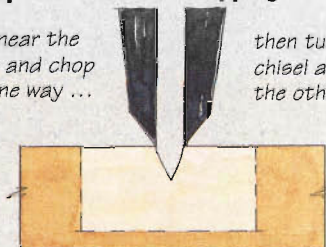
Begin by chopping in the center of the mortise with the flat side of the chisel towards you. Drive it solid, remove it, turn the back face away from you, and position it about 3/8" nearer to you between the gauge lines. You should be able to remove a chip on the second cut. Take 1/8" bites, and repeatedly alternate the chisel direction, driving down

special attention to the sequence of your cuts.

Full-depth method for chopping mortises

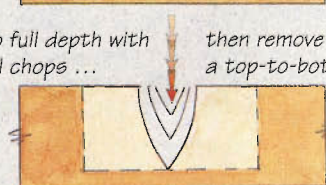
Begin near the middle and chop first one way ...

then turn the chisel and chop the other way.



Get to full depth with several chops ...

then remove waste with a top-to-bottom chop.

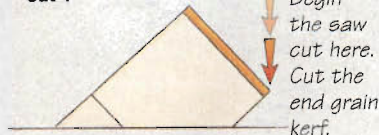


Once mastered, this is a quick and efficient technique for chopping mortises.

Four-cut sequence for sawing tenons

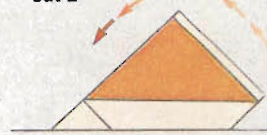
Cut 1

Begin the saw cut here. Cut the end grain kerf.



Cut 2

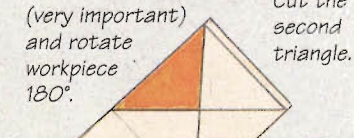
Pivot off the back edge and keep saw teeth in the end kerf. Cut the first triangle.



Cut 3

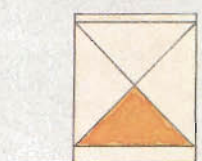
Blow out sawdust! (very important) and rotate workpiece 180°.

Cut the second triangle.



Cut 4

Blow out the sawdust and put workpiece upright in the vise. Cut the third triangle.



The key to accurate sawing: you can only cut one line at a time.

as hard as you can. The chisel will resist coming out easily. Take care to keep both hands behind the cutting edge.

With the layered method, the chisel is levered past the sidewalls twice, compared to once for the full-depth method. That doubles the possibility of the chisel twisting and removing extra tissue from the side walls. I use the full-depth method, but beginners may find the layered method easier to learn. Try both and go with the one that suits you best.

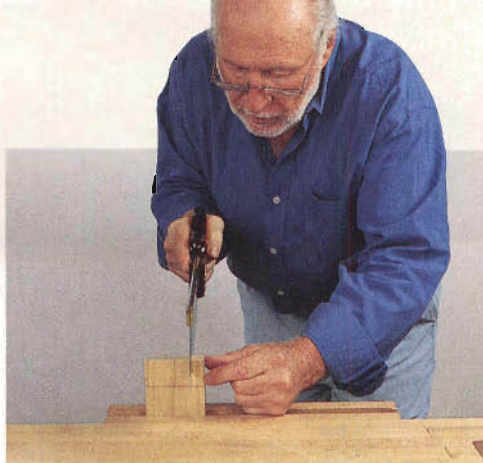
Squaring the End Walls

Once the bulk of the mortise is chopped, you square the end walls. Set the chisel in the knife line, back face to the end you're cutting, and drive it to the bottom of the mortise. Hard blows are unnecessary. It's more important to keep the chisel aligned with the mortise and at a right angle to make the end square. Check the ends and depth of the mortise with a try square (see photo on page 26).

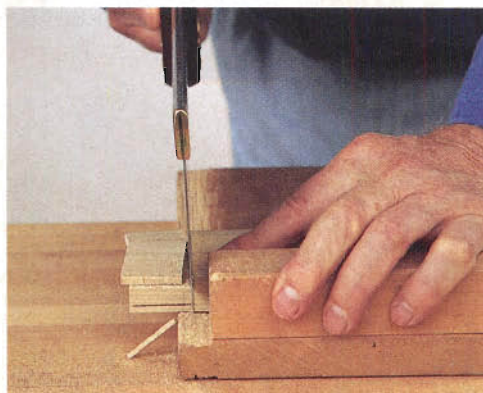
Don't expect to get a flat bottom on a hand-chopped mortise, but you shouldn't be more than 1/16" - 1/8" deeper than necessary. On a leg where two mortises intersect, the last remaining corner material may be removed with a wide bevel-edge chisel. Note: this is not an invitation to pare the side walls.

Tenon Saw

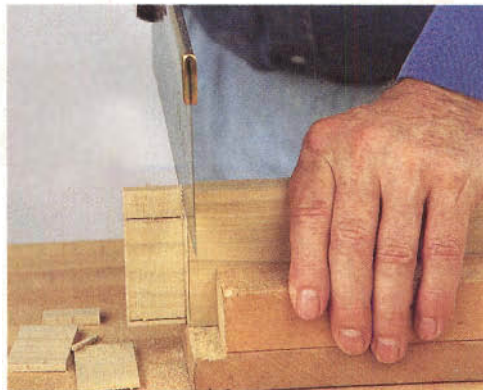
A tenon saw, also called a bench saw, is a robust tool designed for general cutting. Don't cut tenons with a dovetail saw: The blade is too thin and the saw will wander. Four keys to accurate sawing are grip; alignment of wrist, arm and shoulder; motion; and stance (see photo on page 27). Note that four fingers wrap around the handle, but the extended index finger presses against the side of the handle, and points down the



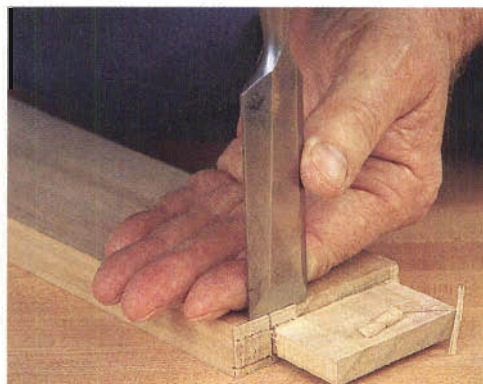
Once you've completed Cut 4, you're ready to reposition yourself and saw the vertical cuts for the two edges of the tenon.



The structural shoulders are removed while holding the workpiece in a bench hook.



Flip the piece over while still in the bench hook and saw the edge shoulders.



With the sawing completed, you're ready to pare the shoulders with your wide bevel-edge chisel.

saw. This grip provides more steering control. Align the wrist, lower and upper arm, and shoulder in one plane so that you can saw back and forth in a straight line, like a piston. Stand balanced on two feet and far enough from the workpiece so that you can maintain the piston-like alignment and motion. Put your spare hand lightly on the work — don't lean on it for balance.

One Line at a Time

To saw a tenon accurately, you make four separate sawcuts, one line at a time. If you attempt two lines at a time and things go wrong on one line, then any adjustments to get back on track will inevitably take you off track on the other line. The first sawcut makes a shallow kerf in the end grain. Each of the remaining three sawcuts cuts a triangle of tissue on the tenon face.

Clamp the workpiece low in the vise at an angle of about 45°. Before making your first cut, you must decide where to saw the kerf relative to the gauge line. Remember, you determined the gauge lines when you set the spurs on the mortise gauge to the width of the chisel. However, the width of gauge lines will vary if you measured from the top or the bottom of the tapered spurs. I want to emphasize that the mortise gauge has little to do with the mortise, which can only be as wide as the chisel, but it has *everything* to do with the tenon and where you make the sawcuts. To determine how close to the line to saw, put the tenon on the mortise and decide (see photos on page 27).

Cut 1 – Begin by cutting the workpiece at the far corner of the end. What may seem awkward at first becomes easier with practice. Extend the sawcut to the near side, making a kerf

that's parallel to the end and about 1/8" deep. This kerf will guide the next cut.

Cut 2 – Saw down the gauge line on the near edge toward the shoulder, all the while keeping the saw teeth buried in the end grain kerf. Don't extend the sawcut on the back edge; rather use it as a pivot. If you let the teeth escape the first cut, they will rag out the end and reduce the guiding effect of the kerf. Do both left and right cuts while the workpiece is in the vise. Stay on the waste side of the shoulder line. You will later pare precisely to the shoulder line with a bevel-edge chisel.

Note that at the end of each cut, the tooth edge is roughly parallel to the benchtop. That was the purpose of angling the workpiece in the vise at the outset. You have now cut the first triangle.

Cut 3 – Remove the workpiece, blow sawdust from the two kerfs, rotate the workpiece 180° in the vise and angle it as for Cut 1.

Blowing out the sawdust is a critical step. A hand saw, unlike a table saw or band saw, does a poor job of removing its own waste. Sawdust buildup in the kerf is the major reason why a hand saw wanders from the line.

Saw down the two gauge lines on the near edge to the waste side of the shoulder line, keeping the saw fully in the end grain kerf. You have now cut the second triangle.

Cut 4 – Remove the workpiece, blow sawdust from the two kerfs, and clamp upright in the vise. Keep the tooth edge parallel to the benchtop as you saw down to the shoulder lines. You have now cut the third triangle.

Leave the workpiece in place and saw down to the waste side of the edge shoulders to create the tenon edges.

You need a bench hook to rest the work in while you saw the



Once the tenon is made, mark the miter. Be sure to angle it the right way (measure twice, cut once).



Return to the bench hook when you are ready to saw the miter on the tenon.



With all the cutting complete, it's time to assemble the joint and test the fit. You should have a tight, push fit. Once you're happy with the fit, it's time to check for alignment, as shown below.



shoulders. Saw about 1/16" from the shoulder line. Clean up the shoulder and cut it square by vertical paring with a wide bevel-edge chisel. Check the shoulders with a try square.

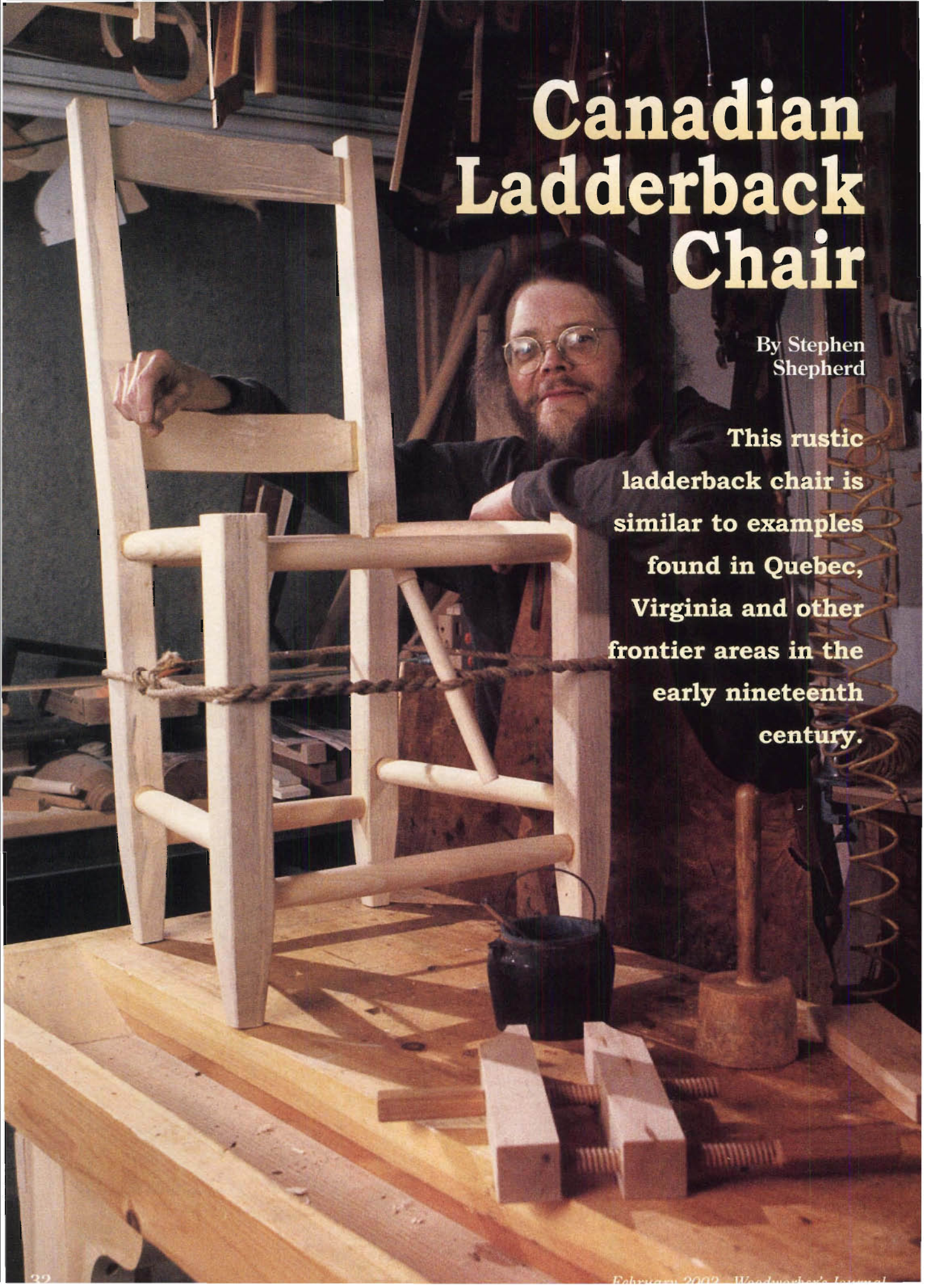
Undercutting the shoulder is bad practice, so avoid it. The paring stage is where you reap the benefit of a clean, deep knife line cut during the marking out stage because the chisel will seat firmly in the knife line.

Since you are dealing with a leg and two rails, mark and cut the tenons at 45°, leaving a gap of about 1/16".

Now is the time to test the fit of the joint. It should be a tight push fit. If it's too loose, try again. If it's too tight, determine exactly why before you make adjustments. Look for crushed tissue or shiny areas that would reveal themselves if you closed the joint with clamps. If the tenon is too thick, make it thinner by clamping the workpiece in the vise and paring across the grain, never down it.

Ian Kirby is a master of the British Arts & Crafts tradition as well as a designer, wood scientist and master woodworker. Look for his continuing articles in upcoming issues of Woodworker's Journal.



A man with a beard and glasses is working on a wooden ladderback chair in a workshop. The chair is made of light-colored wood and has a rope tied around its frame. The man is leaning over the chair, and his hands are visible. The workshop is filled with various tools and wood pieces.

Canadian Ladderback Chair

By Stephen
Shepherd

**This rustic
ladderback chair is
similar to examples
found in Quebec,
Virginia and other
frontier areas in the
early nineteenth
century.**

Frontier life in the early nineteenth century was an exercise in self-sufficiency.

Hardscrabble settlers had to rely on their innate skills and a few basic hand tools to build and furnish their homesteads. Their furniture was simple and utilitarian, made to stand up to the rigors of daily life on the fringe of civilization.

This ladderback side chair is typical of the vernacular furniture forms that evolved during that period and remains popular even today. The chair shown is patterned after an example found in Quebec. With its simple square tapered legs, turned or shaved rungs and cut or bent back slats, it is easy to make with hand tools or power tools.

The seats of many Quebec chairs were strung with fine strips of rawhide or beaver skin in a traditional snowshoe pattern, as shown in the accompanying article (see *Weaving a Gut Seat*, page 36); but you can also use rush, Shaker cloth tape, or twisted sea wrack. It takes me about six hours to build one of these chairs. Finishing it and stringing the seat takes another few hours.

Selecting the Wood

Early craftsmen made their chairs from any locally available woods. I have seen examples in chestnut, white oak and ash, as well as yellow birch, which was the wood of choice in Quebec.

Many of these chairs were made of plain-grained woods such as poplar, spruce or pine and then painted, often with a brick-red color called "Spanish brown." A few show evidence of original hand graining to imitate fancier woods.



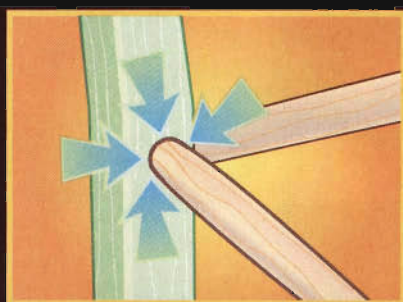
photos by George Shepleford



The author turned his rungs, but they could also be shaped by hand (right) with a drawknife and spokeshave. Either way, be sure to leave a slight belly on the tenons to create space for glue and allow for slight variations in the angle.



Whichever wood you choose, try to select straight-grained stock for the front legs and rungs — it's stronger and easier to work with hand tools. The angled back legs and curved slats will be less apt to break under duress if the grain follows these curves.



Years ago, chairs were often made of green or partially air-dried wood.

To keep the rungs from loosening over time, chair makers would heat them in an oven to dry them out before forming the tenons. Later, as the legs seasoned, the mortises would shrink tightly around the drier tenons, making the joints even stronger.

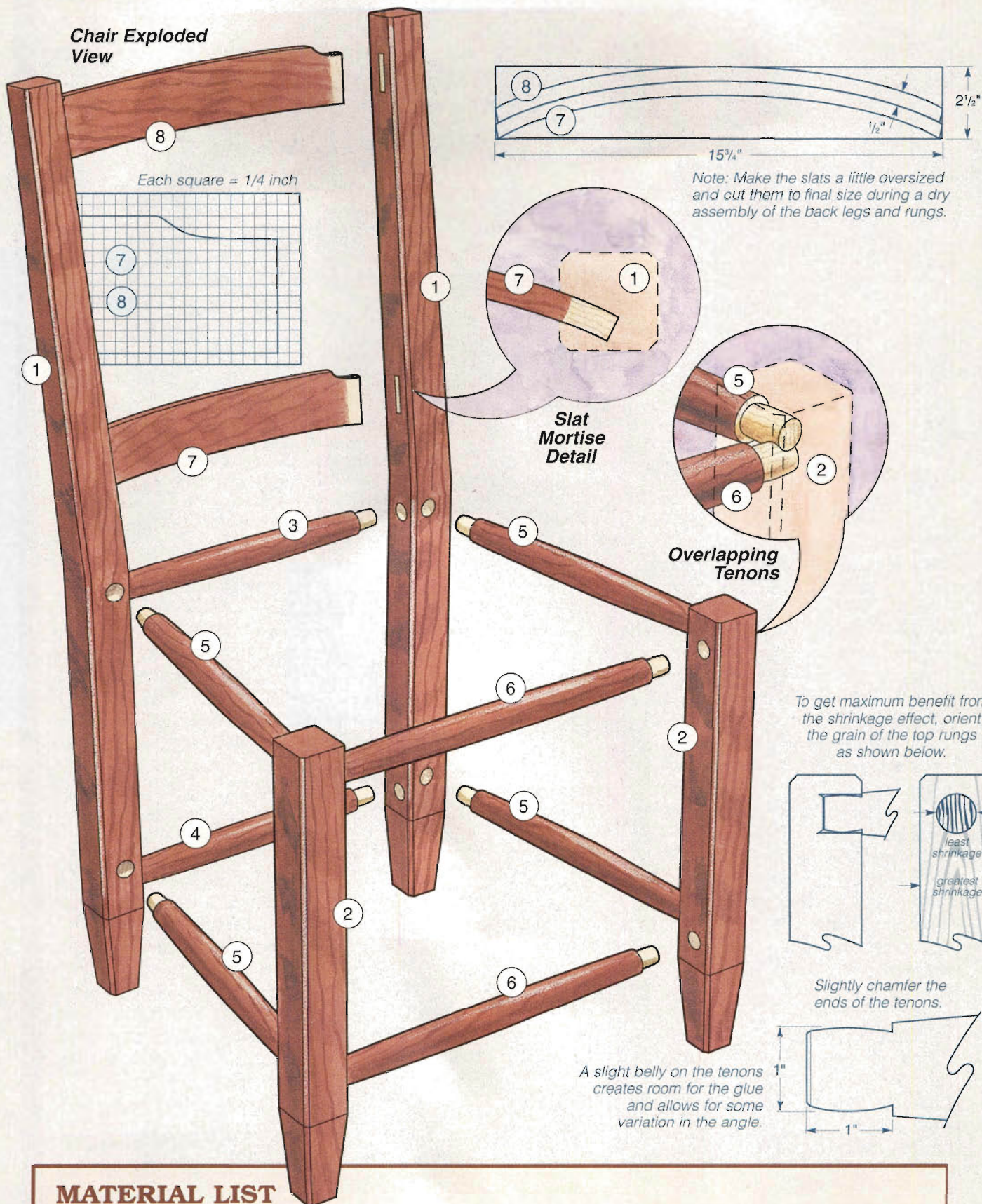
Making the Legs and Rungs First

I always make the back legs (pieces 1) first so I can use them to lay out the front legs, rungs and slats (pieces 2 through 8). To make the chair more comfortable, the back legs tilt back 7° from the seat (see *Elevation Drawings*, page 35), so you'll have to band saw them from stock that is at least 3 1/4" wide. Taper the inside of the uprights as shown to enhance the flare of the top of the chair. I also cut four-sided tapers on the bottoms of the legs.

