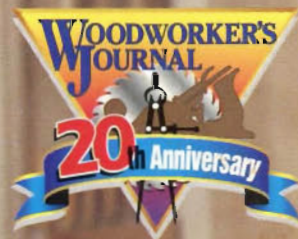


VE TEST: HITACHI MITER SAW • TORMEK SHARPENING CENTER • KELLER DOVETAIL JIG

WOODWORKER'S JOURNAL

Vol. 20, No. 6 November/December 1996



PRAIRIE LANTERN

INSPIRED BY ARCHITECT
FRANK LLOYD WRIGHT Page 52

WORKING WITH VENEERS

HOLIDAY GIFT PROJECTS

- CD Holder
- Victorian Plaque
- Teddy Bear High Chair
- Collector's Display Case
- Turned Candle Holders



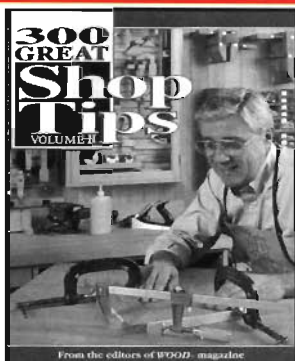
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WOOD® Magazine test, Sept. '93, pg. 45

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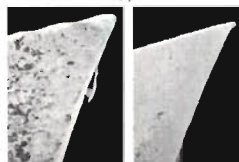
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P. Rose, PA

After installing your blade and 5 in. stiffener the vibration in my saw went down another 20%. I ran several pieces of hardwood through the saw, both **crosscut** and **ripping**, and was amazed at the smoothness. It was like cutting butter, maybe smoother. I have never had a saw blade that **cut this smooth**.

I also am going to send you my old Craftsman blade to sharpen. I'm not satisfied with our local sharpening. Now, how to **justify** another one of your blades.... because **I don't ever want to be without one**.

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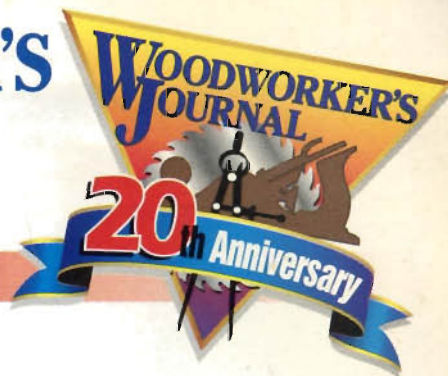
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WOODWORKER'S JOURNAL

Vol. 20, No. 6 November/December 1996



PROJECTS

- 28 Holiday Wall Plaque**
Scrollsaw a nostalgic piece of Victoriana

- 30 Compact Disc Holder**
Store 20 CDs in this handsomely detailed case that makes use of the new pop-out technology

- 34 Tile Trivets**
Great solutions for your gift list

- 38 Teddy Bear High Chair**
A diminutive design that beats the storebought plastic models for charm

- 44 Turned Candle Holders**
Classic colonial profiles and sure-handed instruction from Bob Colpetzer

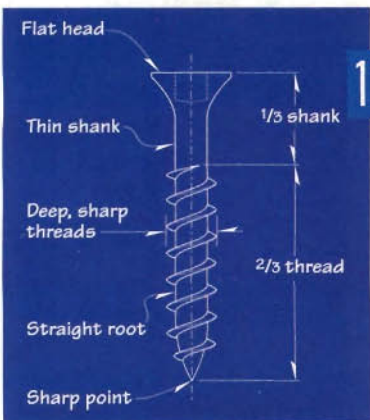
- 52 Cover Story: Prairie Lantern**
In this unforgettable design, Dennis French pays homage to Frank Lloyd Wright

- 64 Collector's Cabinet**
A wall-mounted showcase for your gold coins, glass menagerie, or everyday gew gaws



DEPARTMENTS

- 4 Shoptalk**
6 Reader Letters
9 Readers' Information Exchange
10 Woodworker's Club Spotlight **NEW!**



TOOLS AND TECHNIQUES

- 12 In the Shop: What's New With Wood Screws**
Technology has transformed the lowly threaded fastener

- 21 Special Technique: Veneering**
For beauty and stability, you can't beat veneered woodworking

- 62 Special Technique: Lead Glass**
Making the shade for the Prairie Lantern

- 72 New Tool Roundup: 1996 Trade Show Offerings**

- 77 Tool Review: Three Specialized Router Tables**

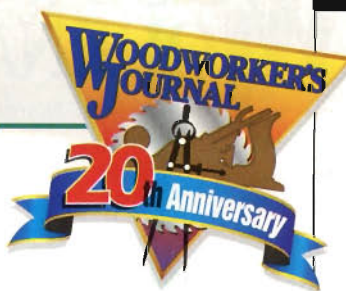
- 79 Shop Test: Hitachi Slide Compound Miter Saw**

- 83 Shop Test: Keller Dovetail Jig**

- 87 Hands On Report: Tormek SuperGrind Sharpening System**



SHOP TALK



It's a rare day that I don't get to talk to a *Woodworker's Journal* reader or two. I sincerely enjoy talking to you—it gives me a chance to find out what you're doing, what you're building, and, more importantly, what you're thinking. I'm especially interested to hear your comments about our projects, be they critical or complimentary. We put a lot of work into developing them and preparing the instructions to help you build them. Your feedback helps guide us as we select and prepare future projects.

Tool Chest Winner Announced

Our thanks to all of you who completed our survey questionnaire and entered the Tool Chest Giveaway. **John Kunte** of Rome, Pennsylvania, has won the drawing and will soon receive the *Woodworker's Journal* Tool Chest.

John tells us he's a long-time reader and subscriber. He retired from a large corporation about six years ago and has since renewed his woodworking activities with a vengeance. John builds mostly Shaker furniture but admits to a special interest in shop jigs and fixtures as well. Between projects, you'll likely find him carving.

Sweepstakes Winners Named

Salvador F. Cano of Rio Rancho, New Mexico, **John Archisletz**, Aurora, Colorado, and **Roger Casper**, Shawnee Mission, Kansas, have won the first three rounds of our *Woodworker's Journal* Anniversary Sweepstakes. Each winner has received a \$1,000 certificate for tools and supplies from **Woodcraft** of Parkersburg, West Virginia. We'll announce additional winners in future issues. Our thanks to the folks at Woodcraft for their continuing support of our Anniversary Sweepstakes.

Woodworker's Club Spotlight Launched

On *page 10*, we're kicking off a new department, the Woodworker's Club Spotlight. Our first installment salutes the local club right here in Peoria, which includes several of our magazine's staffers as members.

We're excited about opening up this new area of interest, which, as far as we know, has not yet been addressed by any other magazine. Over the years, we've had some interesting contacts with a number of active clubs and hope to widen this circle. To those of you who promote "clubbing," we applaud your efforts and will do what we can to help further your interests and communicate your enthusiasm to those who have not yet enjoyed the benefits of woodworking club membership.

Charles Sommers

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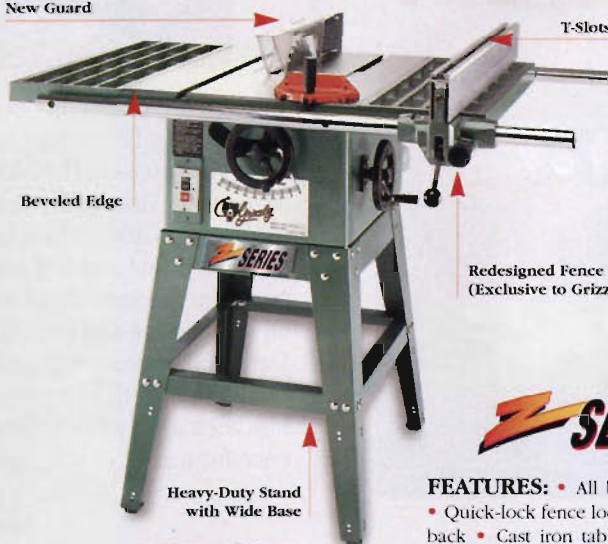
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READER LETTERS



I built two of the Adirondack Rocking Chairs that were featured in your May/June '91 issue. The only difference between yours and mine was that I used poplar to get rid of the scrap in my shop. What I loved about this project was that it didn't require a shop full of expensive tools.

Dan Shaffner
North Canton, Ohio



I keep all my back issues of *Woodworker's Journal* and finally decided to build a pair of the Santa Fe tables featured in the Jan./Feb. '91 issue. I liked the design so much that I used it as the basis for designing and building an entertainment center as well.

Robert Kester
Greenville, Ohio



Here are two of the Heirloom Jewelry Boxes that I completed from your plans in the Nov./Dec. '92 issue using Brazilian rosewood and bird's-eye maple. In building these and four other projects from your magazine, I found that each presented a challenge and an opportunity to learn and improve my woodworking knowledge. Building your projects has been a very rewarding experience for me.

C.P. Ronden
Edmonton, Alberta

Enclosed is my version of the Memorabilia Box from the March/April '96 issue. This was a very interesting and challenging project.

Harry Kittleman
Bend, Ore.



Using your plans from the Sept./Oct. '84 and Nov./Dec. '84 issues, I made this grandfather clock from rough-sawn walnut. I particularly liked the design because of the narrow waist, arched doors, and base panel. Thanks for publishing project plans that average woodworkers can use in their home workshops.

Linda Bolay
Oak Harbor, Ohio

Continued on page 8

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READER LETTERS

Continued from page 6

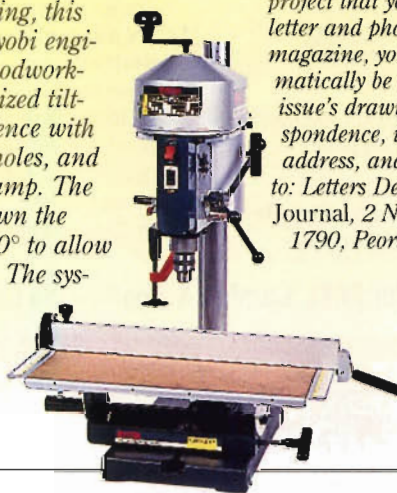


I usually build two or three pieces of furniture per year in my home workshop. This is my rendition in cherry of the blockfront chest featured in your Sept./Oct. '93 issue. I enjoy your magazine and hope to see more plans for furniture of this complexity.

Jim Dinius
Fort Wayne, Ind.

Tool Award

As the winner of our drawing for this issue, Linda Bolay will receive a free Ryobi 18½" wood-drilling system. Unlike most drill presses, which are designed for metalworking, this unit was designed by Ryobi engineers specifically for woodworkers. It features an oversized tilting table, a scaled rip fence with flip stops for repetitive holes, and a built-in hold-down clamp. The head cranks up and down the column and swivels 180° to allow floor-drilling capability. The system requires no belt-switching; instead, you simply crank in the desired spindle speed.



If you would like to be eligible for future tool drawings, send us a good, clear photo and a description of a Woodworker's Journal project that you have built. If your letter and photo appear in the magazine, your name will automatically be entered into that issue's drawing. Send your correspondence, including full name, address, and telephone number, to: Letters Dept., Woodworker's Journal, 2 News Plaza, P.O. Box 1790, Peoria, IL 61656.

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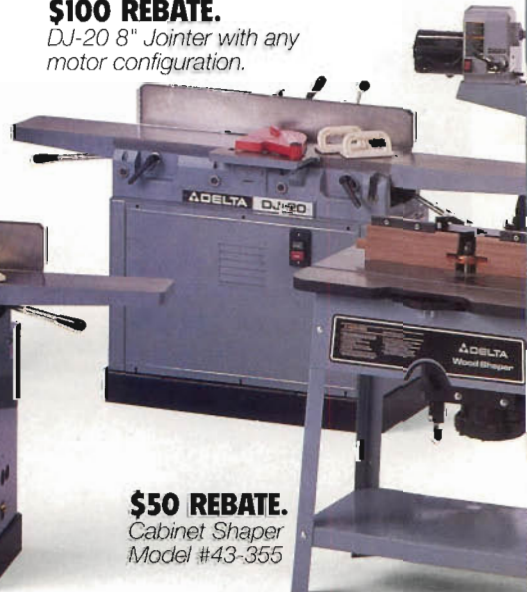
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I am looking for plans or patterns to make a sleigh bed. Any help would be appreciated.

*Nancy Briggs
18927 Albany St.
Elk River, MN 55330-1115*

I am looking for plans to build a director's barstool that has a 30" seat height with canvas or solid-wood seats and back. Thanks!

*Paul Muratet
3733 S. Sandusky Ave.
Tulsa, OK 74135
918/743-8443*

I am interested in obtaining a 16" world globe with the accompanying 17 $\frac{3}{4}$ " brass mounting ring suitable for a floor stand.

*Russell G. Weese
R.R. #7 Belleville, Ontario
K8N 4Z7*

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CLUB SPOTLIGHT

**NEW
COLUMN!**

Editor's Note *Woodworker's Journal* Salutes Woodworking Clubs

This is the first installment of a continuing column that will report activities and events from woodworking clubs across the U.S. and Canada. We're launching this feature with a salute to our local Peoria, Illinois club. If you'd like to see your club featured, or if your club has ideas, special projects, contests, or anything else you'd like to share or brag about, write to: Club Spotlight, *Woodworker's Journal*, 2 News Plaza, P.O. Box 1790, Peoria, IL 61656-1790.

Peoria Club Stays Busy With 10 Meetings a Year

About 12 years ago, Dick Coers, designer/craftsman for *Woodworker's Journal*, and a handful of friends formed the Peoria Area Woodworker's Club. Since then, the club has grown to more than 90 members who are dedicated to sharpening their skills, expanding their knowledge, and cultivating woodworking friendships. The group holds 10 informative meetings a year, sponsors tours, and maintains a library of several hundred books and videotapes.

In addition to the usual club business matters, each meeting features some type of woodworking education or information-sharing. Recently, the club visited the newly outfitted *Woodworker's Journal* shop and got a first-hand look at our new tools and equipment as well as the magazine's new web site.

Peoria club members appreciate good speakers. Programs have included well-known workworkers, local cabinetmakers, sawmill operators, and tool, machinery, and finish suppliers.

It Pays To Belong

Peoria club dues run \$18 a year, but, according to Norm Bartlett, a charter member and the club's unofficial historian, "you wind up making money rather than spending it." Norm cites a standing five percent discount arrangement with Pekin Hardwoods, a local lumber retailer, and special sales by

A&I Supply, a local tool dealer that occasionally hosts club meetings. Reps from manufacturers have also attended meetings and provided free samples. In addition, members pool their purchasing power by group-buying items in bulk quantities.