I dimensioned my chair with the seat 19" off the floor because I'm over 6 feet tall and like a taller chair. If you prefer a lower seat, adjust the front leg height accordingly.

Since the legs are essentially square, you can clean them up easily with a hand plane and chamfer them with a hand plane or spokeshave. The only difficult area to plane is the inside angle of the back legs; you can use a spokeshave or scraper in this grain transition area.

Chair Exploded View



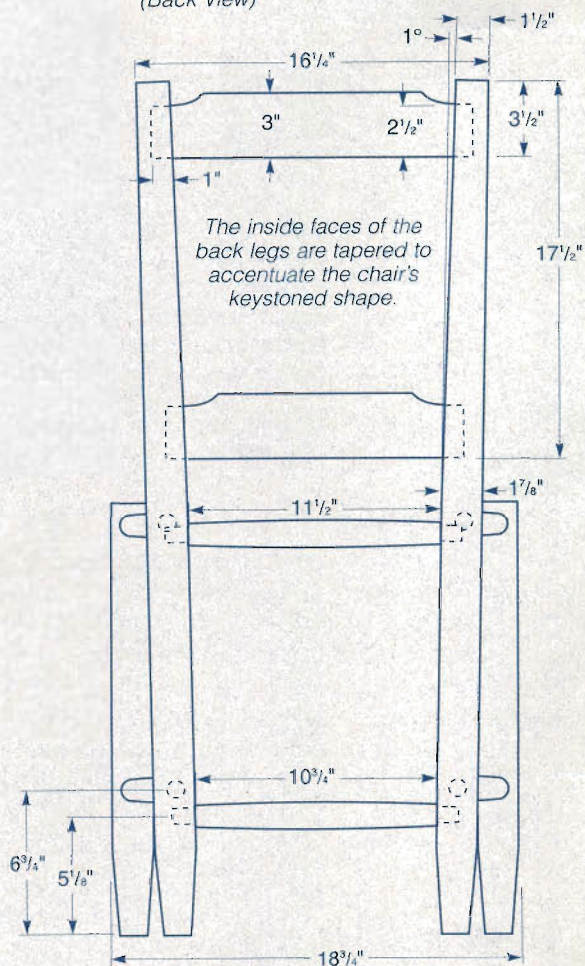
MATERIAL LIST

	T x W x L		
1 Back Legs (2)	1 7/8" x 3 1/4" x 39 5/8"	6 Front Rungs (2)	1 3/8" Dia. x 17"
2 Front Legs (2)	1 7/8" x 1 7/8" x 20"	7 Bottom Slat* (1)	1/2" x 3" x 15 3/4"
3 Upper Rear Rung (1)	1 3/8" Dia. x 13 1/2"	8 Top Slat* (1)	1/2" x 3" x 15 3/4"
4 Lower Rear Rung (1)	1 3/8" Dia. x 12 3/4"	9 Rawhide Bend (1)	1/4" x 36'
5 Side Rungs (4)	1 3/8" Dia. x 14 3/4"		

* (Final sizing during dry assembly)

Chair Elevation

(Back View)

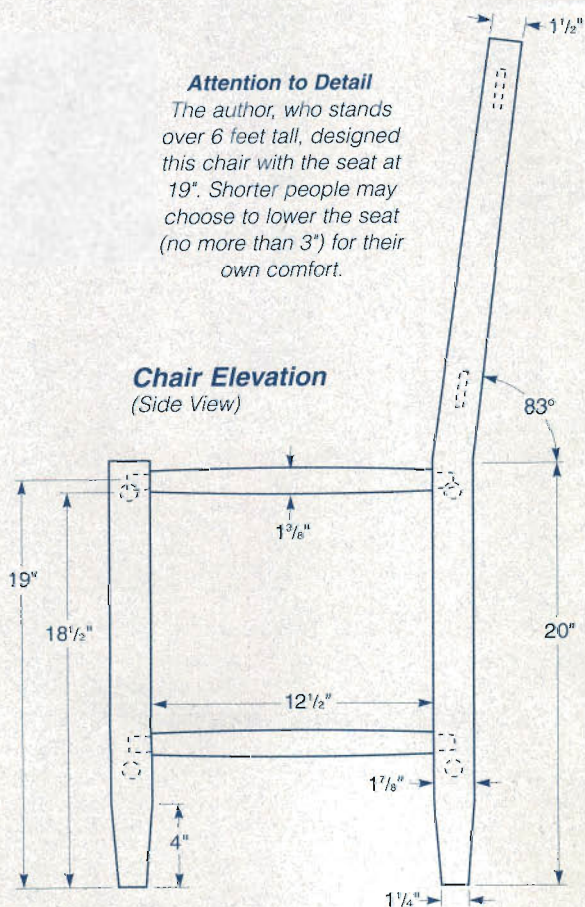


Attention to Detail

The author, who stands over 6 feet tall, designed this chair with the seat at 19". Shorter people may choose to lower the seat (no more than 3") for their own comfort.

Chair Elevation

(Side View)



Now you can lay out the mortises on the back legs. Note that they are angled forward to match the curve of the back slats. Keep this angle in mind as you chop the mortises. If you're using a hollow-chisel mortiser or a drill press to remove the waste, you can establish this angle by placing wedges under the legs.

I turned the rungs for this chair, but you can also shape the rungs by hand, using your drawknife and spokeshave. The best way to hold the blanks for shaping by hand is to use a shaving horse, but a bench vise will do.

You can create a slight shoulder where the tenons begin or let the curve blend into the tenons. I turn a slight belly on the tenons (as shown at left) to create a little space for the glue and to allow for some variation in the angle.



To find the correct drilling angle for the rung sockets, arrange the chair parts and use a bevel gauge to sight the angle.

This method preserves the strength of the joint when the legs season fully and shrink around the tenons. To keep the rungs from coming loose, I used a tip from the past and made the legs from air-dried lumber (12 to 14% moisture content) and the rungs and back slats from kiln-dried wood (6 to 8% moisture content). You can dry the rungs yourself by heating them in a 250° oven for a couple of hours before creating the tenons. I also chamfer the ends of the tenons to make assembly easier.

Note that the lower rear rung (piece 4) is shorter than the one above it. This splays out the tops of the back legs for more visual appeal and added comfort.

Making the Back Slats

This is a very simple chair, with only two back slats (pieces 7 and 8). Some early examples were strung with canvas or rawhide spanning the space between the slats. You could also add a middle slat for more support.

You can make the back slats either by sawing them from solid stock or by bending them. I sawed the slats for this chair with a bow saw, but you could use a band saw or shape them with an adze instead. If you decide to saw them, you will need a blank about 2½" thick. If possible, use blanks whose grain follows the curved profile of the back slats.

If you want to steam bend the slats, cut the blanks to the rough size, steam them until they are pliable, and then clamp them over a form. For steaming, I place a section of stove pipe in a pot of water on the stove, bring the water to boil, and suspend the slats inside the pipe on a piece of wire threaded through a tiny hole in one end. After 15 to 20 minutes, I place them in the three-stick jig. After the bent pieces dry, they can be cleaned up with planes and spokeshaves.



The author uses a bit extension to get a good visual line on the angle as he drills. One of the subtleties of using an auger with a lead screw is that you can determine the depth of the mortise (above) by counting the number of revolutions of the brace.

If you're using green wood, you can bend the back slats without steaming. Just split the wood into blanks of uniform thickness, plane them smooth and bend them in the three-stick jig.

Whichever method you use to form the curves, be sure the ends are of uniform thickness so they will fit nicely into the mortises in the back legs. Rough cut the ends to fit the mortises, but don't cut these pieces to final length yet; those dimensions will depend on how the chair goes together.

Weaving a gut seat: how to do the snowshoe weave



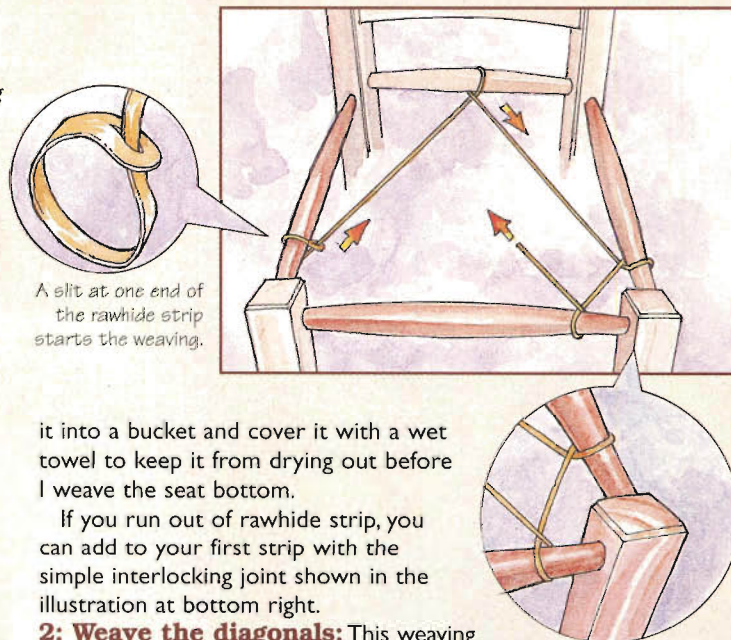
Begin by cutting a circle of cowhide with your scissors. The author uses a lace-making tool (Tandy Leather, Item #378400). Place the tool in a hole in the center of your circle, start the cut, and pull on the end of the strip. The rawhide spins around the cutter as you pull the strip through the cutter.

Many different materials have been used for weaving rustic chair seats; but in Quebec, where this chair originated, gut (usually beaver rawhide) was the material of choice. Patterned after the weave of traditional snowshoes, the gut seat is strong, attractive and easy to make.

The best material I have found for gut seats is untanned cow rawhide "bends" (Tandy Leather; 888-890-1611, Item #909701). The only other things you need to make one of these durable seats are a circle of rawhide, a pair of heavy scissors, a bucket of water and a lace or strap cutter.

1: Cut the gut: To make this seat you'll need a uniform strip of rawhide 1/4" wide by 36 feet long. Rawhide is tough, so it's important to soak it in water until it is soft and pliable before trying to cut it (about six hours — much longer and it becomes difficult to handle).

Begin by cutting a 14" circle of cowhide with your scissors. For strips over 5/16" wide, you'll need to use scissors or a "strap cutter" (Tandy, Item #308000), which is much like a cutting-type marking gauge. After cutting the strip, I place



it into a bucket and cover it with a wet towel to keep it from drying out before I weave the seat bottom.

If you run out of rawhide strip, you can add to your first strip with the simple interlocking joint shown in the illustration at bottom right.

2: Weave the diagonals: This weaving pattern includes diagonal and side-to-side lacing. Begin by weaving the diagonals. Cut a slit in the end of the rawhide strip and pull it around the side rung near the left front leg. Thread the entire strip through the slit and pull it tight. Wrap the strip around the center of the back rung and back over itself, then forward to the right rung as shown in the drawing. Continue this pattern, with the strips about 1½" apart, until you've covered the seat opening, ending up in the back left corner.

Drilling the Rung Sockets

Once you've cut all the parts to their final shape, bore the round mortises, or "sockets," for the tenons. Though I own a compound drill press that easily drills holes at complex angles, I prefer to drill these holes by hand, using a sharp Jennings-pattern twist auger and a beechwood brace.

I use a hand-forged bit extension to give me a good visual line on the angle as I'm drilling. You can use a spade bit with an extension for this step, but one of the subtleties of using an auger with a lead screw is that you can determine the exact depth of the mortise by counting the number of revolutions of the brace.

The lower rungs of the chair are staggered so that their sockets miss each other in the legs; but the top rungs are only partially offset, so they overlap when assembled, as shown in the *Drawings* on page 34. The



In the author's opinion, hot hide glue is the best choice for this project (and all furniture), since it's reversible.

higher side rungs make the seat more comfortable.

The overlapping tenons add mechanical strength to the top rung joints, but it means you'll have to dry fit the front and back subassemblies before drilling the sockets for the top side rungs. Using this approach, you'll be drilling partway into the top rung tenons.

Later, when you're ready for the glue, be sure to orient the grain of the top rungs with the quartersawn grain perpendicular to the quartersawn grain of the legs to get the most

benefit from the shrinkage effect, as shown in the *Drawings* on page 34.

Note that the sockets for the front rungs are drilled at 90° to the front legs in both directions, while the back rung sockets are angled upward slightly to accommodate the splay of the back. To establish this angle, I arrange the back legs and rungs on the floor and use

The transition from diagonal to horizontal weaving begins at the back of the left side rung with a double loop.

NOTE: The snowshoe weave pattern creates an even number of wraps (8 in this case) on the back rung, balanced by an odd number (7) on the front rung. Likewise, there are 4 wraps on the right rung, and 5 on the left.

The diagonal weave is shown in gold, while the horizontal weave is shown in blue.

The lacing should be tight enough not to sag but not too tight; there will be some flex in the wet rawhide, but that goes away when the hide dries. If you weave the rawhide too tight, it can break the chair rungs as it dries and shrinks. Don't ask me how I know this.

3: Weave the horizontals:

To create the six-point star pattern of this weaving style, you weave the gut from side to side, over and under the diagonal strips. The side-to-side weaving begins at the back of the left side rung with a double loop. After each course of weaving, loop the strip around

the diagonal points of attachment and continue back to the other side, ending at the front of the left hand rung where you began the diagonal weave. Secure the end with a knot.

4: Finishing up: When you've finished the weaving, allow the rawhide to dry completely and tighten up. Lightly sand the dry rawhide to remove the surface fuzz. You can also do this with a sootless flame from a propane torch, but be careful to keep the flame moving. I like to finish my gut seats with a coat of marine spar varnish. This makes the rawhide translucent and affords a measure of protection for the leather.

—Stephen Shepherd

a bevel gauge to eyeball the angle, as shown in the *photo* on page 35. Don't worry too much about absolute precision; you can compensate somewhat during final assembly.

Drilling the sockets for the side rungs is a little more complicated because the front leg assembly is wider than the back and the back leg assembly is narrower at the bottom than at the top. To determine the angles for the side rung sockets, I place the front leg assembly on the floor and raise the back leg assembly to its approximate position, then I use my long bit extension to sight the correct angles as I drill, as shown in the *inset photo* on page 36. You could be more scientific about it by figuring out the exact angles from the drawings and making angled plywood guides for your drill.

Fitting the Slats

The final construction step is to fit the curved back slats into the back leg mortises. Begin by dry fitting the back assembly to establish the length of the slats and then cut them to final shape and size. The top slat is longer due to the taper of the legs and the splay created by the back rungs.

Dry fit the two subassemblies again before glue-up. Make sure all the sockets and mortises are the correct depth and angle and that the chair sits squarely on all four legs. You can make minor final adjustments during glue-up.

In my opinion, hot hide glue is the best choice for all furniture, but liquid hide glue, which is more convenient and more readily available, is also good. The biggest advantage of hide glue is that it is reversible,



A rope-and-stick tourniquet or band clamp makes short work of clamping the glued-up chair. Once the chair is clamped up, place it on a flat surface to make sure it dries flat and square.

should you ever need to disassemble the chair in the future. If you aren't concerned about downstream repairs, use regular yellow glue.

Glue up the front and back leg assemblies first, carefully orienting the front and back upper rungs so their tenons are lined up in the sockets correctly (see

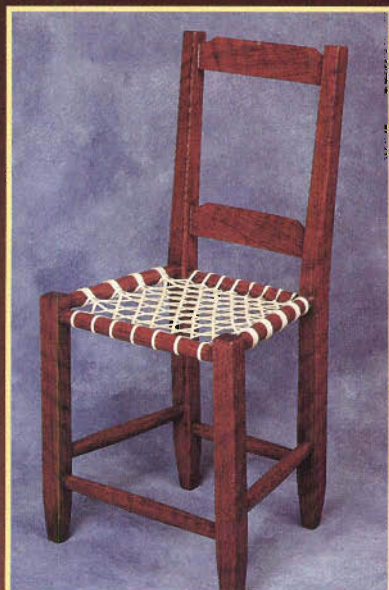
Overlapping Tenon Detail drawing on page 34). With that done, glue the four side rungs in place to bring the chair together. Brush a generous coating of glue on all the joints and clamp the chair together using a rope-and-stick tourniquet (as shown in the *photo* above) or a band clamp.

After I clamp the chair together, I place it on a flat surface to make sure that it dries flat and square. I use a very flat cast iron table for this, but a flat workbench is fine. If the chair has a stubborn little twist in the structure, you can clamp the legs to the table to straighten it out.

Once the glue has set for a while and the wood has absorbed some of the moisture from the hide glue, I wipe off any excess glue and tighten the clamps again.

When the glue has dried, you have the option of installing hardwood pegs to lock the tenons in place and to add a decorative effect. Use a backing block when drilling to keep from splintering the wood around the exit hole. If you don't want the pegs to show, drill the peg holes from the inside or back and don't drill all the way through. You can use regular dowels for the pegs or whittle them for a more rustic effect.

Many of these chairs were made of plain-grained woods such as poplar, spruce or pine and then painted, often with a brick-red color called 'Spanish brown.' A few show evidence of original hand graining to imitate fancier woods.



Stephen Shepherd is a conservator and furnituremaker who lives in Utah. You can visit his web site at www.ilovewood.com.

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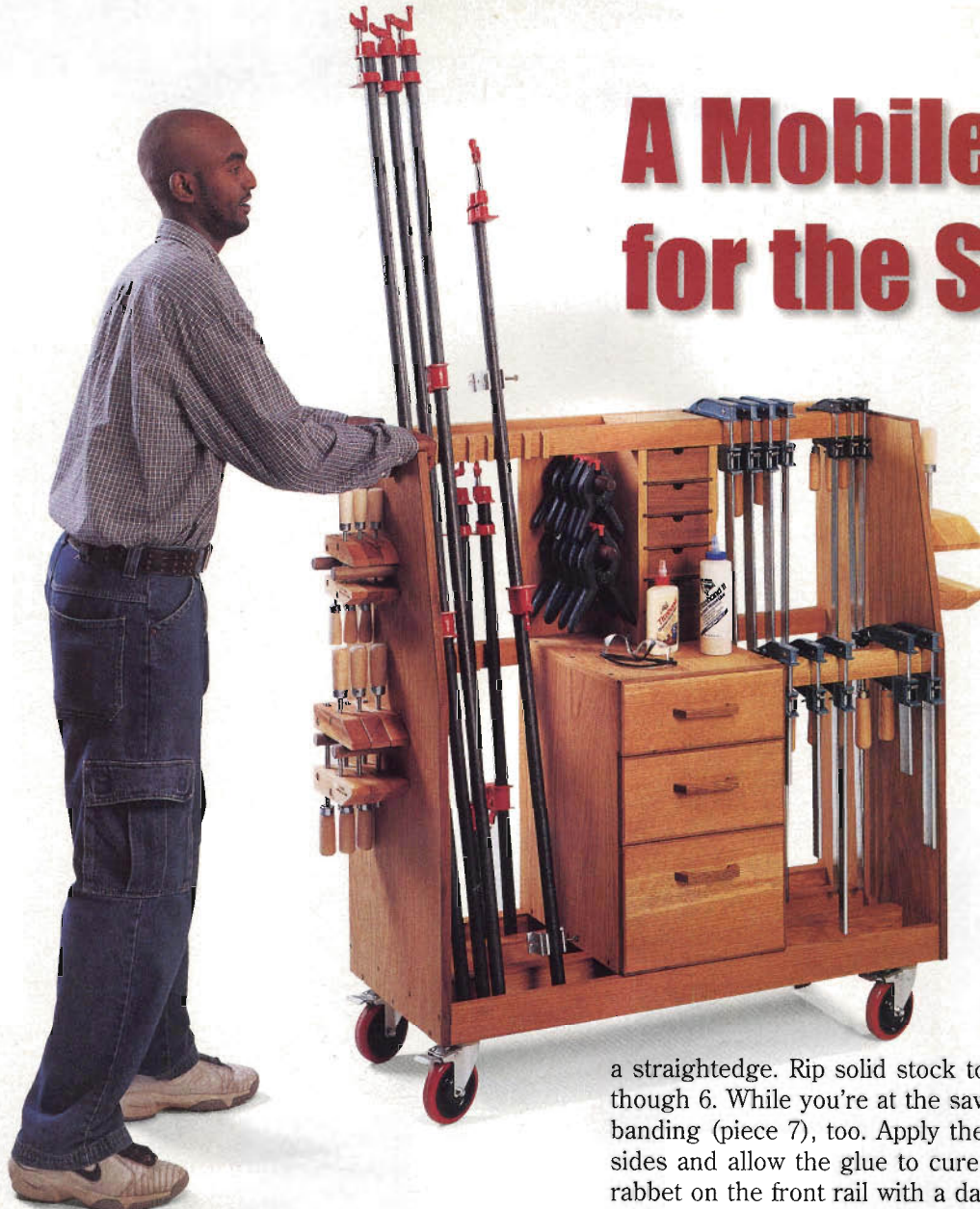


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A Mobile Clamp for the Small Shop



Necessity is the mother of invention. In our shop, that's not a clever proverb, it's a design philosophy. Things start to pile up and we design a shop fixture. This one has caught the eye of more than one visiting subscriber, so we thought we'd present it to all of you. It's a great solution to clutter in the small shop.