Another benefit of membership is the free exchange of information that takes place at every meeting. "There's not one woodworking problem, if you take it to one of the meetings, that someone won't help you with," says Bartlett. "All the guys are helpful, whether you're an amateur or professional. I've learned something new at every meeting I've been to."

Computer Makes Newsletter Less Labor-Intensive

With a mailing list of more than 90 names, club secretary Ed Reid has worked out a system that reduces the cost and labor involved in mailing the 10-issue newsletter. He buys pre-stamped envelopes from the post office with address windows and a preprinted return address for 30 cents each. Next, using his computer, Ed prints the name and address of each member on blank sheets of paper in

the envelope window position. These he takes to a copy shop, which prints a copy of the newsletter onto the already addressed pages. Then, it's a matter of folding and stuffing the newsletters in the envelopes. Reid uses the same computer program to create the library cards members use to check out books and videos and the discount cards used at local retailers.

To generate a healthy exchange of ideas and information, the Peoria club mails newsletters to other clubs around the country, and these clubs reciprocate. If your club would like to participate in the newsletter swap or contact the club about activities, write to Ed Reid, Secretary, Peoria Area Woodworker's Club, 12417 N. Oakmont Ct., Dunlap, IL 61525-9326.



Over the years, Peoria Area Woodworker's Club members have donated toys and other projects to charity. When club member George Sommer donated this gaming table to an auction for the Mennonite Relief Fund two years ago, it brought in a record \$7,000. George used 14 different woods in the table and inlaid small samples of each on the underside of the lid complete with labels that describe each species sample and its place of origin.

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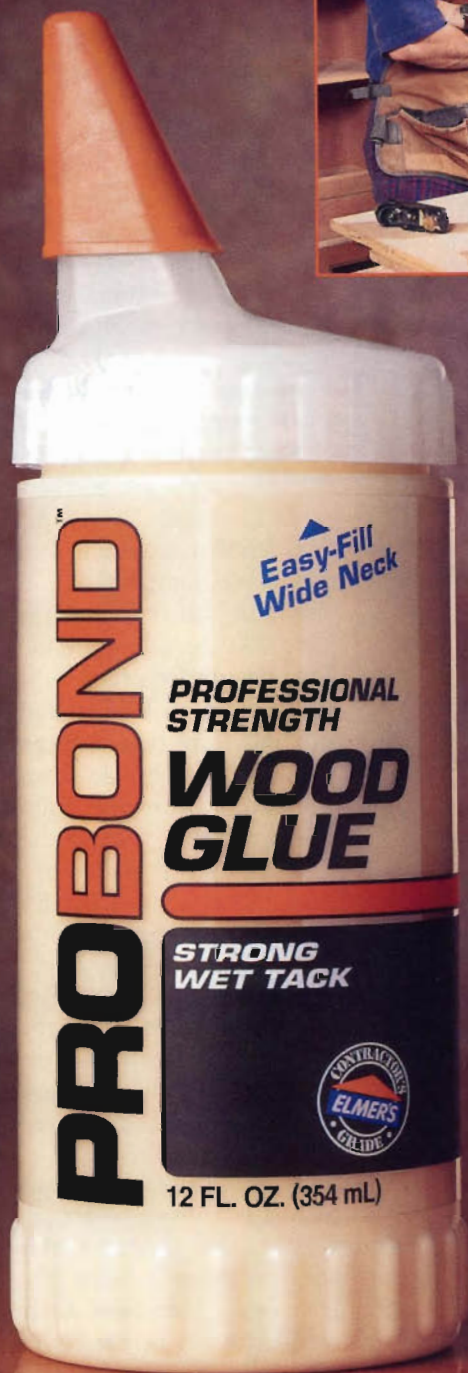
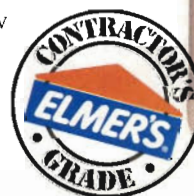
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WOOD SCREWS: What's New

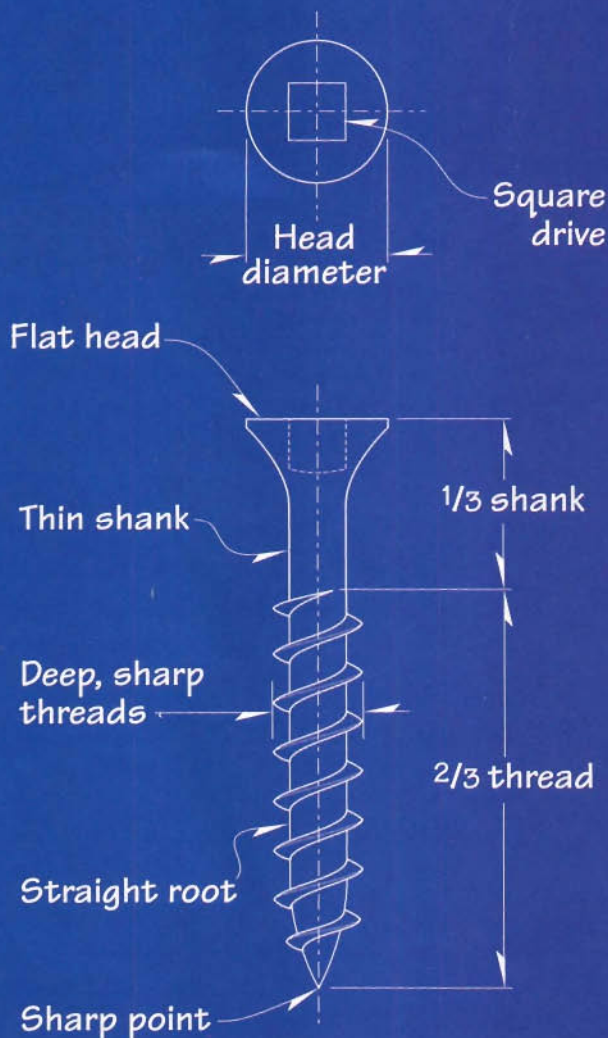
by Bob Colpetzer

Recently, we've seen a lot of innovations that make our woodshop tasks easier if not more fun. You might not pay much attention to the lowly wood screw, but changes to the threaded fastener rank high on my list.

Not that long ago, the only choices we had were slotted or Phillips-head, mild steel or brass. As the technology of building materials has developed, screw manufacturers have modified their products to meet changing industry needs. Such advances as the square-drive, the sharp tip, smaller shank diameters with deeper threads, hardened metals, self-tapping points, double leading, the washer head, and new surface coatings have all arisen to meet specific requirements. Unfortunately, fasteners bearing these new features haven't gotten much exposure outside the commercial arena.

Only lately have manufacturers recognized the sales potential in the growing market of home and hobbyist woodworkers and finally begun offering these products to us. Although still not widely distributed, the "new screws" can now be procured through a growing number of mail-order suppliers, if you know where to look. (For a list, see Sources at the end of the article.) So that you can take full advantage of these newer products, I'll review some of the variations that are available.

Anatomy of a Thin-Shank Screw



Four Drive Types Now Offered

Today, we can choose from among four drive types: slot, Phillips, square, and combination (*photo A*). Until a few years ago, the great majority of screws you'd find on the hardware shelves were slotted. Although relatively inexpensive, these fasteners posed a couple of serious challenges even to the seasoned professional: first, keeping the screwdriver blade from slipping out of the slot laterally and gouging the workpiece; and second, avoiding "cam-out," that familiar experience of the blade jumping out of the slot in response to excessive torque with too little downward pressure.

As you've probably found on your own, two or three cam-outs will break down the slot walls to the point that you'd best remove the damaged screw and drive a new one. If you've tried driving slotted screws using a screw gun or drill/driver, you know what it is to flirt with disaster. I find it very difficult to keep the bit centered in the slot and

still drive the screw with any speed or confidence.

Eventually, Phillips-drive screws were developed to better resist cam-out and deliver more torque to the screw. We use them extensively these days, especially now that affordable drill/drivers have become readily available.

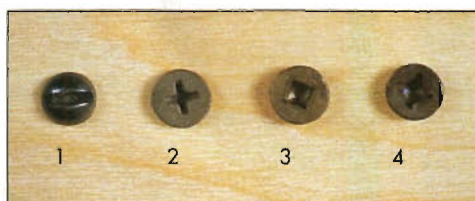


Photo A: Available screw drive types: (1) slot, (2) Phillips, (3) square, and (4) combination.

A Phillips-drive bit locks into the four-pointed star-shaped drive. The four facets help self-center the bit and greatly reduce the chance of the bit slipping out of the slot. This configuration also solves the problem of cam-out—at least until the bit becomes worn. Depending on the bit's hardness (and how it's used or abused), this may happen after driving only a few fasteners. Once a bit wears and no longer fits the drive perfectly, torque capacity drops sharply and cam-out occurs more frequently. As with slotted screws, once you compromise the integrity of a Phillips slot, the screw usually must be replaced.

The square-drive is a newcomer to the home woodshop. Developed in 1908 and used widely in the furniture and cabinet manufacturing industry, it has only recently become available to us woodworkers. I've used square-drives for the past couple of years, and I admit I'm spoiled. I really like their positive, no-slip feel and use them wherever and whenever possible. In fact, I often find myself becoming irritated if forced to deal with slotted screws.

Square-drive screws resist cam-out effectively, even at high torque. A properly fitting bit (*photo B*) locks firmly into the square head, making it ideal for use with a drill/driver. Unlike the Phillips-drive, a square-drive bit will sustain very little wear. However, you must size these bits to fit the screws you're using. You won't be able to cheat a little on bit size as you sometimes can with a Phillips bit.



Photo B: Square-drive bit sizes (l to r): #0, #1, #2, and #3.

The combination drive offers convenience. You can drive these screws with a Phillips bit if you don't happen to have a square-drive bit handy. However, cam-out resistance and torque aren't quite as good as with

the square-drive screw. You'll find this type of fastener available from a number of suppliers under brand names such as Combo, Recex, Quadrex, Square-X, and Spax-S.

New Thread Styles Added Too

Besides the standard single thread found on traditional wood screws, you can now buy screws with higher profile threads, labeled "deep" or "Hi-Fast," and with dual threads, labeled "double" or "Twinfast," depending on the manufacturer (*photo C*). Some also have sharp points and self-tapping or self-drilling features, which make them easier to start and drive (*photo D*).



Photo C: Screw thread styles: (1) standard wood screw, (2) deep or Hi-Fast, and (3) double or Twin fast.



Photo D: Self-drilling screws. Note the "bit" milled into the screw point.

Deep-threaded or Hi-Fast screws have their threads cut deeper into the shank than on conventional wood screws. The deeper threads give more holding power and resistance to pull-out and stripping. These fasteners typically have a single lead, so that one revolution of the screw advances it the length of one pitch. They work best in soft woods or man-made sheet goods that would crumble around fine-threaded screws.

Double-threaded or Twinfast screws have two threads wrapped around the shank. They work best in harder woods and don't perform well in particleboard or other soft materials. One revolution advances the screw two pitch lengths. To take advantage of this feature, use these fasteners to shorten driving time on jobs that require long screws.

Self-drilling or self-tapping screws have specially formed tips to auger and penetrate without requiring pilot holes. However, remember that with fragile materials and for certain applications, it's still a good practice to drill pilot holes to ensure threading and prevent splitting. I've found that these screws work well for pocket-hole face frame joinery. The pocket and shank holes can be drilled in one operation using a pocket-hole jig and bit, and the self-tapping screws can be driven without drilling a pilot hole. I also use them in situations where it's just plain difficult or impractical to drill pilot holes.

On some screws of this type, you'll also find small serrations on the first five or six threads. These little saw teeth help the screw cut into the wood as they're being driven.

Wider Choice of Head Styles

The three most widely used head styles on wood screws are flat, round, and oval. Styles such as panhead, washer-head, and trimhead were developed for more specialized uses. (*See photo E*).

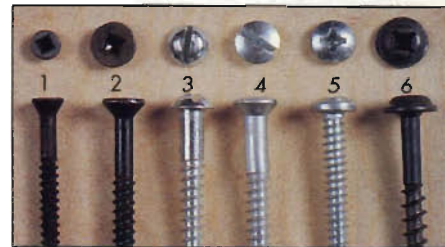


Photo E: Screw head styles: (1) trimhead, (2) flat-head, (3) roundhead, (4) ovalhead, (5) panhead, and (6) washer-head.

Panheads have a semi-elliptical head with cylindrical sides and a flat bearing surface under the head. They're occasionally used for attaching cabinet hardware and for pocket-hole construction. The flat bearing surface shoulders well in the pocket holes, drawing the joint

together without crushing fibers or sinking into the wood.

Washer-head screws have an oversized washer formed as part of the head itself. This provides for an even larger flat bearing surface than found on the round- or panheads. These fasteners work especially well in soft or thin materials where screws with a smaller shoulder would easily sink into the wood. They also come in handy in situations where you need to allow for wood movement.

Trimhead screws have a small, cone-shaped flat head resembling the head of a large casing nail. On all but the hardest of woods, you can drive them flush to the surface or slightly below without countersinking. On harder woods, I recommend drilling a small countersink to set the head flush with the surface, or a slightly larger shank hole if you want to set it below the surface.

Use trimhead screws for jobs that normally require finish or casing nails, or where you need a small-headed screw. They have more drawing and holding power than nails and can be removed if necessary.

Although you can buy trimhead screws with either Phillips- or square-drive, I prefer the square-drive. The Phillips-head screws require a #0 or #1 bit, which is so small that it's tough to get sufficient torque to drive the screw without damaging the small head.

Here's a development to watch: the self-countersinking head. These flat-head steel wood screws have tiny nibs or cutting edges formed into the underside of the head (*photo F*). The nibs cut the countersink as you drive the screw. I've had success with them on particleboard, softwood, and some hardwoods, but birch and hard maple tend to push these screws beyond their capabilities. In those materials, I still prefer to drill conventional countersinks.



Photo F: Self-countersinking screw heads. Note nibs on underside of head for cutting the countersink.

Materials: What Goes Into the New Screws

Originally, steel wood screws were made strictly from mild steel without any type of coating to protect them from rusting. If you needed fasteners with some rust resistance, you had a choice of blued, nickel-, or chrome-plated. For full rust resistance, you'd have to go with brass. Silicon bronze and stainless steel screws offered other options—if you had a marine dealer nearby that stocked them and were willing to pay rather dearly.

You'll still find that standard mild steel wood screws are the most readily available. However, more and more of the new features are being offered on heat-treated steel screws. You can buy them at reasonable prices with clear zinc plating, black phosphate coating, black oxide coating, or with a dry-lube finish. These coatings generally offer only minimal protection against corrosion but should prove adequate for most interior uses.