Slicing up the Sheet Stock

Begin your trip to workshop organization by cutting the cart's sides and bottom to size (pieces 1 and 2) on the table saw. Create the angle on the front corner of the sides (see the *Elevations* at right) with a hand-held circular saw guided by

a straightedge. Rip solid stock to make pieces 3 through 6. While you're at the saw, rip the walnut banding (piece 7), too. Apply the banding to the sides and allow the glue to cure. Now, form the rabbet on the front rail with a dado head in your table saw and notch one of the long rails, as shown in the *Drawings* at right. Clamp and glue pairs of long and short rails together and, after the glue has cured, cut them to length. Attach the appropriate rails and cabinet support to the cart bottom with glue and screws. To assemble the sides and bottom, pre-drill counterbored screw holes and, with the help of a friend, bring the pieces together. NOTE: secure just the middle long rail at this time. See the *Elevation Drawing* for details.

Center Cabinet

A clamp cart should hold more than just clamps: you'll need glue, biscuits and screws — well, you get the idea. Begin making the center storage

Hurry! Gold Series

ping Cart Shop



Roll your clamps right to your work station and the appropriate supplies ... glue, screws and biscuits will be close at hand.

cabinet by cutting its plywood parts (pieces 8 through 11) to size and shape (form the notch to accommodate the back rail). Rip some oak banding (piece 12) and use it to cover the exposed edges of the plywood pieces. Pre-drill counterbored screw holes, assemble the cabinet (without the back) and slide it into place on the cart subassembly. Secure it to the rails with screws. Now go ahead and secure the back with glue and screws.

Cut the parts for the tray bank sides and top (pieces 13 and 14) and band their edges. Notch the upper corner for the rails. Put a 1/4" dado head in your table saw and plow a series of 3/8" deep dados to accept the dust proof tray bottoms, as shown in the *Elevation Drawings* at right. Locate and cut the biscuit joints on the cabinet top and the tray bank sides. From 1/4" hardboard, cut the tray bank divider (piece 15). Now install the tray bank sides and divider with glue, screws and biscuits.

With that subassembly in place you can install the remaining rails, both long and short. Next, cut all ten clamp dowels (pieces 16) to length (mount them to best accommodate the clamps you own), and the pipe dividers (pieces 17).

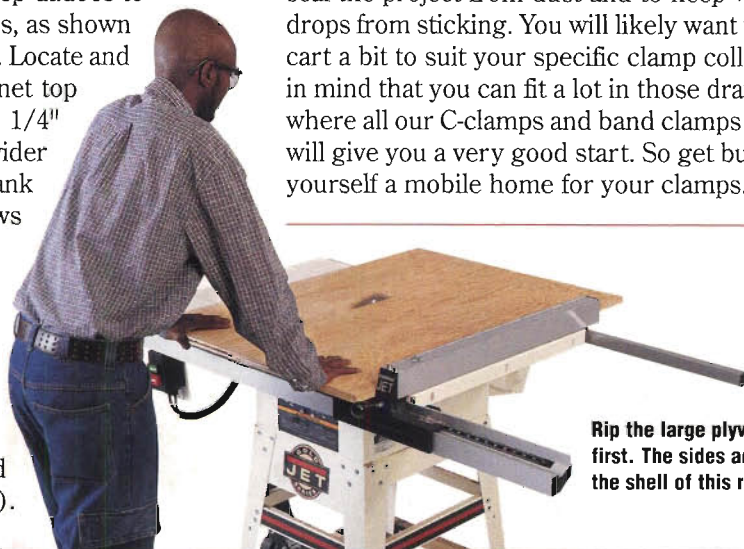
Again, determine whether you have 3/4" or 1/2" diameter pipe clamps before you attach them. The drawer slides, casters and the hinge (pieces 18 through 20) will be mounted a bit later.

Drawers and Trays

The drawer faces (pieces 21, 22 and 23) are cut from 3/4" plywood and edged with the walnut banding. The drawer sides, fronts and backs (pieces 24 through 29) are made from 1/2" plywood with locking corner joints. (See the *Detail*, upper right.) Plow the dados in the sides and fronts for the drawer bottoms (pieces 30) and you are ready to assemble the drawers.

The tray sides, fronts and backs (pieces 31 and 32) are assembled with the same corner joints as the drawers. Their bottoms (pieces 33), are glued and pin-nailed in place. Note the overhanging edges of the bottoms, these fit into the dados you cut in the tray bank sides. The walnut tray faces (pieces 34) are made in pairs — first drill the finger hole and then slice the blank down the center (see layout *Detail*). Attach them with screws.

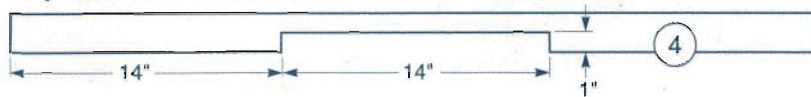
Now mount the drawer pulls (pieces 35), casters, and the hinge on the tray bank top, and you are nearly done. We covered all exposed screw holes with walnut plugs and used a good quality finishing oil to seal the project from dust and to keep wayward glue drops from sticking. You will likely want to modify the cart a bit to suit your specific clamp collection, (keep in mind that you can fit a lot in those drawers ... that's where all our C-clamps and band clamps are!) but this will give you a very good start. So get busy and make yourself a mobile home for your clamps.



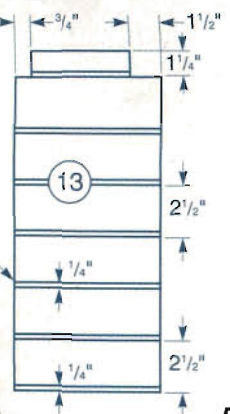
Rip the large plywood pieces first. The sides and bottom form the shell of this rolling cart.

es Promotion ends

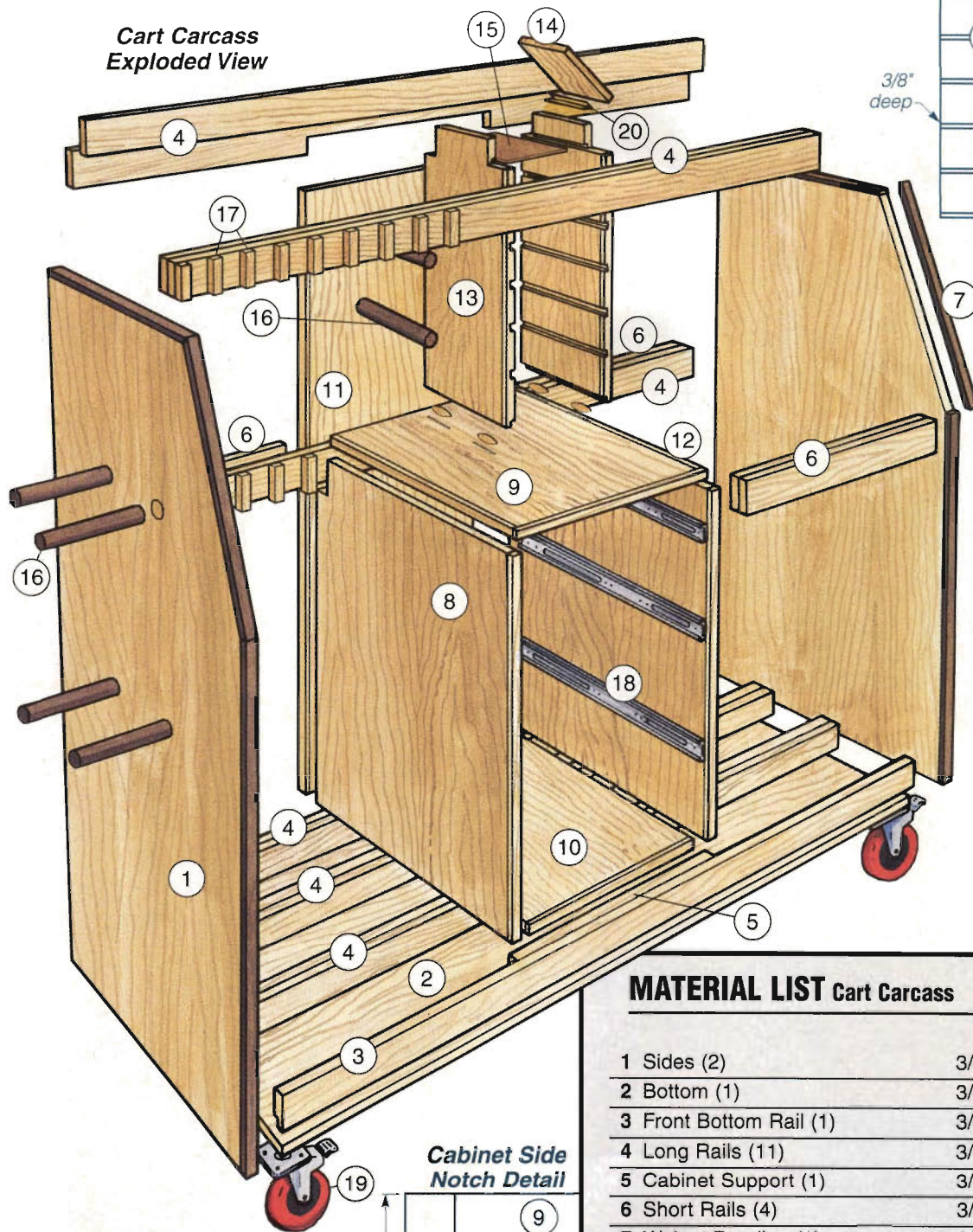
Top Rail Notch Detail (Front View)



Tray Bank Side (Inside View)



Cart Carcass Exploded View



Draw Bottom (Section)

Cart Side

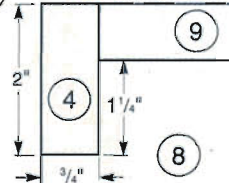


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MATERIAL LIST Cart Carcass

	T x W x L
1 Sides (2)	3/4" x 17 3/4" x 41 1/2"
2 Bottom (1)	3/4" x 17 3/8" x 42"
3 Front Bottom Rail (1)	3/4" x 2 3/4" x 42"
4 Long Rails (11)	3/4" x 2" x 42"
5 Cabinet Support (1)	3/4" x 2" x 14"
6 Short Rails (4)	3/4" x 2" x 14"
7 Walnut Banding (1)	1/4" x 3/4" x 260"
8 Cabinet Sides (2)	3/4" x 16" x 21"
9 Cabinet Top (1)	3/4" x 13 1/2" x 15 1/4"
10 Cabinet Bottom (1)	3/4" x 12 1/2" x 16"

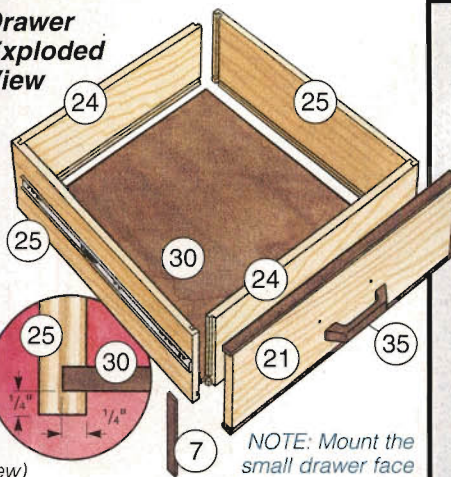
Cabinet Side Notch Detail



March 31.

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Drawer Exploded View

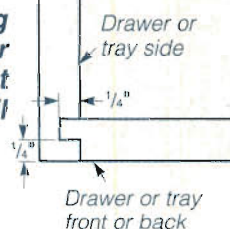


NOTE: Mount the small drawer face to its drawer box first. Mount the middle drawer face next, leaving an 1/8" reveal between the two drawer faces. Repeat the process with the last drawer face.

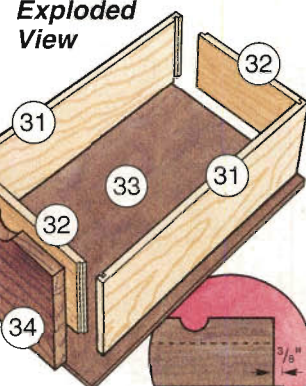
MATERIAL LIST Drawer and Trays

	T x W x L
21 Small Face (1)	3/4" x 4 1/4" x 13 1/2"
22 Middle Face (1)	3/4" x 6 1/4" x 13 1/2"
23 Large Face (1)	3/4" x 9 1/4" x 13 1/2"
24 Small Front & Back (2)	1/2" x 2 1/2" x 11"
25 Small Sides (2)	1/2" x 3 3/4" x 15 1/2"
26 Middle Front & Back (2)	1/2" x 6" x 11"
27 Middle Sides (2)	1/2" x 6" x 15 1/2"
28 Large Front & Back (2)	1/2" x 8" x 11"
29 Large Sides (2)	1/2" x 8" x 15 1/2"
30 Bottoms (3)	1/4" x 11" x 15"
31 Tray Sides (12)	1/2" x 1 3/4" x 6 1/4"
32 Tray Fronts & Backs (12)	1/2" x 1 1/2" x 4 7/8"
33 Tray Bottoms (6)	1/4" x 6 1/4" x 7"
34 Tray Faces (6)	3/4" x 2 3/16" x 5 1/2"
35 Pulls (3)	Wood

Locking Corner Joint Detail

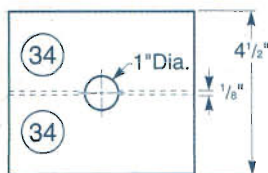


Tray Exploded View

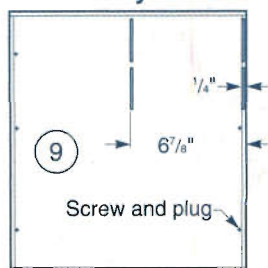


Tray Bottom (Front View)

Tray Face Blank Layout (Top View)

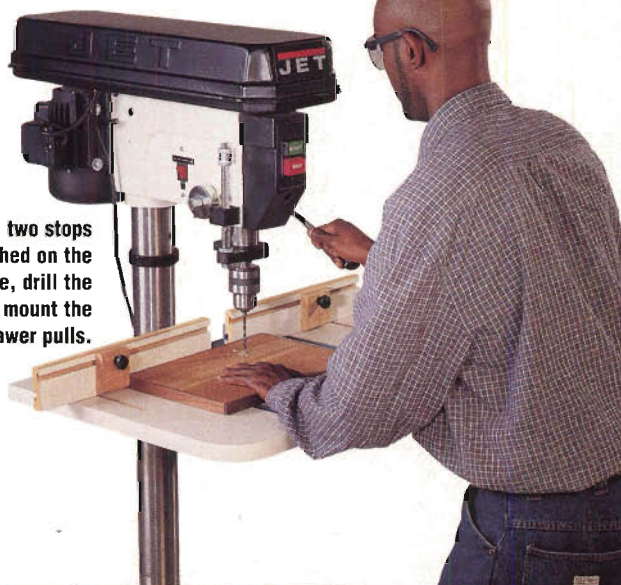


Biscuit Layout Detail



The bottom subassembly is set back the width of the walnut trim.

With two stops established on the fence, drill the holes to mount the drawer pulls.



	T x W x L
11 Cabinet Back (1)	3/4" x 13 1/2" x 38"
12 Oak Banding (1)	1/4" x 3/4" x 115"
13 Tray Bank Sides (2)	3/4" x 7" x 16 1/2"
14 Tray Bank Top (1)	3/4" x 4 3/4" x 7"
15 Tray Bank Divider (1)	1/4" x 6 1/4" x 4 3/4"
16 Clamp Dowels (8)	1" Dia x 8"
17 Pipe Dividers (30)	1/2" x 1/2" x 2"
18 Drawer Slides (3 sets)	16" Full extension
19 Casters (4)	Locking
20 Piano Hinge (1)	Brass

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Piano Hinge #70474	\$4.29

*Four required. **Three required.

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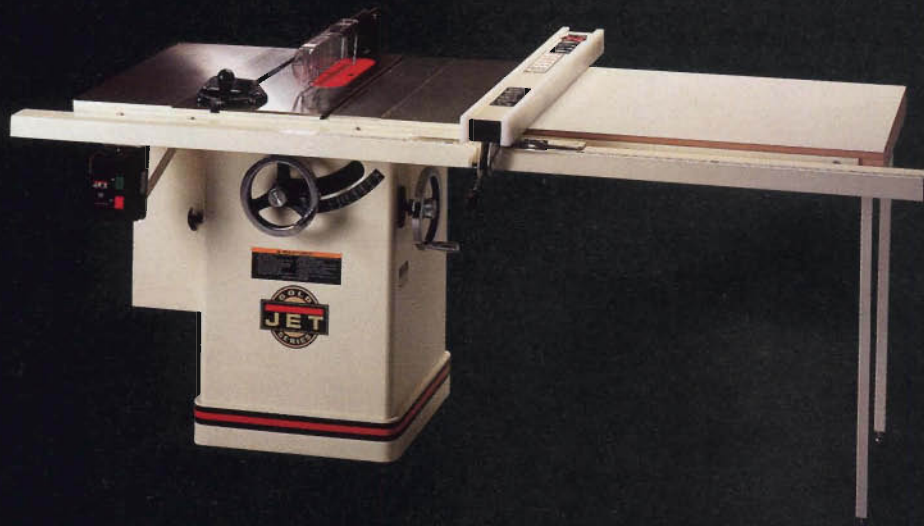
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18-piece
pen turning kit **FREE**

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1000 CFM

Air Filtration System, \$239*

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Tools not shown:

18" Bandsaw, \$1,099*

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and 3 bits **FREE**

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connection kit **FREE**

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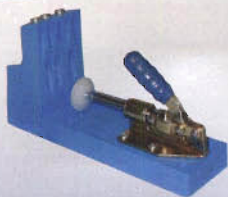
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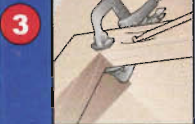
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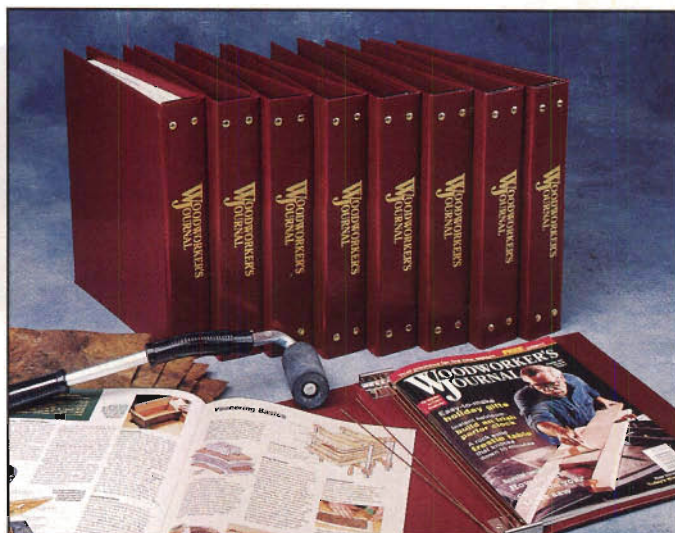
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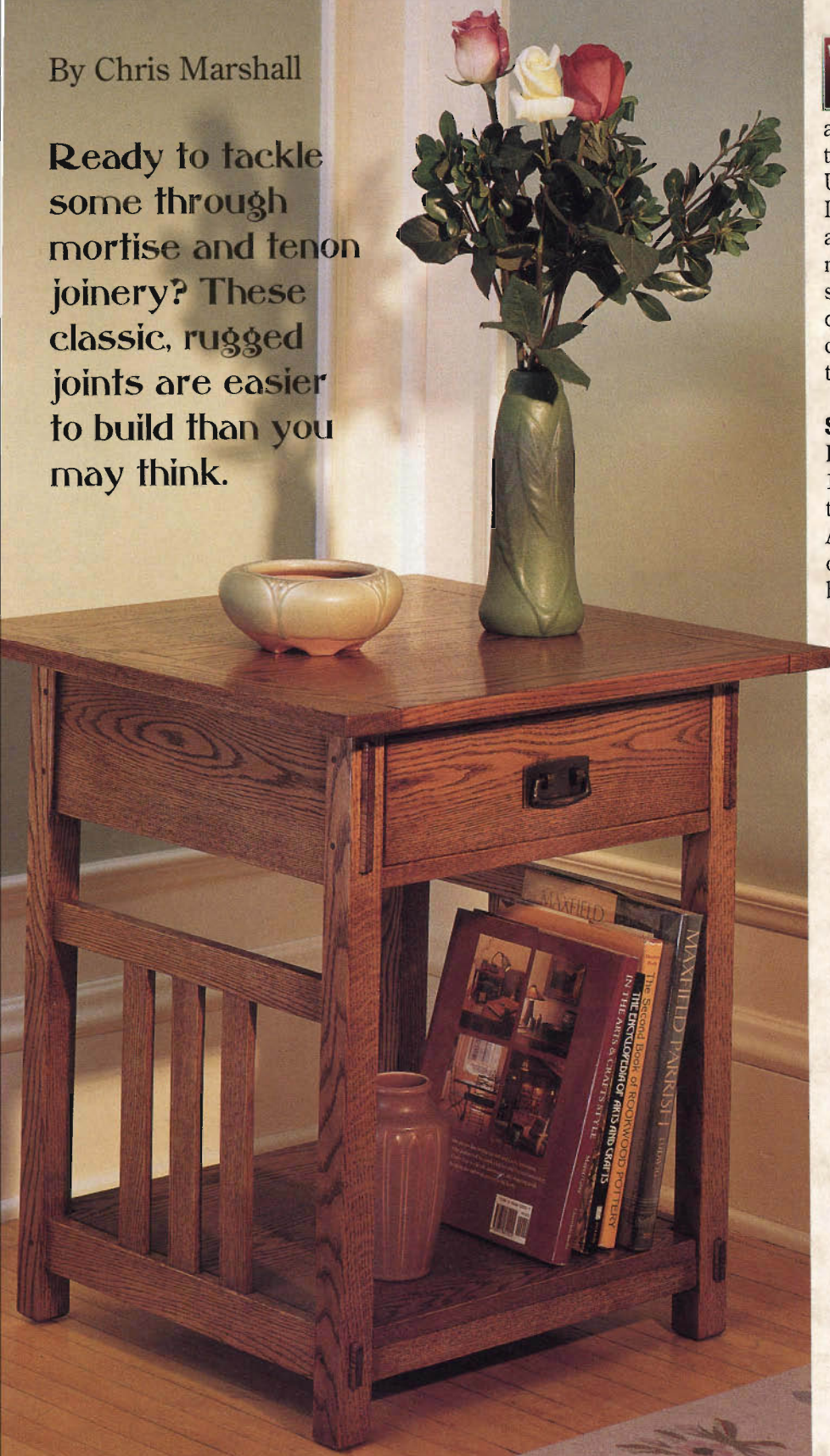


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Arts & Crafts End Table

By Chris Marshall

Ready to tackle some through mortise and tenon joinery? These classic, rugged joints are easier to build than you may think.



Through mortise and tenon joints are attractive hallmarks of Arts & Crafts furniture. They also form rock solid connections for table legs and other high stress parts. Until recently, however, I thought I couldn't make them without buying a mortising machine. Then I tried mortising with a drill press. Problem solved. The technique is accurate, quick and wonderfully low tech. If you can drill a series of holes, deep through mortises are a cinch to make.

Start with the Legs

Begin by planing 8/4 stock down to 1½" for the legs (pieces 1). Cut them to size and joint the faces smooth. As you can see from the *Drawings* on the following page, each leg has a number of mortises, and their arrangement can get a little confusing. Take time now to lay out all the mortises before you begin milling. I choose the best face of each leg (with nice quartersawn rays) to serve as the "show" face.

Conventional wisdom for making mortise and tenon joinery is to cut the mortises first, then trim the tenons to fit. The logic is that you can always trim a thick tenon thinner but you can't make a too wide mortise narrower. On through mortises, this reasoning is especially sage. Since the mortises show, you'll want to make them as neatly and accurately as possible, then fiddle with the tenons to fit the joints together.

The *sidebar* on page 48 will guide you through my process of making the leg mortises, but here are some important tips. Whether you are cutting through or stopped mortises on the legs, start at one end of the mortise and bore a series of holes along its length. Space the holes so they touch but do not overlap, to keep the bit from wandering into the previous hole.

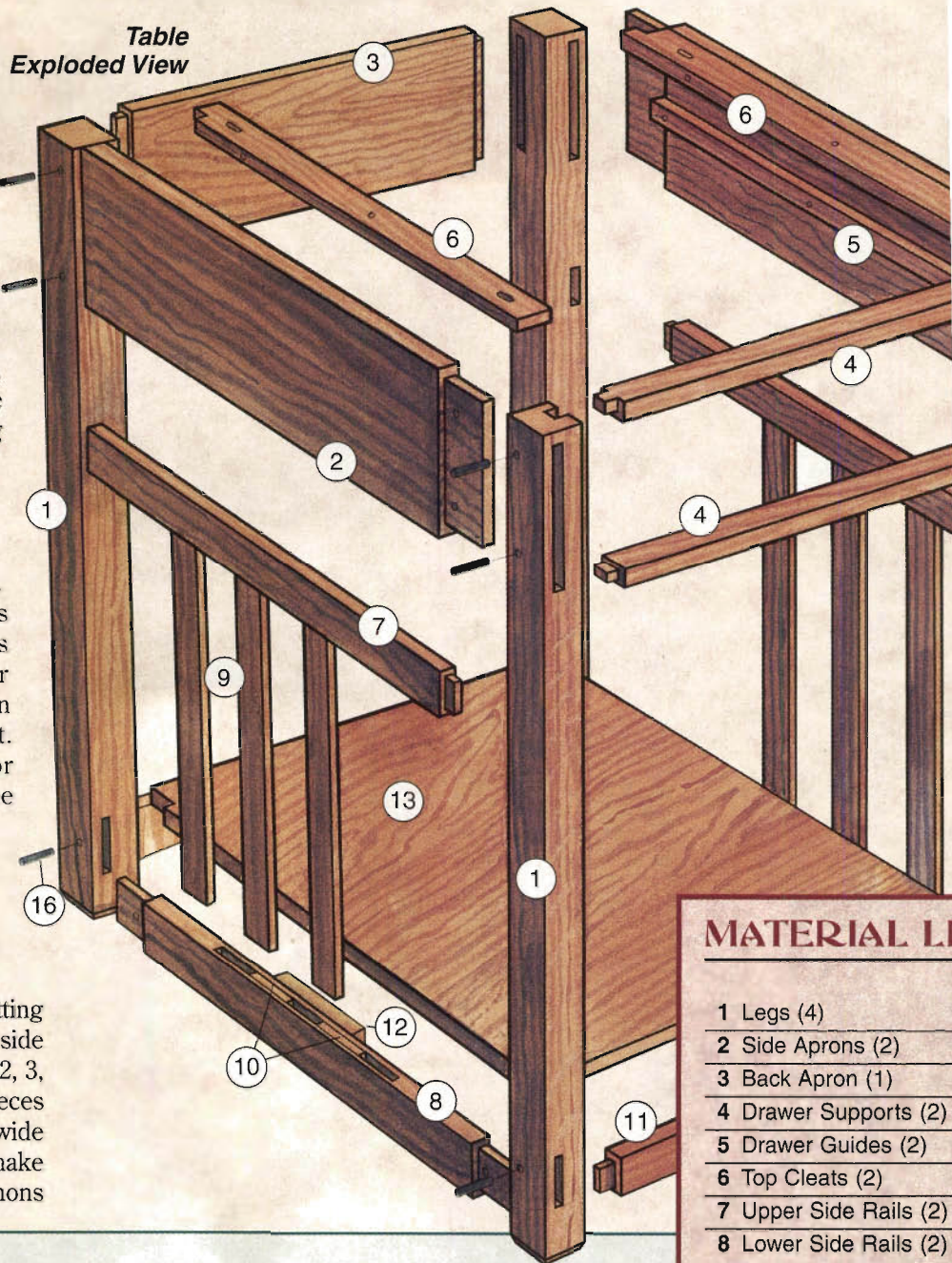
Table Exploded View

Drill all the way through the legs for the through mortises, boring down into the show faces, hiding any tearout on the back beneath the tenon shoulders. When you are about two bit widths from the end of the mortise, skip to the end and drill it out, then back up and drill out the remaining waste. Slide the leg along the jig's fence to drill each hole. Once the first round of drilling is complete, repeat to remove the crest-shaped waste areas that remain.

One jig setup on the drill press allows you to tackle all of this table's mortises except those for the drawer supports, which run perpendicular to the rest. I aligned the bit by eye for hogging these out. Note that the mortises for the upper drawer support are open at the tops of the legs to house the bare-faced upper support tenons.

Turn to the Tenoned Parts

Start the tenoning process by cutting the aprons, drawer supports, side rails and shelf supports (pieces 2, 3, 4, 7, 8 and 11) to size. These pieces all have 3/8" thick tenons. A wide dado blade in the table saw will make quick work of trimming the tenons



MATERIAL LIST

- 1 Legs (4)
- 2 Side Aprons (2)
- 3 Back Apron (1)
- 4 Drawer Supports (2)
- 5 Drawer Guides (2)
- 6 Top Cleats (2)
- 7 Upper Side Rails (2)
- 8 Lower Side Rails (2)

Drilling Through Mortise and Tenon Joints

Drill press mortising sure beats hand chiseling, and it works well for cutting deep through mortises that would otherwise require a long router bit or dedicated mortising machine. The technique doesn't demand a burly floor model drill press or complicated tooling to complete. Armed with a only benchtop drill press and sharp Forstner bit, I had great success. It also helps to have a combination alignment fence and hold-down jig to assist the drilling operation. It's easy to make: just screw a straight piece of stock, 1/16" thicker than the legs, to a piece of scrap plywood. Then fasten a couple of hold-downs to the top of the jig fence (about 5" apart). The fence will align the multiple borings required to create the mortises, and the hold-downs will keep the bit from lifting the legs off the drill press table when clearing the chips from the openings.

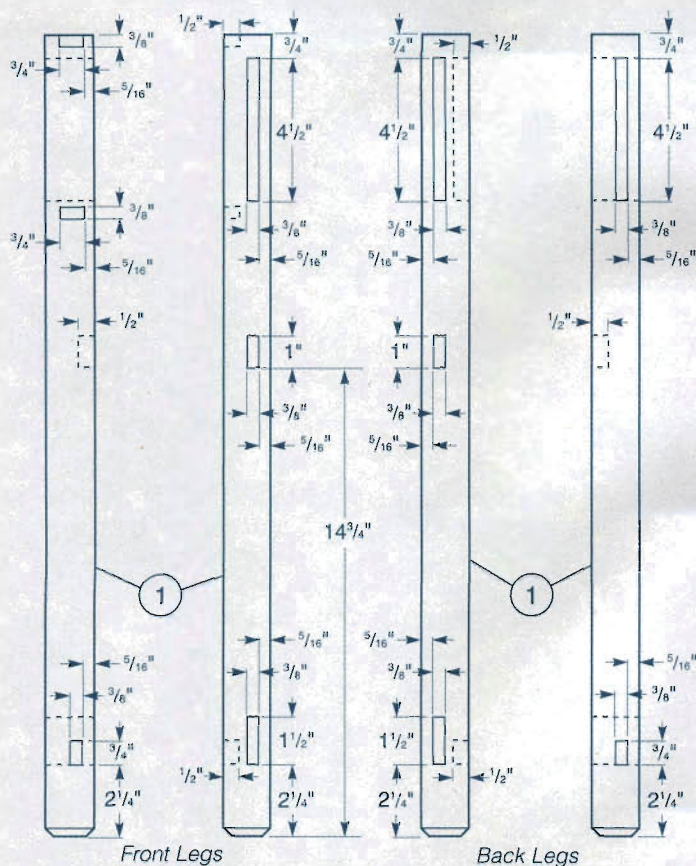


Lay out all the leg mortises with a combination square before you begin milling them. This will help keep their order and orientation clear on each leg.



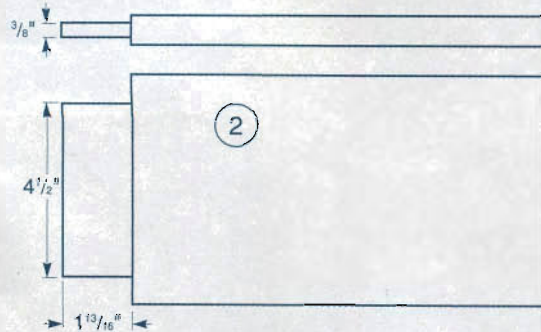
Clamp the hold-down jig to the drill press table so the drill bit spur is centered inside the mortise. Drill a series of adjacent holes along the mortise to remove the waste.

Front and Back Table Legs Mortise Location Details



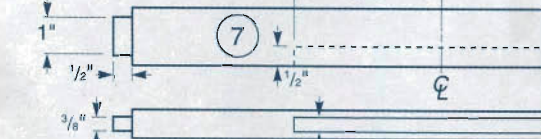
Side Apron

(Top and Front View)



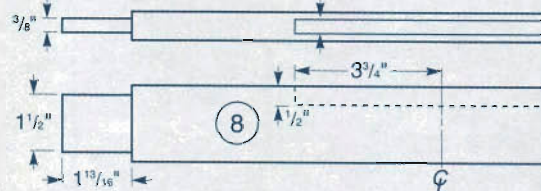
Upper Side Rail

(Top and Front View)



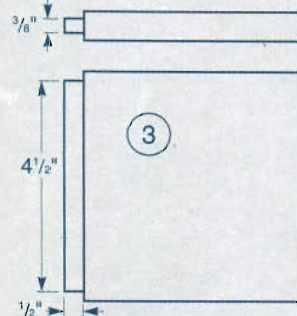
Lower Side Rail

(Top and Front View)



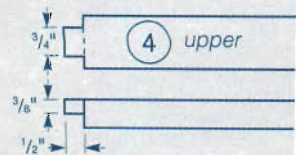
Back Apron

(Top and Front View)



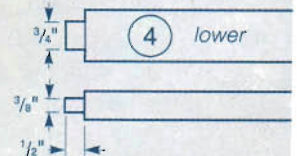
Drawer Support

(Top and Front View)



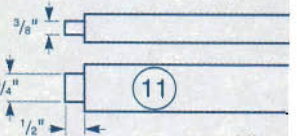
Drawer Support

(Top and Front View)



Shelf Support

(Top and Front View)



T x W x L

1 1/2" x 1 1/2" x 25 1/4"
3/4" x 6" x 19 5/8"
3/4" x 6" x 17 1/4"
3/4" x 1 3/8" x 17"
3/4" x 3/4" x 15 1/2"
3/4" x 1 1/2" x 16 1/2"
3/4" x 1 1/2" x 17"
3/4" x 2" x 19 5/8"

9 Side Slats (6)

10 Slat Spacers* (8)
11 Shelf Supports (2)
12 Shelf Cleats (2)
13 Shelf (1)
14 Tabletop Center Panel (1)
15 Breadboard Ends (2)
16 Dowel Pins (18)

*Cut to fit

T x W x L

3/8" x 1 1/2" x 11 1/2"
3/8" x 1/2" x 1 1/2"
3/4" x 1 1/4" x 17"
3/4" x 3/4" x 4"
3/4" x 17" x 19"
3/4" x 21" x 24"
3/4" x 2 1/2" x 24"
1/4" Dia. x 1 1/4"



Square up the mortise ends with a chisel and mallet. For deep through mortises, a mortising chisel works best. Keep the chisel held square to the leg as you tap it home.

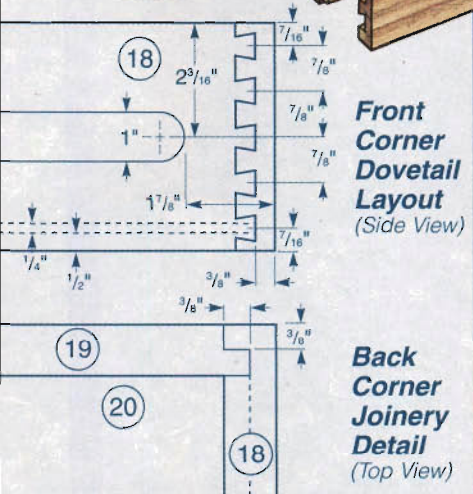
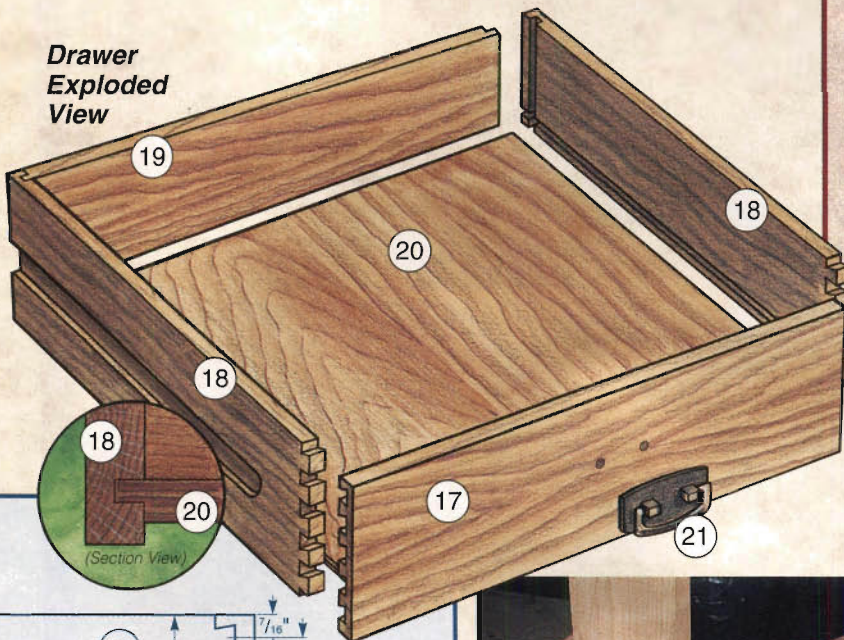


Cut the tenons to thickness and length with a dado blade on the table saw, then make the end cheek and shoulder cuts on the band saw. Guide your work against a fence.



Take shavings off the tenon until it fits its mortise, then chamfer the ends and edges. The chamfers help smooth the assembly and become distinctive visual details.

Drawer Exploded View



to the correct thickness and length. Use the rip fence to index the first long shoulder cuts with parts held face-down against the miter gauge. Make additional passes over the blade to rough out the broad tenon cheeks, and then trim the tenons to width on the band saw. Refine the tenons with a shoulder plane or sandpaper until they slide into their mortises with just a bit of resistance.

Preparing the Rails and Slats

Rather than drill separate mortises for each side slat, I milled a stopped groove into the side rails for all three slats, then filled the gaps with spacers. Cut these grooves on the router table, and square the ends. Now plane enough 3/8" stock to make the slats and spacers (pieces 9 and 10). Cut the slats to size, but wait on the spacers: cut them to fit when you're installing the slats.



Route evenly spaced pins across the sides with a dovetailing jig and 1/2" dovetail bit. Test the setup on scrap before cutting the actual parts.



Mill tails into the drawer face to complete these half-blind joints. On this jig, a stopblock clamped to the fence limits the depth of the cuts.

Assembling the Table Frame

After all this mortise and tenon work, it's time for some assembly. Start by preparing two side frames consisting of two legs, a side apron, the upper and lower side rails and three slats. Dry fit the parts first, then disassemble and do your finish sanding. Glue and clamp the side frames, but fit the slats into their grooves dry. When gluing the through tenons, spread

MATERIAL LIST Drawer

	T x W x L
17 Drawer Face (1)	3/4" x 4 3/8" x 15 7/8"
18 Drawer Sides (2)	3/4" x 4 3/8" x 16 1/2"
19 Drawer Back (1)	3/4" x 3 5/8" x 15 1/8"
20 Drawer Bottom (1)	1/2" x 14 7/8" x 16 1/2"
21 Pull*	Hammered copper

* Available from Woodworker's Journal, item #26757. Call 800-610-0883.