For greater protection from rust and for exterior use, buy screws with yellow zinc plating, hot-dipped galvanizing, or a ceramic coating. Depending on the application and conditions, these coats may provide a 5- to 20-year use life.

Brass screws generally come with solid brass hardware and are also used for applications requiring a decorative screw or greater corrosion resistance. Silicon bronze and stainless screws also provide corrosion resistance and help minimize rot around the screw. These offer greater strength than the softer brass, although not as much as the hardened steel screws. You can now buy the bronze and stainless products



Photo G: Screw materials and coatings: (1) plain mild steel (no coating or plating), (2) stainless steel, (3) dry-lube coating, (4) zinc plate, (5) galvanized, (6) ceramic coating, (7) yellow zinc plate, (8) black phosphate coating (pre-lubricated), (9) solid brass, (10) blued, and (11) brass-plated steel.

Using Drywall Screws In a Woodshop

In many situations, we find it tempting to substitute drywall screws for wood screws. Their availability, relatively low cost, and ease of driving make them an appealing alternative. However, I feel that using them in a wood project can be a mistake. They were designed to fasten drywall to metal or wood studs. If you've used them, you know that they have smaller root and shank diameters and that their heads tend to snap off easily when you torque them into hardwoods.

The bugle-shaped head on these fasteners allows the screw to self-countersink into the drywall sheet without tearing the paper. This shape does not, however, match a conventional countersink. When the head attempts to seat itself in hardwood, it will typically either break off or strip the hole of its threads.

Breaking off even a single screw in a project can be frustrating, which is why I recommend sticking with screws that were designed for use in wood. I think you'll find the small additional cost (if any) for the new-style wood screws more than offset by their superior performance.

through mail-order suppliers and certain home centers.

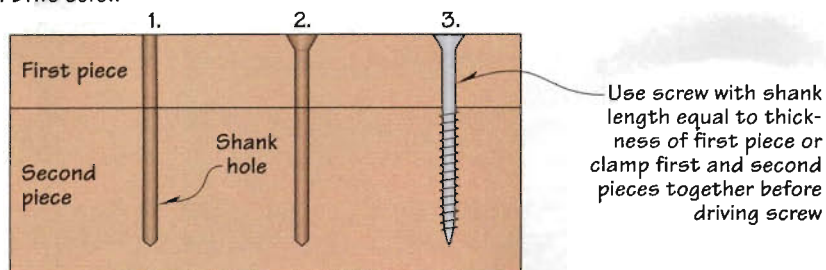
Pre-lubricant and Teflon represent the newest coatings. They make screws easier to drive and help speed assembly. Currently, I find the pre-lubrication limited mostly to basic steel screws, but I suspect it will soon be common on all screw types (*photo G*).

New Shank Diameters

The newer wood screws are being made from a slightly smaller gauge of wire than the old standard products. This change has to do in part with advances in manufacturing techniques. In the past, a piece of wire was cut, the head was formed, and then the blank was chucked into a screw lathe, which cut the threads. The threads and root on these traditional-made screws tapered from the

Figure 1**Installing a thin-shank wood screw**

1. Drill shank hole equal to shank diameter to a depth equal to the screw length
2. Countersink shank hole
3. Drive screw



shank to the point. To get maximum holding power, you had to drill a *tapered* pilot hole using a tapered bit.

Today, manufacturers form the threads on most screws (some brass and silicon bronze screws being the exceptions) by rolling the wire in dies. On traditional screws, even though they're rolled these days, the

tapered profile has been maintained. With the newer-style screws, advances in the rolling process allow manufacturers to use thinner wire to form a screw with threads that are larger in diameter than the original wire. The root on these screws has a consistent diameter over its entire length (no taper), so that, according

to manufacturers, you can use a straight bit to drill one clearance hole the size of the screw shank in both parts without sacrificing holding power. (See *figure 1* and the charts on *page 16*.)

I tried this approach with the newer thin-shank screws and found that, under most conditions, drilling a single hole does in fact work. However, I found certain situations in which it didn't—when fastening two thicknesses of $\frac{3}{4}$ "-thick stock, for example. This requires a $1\frac{1}{4}$ "-long screw, but the shank on such a screw measures less than $\frac{3}{4}$ ". As a result, the screw threads into both pieces, preventing them from drawing tightly together. To avoid this, you must drill a larger shank hole through the first piece to allow the threads to slip freely in the hole. In most circumstances, I still drill the proper-sized clearance and pilot holes, even when using the new-style screws.

TIPS FOR SELECTING AND INSTALLING WOOD SCREWS

1 Select the head style, diameter, length, thread style, material, and finish best suited to the job. To determine correct length, use a screw long enough that two-thirds of its total length threads into the second piece. Use deep-threaded screws if driving screws into soft material, end grain, or particleboard. To speed installation of long screws, choose the double-threaded or "Twinfast" design. If screw heads will be exposed, select the material and/or screw finish that meets requirements for appearance and corrosion resistance.

2 Use enough screws to draw the parts together and provide the necessary support.

3 When joining two pieces together, drill the shank (clearance) hole in the first piece large enough that the screw body (shank and threads) slips freely in the hole. Note: If the

screw threads into any part of this hole, it will not draw the second piece tightly to the first. Exception: When using a thin-shank screw with the proper shank length for the thickness of the first piece.

4 Drill the pilot hole into the second piece so that it aligns precisely with the shank hole in the first piece. Size the pilot hole to match the screw's root diameter and drill it full length so that the screw does not bottom out before it's fully installed.

5 To set flathead screws flush to the surface, countersink the shank hole. Drill the countersink deep

enough so the surface diameter of the hole equals the screw head's diameter.

6 When counterboring screws, drill the counterbore to diameter and depth first, then drill the shank hole. To save time, use a correctly set countersink/pilot drill combination tool and drill all holes in one operation.

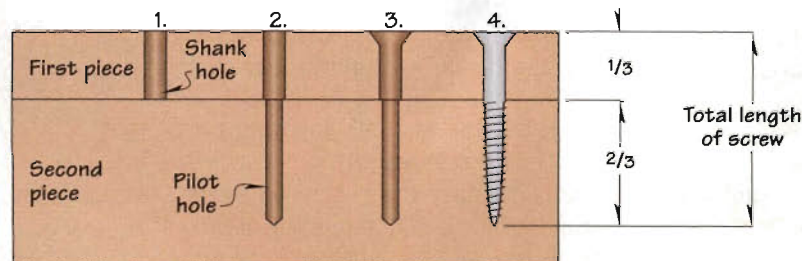
7 Before driving, lubricate screw threads with paraffin, bee's wax, or other lubricant. Do not use soap—it attracts moisture that may corrode the fastener and discolor the wood.

8 Match the type and size of driver bit to the screw.

9 To drive screws with a drill/driver, adjust the clutch to the lowest torque setting that will drive the screws home. Operate the drill at a slow speed for maximum torque and control and to minimize bit wear.

Installing a standard flathead wood screw

1. Drill shank (clearance) hole
2. Drill pilot hole
3. Countersink clearance hole
4. Drive screw



Single Hole Drilling Chart: Thin-Shank Screws

Screw Size	Body or shank dia. (inches)	Thread dia. (inches)	Pilot hole dia. (inches)
4	.095	.116	$\frac{3}{32}$
6	.118	.142	$\frac{1}{8}$
8	.136	.168	$\frac{9}{64}$
10	.157	.194	$\frac{11}{64}$
12	.176	.220	$\frac{3}{16}$
14	.201	.246	$\frac{13}{64}$

*NOTE: Shank length of screw must equal thickness of first piece when attaching parts using single hole method

Standard Wood Screw Drilling Chart

Screw Size	Head Size (inches)	Shank Hole (inches)	Pilot Hole (inches)
0	.119 ($\frac{1}{8}$)	$\frac{1}{16}$	$\frac{3}{64}$
1	.146 ($\frac{9}{32}$)	$\frac{5}{64}$	$\frac{3}{64}$
2	.172 ($\frac{11}{64}$)	$\frac{3}{32}$	$\frac{1}{16}$
3	.199 ($\frac{13}{64}$)	$\frac{7}{64}$	$\frac{1}{16}$
4	.225 ($\frac{15}{64}$)	$\frac{1}{8}$	$\frac{5}{64}$
5	.252 ($\frac{1}{4}$)	$\frac{1}{8}$	$\frac{5}{64}$
6	.279 ($\frac{9}{32}$)	$\frac{9}{64}$	$\frac{3}{32}$
7	.305 ($\frac{5}{16}$)	$\frac{5}{32}$	$\frac{7}{64}$
8	.332 ($\frac{11}{32}$)	$\frac{11}{64}$	$\frac{7}{64}$
9	.358 ($\frac{3}{8}$)	$\frac{3}{16}$	$\frac{1}{8}$
10	.385 ($\frac{25}{32}$)	$\frac{13}{64}$	$\frac{1}{8}$
11	.411 ($\frac{7}{16}$)	$\frac{13}{64}$	$\frac{9}{64}$
12	.438 ($\frac{7}{16}$)	$\frac{7}{32}$	$\frac{9}{64}$
14	.491 ($\frac{1}{2}$)	$\frac{1}{4}$	$\frac{5}{32}$
16	.544 ($\frac{9}{16}$)	$\frac{19}{64}$	$\frac{3}{16}$

A slightly oversized clearance hole also allows for the natural expansion and contraction of the wood.

Where To Buy the New Wood Screws

Many hardware stores and home centers, in addition to most mail-order suppliers, now carry the new

screws. (Again, see Sources.) However, not all wood screws are created equal. You can generally rely on uniformity of diameter and length, but otherwise you won't find any hard-and-fast standards of thread quality, finish, or material strength. I recommend buying from a supplier that sells screws to industry or the trades. This could be a cabinetmaker's supply house or a catalog source. When ordering from an unknown supplier for the first time, buy just a few at first to check the quality. (See the chart *above right* for available sizes and lengths of thin-shank screws.)

Available Sizes and Lengths: Thin-Shank Square- and Combination-Drive Wood Screws

Length (inches)	Screw Sizes				
$\frac{1}{4}$	-	-			
$\frac{3}{8}$	4	-			
$\frac{1}{2}$	4	6			
$\frac{5}{8}$	4	6	8		
$\frac{3}{4}$	4	6	8	10	12
$\frac{7}{8}$		-	8	-	-
1		6	8	10	12
$1\frac{1}{8}$		-	8	-	-
$1\frac{1}{4}$		6	8	10	12
$1\frac{3}{8}$		-	8	-	-
$1\frac{1}{2}$		6	8	10	12
$1\frac{3}{4}$			8	10	-
2			8	10	12
$2\frac{1}{4}$			8	10	-
$2\frac{1}{2}$			8	10	12
$2\frac{3}{4}$			8	10	-
3			8	10	12
$3\frac{1}{2}$			-	10	-
4			8	10	12

screws. (Again, see Sources.) However, not all wood screws are created equal. You can generally rely on uniformity of diameter and length, but otherwise you won't find any hard-and-fast standards of thread quality, finish, or material strength.

Trimming Or Covering The Screws

We normally hide screw heads by counterboring the shank hole and then filling the hole with a wooden plug. You can buy plugs or make your own. In cases where it's not desirable or feasible to use a permanent, glued-in plug, choose one of the other alternatives available (*photo H*).

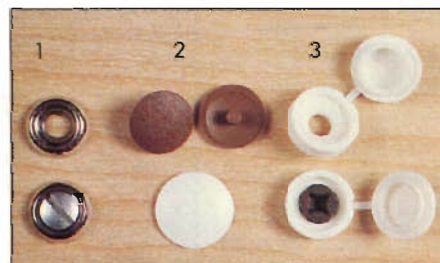


Photo H: Screw trimmings: (1) finishing washer, (2) screw-head caps, and (3) washer with cover.

Continued on page 18

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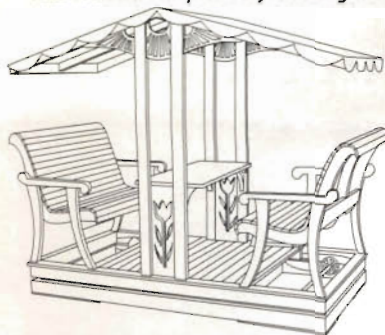
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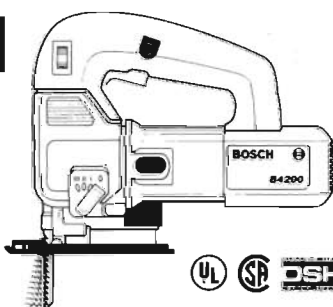


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Continued from page 16

Finishing washers help to dress up exposed flat- or ovalhead screws. They also help distribute the load and keep the screw from sinking too deeply into softwoods or other materials. You can buy these washers in brass, steel, stainless steel, nickel-plated brass or steel, or steel with a dead-black finish. Just match the size of the finishing washer to the head of the screw you are using. You should have no trouble finding them for no. 6, 8, and 10 screws.

Screw-head caps cover flathead screws that are countersunk flush to the surface. These thin plastic domes have a short post that fits either the star of a Phillips-head or the hole in a square-drive screw. The caps come in a variety of colors and wood shades.

I find these useful for covering screws that need to be removed occasionally, such as in knock-down furniture. Just match the size of the cap to the size of the drive bit you use. As with finishing washers, you'll find caps to fit no. 6, 8, and 10 screws.

Washers with covers, sometimes referred to by the trade name Snap Caps, make it easy to both add a finishing washer and conceal the screw head. To install these, simply drive the screw through the plastic washer and into the material, then snap on the plastic cap. The caps are available in two basic sizes and a variety of colors. 

SOURCES

Constantine
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Highland Hardware
800/241-6748

Lee Valley Tools
800/871-8158

Leichtung
800/321-6840

McFeely's
800/443-7937

Trendlines
800/767-9999

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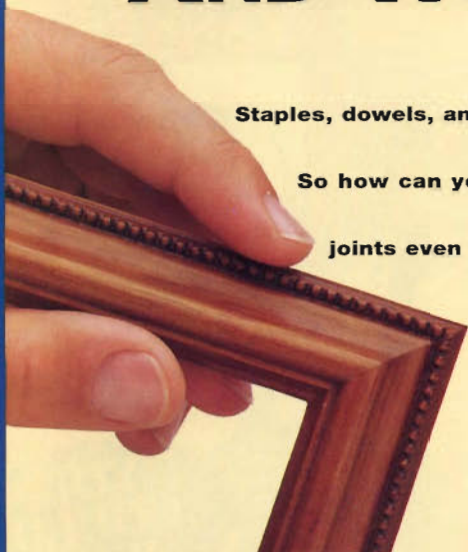
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Learning to love (and work with) Veneers

by Tom Jackson

Editor's Note

In the last issue, we told you about the vacuum-bag veneer press, a relatively new tool for adhering veneer to a substrate. In this article, we'll tell you the rest of the story: how to select, arrange, machine, and glue veneers.



selection of species and figure is nearly unlimited.