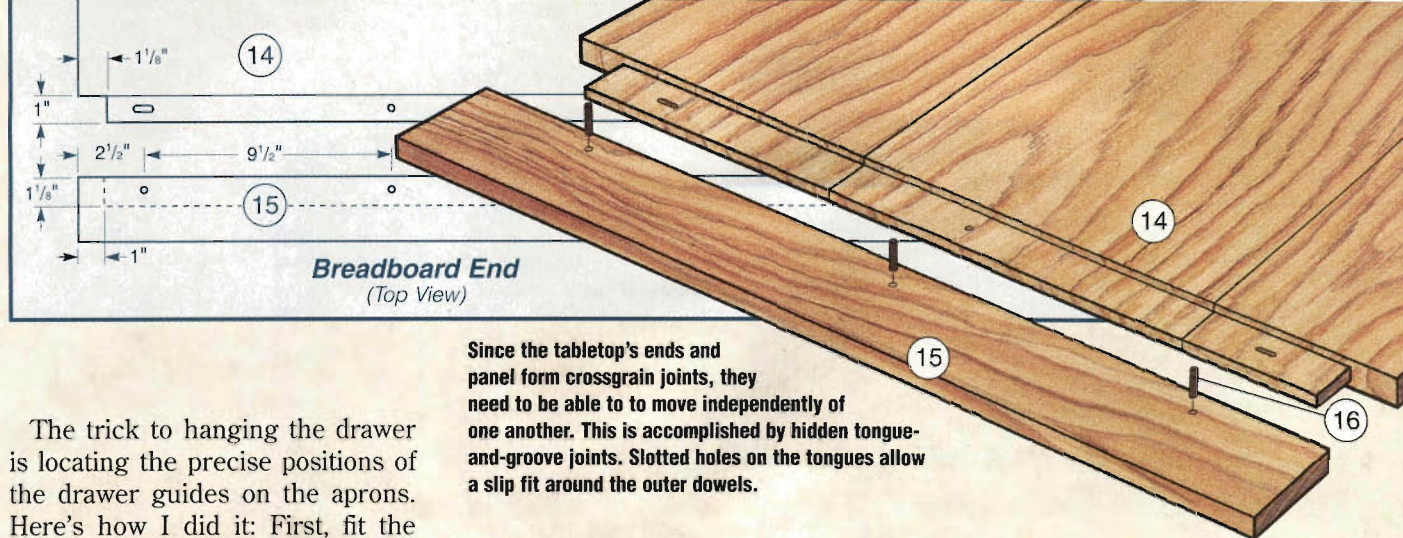
glue on the tenons only, not their mortises. Keep the first 1/2" or so of the tenons free of glue and you'll have no glue to clean off the exposed ends after sliding the parts together. Once each side frame is clamped up, drill and insert six dowel pins to lock the joints. I used walnut dowels to create a nice contrast with the oak parts. Now, cut the spacers to fit and glue them between the slats.

Join the two side frames together by gluing and installing the drawer supports, back apron and shelf supports in place. Spread clamps across the frame to close the joints.

Making and Hanging the Drawer

There are no surprises in the construction of the flush fit drawer. Cut the face, sides and back (pieces 17 through 19) to size, then mill all the corner joinery. I used an Incra™ jig to form the half-blind dovetails and a dado blade to cut the back rabbet and dado joints. After milling the corner joints, rout grooves along the appropriate inside faces to accept the bottom panel. Be sure to stop this groove on the face or it will show after assembly. Sand the parts and glue up the drawer box. Cut the bottom panel (piece 20) to size, slide it into place and pin it to the drawer back with brads.

The drawer hangs on a pair of guides (pieces 5) that fit into stopped dadoes in the sides and attach to the side aprons. Plow the guide grooves into the sides with a 3/4" straight bit in the router table. Now rip and cross cut the drawer guides, round their front ends and sand them until they slide easily in the drawer grooves.



Since the tabletop's ends and panel form crossgrain joints, they need to be able to move independently of one another. This is accomplished by hidden tongue-and-groove joints. Slotted holes on the tongues allow a slip fit around the outer dowels.

The trick to hanging the drawer is locating the precise positions of the drawer guides on the aprons. Here's how I did it: First, fit the entire drawer assembly into place with the guides in the drawer grooves. Hold it in place with a scrap block clamped to the back apron. Adjust the drawer face for a flush fit. Mark the top and bottom edges of the guides on both aprons near the back. Pull the drawer out, position the guides on the aprons and fasten them through their rear pilot holes with screws. Replace the drawer and insert thin shims of cardboard around the face to center it evenly in its opening. Then, mark the drawer guide positions on the aprons near the front. Finally, adjust the guides to your front reference marks with the drawer removed, and drive in the remaining screws.

Adding the Tabletop and Shelf

Breadboard tops aren't typical features of Arts & Crafts tables, but I chose this style because the breadboard ends help keep the top flat and hide its end grain. To make the top, glue up a wood panel for the center section (piece 14), and cut the breadboard ends (pieces 15) to size. Next, chuck a 1/4" straight bit in the router table and plow a long stopped groove into one edge of each breadboard end. With the grooves cut, mill the center panel tongues just as you made the tenons (see *Elevation Drawings*). Notice that the tongues are 1/4" narrower and 1/8" shallower than the grooves to allow for wood movement.

Attach the breadboard ends to the panel with six dowels (pieces 16)

driven through the tabletop. Be sure to first form slotted holes in the tongues for the outermost dowels so the center panel can expand and contract. Spread glue along just the center 4" or so of the tongues when installing the ends. Use a light film of glue on the dowels to keep excess glue off the tongues.

The center panel will expand and contract across the grain far more than the breadboard ends will move along the grain, so the parts won't always line up. To help minimize this mismatch, I suggest you use lumber kiln dried to at least 8%. If there's room in your budget, choose quartersawn stock for the top — it will move significantly less than plain sawn lumber.

To install the tabletop, cut the top cleats (pieces 6) to size and shape, outfitting them with round and slotted screw holes. Align the cleats flush with the tops of the aprons, then attach them with glue and screws. Position the tabletop and adjust it for an even overhang. Press a scratch awl up through the cleat holes to mark the top for screws. I fitted the four screws in the slotted holes with washers to ensure these joints would slip when necessary.

Now for the shelf (piece 13). Glue up a solid panel and cut it to size, notching the four corners so they fit around the legs with 1/8" of

extra clearance for seasonal expansion. Cut and screw two shelf cleats (pieces 12) to the lower side rails, and attach the shelf to the cleats with screws driven in from below.

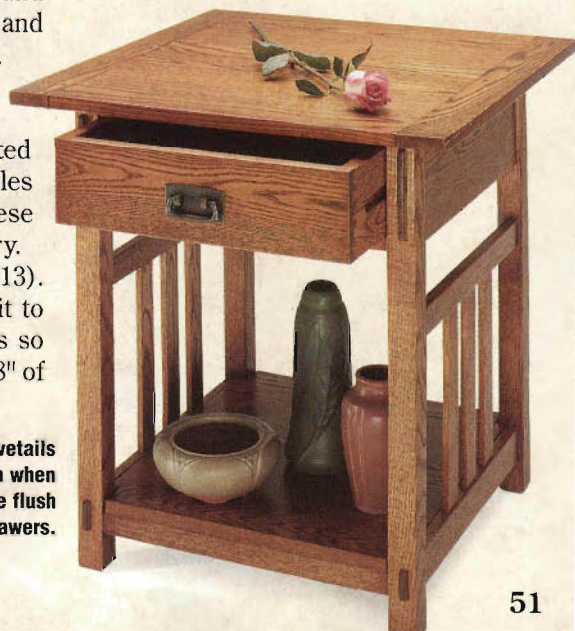
Finishing Up

Give the tabletop and shelf a final sanding. Tint the end table with a medium-dark stain, followed by a topcoat of varnish and paste wax. While you're at it, wax the drawer guides and their grooves for slippery smooth drawer action. Attach a reproduction Stickley drawer pull (piece 21) to complete the table.

I hope this mortising technique draws you into building more Mission style furniture, as it has for me. Now that through mortise and tenons are within my reach, I know I'm hooked.

Chris Marshall is a freelance writer and woodworker who lives in Ohio.

Half-blind dovetails are a nice touch when assembling the flush fitting drawers.



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(Circle No. 139 on PRODUCT INFORMATION form)

Dust Control

By Sandor Nagyszalanczy

Innovations in dust control and collection are making the shop a cleaner, safer place to work.



It wasn't all that many years ago that the chief means of dust collection in most shops was a broom. In recent years, however, concerns have increased over the impact of wood dust on respiratory health. There's also greater awareness that sawdust-strewn home woodshops are often the cause of residential fires. Now, the wish list for 21st century woodworkers not only includes hand planes, routers and table saws, but dust collectors, shop vacuums and air filtration devices.

Fortunately, technology and product design have kept up with our desire to make dust collection as important to a good workshop as electricity and lighting. A few of the noteworthy improvements in dust control and collection equipment and accessories include: better filters for our dust collectors and

shop vacuums that remove fine dust more efficiently; a specialized vacuum designed to keep shop floors clean; disposable bags for our portable power tools; advanced electronic systems to make central collection systems easier to control;

air filtration devices (AFDs) that are more convenient to use; and affordable downdraft tables to capture fine dust while sanding. Regardless of the size of your shop or the type of woodworking you do, these innovations are available to help keep chips and sawdust under control and make your shop a cleaner, safer, and healthier place to work.

Better Filters for Dust Collectors

Without a filter, a dust collector's exhaust will spew a steady stream of fine dust particles into the air. The better the fine particle removal ability of the filter media, the fewer the respirable particles that end up in your lungs. Indeed, replacing inexpensive canvas or woven synthetic filter bags with high quality filter media is an important step toward upgrading



your shop's central or portable dust collection system.

But just changing filter media isn't enough — there must be enough square feet of filter surface area in order for your collector to "breathe" properly (all the air that the blower sucks in must escape through the filter). There are two simple ways to improve a collector's filtration and increase the filter surface area:

1. Replace standard size bags with oversized polyester felt bags.
2. Replace filter bags with a pleated cartridge filter.

Oversized Bags for Portable Chip Collectors

Big and floppy as the Cat in the Hat's hat, oversized filter bags may look funny, but they do their dirty job with aplomb. Sized to replace the standard bags found on most two- or four-bag single-stage chip collectors, oversized bags (available from Oneida Air Systems) are made from high quality felted polyester filter cloth. These thick cloth bags remove a higher percentage of respirable particles than woven canvas or Dacron™ bags (the kind typically supplied with most inexpensive chip collectors) do.

Because felted fabric is made from countless fine polyester

fibers pressed into a thick, matted material, it's harder for the air to pass through these bags. To compensate, oversized bags have lots more surface area than stock bags, providing plenty of surface area for the filtered air to escape.

Oversized bags are easy to install: simply reuse the straps from your stock bags to fasten the new bags in place. Even though the oversized

clean can also be used in lieu of bags, to filter the air from your collection system. Although they're more expensive than regular filter bags, pleated cartridge filters have their fabric media accordion folded to pack a large amount of surface area into a more compact package. For example, the single 66 inch long, 16 inch diameter cartridge shown

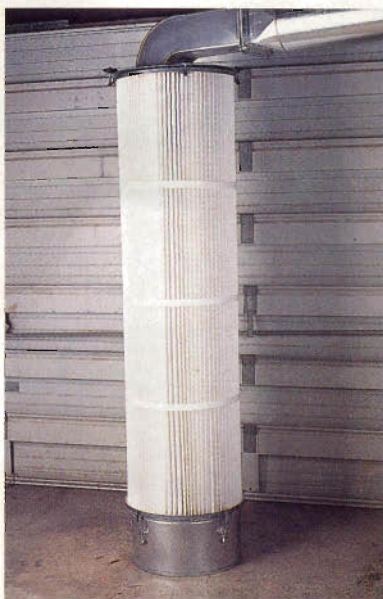
below (available from Oneida) has the same amount of filter surface area as several large bags, which would take up a lot more space. A cartridge filter is a smart choice if you're trying to shoehorn a central collector into a small shop or a cramped closet or utility shed.

A large pleated cartridge filter is designed for use with central collectors equipped with a cyclone or other pre-separator device — you can't connect it directly to

a single-stage chip collector. The inside of the filter media is treated with a special slippery coating that prevents dust from sticking and clogging the pleats (an occasional blast of compressed air keeps the filter clean). The fine wood that's filtered collects in a small canister attached to the bottom of the cartridge, for easy disposal.



The upper bag on the chip collector at left has been replaced with an "oversized" Oneida bag. The lower one is the stock bag that came with the collector, demonstrating the contrast in sizes. Pleated cartridge filters, like the one shown in the photo at right, have their fabric media accordion folded to pack more surface area into a compact package. This Oneida cartridge has the same amount of filter surface area as several large bags.



lower bags have lots more room for chips to accumulate, always empty the lower bag when it's only about one third full. As the bag fills up, it blocks the air's ability to escape, thus degrading the performance of the collector.

Pleated Cartridges Replace Filter Bags

Believe it or not, the same style of pleated paper/fabric air filter used to keep an automobile engine's air

continues on page 56 ...

Barrel Top Collector

Another place you'll find a pleated cartridge filter is on JET's model DC-650TS canister style collector. This kind of portable collector is terrific for small shops, because its two-stage design deposits the lion's share of chips and sawdust into an easy-to-empty drum or garbage can. Most canister collectors have a small filter bag, which is typically cotton — not very good for capturing fine dust. JET's new collector replaces the bag with a compact cartridge filter that efficiently removes micron-size particles, yet keeps collector performance high. When the cartridge is clogged or full of dust, simply remove it and shake it out, and blow the pleats clean with compressed air.

Better Filters for Shop Vacuums

Dust collectors aren't the only woodshop devices that benefit from better filters: Many shop vacuums currently on the market feature



Some shop vacuums, like Fein's 42989, now use filter media capable of capturing respirable dust particles. Their unit has a cloth filter bag made from felted polyester fabric. And if you're not ready to invest in a new vacuum, "Clean Stream" has replacement filters that strain out a very high percentage of fine dust.

high quality filter media capable of trapping respirable dust. To improve performance, models like the Fein 42989 use filter media capable of capturing respirable dust particles efficiently. The Fein's large cloth filter bag is made from felted polyester fabric, the same kind used to make industrial quality dust collection bags (see section above). By keeping fine dust down, an efficient filter like this can provide relief to those who suffer from allergies or respiratory problems or have a high sensitivity to wood dust.

You don't necessarily have to buy a new shop vacuum to get cleaner shop air: Improve your current vac's fine dust filtering ability by replacing its standard cartridge with a "Clean Stream" replacement filter; (available for various Sears® Craftsman & Shop-Vac® brand models). Clean Stream filters are made from fabric manufactured by the company that makes Gore-Tex™ garments. Their



Unlike most canister collectors, which have a cotton dust bag, JET's portable DC-650TS has a pleated filter that efficiently removes micron-size particles. When it's clogged, remove the cartridge and blow the pleats clean.

A cartridge filter is a smart choice if you're trying to shoehorn a central collector into a small shop.

filter fabric is designed to strain out a very high percentage of respirable particles, thus keeping your shop air healthier to breathe.

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Although it's been around for a few years, I only recently discovered a different kind of shop vacuum

continues on page 58 ...

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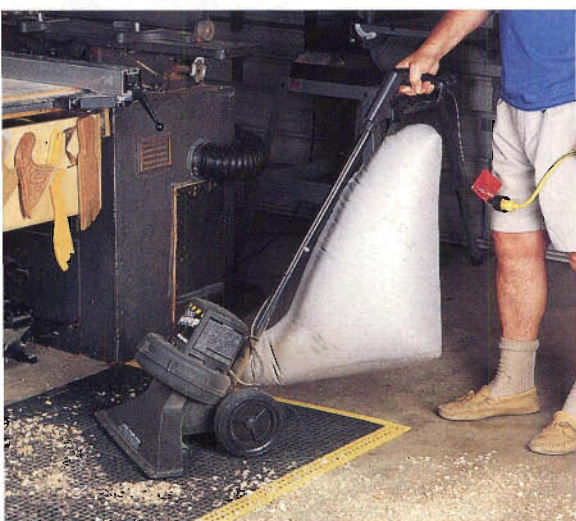
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that makes child's play of cleaning up large expanses of dusty, dirty shop floor. The Shop-Vac™ Model 405EDI "Shop Sweep" features a powerful blower (driven by a 1.4 amp motor) mounted atop a wide, big-mouthed floor pickup. The blower has a high-impact impeller (fan), so it won't self-destruct in case you accidentally suck up a Mason jar full of nails or screws.

Although you'll still need to use a regular shop vacuum for cleaning off benchtops and shelves, the specialized Shop Sweep quickly inhales dust, coarse chips and debris from a smooth floor. Everything's blown into a large 8-gallon fabric bag with a rear zipper, for easy emptying. You can use the Shop Sweep indoors or outdoors. Large wheels help the vac scoot over cords and small obstructions. A flick of the toe sets the Shop Sweep's handy kickstand, which keeps the unit from falling over backwards when it's not in use.



Shop-Vac's Model 405EDI "Shop Sweep" features a powerful blower mounted atop a wide, big-mouthed floor pickup. The blower has a high-impact impeller (fan), so it won't self-destruct in case you accidentally suck up a Mason jar full of nails or screws. Everything's blown into a large 8-gallon fabric bag with a rear zipper, for easy emptying.

Automatic Central Control System

If you're the forgetful type, you've probably forgotten to switch your central collector on when taking a cut or two on the table saw. Or perhaps you failed to open the blast gate on your planer and accidentally clogged the cutterhead with shavings. You can avoid such headaches by controlling your central collector with an automated device, such as the Ecogate automatic blast gate system. Ecogate employs special solenoid-operated blast gates that automatically open and close when the machine at that gate is turned on or off. A small contact pickup mounted to the machine's motor housing "senses" vibration, then sends a signal that activates the gate. Wiring from each auto gate goes to a green control box that automatically switches the central collector on and off; all you do is switch the machines on and concentrate on your work. Pretty neat, huh?

The basic Ecogate system handles up to eight individual gates, and can control practically any type collector motor (110V, 220V, or 3-phase). For larger systems with more gates, "green box" controllers can be connected in series, up to 128 gates! Ecogate produces larger, even more sophisticated systems for industrial applications.

Easier-to-use Air Cleaners

Even the best central collection systems don't do a perfect job; there are always some chips and dust that escape. To take care of the unhealthy airborne dust, many woodworkers use air filtration devices (AFDs) in their shops. Also known as



Forget to switch your collector on ... or open a blast gate? As you turn your machine on and off, Ecogate's system automatically starts or stops the collector's blower, and its special solenoid-operated blast gates automatically open and close.

powered air filters or air cleaners, an AFD is basically a box with a motorized fan that draws dusty air through a series of filters, and then blows the clean air out and around the shop (the circulation helps move dusty air toward the unit's intake).

Since it takes quite a bit of time for an AFD to filter all the dusty air in a shop thoroughly, it's best to let

continues on page 60 ...

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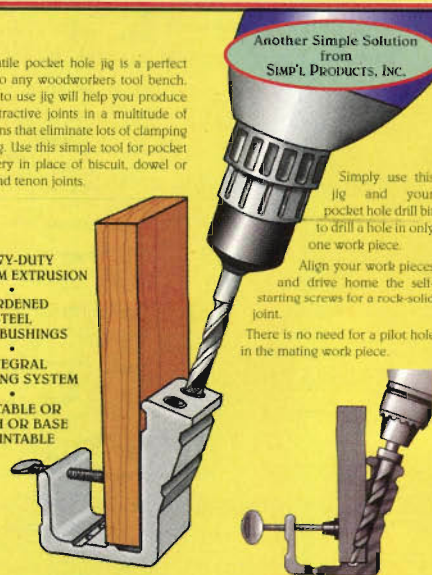
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It's a good idea to let your air filtration device run for a few hours after making sawdust. JET's AFS-1000 has a built-in timer that can be set to automatically shut off power after two, four or eight hours. A compact remote control makes it easier to operate units mounted out of reach.

the device run for a few hours after you've stopped making sawdust. To make operation more convenient, the JET AFS-1000 features a built-in timer that can be set to automatically shut off power after two, four or eight hours. Setting the timer or switching the AFS-1000 on or off manually is accomplished with a compact remote control that JET provides. The remote is especially handy if the AFD is mounted near the ceiling or on a high shelf where it's out of reach.

Shop-Vac's Portable Air Cleaner

If you're an occasional woodworker who produces sawdust a small puff at a time, you can keep the air around you more breathable by using a portable AFD, such as the Shop-Vac's Series AC235 Portable Air Cleaner. This compact unit doesn't take up much space on a benchtop or hanging on the wall — and comes with mounting straps and a pull chain on/off switch.

While the cylindrical device won't do the work of a larger air filtering device — it's rated to move only 235 cubic feet of air

per minute — the AC235 is certainly adequate for sucking up dust produced by small powered abrasives tools or by hand sanding. It works best when the unit's intake is pointed at and placed fairly close to the dust source. The light Shop-Vac's top handle makes it easy to lift and carry to where it's needed. The AC235 traps small dust efficiently by using a three-stage filter: A coarse pre-filter keeps larger dust and debris from

getting inside while a foam sleeve and pleated-cartridge filter handle fine dust removal.

New Bags for Power Tools

Canvas collection bags on dust-belching power tools like belt sanders and random orbit sanders are a good thing. But, considering how poor a job canvas does of keeping extra-fine dust in the bag and out of the air, there is definitely room for improvement. A few years ago, European manufacturers, including Bosch and Metabo,

started offering alternative paper bags for some of their sanders.

Models including the Bosch 3727 DVS random orbit sander and the Metabo Sr 358 half-sheet orbital sander use their built-in fans to suck dust through perforated sanding discs/sheets and blow it into disposable paper dust bags.

The paper bags filter more fine dust than woven cloth bags do. And when they're full, they detach easily from the tool for disposal; a much cleaner proposition than unzipping a cloth bag and attempting to dump its dusty load.

continues on page 62 ...



Occasional woodworkers will breathe easier when sanding by using Shop-Vac's Series AC235 Portable Air Cleaner. This compact unit doesn't take up much space on a benchtop, shelf or hanging on the wall — and comes with mounting straps and a long pull chain on/off switch.

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questions that come up when
you are reading each issue.

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A few years ago, European manufacturers, including Bosch and Metabo, started offering alternative paper bags for some of their sanders. The units use their built-in fans to suck dust through perforated sanding discs/sheets and blow it into disposable paper dust bags, which filter out more fine dust than woven cloth bags.

Collection Bag for Contractor Saws

Full-blown dust collection isn't for everyone. Some people prefer a simpler approach to dealing with the mountains of chips modern power machines produce. Adding a box or bag under a jointer's chip chute is a perfectly acceptable way of catching that machine's large shaving output. But contractor's style table saws, popular in many woodshops, are more of a problem. The tool's open design allows chips to disperse in all directions. To remedy this situation, Woodcraft offers a simple collection bag that fits all contractor's saws. A series of snap fasteners screwed to the perimeter of the saw's base keeps the bag in place, yet allows easy removal for emptying sawdust (or to retrieve an arbor wrench you've accidentally dropped inside).

random orbit sanders are especially good at blowing bilious clouds all over the place. One way to tame these dusty demons is to work atop a sanding table. Often used in industrial shops, a sanding table is basically a hollow box with a perforated top that uses vacuum to create a downdraft to pull dusty air down and away from parts that are sanded on top of it.

If you're willing to do a little work, Rockler Woodworking and Hardware has introduced a downdraft table hardware kit and plan, featuring a prewired 3/4 HP motor. Large commercial sanding tables may connect to a central collection system or have their own built-in fans and filters. The model 50-880, a compact,



Delta's model 50-880 sanding table has its own electric fan that draws dusty air down through its perforated top where dust is trapped by a drawer-mounted pleated filter.

A Sanding Table for the Small Shop

A dust bag or small collection hose isn't always enough to keep a shop clean when using portable power sanders. Belt sanders and



The open base design of contractor's style table saws (popular in many hobbyist shops) allows chips to disperse in all directions. Woodcraft offers a simple collection bag that fits any make of contractor's table saw.

inexpensive version of the latter, is available from Delta. A completely self-contained unit, the 50-880 uses a 1/2 HP motorized fan to draw dusty air down through holes in the table's top (Delta's 50-885 has a 1 HP motor and larger top). The downdraft air passes through a pleated filter, which removes the dust before returning clean air to the shop. The filter is mounted in a handy drawer, for easy cleaning. To contain dust thrown out sideways, say by a belt sander, Delta's downdraft tables have adjustable side curtains, with narrow flaps of heavy fabric that allow long or wide workpieces to stick out past the perimeter of the table.

Sandor Nagyszalanczy is a professional writer, furniture designer, and author of seven books, including Woodshop Dust Control now available from Taunton Press Books (800-888-8286).

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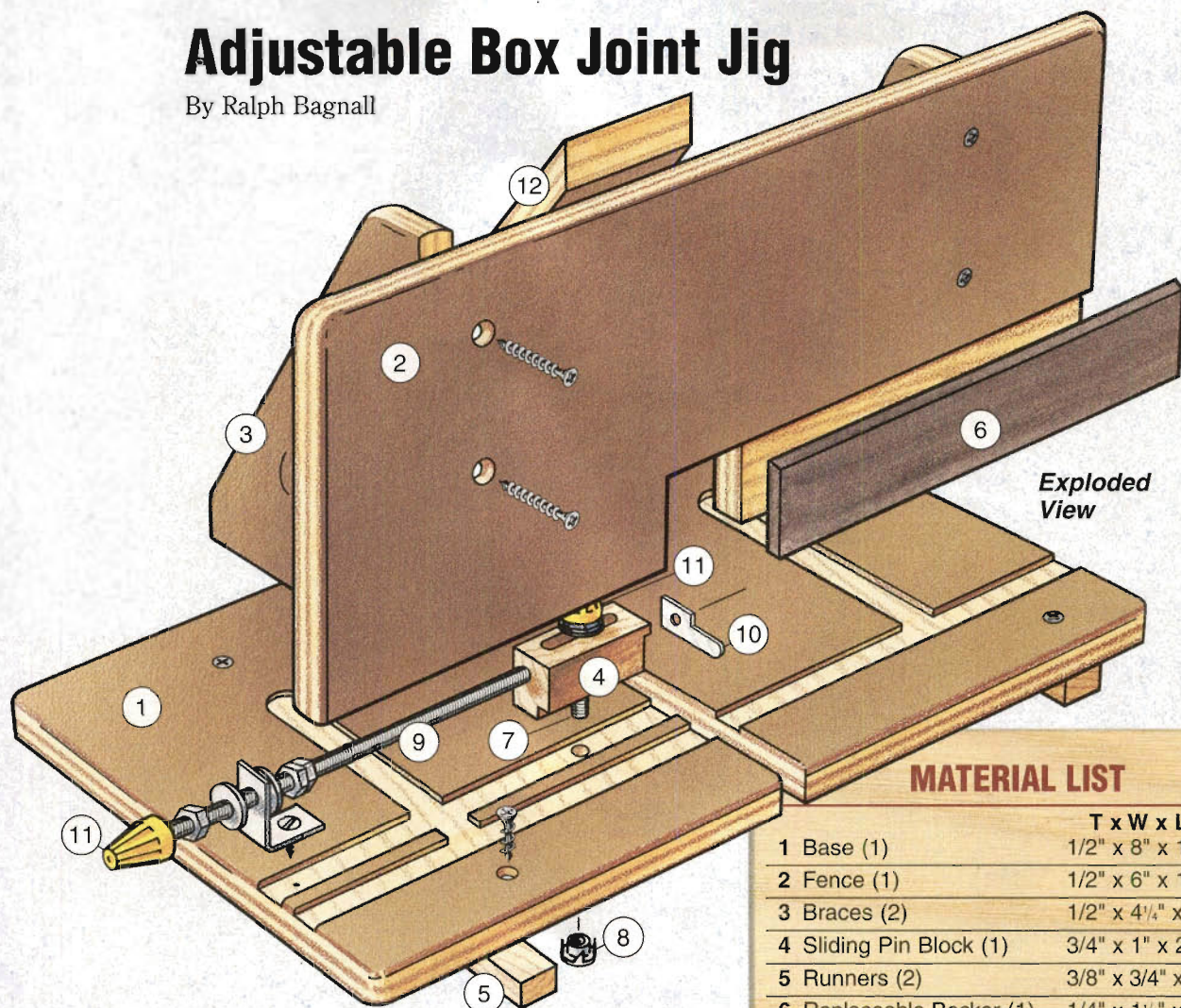
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Adjustable Box Joint Jig

By Ralph Bagnall

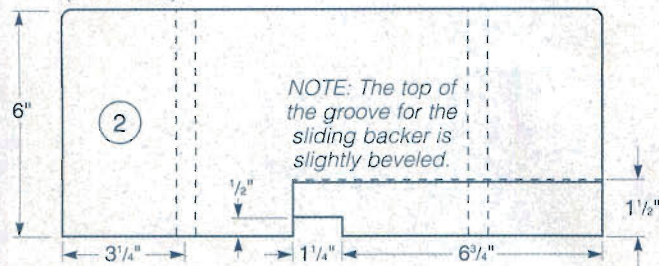


MATERIAL LIST

	T x W x L
1 Base (1)	1/2" x 8" x 14"
2 Fence (1)	1/2" x 6" x 14"
3 Braces (2)	1/2" x 4 1/4" x 6"
4 Sliding Pin Block (1)	3/4" x 1" x 2 1/4"
5 Runners (2)	3/8" x 3/4" x 8"
6 Replaceable Backer (1)	1/4" x 1 1/2" x 8"
7 Clamping Screw (1)	1/4" x #20 x 1 3/4"
8 Teenut (1)	1/4" x #20
9 Adjustment Screw (1)	1/4" x #20 x 5 3/4"
10 Pin (1)	Reinforcing strap
11 Knobs (2)	Electrical connectors
12 Guard (1)	1/2" x 2" x 4"

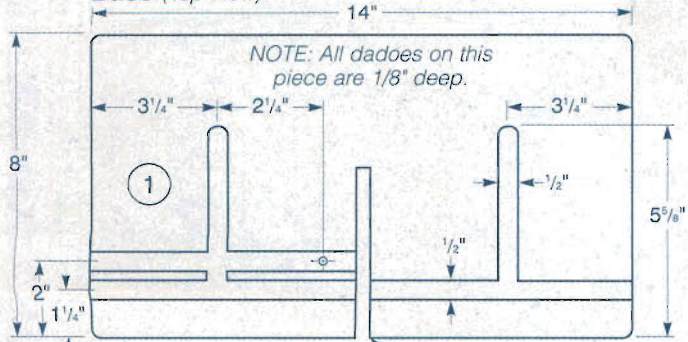
Fence

(Front View)



(End View)

Base (Top View)

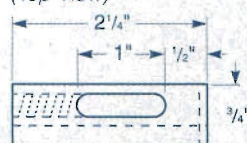


(End View)

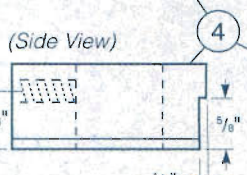
Through cut is formed first time jig is used.

Sliding Pin Block

(Top View)



(Side View)

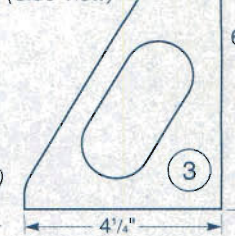


(End View)



Braces

(Side View)



Over the years, I have created a number of box joint jigs. Setting up the pin to match the dado blade and getting the spacing just right makes them pretty much single use items. This time, I set out to create an adjustable, reusable box joint jig.

Soon after I started designing my new adjustable box joint jig I figured out that having the pin precisely match the dado blade is unnecessary. The pin in my jig is quite thin, since only its leading edge is used to set the spacing. In addition, it's mounted on a sliding block, which allows me to make micro adjustments.

Machining the Parts

I cut the larger pieces of this jig out of 1/2" MDO. Shallow dado slots are milled into the base (piece 1) for the fence, braces, and sliding pin block (pieces 2 through 4). Two matching dadoes are cut into the rear face of the fence to receive the braces. The runners (pieces 5), which must fit snugly into your saw's miter slots, are cut next. I also cut openings in the braces to provide a safe place for my hands.

The fence needs a wide slot to accept the replaceable backer (piece 6). The top of this slot is beveled to keep the backer in place. The bottom edge rides in the dado milled into the base. I used 1/4" hardboard for the backer. It is important that the face of the backer is flush with the face of the fence.

I made the hardwood parts out of maple. The sliding pin block has a rabbet on its bottom, creating a step that rides in the dado in the base; a 1/4" slot is milled through the block for the clamping screw (piece 7). Next, I drilled a 5/16" clearance hole in the base and counterbored it on the bottom. This hole houses the Teenut (piece 8), for the clamping screw. One end of the sliding pin block is drilled and tapped for the adjustment screw (piece 9), and the other end is mortised to accept the pin (piece 10). I made these cuts on a longer stick and trimmed the block off.

For hardware, you need a 1/2" x 3" reinforcing strap (for the pin), a 1/2" x 1" corner strap, and about 12" of 1/4" #20 threaded rod with a few 1/4" #20 nuts. The corner strap simply holds the end of the adjustment rod, so one of the existing holes will need to be drilled out to 1/4". I opted to make my own knobs (pieces 11) for the threaded rods by screwing and gluing electrical connectors onto the ends.

If your dados are snug, you can dry fit everything together. You are going to need to cut a notch in the fence to allow for index pin adjustment. Dry fit all the parts except the pin, and mark the required opening. You also want to drill a hole in the right side brace for the threaded rod to pass through.

Assembling the Jig

Now you can glue and assemble the jig. This is the time to add the runners for the miter slots. Set

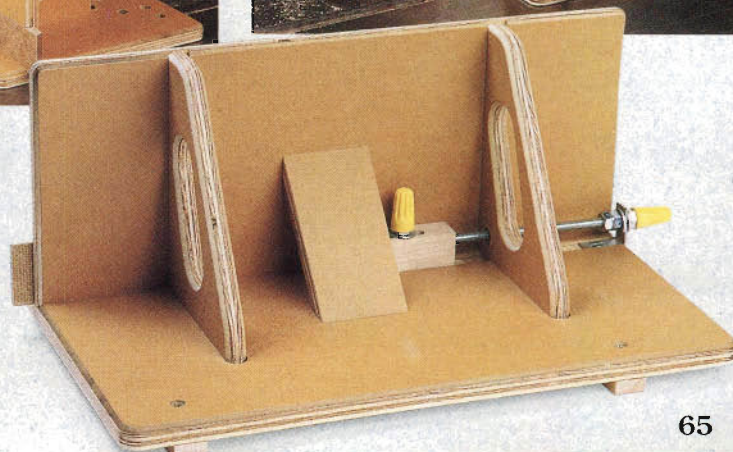
them into the miter slots, and use a square against the saw's fence to ensure the jig and runners are square to the blade. For safety, I added a guard (piece 12) where the blade comes through the fence to keep the blade covered during use.

Using the jig couldn't be simpler. Set up your dado blade to the desired width. Slide the backer out of the way, loosen the clamping knob on the pin block, and turn the adjusting knob until the pin is the proper distance from the dado blade. Retighten the clamping knob and slide the backer up to the pin. Cut a pair of test parts. If the spacing is off, re-adjust the pin. From here on, the jig is used like any other box joint jig. When you use it again for a different spacing, simply trim off the cut end of the backer (you can do this several times) and slide it back into place.

Once the pin is adjusted, the first series of box joints can be formed (below). After the last cut, this piece is clamped in place and used to index the first cut on the joining side, as shown in the photo at right.



The author used electrical connectors (wire nuts) as knobs on his adjustment screws.

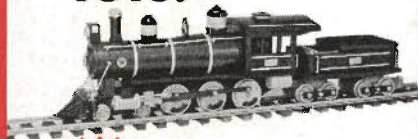


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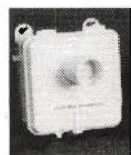
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What's New in Router Bits

By Bill Hylton

Nearly every week the mailman brings a new woodworking catalog or two. And rare is the catalog that doesn't show a couple of "new" router bits. If you are like me, you pause at each new bit listed, stare at the photo and study the description. Then you try to decide if this miraculous new item really will change your woodworking life for the better.

Recently, *Woodworker's Journal* editor Rob Johnstone called with a dream assignment: "How about trying out some new router bits and telling us what you think." Wha-hoo! Instead of looking and dreaming, I looked, called and, a few days later, had a benchtop full of new bits. I peeled off the dip, wiped off the oil, and made the chips fly. I made some doors I didn't need, a selection of moldings, and a few octagonal containers. I can report that the new bits I tried do work as advertised.

To be forthright, none is going to change the course of router woodworking. Mostly they address a specific woodworking problem and provide a solution. Here are the best of the ones I tried.

Freud One-Piece Rail and Stile Bit

One-piece rail and stile bits are old hat. They're less costly than two-piece sets and easier to use than the reversible assemblies.

Both the profile and the cope cutters are mounted on the same tool body. Set it at one height in the router table for the coping cuts, then raise (or lower) the bit to do the sticking cuts.

This Freud bit is big, for router table use only, and it needs to be run at reduced speed. Three different profiles are available: ogee, bead and classical bead.

Lee Valley Reversible Frame-Panel

Miniature rail and stile cutters seem to be hot these days, and Lee Valley has introduced two-bit sets (and yes, they cost more than 25 cents) in this category, as well as one-piece reversible assemblies. Three different profiles are available in either configuration.

If you are cost conscious, you can save almost 30 percent over the cost of a two-bit set by buying a reversible bit.

If there's a hitch with these bits, it is the maker's perception of

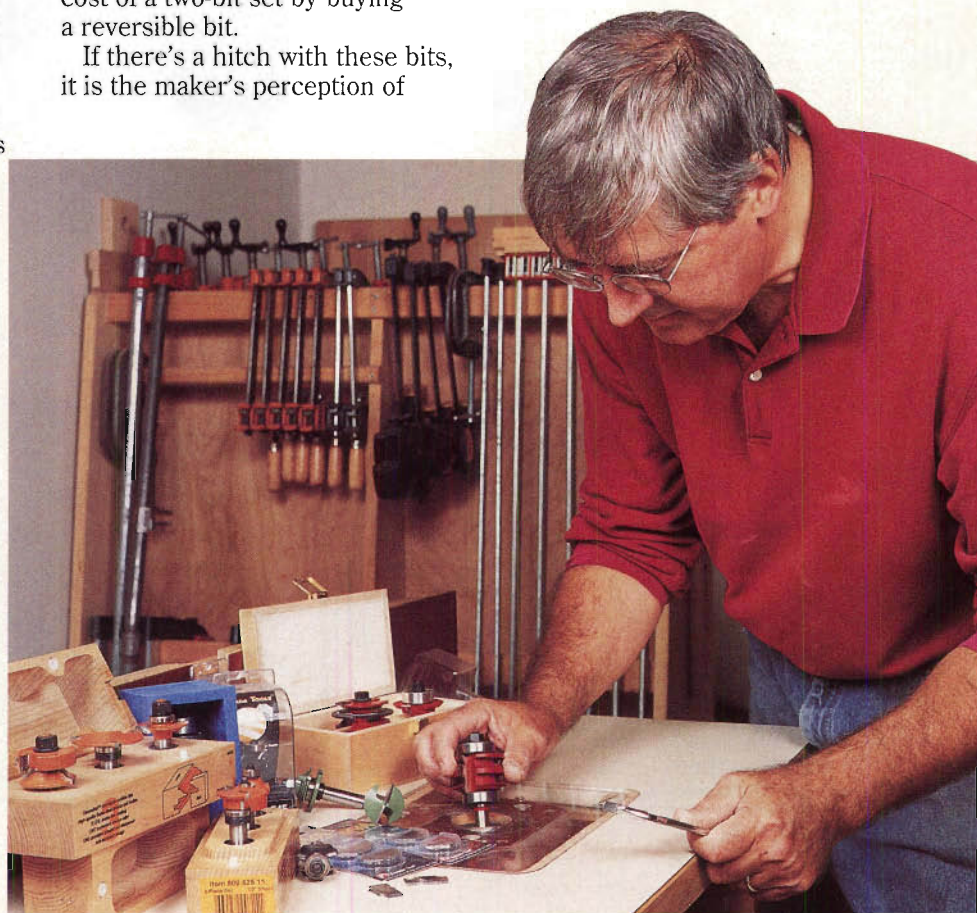
"miniature." The stock needs to be at least 5/8" thick: 3/16" to 1/4" thicker than most other miniature sets on the market.

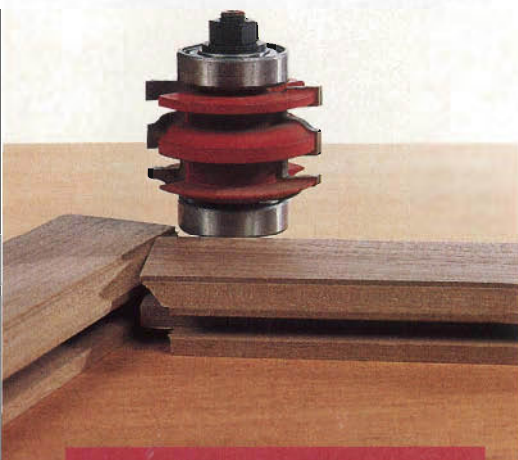
Freud Recoverable-Bead Glass-Door

Bits for making cabinet doors with glass panes instead of wooden panels are available from a number of manufacturers. But until now, you'd have to cobble a means of securing the glass in the finished door. The bits simply cut a rabbet for the glass. Two new sets address that glazing problem.

Freud's approach is a so-called recoverable bead cutter. It is available in three profiles (ogee, bead, and quarter-round). What it does is slot the stock and simultaneously mold both edges. One molded edge projects 1/8" beyond the other. This is the width

"A dream assignment: Try out new router bits and tell us what you think. Wha-hoo!"





you must use the fence setting to reduce the bite.

When you rip the bead free, you have to set the table saw's fence very carefully. A cut that skims material off the shoulder of the rabbet affects the joint.

The rail won't seat against the shoulder, so the joint will have a gap, and it won't be as strong.



With Freud's one-piece rail and stile set, both cope and sticking cuts are made with the workpieces face-down. This makes it easier to get the faces flush, even if the stock thickness from part to part is off a skosh. Simple and logical, but until now, no one's constructed the bit this way.

of a table saw blade's kerf, so you can rip that molded strip from the part, then use it to secure the glass.