Today, we have several tools—vacuum-bag presses and routers, among others—that make veneering easier and faster. To achieve professional results, however, you need to combine modern technology with the age-old skills of selecting the right pieces and arranging them in eye-pleasing patterns. Here's how to do both.

Choosing the Right Veneer

Like solid lumber, veneer can be cut in different ways, and the method used determines the look of the grain. Rotary-cut veneers are peeled from the log, which yields wide, wavy grain patterns. (See *figure 1*.) This produces a less attractive figure than other methods, so we usually

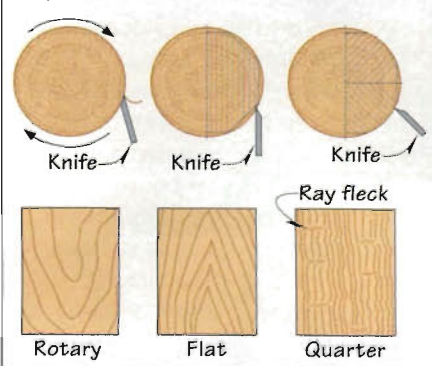
Veneered furniture may suffer from a tarnished reputation among those who don't know much about it. Like any other wood-working operation, however, veneering can be done well or done poorly. Done well, this technique has given the world some of its most beautiful and enduring works of wood.

In the Middle East, archaeologists have uncovered fragments of veneered work that are more than 5,000 years old. In the fifth century B.C., the Greeks further advanced the craft to the point that it was considered a high

art. A great many of the museum pieces we admire today, dating from as far back as the Renaissance, were built using veneers.

Aside from their beauty, perhaps the best reason to use veneers today is economy. The better grades of solid stock, especially exotics and highly figured pieces, will burn holes in your budget fast; even hardwood plywood runs from \$50 to over \$100 for a full sheet. Veneers, on the other hand, cost just a fraction of what you'll pay for solid stock. You buy only what you need, and your

Figure 1



WHAT ABOUT VENEERS WITH BACKINGS?

In recent years, some manufacturers have started applying backings to veneers. These backed products offer a measure of flatness, strength, and flexibility that you won't get with most raw veneers.

Paper is often used as the backing material, but you'll also find cloth and fiber backings, which improve flexibility. A layered foil-and-paper backing, known as SanPly-4, prevents glue from bleeding through to the veneer face and finish from transmitting to the substrate. In addition, you can now buy veneers backed with heat-set glue and pressure-sensitive adhesives (PSA).

Before bonding face veneers to a backing, manufacturers join the edges, so you get large sheets without having to join and tape pieces. The flatness of these sheets also makes it possible to veneer small and medium-sized panels using weighted cauls, thus eliminating the need for a veneer press. Some firms will even custom-match and join diamond or book-matched patterns on backings according to your specifications.

There are tradeoffs, however. The face veneers you'll get on backed products are often less than half the thickness of raw veneers. Some are sliced as thin as $\frac{1}{1600}$ " (compared to $\frac{1}{40}$ " to $\frac{1}{32}$ " for raw veneer), which makes them easy to sand through. Woodworkers also cite another drawback: the large backed sheets tend to restrict creativity. Smaller sheets of raw veneer, some claim, give you more freedom to design different patterns and layouts.

Finally, consider the price. Backed veneers typically cost three to four times as much per square foot as the same species and figure in raw veneer. However, given the improved performance, time savings, and other advantages, backed veneers are worth considering for many applications.

restrict it to construction panels or utility plywoods.

Quarter-cut veneers, like quarter-sawn lumber, offer fairly straight grain lines. With species like oak and sycamore, you'll also get pronounced ray flecks. The straightness of the grain can create a monotonous appearance unless you work the pattern to enhance the design, as with the Stickleys' use of quartersawn white oak in their Craftsman-styled furniture.

Flat-sliced veneers most closely resemble plainsawn lumber. This method reveals the tree's annual rings in longitudinal section—what we commonly call "cathedral" peaks in the grain.

Start Organized, Stay Organized

When you shop for solid lumber, you find it stacked and stored in random fashion. Veneers come packaged in "flitches"—stacks of veneer sheets all cut from the same log and organized in the exact same order as they were cut. In fact, when you open a package, always number the sheets with a lumber crayon. Later on, this will enable you to get the best grain match when edge-joining the different sheets.

After you number the sheets, determine whether they're flat enough to work easily. If your veneer looks too wrinkled to permit joining and taping of the edges—often the case with burls and other highly figured woods—then see "Flattening Wrinkled Veneers" *opposite*.

Matching Patterns and Laying Out Veneers

By arranging the pieces in different configurations, you can create a variety of grain patterns. (See *figure 2*.) *Slip-matched* patterns use a simple side-by-side layout. To *book-match*, you invert every other piece, creating mirror-image grain patterns. For *diamond* and *reverse-diamond* patterns you book-match along one edge and butt on the other. *Radial* layouts consist of pie-shaped pieces.

For many of us, visualizing complex patterns can be difficult, but one or two handheld mirrors can help. To see what a particular piece would look

Figure 2

Veneer layout patterns



Diamond



Radial



Reverse diamond



Slip



Book

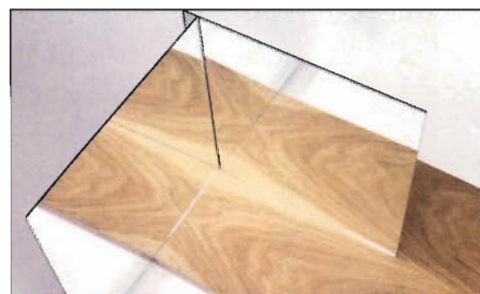


Photo A: Mirrors held perpendicular to the veneer surface enable you to visualize patterns and find the best locations for the edges.

like book-matched, hold the edge of a mirror against the veneer parallel with the grain. To preview a diamond pattern, hold two mirrors at right angles and place them in various locations (*photo A*). For radial layouts, hold two mirrors together at an angle of less than 90° . When you get the desired pattern, mark the veneer along the mirror edges.

When laying out a pattern, avoid butting the edges of pieces that fall more than two sheets apart in the original flitch. If you lay out eight pie-shaped wedges in sequence, for example, the pattern on the last piece, no. 8, will differ considerably from that on wedge no. 1. To avoid this, use the layout sequences shown in *figure 3*.

Choosing a Substrate

For veneer substrates, we prefer to use furniture-grade particleboard or medium-density fiberboard (MDF) wherever possible. These two products have exceptionally flat, smooth faces. You don't have to sand them, plug knots, or search the surface for tiny defects that might show through the veneer. And because they're void-free, you needn't worry about spots on the surface imploding under vacuum pressure.

Another advantage you'll gain with these products is stability. Because they have no grain direction, you won't have to allow for wood movement conflicts when you lay out your veneers. This allows you to make more efficient use of short pieces and offcuts.

When shopping for particleboard, make sure you get furniture- or cabinet-grade rather than the coarser underlayment-grade used in home construction. MDF will be a little harder to find, but most home centers and lumberyards can get it for you as a special order.

For situations where the substrate must support a load across a span (shelves or tabletops, for example), plywood makes the better choice. It also weighs less than particleboard or MDF, which can make a noticeable difference in large projects that have lots of parts. Again, if you decide to use plywood, make sure you get furniture- or cabinet-grade. Lesser grades may have voids in the core.

We recently discovered a hybrid product called Classic Core. It has a three-ply core sandwiched between thin layers of particleboard that are faced with fir veneer (*photo B*). This product offers the strength and low weight of plywood along with the dead-flat surface of particleboard.

Balanced Construction: A Few Rules To Remember

Look at the edge of a piece of plywood, and you'll always find an odd number of layers—three, five, seven, etc. Manufacturers call this balanced construction: a core layer sandwiched between equal numbers of layers with the grain of each layer running perpendicular to that of its contiguous layers. If the layering were not balanced, differences in expansion and contraction rates would cause the panel to bow and twist severely.

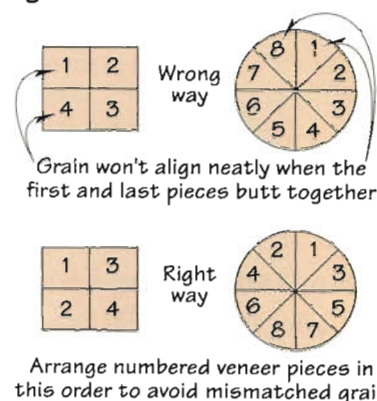
The principle of balanced construction has a couple of implications for veneering. First, always veneer both faces of a substrate and glue the veneers on at the same time. This holds true for any substrate. If you veneer just one face or one face at a time, the water drawn out of the glue will elevate the moisture content on that side of the panel, causing the panel to warp within minutes of removing it from the veneer press or vacuum bag.

This doesn't mean you have to waste your premium veneers on faces that will be hidden from view in the



Photo B: As a veneer substrate, Classic Core plywood combines the strength of plywood with the flatness of particleboard.

Figure 3



assembled project. On "no-show" faces, use a lesser grade of the same species or a less expensive species with the same thickness and similar expansion and contraction character-

FLATTENING WRINKLED VENEERS

To level out the hills and valleys in a sheet of wrinkled veneer, you have to coat it with a flattening agent and weight it for several days between screens and newspapers. You can buy commercial flattening agents (listed in Sources at the end of the article) or make your own using the following formula.

Start by mixing a solution of four parts water, two parts yellow glue, one part denatured alcohol, and one part glycerine. Brush this solution onto both faces of the veneer, and allow it to soak in for a few minutes. Then, stack the veneers in a sandwich of newspaper and fiberglass window screens as shown at *right*. The newspaper acts as

a blotter and the screens prevent the newspaper from sticking to the veneer.

Put a caul or cover board on top of this stack, and press it with a vacuum-veneer bag or weight it with a few bricks. Allow the stack to sit for at least two hours, then change to fresh newspaper. Change the paper at least six times over the course of at least two days to ensure that the veneer dries completely.

This treatment will keep the veneer flat for several months. If you don't use the veneers right away, store them flat under a weighted caul or cover board to maintain their flatness.

Dry and flatten wrinkled veneers between layers of fiberglass screen and newspaper

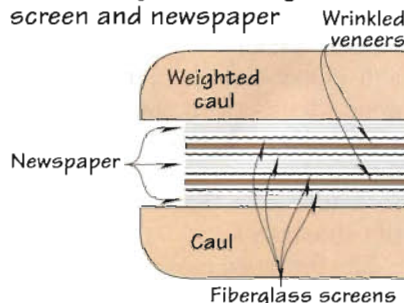
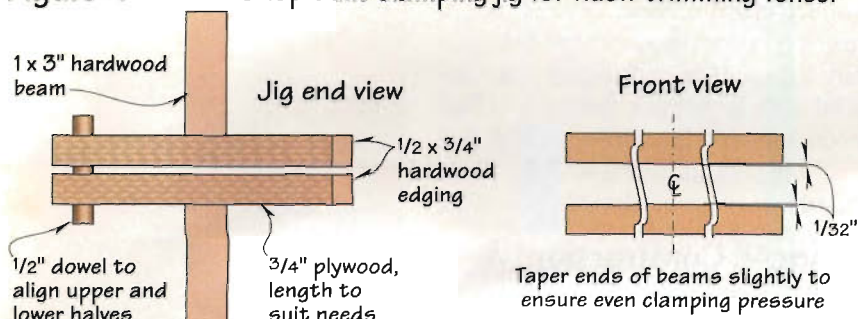


Figure 4 Shop-built clamping jig for flush-trimming veneer



istics. (If in doubt, R. Bruce Hoadley lists the expansion/contraction rates for most species in his book, *Understanding Wood*.)

The second rule of balanced construction: When veneering plywood, apply the veneer so that its grain runs perpendicular to the face grain. This duplicates the crisscross grain orientation of the layers beneath it and keeps the tension in the panel equal. When veneering solid wood, however, align the grain of the veneer parallel to that of the substrate.

Cutting and Jointing Veneers

The traditional techniques for cutting veneers—with a veneer knife or veneer saw—work as well as ever, but today's power tool techniques will do the same work faster and sometimes more accurately.

You can cut small pieces of veneer—up to 18" long or so—individually on a tablesaw or jointer. To crosscut on a tablesaw, sandwich the veneer between two pieces of scrap plywood and feed this assembly through the blade using a sliding table fixture. To joint pieces of this size, hold the veneer against your jointer fence sandwiched between two flat pieces of scrap, and pass the three over the cutter head (*photo C*). Set the infeed table for a light cut (about $\frac{1}{32}$ ").

To cut longer pieces or gang-cut several pieces, build a clamping jig for your router, as shown in *figure 4*. This jig both clamps the veneers and serves as a straight-edged guide for a piloted flush-trim bit (*photo D*).

To prepare the veneers for gang-cutting in the jig, first determine the pattern you want to create (book-matched, diamond, etc.), then mark the cut lines with a pencil. Be sure to

oversize your veneers (as well as the substrate later) about $\frac{1}{4}$ " around the perimeter so you can trim the veneered panel to final dimension. Next, stack the veneers together with the cut lines aligned, then secure the bundle by taping the edges adjacent to those that will be cut. (Note: On veneers, always use a low-tack masking tape such as 3M's Professional Painter's Tape or the blue 3M Low-Mask Masking Tape. A tape with more holding power may pull up slivers of veneer when removed.)

Clamp the veneers in the jig with the cut line about $\frac{1}{16}$ " shy of the front edge of the jig. Make your first pass with a flush-trim router bit, then reposition and reclamp the veneers in the jig, aligning the cut line with the front edge. Rout away the remaining $\frac{1}{16}$ " of material using a "climb cut" as shown in *figure 5*.

Climb-cutting with a router produces super-smooth, fuzz-free edges with virtually no tear-out, but use this technique only to remove the last whisk of material— $\frac{1}{16}$ " or so on veneers, $\frac{1}{32}$ " on solid stock. Note: Before climb-cutting, remove the bulk of the waste with a conventional cut. Trying to remove too much material with a climb cut can cause a dangerous kickback.

Taping the Seams

After you've cut the edges and ends to be joined, lay out the pieces and check for fit. If the joints look good, temporarily tape the pieces together with a few strips of masking tape across the seams on the back face (the face that will be glued to the substrate).