A separate cope-cutting bit supplements the sticking bit in Freud's set. The sticking bit is big (2 3/8" diameter and 3" high), so it must be used in a router table and run at a reduced speed (16,000 rpm maximum). The table fence must be used because the bit has no pilot bearing. Set the bit height to center the slot on the stock's edge. If you want to make the cut in stages (thus lessening the strain on your router),

CMT Sommerfeld Glass-Panel Door

CMT's approach (using a bit set designed by Marc Sommerfeld) is to provide a special slot cutter with a conventional sash set. You rout the rails and stiles. Then you use the special cutter to slot the shoulder of the glass rabbet. After the door is assembled and the glass placed, a rubber retainer, which secures the glass, is pressed into the slot.

The rails can be slotted from end to end, but you will want to stop the slots in the stiles. Otherwise, they'll show on the top and bottom of the assembled door.

Freud's 2 + 2 with Back Cutter

Introduced last year, the 2 + 2 raised panel bits from Freud have been enhanced with back cutters, so you can raise the panel and fit it to a standard panel groove in one operation.

The big difference between the new Freud bit and others with back cutters is the 2 + 2 design. The two conventional upshear cutting edges are supplemented with two smaller downshear edges. The large edges do the bulk of the cutting, while the small wings yield a splinter-free edge where the raised field intersects the bevel.

A slight increase in cut width (1/8") has been achieved by eliminating the pilot bearing. Without the bearing, you need to use the fence, and that means straight-line cuts only.



Lee Valley's reversible frame and panel bit set for cutting miniature rails and stiles is a cost-conscious option. You get an arbor with a bearing and separate profile and slot cutters. To switch between cope and sticking cuts, you change the positions of the cutters on the arbor. The center small photo shows the setup for a cope cut, while the bottom photo shows the setup for a sticking cut.

Tool Preview continues on page 72 ...



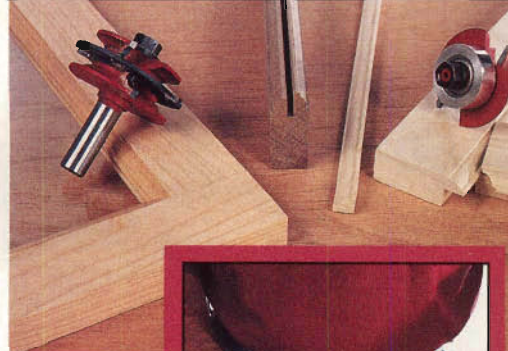
Lee Valley Shaker Panel

At the other end of the panel spectrum is Lee Valley's Shaker panel bit, which isn't exactly what its name might suggest. It's a back cutter. The modest size bit cuts a wide rabbet with a slightly (22°) beveled shoulder. The Shakers wanted a flat, unembellished panel for cabinet doors, and to get it, they'd raise the panel, but assemble the door with the raised field facing the cabinet interior.

To cut the slot in the right location with CMT's glass panel door set, you lay the workpiece face-down on the router table, then adjust the bit so its shank-mounted bearing rides on the delicate edge of the stuck profile. That will give you the correct slot depth, and positions the rubber retainer (inset picture above) to hold the glass without it rattling.



When you use Freud's recoverable bead glass door set, after the door is assembled, securing the glass is a simple matter of fitting the 1/8" bead strips, mitering their ends, and gluing them in place. The completed door looks very finished from either side.



When you use Freud's recoverable bead glass door set, after the door is assembled, securing the glass is a simple matter of fitting the 1/8" bead strips, mitering their ends, and gluing them in place. The completed door looks very finished from either side.



Lonnie Bird's Sets from CMT

Lonnie Bird is a well-known furniture maker and teacher who specializes in exquisite reproductions of 18th century furniture — highboys, tea tables, corner cabinets, slant-front desks. Working with CMT, Bird

has designed three cutter sets that allow you to do with routers the kind of reproductions that he creates using the shaper and custom cutters. The bit sets are useful for fairly specific applications, and are demanding to set up and use (especially the first time).

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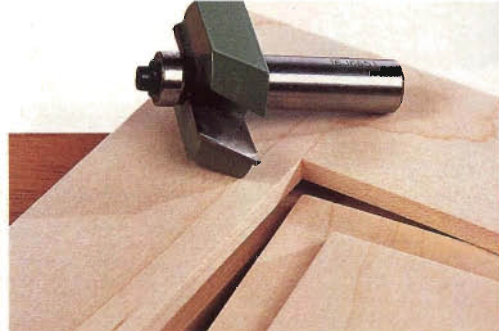
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Crown Molding Set: Router woodworkers like me usually make a complex molding, particularly a crown molding, by building it up.

We'll cut the cove on one stick, the profile above it on another stick, and the profile below on a third. Then we'll glue them together. Bird feels this is an inappropriate method for the very expensive reproductions he makes; the molding should be a single, solid piece.

A unique shaper capability is reversibility. You can turn a shaper cutter over and, by reversing the direction of rotation (a good shaper can run counter-clockwise and clockwise — forward and reverse), cut into the top of an edge. This feature allows you to cut a profile into otherwise inaccessible edges. To adapt this capability for the



Lee Valley's Shaker panel bit is actually a back cutter. The modest size bit cuts a wide rabbet with a slightly (22°) beveled shoulder.

router, Bird inverted the cutting heads of the bits in this set. The bead and ogee profiles, he pointed out to me, aren't at all unusual, but because of the inverted design and the diameter of the cutting heads, the bits can put those profiles on the top and bottom edges of a large crown molding blank that's already been coved.

While the inverted bits are innovative, the centerpiece of the set, especially when you lift the lid on the wooden storage box, is the cove cutter. It's a heavy disk with

Tool Preview continues on page 74 ...

With Freud's 2 + 2 back cutter, even when you're working with 3/4" stock, the face of the panel will be flush with the frame, and the tongue will fit a standard 1/4" wide panel groove. The back cutter forms a cove.

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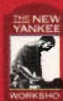


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If you don't want to grind your own shaper cutters for a period desk, CMT's small arch door set provides the correct width for bevel edging the panel and the correct radius for the bead on the door frame.



CMT's crown molding set comes with general instructions. The author cuts a sample with each bit, then uses the samples to sketch crown molding layouts before setting up his table saw and router table.



bulky carbide cutting tips used in the table saw, and you cut coves with it in the usual way: feed the workpiece across the blade at an angle, guided by a straight-edge clamped to the saw table. The cutter takes the deafening "ZING!" out of the operation, reduces the stress on the blade and saw, and produces an easily sanded finish.

Small Arch Door:

Proportions set Bird's small-door set apart from other "small" sets on the market. "If you are creating expensive furniture," Bird told me, "the details are important." For a period slant-front desk he makes, an important detail is a small raised panel door in the gallery. The bevel edging the panel is a certain width, the bead on the door's frame is a certain radius. Grind your own shaper cutters, as Bird has done hundreds of times, or reach for this router bit set.

Divided Light Door: Making divided light doors is challenging. Used on period corner cupboards, for example, these doors hold 4 or more glass panes — as many as 15 in some projects — separated by narrow mullions and muntins.

What this set does is expedite the traditional mortise and tenon construction. Strong joinery is critical, because the glass isn't one single, rigid pane. The time-consuming part



CMT's divided light door set provides the cutters to produce the sticking profile and

to cope it. You must lay out all the mortises and tenons. That done, cut the copes, then rout the sticking profile with the set's beading bit. Finally, rout the rabbets for the panes.

of the traditional construction is the ticklish hand work of mitering the sticking profile at the joints. Bird's set replaces the hand-cut miters with router-cut copes.

CMT 22 1/2° Lock Miter

CMT's 22 1/2° lock miter set is primarily intended for corner cabinetry. Whereas the conventional lock miter bit produces a right angle assembly, this two-bit set produces a 45° assembly. Beyond the obvious cabinetmaking application, this angled joinery cutter can be used to assemble any octagonal structure, from boxes and planters up to posts. It can be used on thicknesses between 5/8" and 3/4".

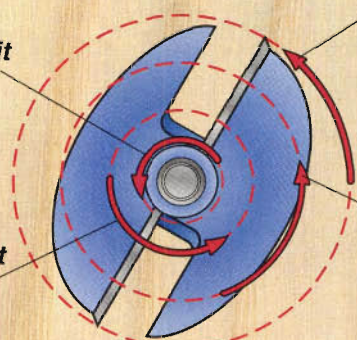
Tool Preview continues on page 76 ...

From 0 – 228 mph in about a second

Most woodworkers know a router runs at about 22,000 rpm. Each point along the cutting edge of a 3" diameter bit is traveling a different distance in each rotation of the bit. The farther from the centerpoint, the faster the point must move. The critical point is the very tip. At 22,000 rpm, the tip of a 3/4" diameter bit is moving at 49 mph, while the tip of a 3 1/2" bit is moving at 228 mph. A tip speed of 130 mph is the maximum to achieve optimum cutting performance with appropriate safety.

**3/4" Dia. Bit
Tip Speed**
22,000 rpm
= 49 mph

**1 1/2" Dia. Bit
Tip Speed**
22,000 rpm
= 98 mph



**3 1/2" Dia. Bit
Tip Speed**
22,000 rpm = 228 mph
12,500 rpm = 130 mph
10,000 rpm = 104 mph

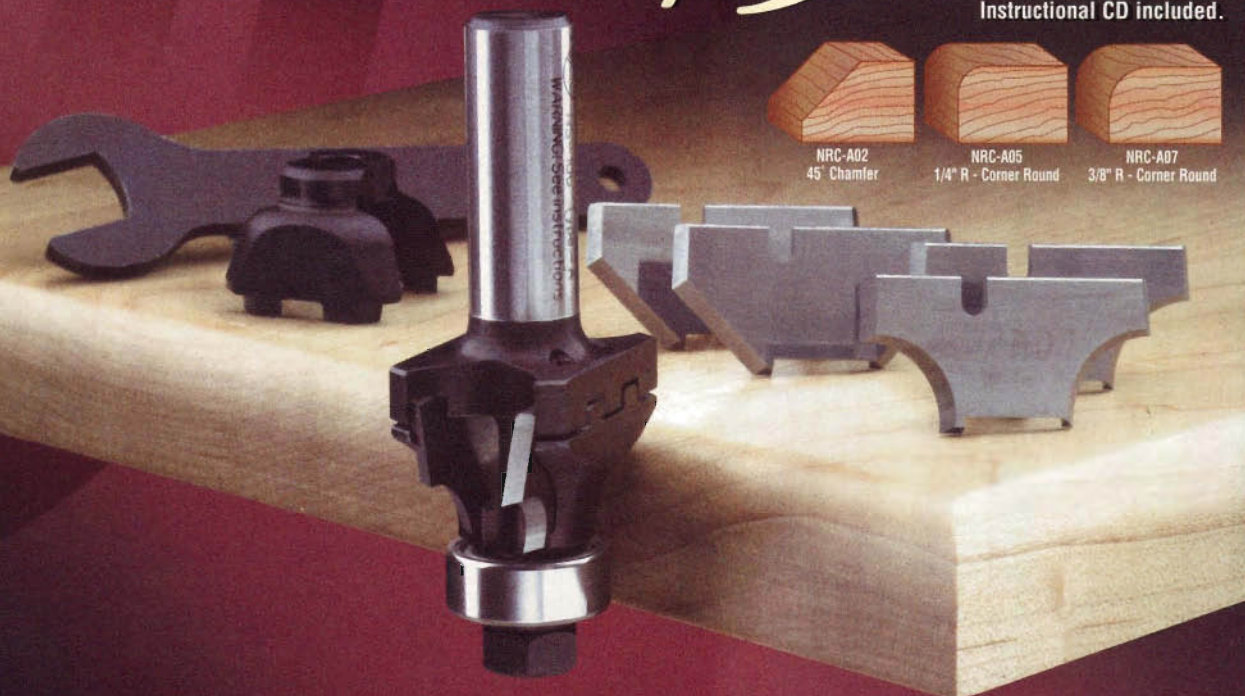
**2 1/2" Dia. Bit
Tip Speed**
22,000 rpm = 164 mph
12,500 rpm = 130 mph
14,000 rpm = 104 mph

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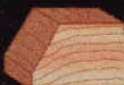
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A07



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A09



A10



A11



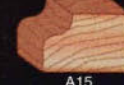
A12



A13



A14



A15

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"Insert tooling" — bits with replaceable cutting tips, like the Jesada and Amana bits at right — have been used in industrial settings for years. Jesada's cutting tips (inset photo) are mounted with Torx screws. When they get dull, you toss the old tip and buy a new one.

Lee Valley Bird's Mouth

Lee Valley's approach to angled joinery draws on boat building tradition to come up with the bird's mouth joint. The edge of one part is V-grooved, while the edge of the other is left square. Seat the square edge in the V-groove, and the parts are caught at an angle. Lee Valley has three different bits that actually give you four different angles.

This is nifty. The joint is simple in concept, and the bit is easy to set up, surprisingly flexible in application, and, because you need only one bit to cut the joint, relatively economical. A 16-page pamphlet provided with each bit does a great job of explaining and documenting the potential of the joint.



The Lee Valley bird's mouth set includes diagrams to help you make 6-, 8-, 12- and 16-sided structures, including tapered and cone-shaped ones.

Jesada Insert Bits

"Insert tooling" is a term that encompasses all those bits with replaceable cutting tips. The concept isn't new. It's been used in industrial setting routers for years.

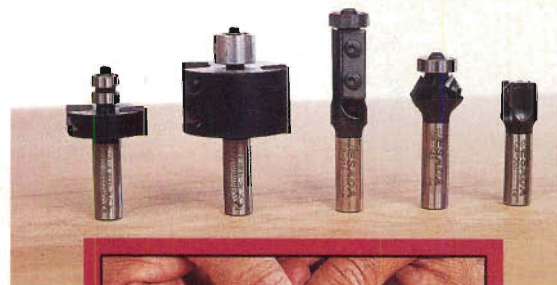
Now Jesada, a manufacturer that sells direct as well as through

catalogs and dealers, has added a few basic insert bits to its line.

Included area couple of straight bits, a flush trimming bit, and a bevel-trimming bit. The cutting tips for these bits are mounted with one or two Torx screws. The cutting tips, because they aren't heated to braze them to the tool body, can be made of a harder grade of carbide, which holds an edge longer. Since each tip is sharpened on all four edges, you can loosen and turn it to expose a new edge when the first dulls. When all the edges are dull, you toss the old cutting tip and buy a new one.

Amana Nova System

Amana, long a leader in insert tooling, has introduced an innovative new line, the Nova System. These cutters allow you to chamfer and profile edges and grooves. The system features two toolholders, one with a pilot bearing for edge cuts, the other for grooving, along with a dozen or more



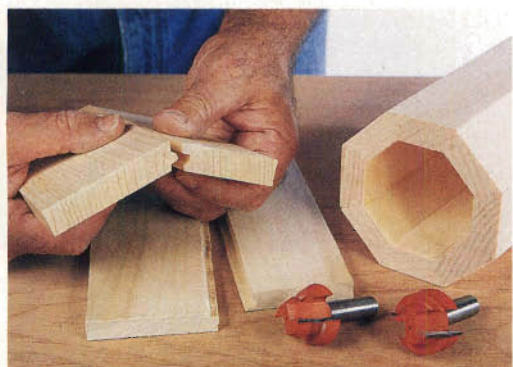
interchangeable cutting slips. The slips are supplied in pairs. They fit only one of the toolholders, and they'll only go into it one way; you can't get it wrong.

The toolholders are big, but well-balanced. You can use them in a hand-held router. You can lock the toolholder in a router and, instead of switching bits, just switch cutting tips. In fact, it's easiest to switch the tips with the toolholder secured in a router.

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



The tool holders from the Amana Nova system are big but well-balanced: you can even use them in a hand-held router. Lock the toolholder in a router and, instead of switching bits, just switch cutting tips.



CMT's 22½° lock miter set has one bit that bevels and grooves the workpiece and a second that bevels and forms a tiny tongue on the mating edge. You use the bits in a table-mounted router, and adjust each to the same elevation.

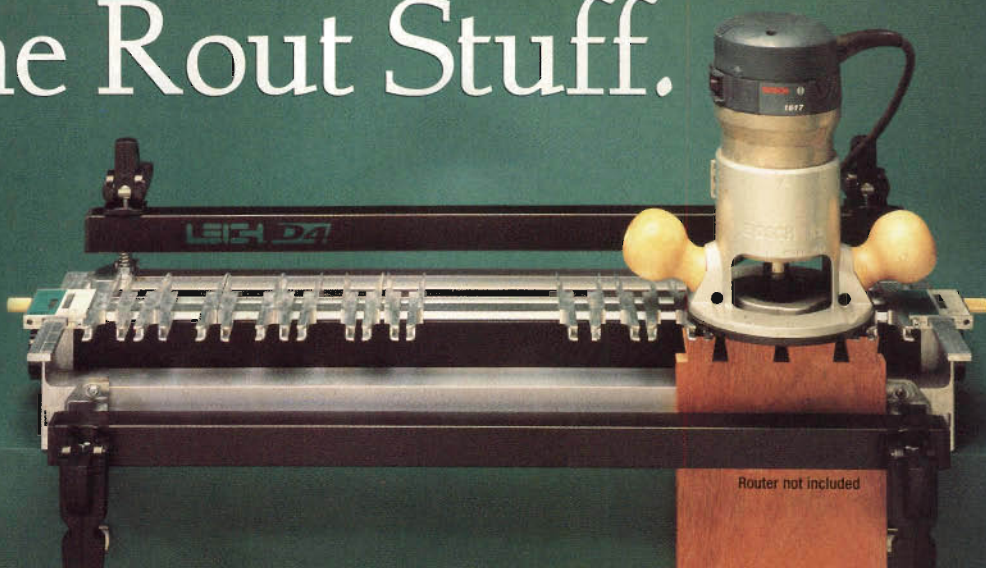
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Working With Water-based Finishes

By Michael Dresdner

Water-based finishes have taken the woodworking community by storm, and for good reason. They are similar to solvent-based finishes in durability, but smell less, give off fewer solvent fumes and, perhaps most important, are non-flammable. That's enough good news to make them worth looking into, but like all materials, they have their quirks and drawbacks.

The Nature of the Beast

The first thing to clarify is that water-based or waterborne finishes (the two terms are used interchangeably) are NOT water soluble. A water soluble finish would dissolve in water after it was dry and would not be waterproof. All water-based finishes are waterproof. In fact, the resins in water-based finishes are quite similar to those in standard solvent-based finishes.

Another misconception is that waterbornes are solvent free. Waterbornes have just enough solvent to form the film, but are diluted with water to make them thin enough to spread. Where lacquer might be 75% solvent, water-base will have less than 10% solvent along with 60% water, and several additives to make the mixture work. These are very complicated formulas, and it is best not to tamper with them by thinning with more water.

Types of Waterbornes

Most water-based coatings are made using acrylic resin, polyurethane resin, or a blend. The vast majority of coatings are a combination of the two resins, even though they may be called simply "polyurethane" or even "clear finish." Polyurethane resin is tougher and more durable, while acrylic resin adds clarity and good brushing and spraying

qualities. Acrylic water-based coatings are about as durable as furniture lacquer, and water-based polyurethanes are about equal to oil-based polyurethane. The blends vary in durability, but most are tougher than lacquer and similar to polyurethane.

Most solvent-based finishes are slightly amber in color, but waterbornes are clear. Those which contain a lot of polyurethane resin may have a slight blue-gray tint, but that will only be apparent when many coats are applied over very dark wood or stain. Waterbornes keep light woods blond and won't "yellow" white or light color stains. They also stay clear and won't

Water-based finishes, while offering plenty of advantages to the home woodworker, do have their quirks and drawbacks.



yellow or discolor over time. Some are available in both interior and exterior formulations, and the ones designed for outdoor use will say so on the label.

Forming a Film

Water-based coatings form a finish in two distinct stages: first water evaporation, and then solvent evaporation. After you spread the finish on the wood, the water starts to evaporate, leaving the solvents and the resin. This lets the mixture stick together to form a sort of brickwork of finish globules. The solvent evaporates last, leaving behind a dried layer of resin.

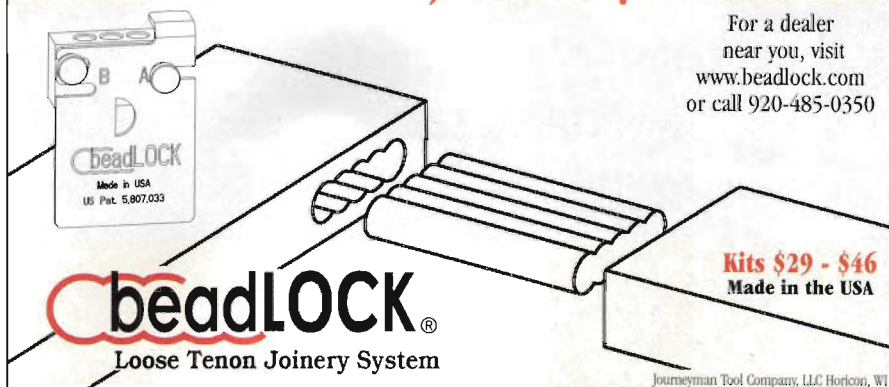
The coatings can be dry to the touch in as little as ten or fifteen minutes, and feel hard enough to use in a day or two. A small amount of solvent stays behind, however, and evaporates very slowly, and until it is gone, the finish is not yet as tough as it will be once it is fully cured. For that reason, you should avoid using any cleaning chemicals or solvents on the finish for at least a month.