Flip the taped pieces over, and apply veneer tape across the seams on the

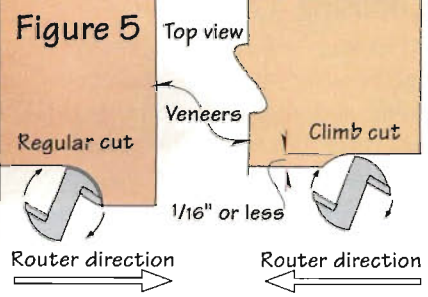


Photo C: Straighten short pieces of veneer on the jointer by sandwiching them between pieces of scrap block.

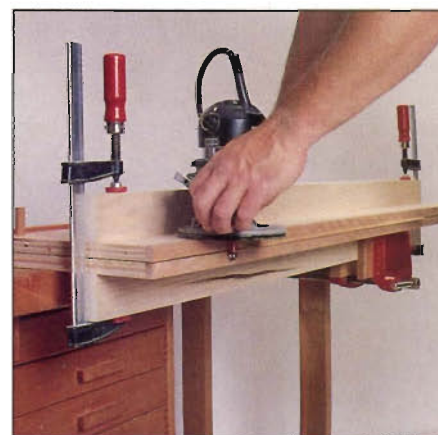


Photo D: As an alternative to jointing, straighten your veneer edges using a shop-built clamping jig, handheld router, and flush-trim bit.

front face to pull the joint tight (*photo E*). Then, apply tape along the full length of the seam. Veneer tape is a special, ultra-thin tape that won't indent the veneer under clamping pressure. It must be moistened slightly prior to application. You can buy a dispenser that does this automatically or just run the tape over a damp sponge. After the veneer tape dries, remove the masking tape from the opposite face.

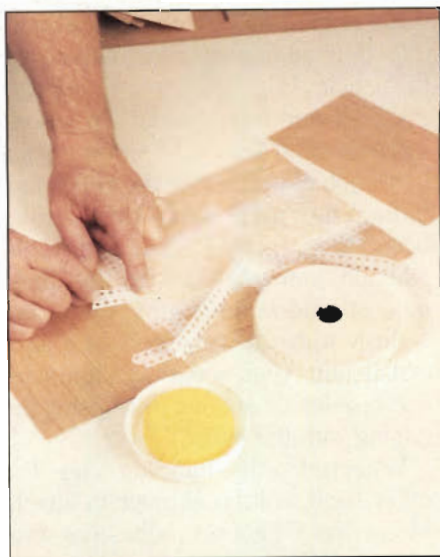


Photo E: Apply moistened veneer tape to the veneer joints prior to gluing. Use this special type to avoid damaging veneer.

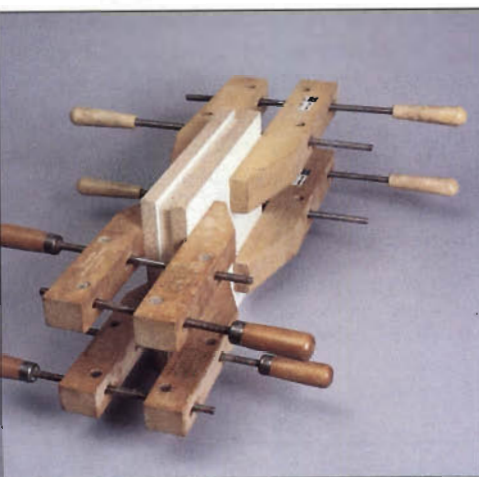


Photo F: Small pieces of veneer can be pressed between cauls using handscrew clamps.



Photo G: For larger sheets of veneer, apply pressure using clamps, cauls, and equally spaced rows of beams. The ends of the beams should be tapered like those on the router jig shown in figure 4.

Choosing Your Glue

The adhesive you select often makes the critical difference in determining the long-term success of a veneered project. The choices include white PVA, yellow aliphatic resin, epoxy, and urea-formaldehyde glues.

Before selecting an adhesive, consider the following five questions:

- Does the project involve a horizontal surface like a tabletop?
- Are you using burls, crotch figures, or other delicate veneers?
- Will the project have multiple veneers such as inlays or crossbanding?
- Are you using an oily wood such as teak or mahogany?
- Is the panel large enough that you'll need more than 5 or 10 minutes of open time before the glue starts to set?

If you answered "yes" to any of these questions, choose a urea-formaldehyde formula. These two-part adhesives have a high bonding strength and a long open time. They also resist creep, which means that they won't let the veneer (or crossbanded veneers) flex or move in response to humidity or temperature changes.

You'll find two types of urea-formaldehyde glues on the market: a powder that mixes with water and a liquid resin that comes with a powdered catalyst. (You can also get a urea-formaldehyde glue with a light colored catalyst to minimize glue lines on lighter woods.) Note: Urea-formaldehyde glue is toxic. Always wear a respirator and gloves when mixing and working with it.

If you answered "no" to all five questions, then you can get by with a white or yellow glue. Either of these will be easier to use and clean up as well as less expensive.

Epoxy will also work on veneer, but it often produces more bleed-through than is desirable. Occasionally, you'll see contact cement cited as a veneer glue, but we don't rec-

ommend it. These adhesives offer a relatively low bonding strength, little creep resistance, and no satisfactory way to repair delaminations.

Gluing and Pressing

Before you mix or apply the glue, prepare two cauls for the panel. (A caul is a smooth, flat surface that protects the face of the veneer during pressing and distributes the pressure evenly. Melamine-faced particleboard and shower-stall paneling both make excellent cauls.) Cut the cauls about 1/4" larger around the perimeter than your panel.

With the cauls cut and the veneer prepared for both faces of the substrate, you're ready to glue up and press. On smaller surfaces, apply white, yellow, or urea-formaldehyde

BUYING AND STORING VENEERS: TIPS FROM OUR CRAFTSMAN

- 1** Some companies will allow you to order a veneer sample and place a reservation on the rest of the flitch. If the sample meets your needs, then you can order the whole flitch or the part of the flitch from which the sample came.
- 2** Call and talk to a salesperson to find out if the firm's figured veneers are steamed and pre-flattened. This will save you some work.
- 3** With small orders, include a copy of your cutting list. The dealer may be able to assemble the order from offcuts and save you a bit of money.
- 4** If you're ordering several species for inlays or borders, make sure all veneer thicknesses are identical.
- 5** Buy about 20 percent more veneer than you need. If you botch one piece, the dealer may not be able to match the damaged piece from the same flitch at a later date.
- 6** Long pieces of veneer are often shipped in rolls. Unroll the package as soon as you get it and keep the veneers stored on a flat shelf under weight.
- 7** If you store your veneers for any length of time, cover the ends with a strip of masking tape to prevent splitting.
- 8** Let the material acclimate to your shop a day or two before working.

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glue with a bristle or foam brush. On larger surfaces, use a foam paint roller and paint tray or roller applicator.

Apply the right amount of adhesive evenly to each surface. Use about the same quantity of glue as you would paint if you were trying to cover the color underneath it in one coat.

Start with the "show" face of your substrate, and spread glue evenly on it. Note: Apply glue to the substrate only—never to the veneer itself. If you put glue on the veneer, it will curl up immediately. Next, position the veneer on the substrate, taped side up, so that you have an even overhang around the edges. Place the caul on top, flip the panel over, and repeat the procedure on the "no-show" face of the substrate.

Place the panel and cauls in a conventional veneer press or a vacuum-bag press. (Photos F and G show two examples of shop-built veneer presses.) With either a manual or vacuum unit, keep in mind that it's more important to exert *even* pressure across the workpiece than it is to apply a lot of pressure.

wood edging or veneered edge-banding. (For additional information, see the article "Edging Plywood" on pages 20-25 of our July/August '96 issue.) Keep in mind that solid wood does a better job of protecting the edges and hiding the nicks and knocks that beset some pieces of furniture. In addition, you can oversize the thickness of solid-wood edging, then sand it flush with the veneered face after installation. (For accurate alignment, use biscuits or splines to register the edging with the panel.)

Veneered edge-banding, on the other hand, will be simpler to attach. Many have heat-set adhesives that allow you to iron them on; a few come with peel-and-stick backings. These commercially made bandings come in a limited selection of woods and figure, but you can, as an alternative, glue on a strip of the same veneer you use on the face. Use clamps and protective cauls to apply pressure. If you choose edge-banding, remember to apply it to the edge before you veneer the two faces. This will minimize the visibility of the band's glue line. 

Lead photograph: Studio Alex

Other photographs: Kevin May

Walnut burl vanity shown in lead photograph designed and built by Prairie Woodworks, Downs, Ill.

Edging Veneered Panels

If you need to cover the substrate edge on a veneered piece, use solid-

SOURCES

Veneers and Supplies. Contact the following for information about the products listed:

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716/655-0206

Raw veneers, rare and exotic veneers, veneer tape, vacuum-veneering kits

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Urea-formaldehyde glue, veneer-flattening solution

Constantine
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Raw veneers, backed veneers, rare and exotic veneers, veneer tape, vacuum-veneering kits, urea-formaldehyde glue

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FROM THE MAKERS OF QUICK-GRIP® BAR CLAMPS

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A Victorian Wall Plaque For the Holidays



We didn't have to look far when we went in search of a festive holiday scrollsaw project. Terry Quiram, brother of staff technical illustrator Dana Quiram, shared with us this Victorian plaque that he had recently completed.

We show the pattern at *right* full-sized, so you simply photocopy it, adhere it to your stock with a spray adhesive, and start scrollsawing.

Terry advises that he used a no. 4 blade for cutting the larger shapes and a no. 1 double-tooth blade for the small details. He drilled start holes in the small areas using a no. 70 (.028") bit secured in a pin vise and then chucked into his drill press. If you have trouble threading the blade through the hole, Terry recommends grinding or filing the top end of the blade to a point.

For the plaque, select whatever stock suits your fancy. Terry scrollsawed the plaque shown in the photo from $\frac{1}{2}$ "-thick cherry and framed it with $\frac{7}{8}$ x $1\frac{1}{2}$ " walnut, which he beveled on the front edge.

The plaque presents several attractive display possibilities. Backing it with a colorful plastic or paper enhances the design whether you hang it on a wall or in a window or display it on an easel.

We went one step further and built a light box for the back and outfitted it with a small light bulb. The back-lighting enables us to attractively display it almost anywhere. 

*Lead photograph: StudioAlex
Project designer and sawyer: Terry Quiram*





Attractive cabinet with pop-out touch

COMPACT DISC STORAGE CABINET



Just In Time For The Holidays



Collect more than three or four CDs, and storage often becomes a problem. To help you get the situation under control, we've put together this simple yet handsome cabinet with something extra. Compact-disc cases placed in the special CD holder pop forward with the lift of a finger for easy retrieval. Best of all, the cabinet goes together quickly, making it the perfect gift for audiophiles on your list, whether their collections be large or small.

Prepare the Cabinet Stock

Step 1. To prepare the cabinet stock, cut a $\frac{3}{4} \times 7 \times 36$ " piece of maple. Then,

joint and rip the piece to $6\frac{3}{4}$ " wide and plane it to $\frac{5}{8}$ " thick.

Step 2. From the prepared maple, miter-cut two sides (A) and a top (B) to dimension. Note: See the Front View drawing to determine which crosscuts to miter. (We laid out and cut the parts in a side-top-side sequence in order to wrap the grain around the cabinet.)

Step 3. From a second piece of $\frac{5}{8}$ "-thick maple, rip and crosscut the base (C). Chamfer the front edge and both ends (but not the back edge) as shown on the Side View drawing.

Step 4. Rout $\frac{1}{4}$ " grooves $\frac{1}{4}$ " deep into the back inside edges of the sides,

top, and base. (For location, see the Exploded View.) Note: Measure the thickness of your plywood back before routing these grooves. If it's significantly undersized, either obtain new stock of more nominal thickness or change the groove width.

Step 5. Position the two CD holders on the inside faces of the sides. (See Source at the end of the article to mail-order the CD holders.) Align them with the front edges of the sides and orient the correct end to the top. Mark and drill pilot holes for the screws that secure the holders to the sides. To make final assembly easier, drive the screws now, then remove.

Assemble the Cabinet, Then Cut the Keys

Step 1. To keep the cabinet sides parallel during glue-up, cut a 6 $\frac{3}{4}$ "-wide scrap block to the same length as the mitered top (inside face).

Step 2. Lay out the sides and top in order with their inside faces down. With the tips of the miters touching, tape the parts together using strips of masking tape running lengthwise across each joint. Next, flip this assembly over, brush glue onto the mitered ends, then fold the assembly into a rectangle. Insert the spacer into

BILL OF MATERIALS

PART	T	W	L	MTL.	QTY.
CABINET	A Sides	$\frac{5}{8}$ "	6 $\frac{3}{4}$ "	13 $\frac{1}{4}$ "	M 2
	B Top	$\frac{5}{8}$ "	6 $\frac{3}{4}$ "	6 $\frac{7}{16}$ "	M 1
	C Base	$\frac{5}{8}$ "	7 $\frac{1}{4}$ "	7 $\frac{1}{4}$ "	M 1
	D Back	$\frac{1}{4}$ "	5 $\frac{5}{8}$ "	13 $\frac{5}{8}$ "	BP 1
	E Keys*	$\frac{1}{8}$ "	1 $\frac{3}{16}$ "	1 $\frac{3}{16}$ "	W 8

*Parts initially cut oversized, then trimmed to final size during construction. Please read instructions before cutting.

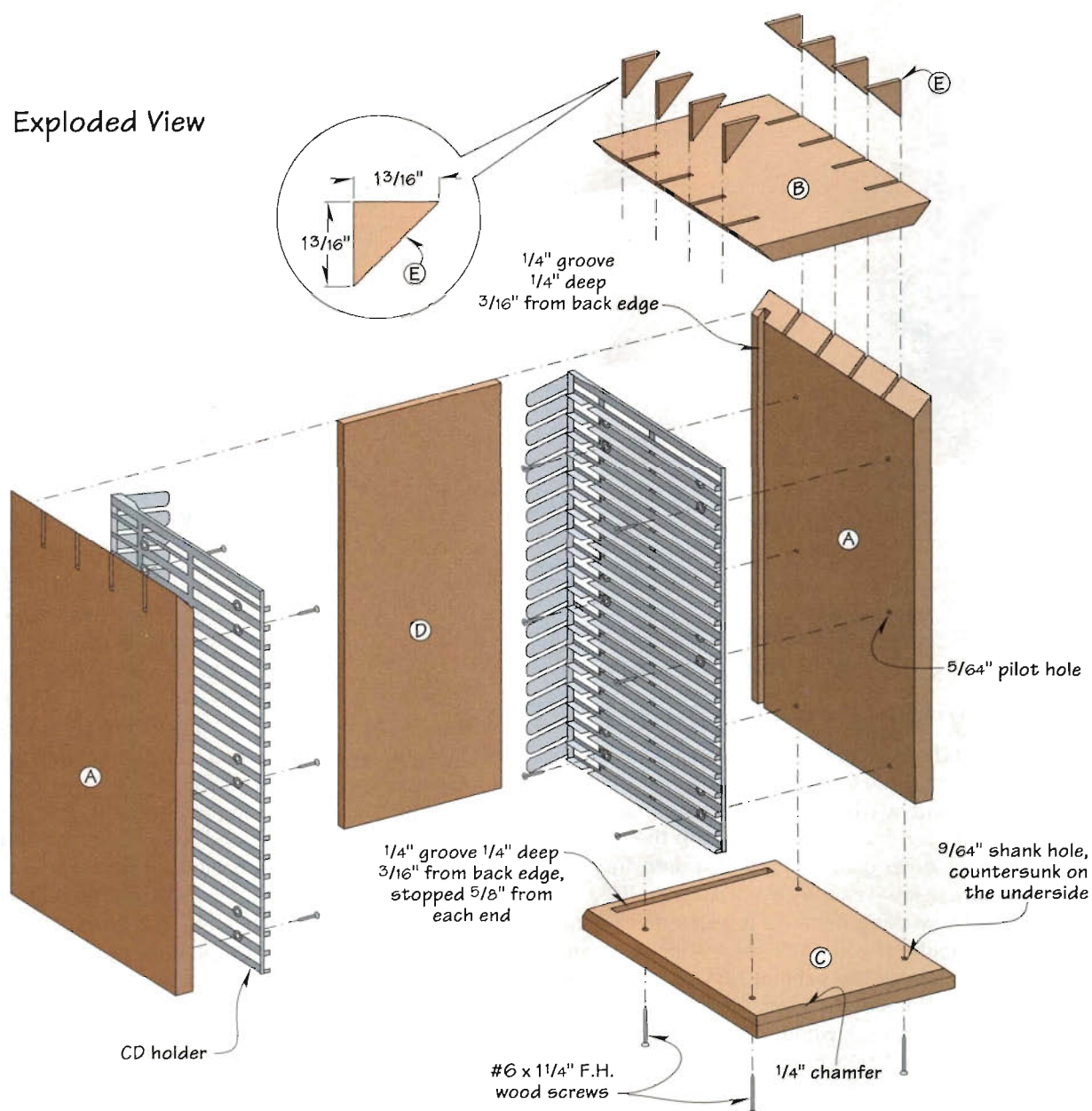
MATERIALS LIST

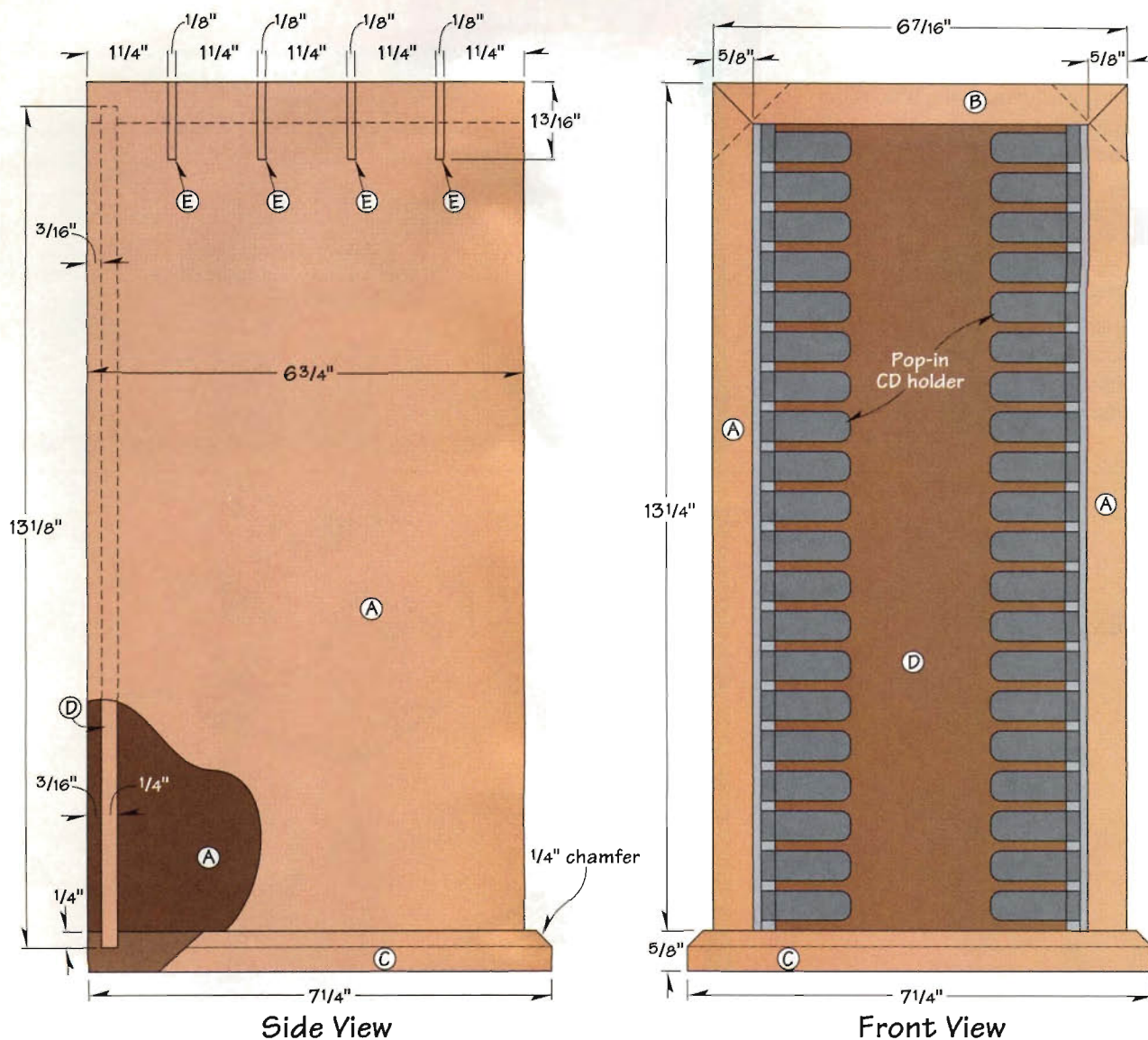
M—maple
BP—birch plywood
W—walnut

SUPPLIES

Four #6x1 $\frac{1}{4}$ " flathead wood screws, finish. (See Source at end of article for additional supplies.)

Exploded View





PRO TIP

Why We Use CA Glue For Keys

We wanted the keys to fit the slots as snugly as possible. Yellow or white glues can cause keys to swell a few thousandths of an inch almost immediately, which may be just enough to destroy the tight tolerances needed for this joint and turn the glue-up into a disaster.

Rather than drive glue-swollen keys into fragile mitered corners, we prefer to use low-viscosity cyanoacrylate (CA) glue. This adhesive doesn't cause swelling because it wicks quickly into a dry joint and then cures rapidly. If you don't see evidence of wicking after applying from the top, lay the cabinet horizontally and run a bead of CA glue along the sides of the keys.

Note: If gluing a dark wood, don't use a CA accelerator. It sometimes leaves white flecks or spots that show on darker stock.

the open end, and wrap tape around that end to keep the assembly square and the spacer in place. Check the assembly for square, adjust if necessary, and allow the glue to dry.

Step 3. Cut the key kerfs into the top corners of the assembled cabinet as detailed on the Exploded View and Side View drawings. (We used a slotting jig on our tablesaw and a 1/8" flat-ground rip blade.) For information on building a slotting jig, see *page 51* in the March/April '96 issue of *Woodworker's Journal*.

Step 4. To make the keys (E), rip a 12" length of walnut to 1 1/2" wide. Plane the piece until it slides into the kerfs with just a little friction. Next, crosscut four 1 1/2" squares from the

walnut strip, then bandsaw these squares in half diagonally to make eight $1\frac{1}{2} \times 1\frac{1}{2} \times 2\frac{1}{8}$ " triangles.

Step 5. Tap a key into each slot. Next, run a small bead of low-viscosity cyanoacrylate (CA) glue along one edge of each key and let the adhesive wick into the joints. (See the Pro Tip *below opposite*.)

Step 6. Trim and sand the keys flush with the top and sides.

Fit the Back, Apply Finish, and Assemble

Step 1. With the spacer still in place, position the side and top assembly on the base, centering it from side to side and aligning the back edges flush. Clamp this assembly, then drill and countersink four shank and pilot holes through the base and into the sides.

Step 2. Measure the back opening (including the grooves), then cut the back (F) from $\frac{1}{4}$ " plywood, sizing it $\frac{1}{16}$ " smaller than the length and width of the opening. (Because both sides of the back will show, we used birch plywood with two good faces.)

Step 3. Remove the clamps, spacer, and base. Finish-sand all pieces to 220-grit, then remove all sanding dust.

Step 4. Apply the finish of your choice to all surfaces. (We sprayed on one coat of sanding sealer and two coats of satin lacquer, sanding with 320-grit after each coat had dried.)

Step 5. Attach the CD holders to the inside walls using the screws provided. Insert the back into the grooves in the sides and top, then screw the base to the sides using #6x $\frac{1}{4}$ " flat-head wood screws. 

Project design: Dick Coers

Photograph: Kevin May

Produced by: Tom Jackson

SOURCE

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Great Solutions For A Long Gift List

Tile Trivets

by Leon A. Frechette



I find something uniquely pleasurable about creating things with my own hands and following a project through to completion. Designing and constructing simple kitchen trivets like the ones shown below can yield a surprising amount of satisfaction. The great variety of unique tiles available these days allow us to express our individual tastes and create one-of-a-kind designs. Stop and visit a tile store and pick up a few interesting samples.

You'll also find trivet-making a creative way to use up some of those cutoffs and scrap materials that clutter your shop. If you've got a holiday gift list as long as your arm, trivets also lend themselves to mass production. I originally got started making them because my wife needed open-house and Christmas gifts. Once I got rolling, I discovered they were simple to build, easy on the check-book, and handy for filling down time during any part of a shop day. Feeling creative?

You can produce an unlimited variety of trivets in different sizes, shapes, and colors. Note how the grout color is used to complement the tiles and frames.





Photo A: Test-matching different types of woods and finishes with the tile can help you better visualize the finished product before you build it.

Before You Start

Simple though these trivets might appear, I've found that it requires a bit of planning to achieve a really nice finished product that will harmonize with a home's decor. As you start designing, consider where the trivet will likely be used and what color scheme prevails in that area.

Select the type of tile you want to use and decide whether a natural, stained, or painted finish will complement it best. If natural, choose a wood of appropriate color and grain. If you opt for staining or painting, select a product that goes with the tile.

Once you've settled these questions, select a grout color that complements both the tile and frame. Finally, you need to figure out overall dimensions that make sense for the kitchen your trivet will end up in. Consider these various design elements side by side so you get a better feel for how the finished product will look (*photo A*).

To construct the tile trivets, you'll need the materials and supplies listed in the Materials box *above right*.

If you've gathered the necessary materials and tools, let's get started. But first, one more design element:

how wide do you want to make your frame? The trivets shown *opposite* have a finished frame profile of $\frac{5}{8} \times \frac{3}{4}$ ". You can go with any width you want, but I've found that a $\frac{5}{8}$ " thickness best accommodates most of the tiles being sold these days.

Cut and Assemble Your Frame

Step 1. Rough-cut your framing stock to width and length plus $\frac{1}{16}$ ". Next, plane each piece to a uniform $\frac{5}{8}$ " thickness and to the width you've chosen (*photo B*).

Step 2. Using your table-mounted router and a fence, rout a $\frac{5}{16}$ " rabbet along one edge of each piece of frame stock (*photo C*). (This will become the inside back edge of the frame.) Use the dimensions shown in *figure 1* to set the router. Note: I cut the rabbet just shy of $\frac{5}{16}$ " deep so that when I add the $\frac{1}{4}$ " tempered hardboard back and glue, the back will recess slightly from the frame. You don't want the back to fit flush with the back of the frame.

Step 3. Using a $\frac{1}{4}$ " round-over bit and your table-mounted router, rout

Materials You'll Need

- ◆ $\frac{1}{4}$ " tempered hardboard
- ◆ Wood for the frames (If they're to be stained, use a hardwood; if they're to be painted, use a closed-pore wood such as pine, birch, or alder.)
- ◆ Yellow wood glue
- ◆ Stain, clear finish, or paint
- ◆ 220-grit sandpaper and #0000 steel wool
- ◆ Tile: quarry, mosaic, or decorative (available in shiny, matte, glazed, or unglazed surface finishes)
- ◆ Premixed tile grout
- ◆ Clear silicone caulk
- ◆ $\frac{1}{2}$ "-diameter adhesive cork pads
- ◆ 4" paper painting tape (adhesive)
- ◆ Sandable wood filler
- ◆ 1" finish nails (3d)

along the outside front edge of your frame stock. On the opposite (inside front) edge, rout a $\frac{1}{8}$ " round-over where shown in *figure 1*.

Step 4. Measure the tile, then crosscut the frame pieces to tile width and length plus $\frac{1}{4}$ ". Since you'll miter-cut these pieces at 45° , mark the cut

Figure 1 Frame cross section

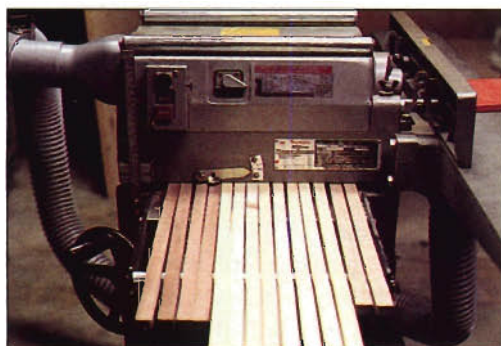
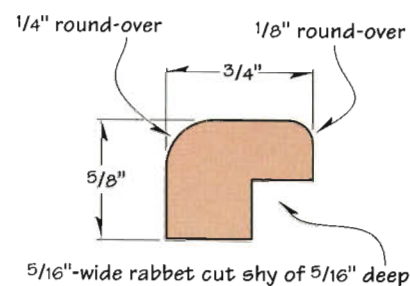


Photo B: Plane the frame stock to final thickness and width. Be careful not to confuse the face with the edge (thickness with width).