Compatibility

Water-based coatings will adhere well on clean raw wood, over dye stains, and over some pigments, but some brands may peel off of some stains. If there is any grease, oil, wax, or other contamination on the wood, the finish may create uneven puddles called fisheyes. You can avoid both of these problems by sealing the stained or raw surface first with a thin coat of dewaxed shellac or wax-free Zinsser SealCoat®. One thin coat brushed, sprayed, or wiped on and off will seal in any contamination and guarantee that the finish will

continues on page 80 ...

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FINISHING THOUGHTS

adhere over any stain. The same treatment works if you want to add a coat of water-base over an existing finish, such as old varnish or polyurethane. Clean the surface, sand lightly, and seal it with dewaxed shellac or SealCoat® and the new coat will adhere to the old.



Over-applying is one of the top problems with water-based finishes. To prevent this, use a foam paint pad, as shown above.

Applying Waterbornes

The most common problem I see among waterborne users is that they put on too much. Apply it too thickly and it will not lay out well, and might even turn cloudy from excess water trapped in the drying film. The best advice I can offer you, whether you are spraying or brushing, is to put on less than you think you should. Each coat should leave the surface barely wet. Fortunately, no matter how the finish looks when it is wet, it will always look better once the finish has dried overnight.

Pay attention to your finishing environment too. Water-based finishes are more finicky than solvent-based ones, and prefer a warm, dry room. You'll get better results if the temperature is 70 degrees or warmer, and the relative humidity is around 50% or lower. Cold temperatures (below 60 degrees) or very high humidity (above 80%) can prevent the finish from curing properly, and will make it harder for the film to level itself.

The water in the mixture will make the first coat of finish raise the grain on raw wood, making it feel rough to the touch once it is dry. Sand it lightly to bring down the "fur" and it will not rise again after that. It is a good idea to sand lightly between each subsequent coat anyway. The low solvent content means the finish

can't redissolve the coat below it, and a light sanding with 320 grit sandpaper will both smooth the surface and help increase adhesion. Avoid the white/gray self-lubricated sandpaper, since it can

create fisheyes in the next coat. Instead, use the gold self-lubricated paper from 3M. It is designed for sanding waterbornes.

Brushing

You can brush, spray, roll, sponge, or pad on water-based finishes, but some tools and techniques work better than others. For large, flat surfaces, I find that a paint pad is ideal. It allows you to cover large areas quickly and, because the nap is so short, it makes it more difficult to flood on too much finish. You'll get fewer air bubbles in the finish (called "foaming") and a much smoother end result.

Start by stirring the finish well, then strain it through a paint filter or old nylon stockings. Water-based coatings sometimes form "gel specks," which are tiny globs of coagulated finish that look like pale tadpoles. Straining will eliminate them. Pour some finish out into a flat pan, dip the pad, then scrape off some excess so that the pad is wet, but not dripping. Stroke the pad over the wood, then go back over it, ONCE, immediately to blend it out. After that, leave it alone. Going back over it again will only make it worse.

For those areas where a flat pad won't work, switch to a nylon or "Taklon" brush. With all water-based materials, you must use synthetic bristle brushes, since natural bristles will "splay" and

continues on page 82 ...

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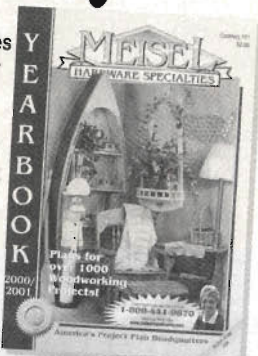
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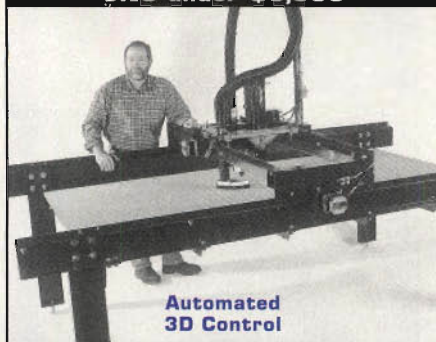
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become soft and unruly in water. Of the synthetic bristles available, nylon is softest and will leave the fewest brush marks. Pre-wet the brush by soaking it in water for a minute or two, then shake out all the excess.

Dip the bristles about a third of the way into a pan, and brush smoothly in the direction of the grain. You can go back over it immediately to smooth it out, but only once.

Brush carefully; flipping the bristles through the wet finish briskly will create air bubbles. Don't brush back and forth, and don't go back over the finish after it starts to set up. The stuff dries very fast, and rebrushing or scrubbing will create foam and make the surface rougher.

For those times when you simply can't get rid of those tiny air bubbles in the finish, add about one ounce of half and half cream per quart of coating. It will act as a defoamer, eliminating bubbles.

Spraying

Water-based coatings spray much like other materials, with a few minor differences. Starting with the gun itself, make sure the tip and all fluid passages are stainless steel or plastic, since plain steel will rust. I find that a smaller tip size works better — 1 mm to 1.3 mm.

As with brushing, spray lighter coats than you are used to spraying with solvent-based finishes. Nitrocellulose lacquer is usually sprayed at well below 20% solids, while waterbornes are typically 30% or higher. One coat of water-based will be equivalent to one or two coats of lacquer. It's quite easy to get runs and drips on vertical surfaces, and spraying less will help with that, too.

For those times when you simply can't get rid of those tiny air bubbles in the finish, try adding about one ounce of half and half cream per quart of coating.



Don't worry if it looks a bit pebbly, since it will usually flow out by morning.

Keep the gun tip about 8" from the wood to avoid over-spray and stick to one or two coats per day to allow plenty of drying time between coats. If you must

thin the finish, I recommend a small amount of Flood Floetrol® rather than water. It will slow down the drying time and make it lay out more smoothly.

Even though they aren't flammable, water-based coatings contain solvents, so you still need a spray booth and a ventilation fan. You may be able to use a more gentle fan, since there are fewer solvents. A strong flow of cool air over the wet finish can chill the surface and prevent it from flowing out smoothly.

Cleanup

If you've ever tried to clean a brush or spray gun using soap and water, you probably noticed that instead of dissolving, the finish turned into a gooey mass. That's because water-based finishes tend to coagulate if too much water is added to them — another good reason to avoid thinning the stuff. Instead, add some household ammonia to the cleanup water. It will help break up the finish and let you scrub the brush or gun clean. Incidentally, that ammonia trick also works when cleaning up water-based finishes' "first cousin": latex paint.

Contributing editor Michael Dresdner is a nationally known finishing expert. His latest book, The New Wood Finishing Book is available from Taunton Press.

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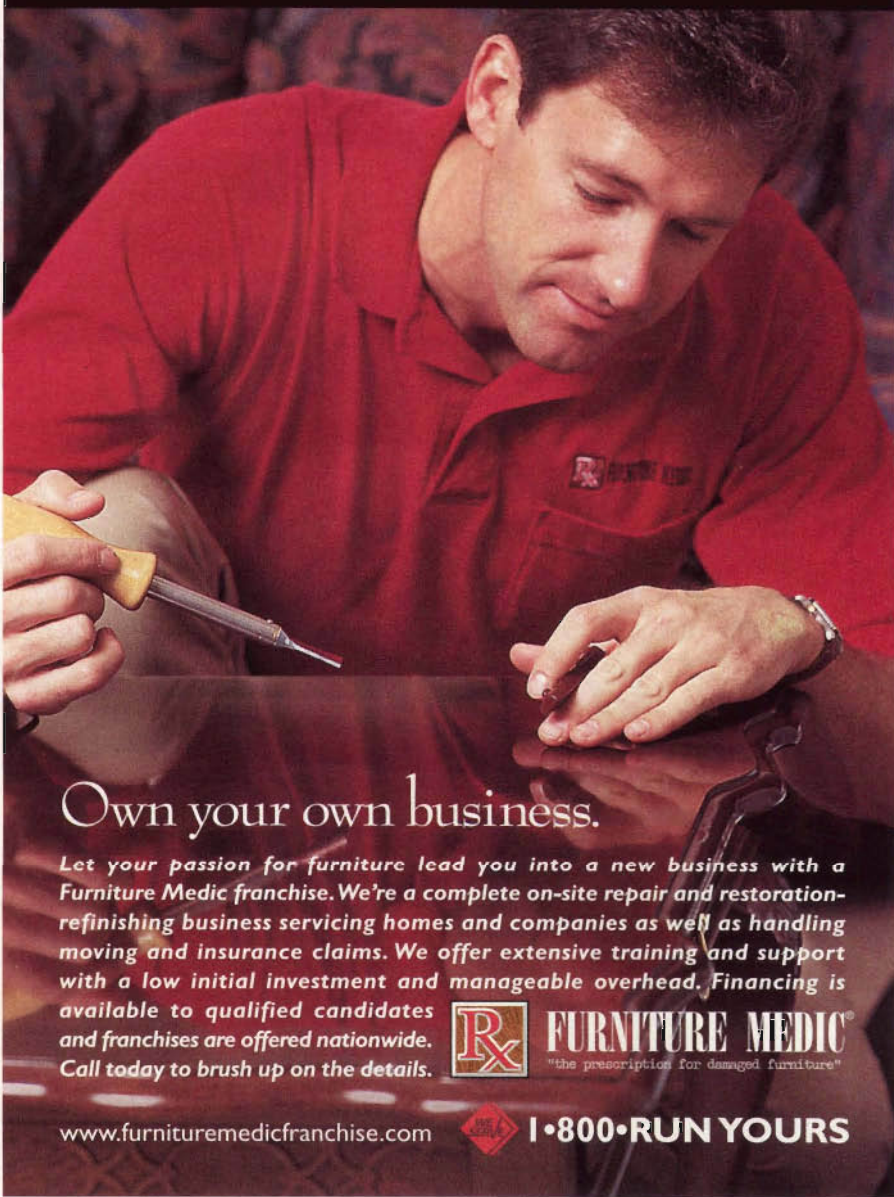
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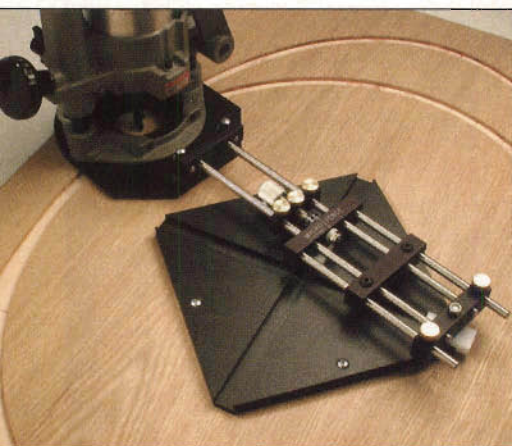
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Shortcuts to Smart Cutting



Cut HUGE Ellipses With Your Router

The new Ellipse Jigs from Micro Fence offer control, quick and repeatable setups and flawless seams when joining curved components. According to company literature, you can “cut ellipses from as small as 15 inches in the minor axis to over 10 feet long in the major,” depending on the jig.

These jigs also combine with Micro Fence’s Circle Jig and Model A Mounting Bar to cut both small and oversize ovals and ellipses. The company offers special guide shafts for making larger ellipses and/or circles — up to 8 feet in diameter, plus optional tracks that deliver more size and shape versatility. With a set of Micro Fence jigs, the average woodworker can build oval tables, create round top window trim, or rout out other elliptical forms with relative ease. Packages run from \$139.95 to \$954.95. *For more info, call 800-480-6427 or visit www.microfence.com.*

Seeing is Believing

Engineers at the Olson Saw Company don’t fret much any more about their customers seeing pilot holes in their workpieces. Their new FretLite™ illuminates those pilot holes ... from underneath! Using a high intensity LED bulb powered by two replaceable lithium batteries, the FretLite makes

blade insertion through pre-drilled pilot holes on the underside of the workpiece both fast and easy. This is important to sawyers who have trouble seeing these tiny holes clearly, especially in dark shades of wood. Equipped with a push-button switch, the device mounts

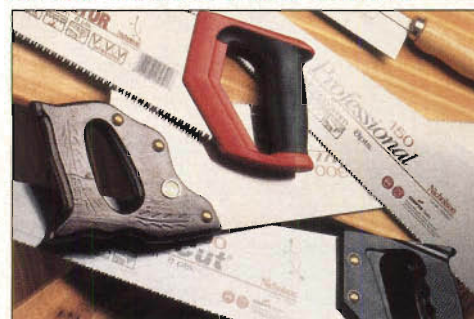


magnetically under your scroll saw table (it has an adhesive plate for aluminum or nonferrous tables). The FretLite is only 2" high and 3/4" deep, with an impressive battery life of 124 hours of use. The light shed by the FretLite reduces both frustration and eye strain, cuts down on project time, and does so for a street price of \$20.

For more information, call 203-792-8622 or visit www.olsonssaw.com.



New Nicholson Saws



The Nicholson division of Cooper Tools has just introduced an expanded selection of handsaws. Their 300 Premium Series saws feature walnut stained and engraved wood handles and heavy-gauge blades. Their traditional cut models “have precision set and double filed teeth for smooth, sure cuts,” while their aggressive cut models “feature triple ground teeth for superb sharpness and bite.” The Predator series have co-molded ergonomic handles. All saws, ranging in price from \$5.99 on up, boast induction hardened teeth that never need to be re-sharpened. *For more info, call 919-362-1670, or visit www.coopertools.com.*



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(Circle No. 83 on PRODUCT INFORMATION form)

Still Stumped on Our Stumper?

Ahoy, there mates! Have any of you lost your peg leg? That's one suggestion for this month's mystery tool, shown at right. The tool, submitted by **Ansel Heram** of Onalaska, Wisconsin, is 16½" long, with a metal portion ending in a spade-shaped tip. The metal is bolted to a wooden end which concludes in a slight curve. The wood handle attached to the metal is 4" long and about 1" in diameter. If you can identify it as something besides a leftover from the days of Long John Silver, send in your answer to Stumpers — you might just win some treasure!

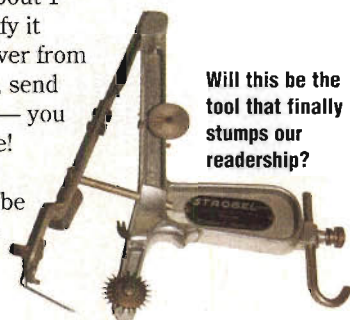
And, while you're at it, maybe someone can follow a map to the answer for the October stumper, at right. We've received a paltry number of replies to this one, none particularly credible. Let's refresh your memory about the tool belonging to **Bill Clough** of Meadville, Pennsylvania. It's labeled with the name Strobel on one side. The other side says "Strobel sonne, Spezial - Nahmaschinen Fabrik, Gegr. 1883, Muchen 12, Heimeran-Str, 70." Achtung, readers! Have we finally stumped you?

If we have, it sure wasn't with the mystery tool from our December issue. As **Leonard Campbell** of Center Harbor, New Hampshire, put it, we got "quite a few snips of information" about **Dan Kautt's** funny-looking scissors. "The object in question," said **Brother Maurice Mansfield** of Lemhi, Ohio, "is a candlewick trimmer." "As the handles are closed, the flat blade smothers the flame and cuts off the carbonized tip of the wick," explained **Lloyd Draper** of Lewiston, New York.

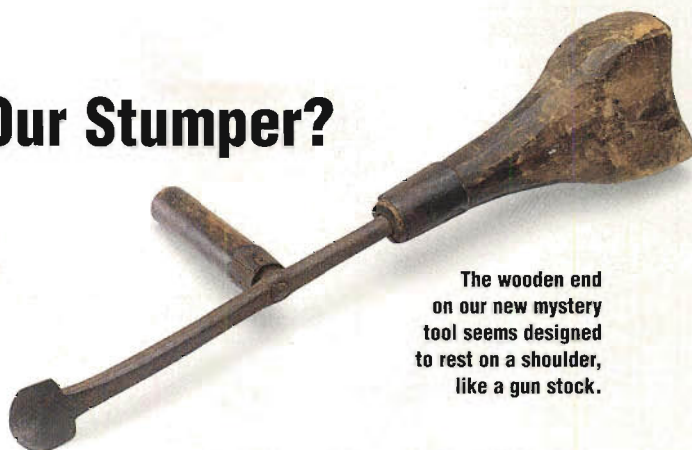
"The excess wick, a sooty affair, would simply fall into the box," according to **Eric N. Jones** of Waynesboro, Virginia. For **Bruce Harris** of Fargo, North Dakota, this means, "You can trim wicks and not get your pinkies sooty," while **Brian Jones** of Bloomington, Illinois notes that it prevents the wick from being "flipped across the room into your favorite aunt's blue hair." **Don Lemons** of Elko, Nevada, notes that "sometimes there is a spark of fire still in the wick, and the box is a safety measure."

Trimming the wicks on gas or oil lamps "made it easier for the oil or gas to climb the wick, making it easier to light a lamp," said **Don Harris** of Plymouth, Minnesota, while **James Leone** of Lock Haven, Pennsylvania, added that trimming the wicks of candles meant that they "would not emit a black sooty smoke, thus reducing the light given off."

Other parts of the tool had their functions, as well. **Judy Skidd** of Wilton, Connecticut, knew that the point of the wick



Will this be the tool that finally stumps our readership?

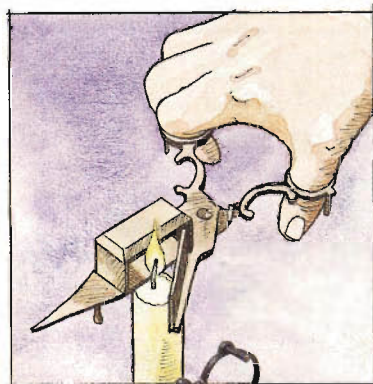


The wooden end on our new mystery tool seems designed to rest on a shoulder, like a gun stock.

trimmers "was used to elevate the stuck [candle] wick out of the wax." As for what **Jim Denker** of Scituate, Massachusetts, described as "three small (a little over 1/2" long) posts protruding from the right blade and each of the finger holes," **Erik Hemmingsen** of Kennet Square, Pennsylvania, says "they kept the possibly waxed or sooty tool up off its resting place." **Monroe J. Mechling** of Steubenville, Ohio, pointed out that the fingerholes are two different sizes. "These trim the candle butt to fit in a standard size candle holder," he said. "The C-shaped design [underneath the finger holes] forms a kind of spanner wrench to twist a candle stub that has dripped in the holder."

While **Harold E. Hunt** of Costa Mesa, Calif., thinks that

"Thomas Edison eliminated the need for these [trimmers] for the average household," **Robert England** of Eugene, Oregon would disagree: "We have an almost identical one which we use every Christmas," he said. And, like most tools, people have put them to uses that weren't necessarily what the manufacturer intended: "I recall my grandfather 'catching hell' for cutting the tips off his cigars with the things," revealed **Ivan Gilpatrick** of Gouldsboro, Maine.



Many readers identified this wick trimmer.



WINNER! For taking the time to respond to Stumpers, **Gary Preston** of Long Beach, California wins a collection of



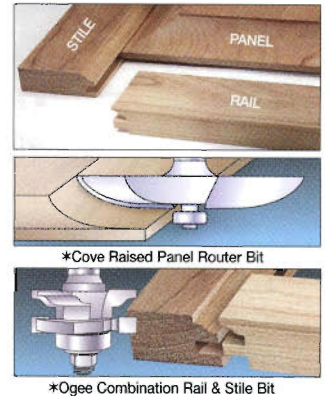
American Tool's Quick Grip clamps. We toss all the Stumpers letters into a hat to select a winner. Send your question or answer to Stumpers Dept., Woodworker's Journal, P.O. Box 261, Medina, Minnesota 55340. Or e-mail: jtakes@woodworkersjournal.com

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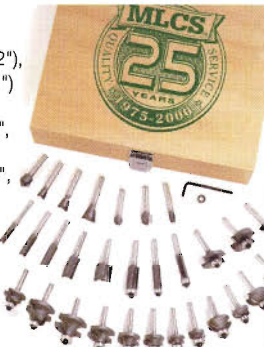
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1 Multi Bead/Reed Bit (1/8" r),
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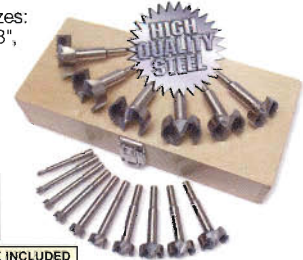


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1-7/8", 2", 2-1/8".



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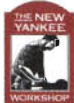
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