Photo C: Spring-loaded rollers on the author's router table safely hold the frame stock and help prevent the workpieces from kicking back. When rabbeting your frame stock, use push blocks and keep your fingers in sight at all times.

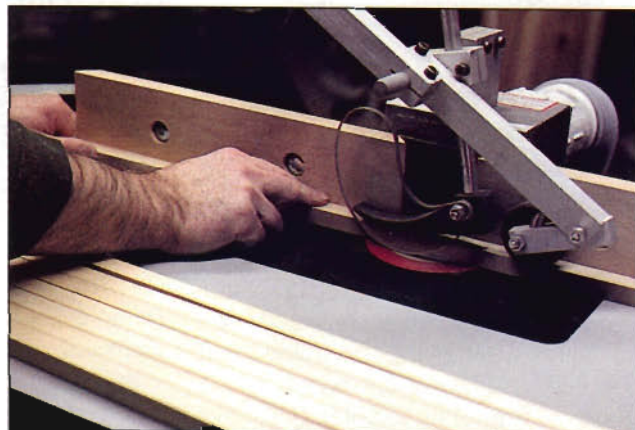




Photo D: To prevent tear-out when cutting the frame miters, the author places the inside edges of the frame pieces against the fence with the front face up.

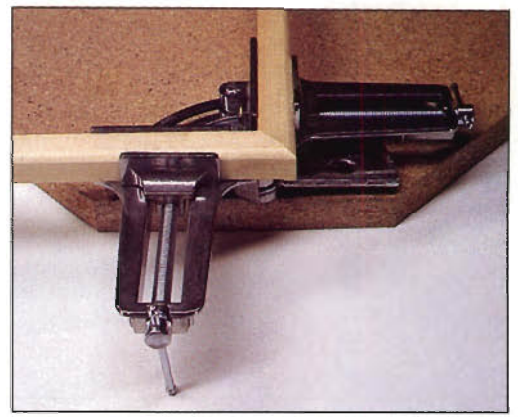


Photo E: To assemble and glue the frame, either use adjustable corner clamps or build a jig.

lines on the inside edge of each piece. Note: The extra $\frac{1}{4}$ " of length allows $\frac{1}{8}$ " of clearance on all sides of the tile for grout. If you want a wider grout channel, lengthen the frame parts slightly, but I recommend a maximum width of $\frac{3}{16}$ ".

Step 5. Miter-cut the frame pieces to length. (I use a power miter saw fitted with a 60-tooth carbide-tipped blade.) To prevent chipping and tear-out on the front face of the frame, place the frame stock with its inside face against the fence and its front face up (*photo D*). Note: Whichever tool you use to miter the pieces, use a stopblock to ensure uniform lengths.)

Step 6. Dry-assemble the frame and test-fit the tile in it. The narrow pieces can be difficult to glue, hold together, and nail, so use corner clamps (*photo E*) or build a jig to hold the pieces together.

Step 7. Working one corner at a time, glue, assemble, clamp, and nail the frame together. If you are hand-nailing, first snip off the head of a 1" (3d) finish nail, chuck it into your hand drill, and drill a pilot hole at each corner. Then, drive one nail to reinforce the joint; or, use an air nailer and shoot two #18x1" brads per corner (*photo F*). Note: Use glue sparingly to avoid squeeze-out. Keep a damp cloth or sponge handy to wipe off any excess glue immediately. Pat the frame dry with a white paper towel.

Step 8. Allow the glue to set for five minutes before removing the frame from the clamp. After you've secured all four corners, lay the frame front face down. Place a flat board (larger than the frame) on top of it. Position a

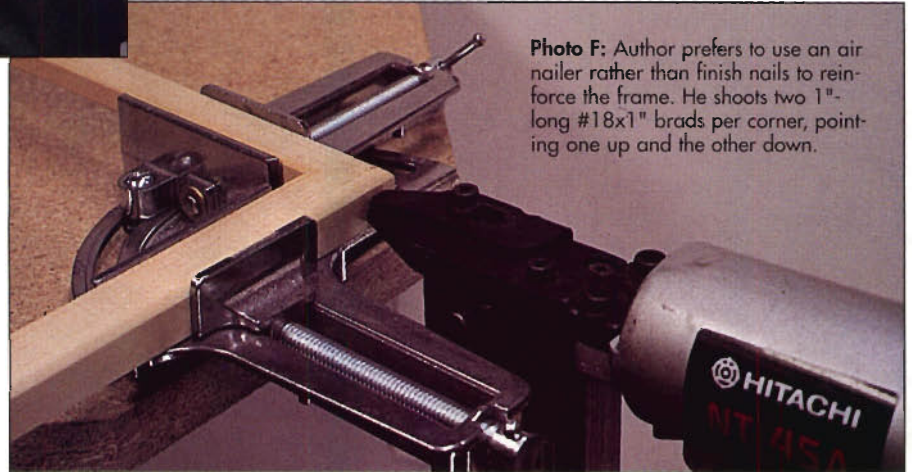


Photo F: Author prefers to use an air nailer rather than finish nails to reinforce the frame. He shoots two 1"-long #18x1" brads per corner, pointing one up and the other down.

weight on the board (a gallon can of paint works well), and allow the glue to set for an additional hour.

Step 9. To cut the bottom, turn the frame front face down. Measure the rabbeted opening, then cut a piece of $\frac{1}{4}$ " tempered hardboard to fit it snugly. Apply wood glue to the inside corner of the rabbet and install the hardboard with its textured face down (toward the front of the frame, as shown in *photo G*). Place a weight on the hardboard (not on the frame) and press it for about an hour.

Next, Finish the Frame

Step 1. Set the nails, and fill the holes with sandable wood filler. Note: If you plan to paint the frame, use light-colored birch or fir filler, as darker fillers may show up through the paint. For a natural look, match the filler to the type of wood you're using. Since you've planed the parts smooth already, finish-sand the frame using a sanding block and 220-grit sandpaper.

Step 2. Apply the finish you've chosen. For painted trivets, use a quality

latex, applying three coats and sanding between coats with 220-grit white sandpaper. (On the stained frames, I use Minwax's Woodsheen, a rubbing oil stain and finish, and Pastels wood stain.) Allow eight hours for stain to dry and several days for paint. Then, apply three coats of clear finish to protect the frames from scratches, stains, and water marks. (I use Polycrylic satin from Minwax, which cleans up with water and has an inoffensive odor.) Sand each coat after it dries, then remove the sanding dust. Hand-rub the final coat with #0000 steel wool, rubbing with the grain.

Note: Before applying a clear finish over paint, test for compatibility on a scrap piece. I haven't encountered any problems with Polycrylic, provided I sanded the painted surface first, then applied very thin coats of the finish, allowing each coat to dry for at least two hours. (A thick coat causes the finish to separate, creating a "tree bark" appearance.) To determine if the finish is dry enough, test-sand it using 220-grit white sandpaper. If a white powder appears, the finish is dry and ready for the next coat.

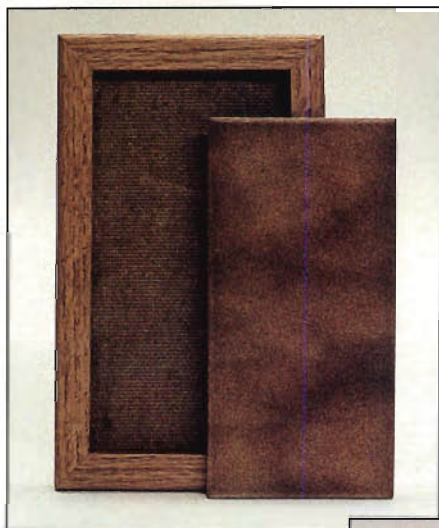


Photo G: When installing the 1/4" tempered hardboard back in the frame, insert it with its textured face forward.

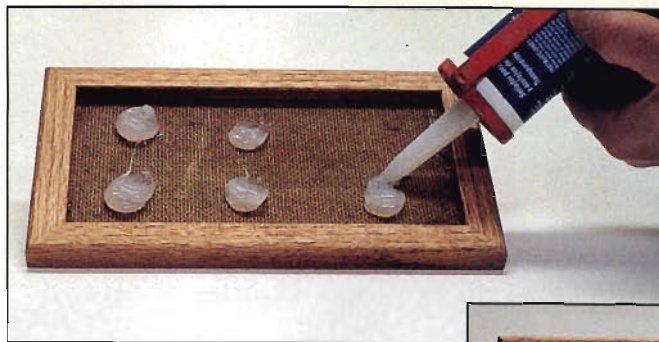


Photo H: Apply six or eight dots of the silicone caulk to the trivet frame bottom, keeping the adhesive away from the edges. Use more on larger trivets.

Photo I: Carefully place the tile squarely inside the frame, keeping the margins uniform along the sides.



Photo J: Using a rubber float to grout the tile simplifies this phase of the project and ensures good results.

Now, Install the Tile

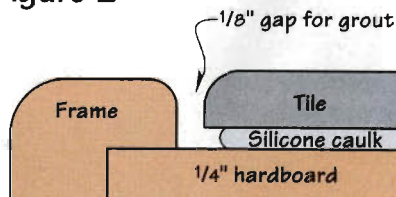
Take care to install the tile correctly. Note that tiles come in different thicknesses—the measurements I gave previously apply to most tiles, but you may encounter a thinner tile. If you do, don't panic. Since you'll adhere the tile using a transparent silicone caulk, simply adjust the thickness of the caulk to level the tile's edge with the frame face.

Step 1. Apply six to eight dots of silicone caulk to the trivet bottom (*photo H*). Note: Keep the caulk at least 1" away from the edges so that the silicone won't ooze out and fill in the grout channel when you press the tile into place.

Step 2. Insert the tile, centering and squaring it to the frame. Apply just enough downward pressure to align the tile's face with the frame face. (See *figure 2*.) Now, set the trivet aside, and allow the silicone to cure for 24 hours.

Step 3. To grout the tile, first apply paper painting tape right up to the frame's inside edge to protect the finish. Note: The grout color makes a noticeable difference in the trivet's final appearance, so choose a color that harmonizes with both the tile and the frame. (I use a premixed grout that includes special additives to protect its finish.) Force the grout

Figure 2



into all areas between the tile and frame, filling it completely and removing all air pockets (*photo J*). Then, wet an index finger and run it over the entire grout channel to create a uniform finished line.) Carefully wipe away any excess with a damp sponge, then remove the painting tape and allow the grout to dry. Now, buff the surface of the tile and frame with a dry white cotton cloth.

Step 4. After buffing the trivet, turn it front face down. Check the frame and hardboard back for any paint or stain marks. Remove them with your sanding block and 220-grit sandpaper. Blow off the dust with compressed air, or wipe it with a cloth.

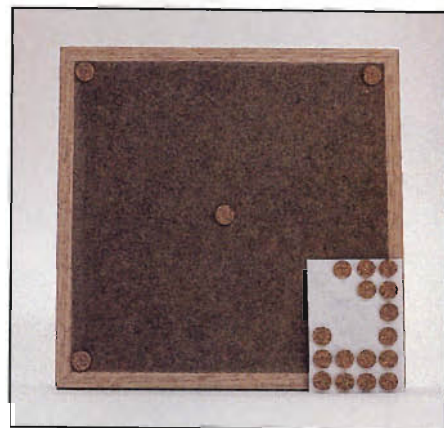
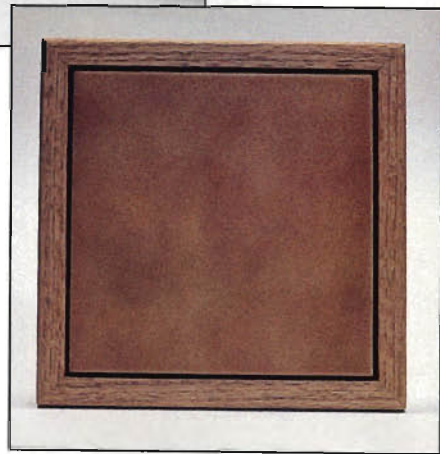


Photo K: Apply 1/2" adhesive cork pads in the center and corners of the trivet bottom. Author prefers cork pads to felt.

Step 5. Adhere 1/2"-diameter adhesive cork pads, one in each corner of the back (not the frame) and one in the center (*photo K*). Don't use felt pads; they compress under weight and also absorb moisture. 

Leon Frechette has more than 20 years of experience in construction, remodeling, and related woodworking fields. His fifth book, Accessible Housing (McGraw-Hill, Inc.), was released last spring.

Project design, photographs: By the author

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Just In Time For The Holidays

Before You Start

We planned to paint our high chair, so we chose to build it out of poplar. If you wish to stain or clear-finish your chair, we suggest making it out of a fine-quality hardwood such as cherry, maple, oak, or walnut.

First, Make the Legs

Step 1. To make the back legs (A), rip and crosscut two 1 $\frac{1}{2}$ x 23" pieces of stock. Face-joint and plane them to $\frac{3}{4}$ " thick. Next, lay out a centerpoint (11 $\frac{1}{2}$ " from the ends) and 1 $\frac{1}{4}$ " in from one edge. Using clamps and a flexible straightedge, lay out the backside curve as shown in *photo A*. Move the clamps and flexible straightedge forward $\frac{9}{16}$ " and strike the second curved line parallel to the first.

Step 2. Lay out hole centerpoints for the arm tenon and the front-to-rear rung on the front edge of both pieces using the dimensions shown in *figure 1*. Next, set a fence on your drill press, square it to the table, clamp one of the workpieces to it, and drill the holes (*photo B*). Drill the second workpiece.

Step 3. Using double-faced tape, adhere the two workpieces face to face. Bandsaw the legs to shape, sawing just wide of the lines. Next, using a stationary disc sander and a large-diameter oscillating spindle sander, sand to the lines. Separate the two

legs, and mark the front and inside faces on each.

Step 4. Using dimensions shown on the Front View drawing, lay out and then drill the $\frac{1}{4}$ " holes $\frac{1}{4}$ " deep into the inside face of both rear legs for the upper and lower cross rungs.

Step 5. Lay out and cut a mortise for the back plate into the inside face of both rear legs parallel with the edges where dimensioned on the Exploded View and Front View drawings. Note: We used a spindle mortiser to cut the mortises. As an alternative, make the template dimensioned in *figure 2* and use it and a handheld router fitted with a $\frac{3}{8}$ "-o.d. guide bushing and $\frac{1}{4}$ " straight bit to cut the mortises.

Step 6. From $\frac{1}{4}$ "-thick stock, rip a 1 $\frac{3}{4}$ x 12" piece for the back plate (B). Fit your table-mounted router with a $\frac{1}{8}$ " round-over bit, and rout the edges using a fence. Test-fit the plate in the mortises and adjust if necessary. Then, crosscut the plate to 6 $\frac{1}{4}$ " final length.

BILL OF MATERIALS

CHAIR

PART	T	W	L	MTL.	QTY.
A Legs-back*	$\frac{9}{16}$ "	$\frac{3}{4}$ "	23"	P	2
B Back plate*	$\frac{1}{4}$ "	1 $\frac{3}{4}$ "	6 $\frac{1}{4}$ "	P	1
C Legs-front*	$\frac{9}{16}$ "	$\frac{9}{16}$ "	12 $\frac{7}{8}$ "	P	2
D Arms*	$\frac{1}{2}$ "	$\frac{1}{2}$ "	7 $\frac{1}{8}$ "	P	2
E Seat	$\frac{3}{4}$ "	7 $\frac{1}{2}$ "	7 $\frac{3}{4}$ "	P	1

TRAY

F Sides*	$\frac{5}{16}$ "	$\frac{5}{8}$ "	7 $\frac{1}{2}$ "	P	2
G Front*	$\frac{5}{16}$ "	$\frac{5}{8}$ "	8 $\frac{1}{4}$ "	P	1
H Bottom*	$\frac{1}{8}$ "	2 $\frac{1}{4}$ "	8 $\frac{1}{4}$ "	P	1

*Parts cut to final size during construction. Please read all instructions before cutting.

MATERIAL LIST

P—poplar

SUPPLIES

Two $\frac{3}{8}$ " screw-hole buttons; $\frac{1}{4}$ " dowel stock; #6x1", #8x1 $\frac{1}{4}$ " flathead wood screws; paint or finish.



Photo A: Use a flexible straightedge to lay out the curved back legs.



Photo B: After laying out the curved back legs, drill holes in the blanks before bandsawing legs to shape.

Figure 1

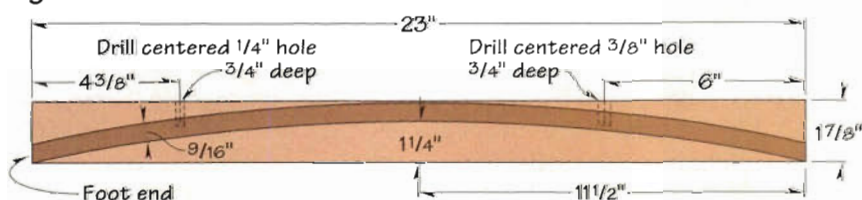
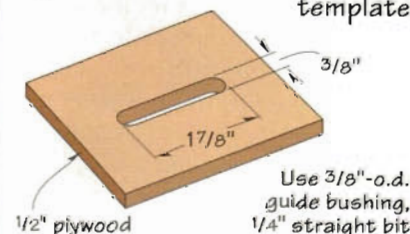


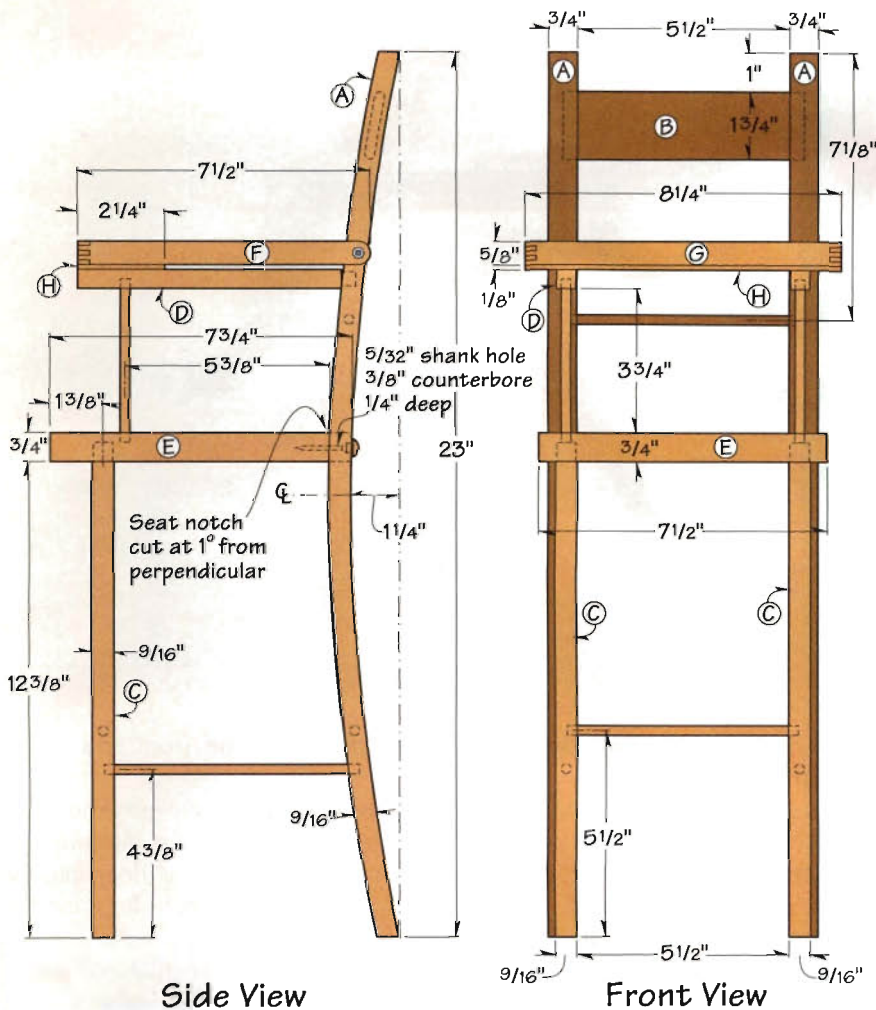
Figure 2

Mortise-routing template



PRO TIP

When buying $\frac{1}{4}$ " (or any size) dowels, drill a $\frac{1}{4}$ " hole (or appropriate size) through a piece of scrap and take it with you to the store. Test-fit the dowels in the hole, and reject any that are undersized or badly out-of-round.



Step 7. Rip and crosscut two $\frac{9}{16} \times \frac{9}{16} \times 13\frac{1}{2}$ " pieces for the front legs (C) and two $\frac{1}{2} \times \frac{1}{2} \times 12$ " pieces for the arms (D).

Step 8. Turn $\frac{1}{2} \times \frac{1}{2}$ " tenons on one end of each front leg and a $\frac{3}{8} \times \frac{3}{8}$ " tenon on one end of each arm. (We used a caliper to match each tenon diameter to the diameter of the bit used to drill the holes. We cut the shoulders and tenons with a skew.) Then, trim the parts to final length (cutting the unturned ends) and lightly chamfer the tenons with sandpaper to ease assembly.

Note: If you don't have a lathe, we suggest whittling the tenons and using a steel sizing plate to gauge them. To do this, drill a $\frac{3}{8}$ "- and a $\frac{1}{2}$ "-diameter hole through a steel plate, then tap the whittled tenons into their respective holes. The sharp edges of the steel will scrape off the high spots.

Next, Form the Chair Seat

Step 1. From $\frac{3}{4}$ " stock, cut a $7\frac{1}{2} \times 7\frac{3}{4}$ " blank for the seat (E). Using dimensions shown in figure 3, lay out the two back corner notches, the front corner radii, and the centerpoints for the $\frac{1}{2}$ " holes in the underside.

Step 2. Cut the notches in the seat for the back legs. (We cut $\frac{5}{8}$ "-deep kerfs in the seat's back edge 1" from each end with our bandsaw and rip fence. Next, we set the miter gauge on our tablesaw at 1° from perpendicular to the saw blade, placed the seat blank on edge against it, and cut to the bandsaw kerf to finish forming the notch (figure 4). Note: To finish cutting the notch on the opposite side, you must flip the workpiece and reset the miter gauge at 1° from perpendicular in the opposite direction.

Step 3. Bandsaw the 1 1/4" front corner radii, cutting just outside the line. Then, sand to the line.

Step 4. Drill the two $\frac{1}{2}$ " holes $1\frac{7}{32}$ " deep where marked in the underside of the seat.

Dry-Assemble the Chair And Position the Arms

Step 1. From $\frac{1}{4}$ " dowel stock, cut the seven rungs to the lengths shown on the Exploded View. (See the Pro Tip above for advice on buying dowels.)

Step 2. Lay out and drill the $\frac{1}{4}$ " holes $\frac{1}{4}$ " deep in the undersides of the arms and top face of the seat for the arm supports. To do this, dry-assemble and temporarily clamp the four legs, seat, and arms. Next, level the seat by standing the assembly on a bench and measuring from the work surface to the seat front and back. Using the technique shown in figure 5, align the arms parallel with the seat, space in $5\frac{3}{8}$ " from the back legs, and mark the hole centerpoints on the top face of the seat and the underside of each arm.

Step 3. With the chair still assembled, mark the area on the back legs where the seat joins them. Next, disassemble the chair. Using a $\frac{1}{8}$ " round-over bit, rout all edges on the arms, front legs, and the front and side edges of the seat. Round over the edges of the back legs except in the areas where they join the seat. Finish-sand all parts to 180-grit if painting, 220-grit if applying a stain or oil finish.

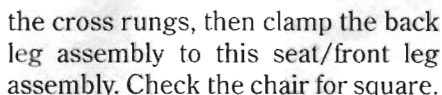
Step 4. Glue, assemble, and clamp the back legs, back plate, and the two cross rungs. (See the Pro Tip above opposite. We used the seat notches to correctly space the legs, then checked the assembly for square.)

Step 5. Glue and assemble the front legs and cross rung. Note: Insert

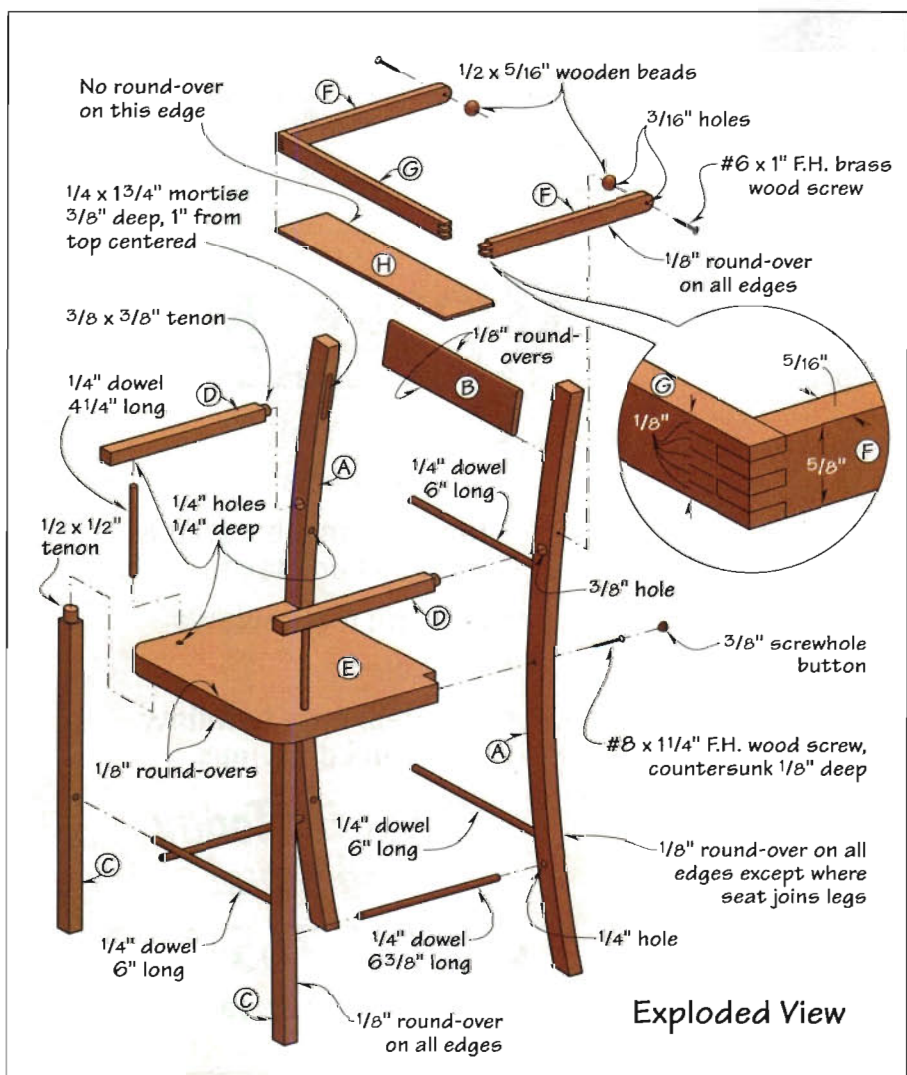
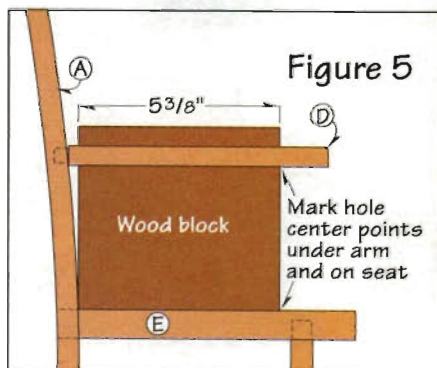
To apply and spread glue inside the 1/4" holes, first squeeze a drop or two of the glue in the hole, then insert a 3/32"-square scrap piece into the hole and spread the glue to all surfaces. Don't overfill the hole—too much glue will keep the dowels from bottoming in the holes.

the cross rung into the upper inside-face holes, orienting the legs so that the lower holes face to the rear. (We temporarily inserted the leg tenons into the seat holes to space the legs and keep them parallel.)

Step 6. Glue the front legs and arm supports (dowels) to the seat, the arms to the supports, and the side dowels to the front legs. While the glue is still wet, glue and insert



Step 7. To screw the seat to the back legs, first drill a centered $\frac{3}{8}$ " counterbore $\frac{1}{4}$ " deep into the back legs where shown on the Exploded View. Next, drill shank holes through the legs and pilot holes into the seat to accept #8x1 $\frac{1}{4}$ " flathead wood screws. Drive the screws to secure the legs.



Now, Make the Tray

Step 1. Plane a 2½x12" piece of stock to ⅝" thick. From it, rip three ⅝"-wide pieces. Crosscut two pieces to 7½" long for the tray sides (F) and one piece to 8¼" long for the tray front (G).

Step 2. Cut box joints on one end of both tray sides as dimensioned on the Exploded View detail. Next, cut mating box joints on both ends of the tray front. (We cut the box joints on our tablesaw using a 1/4"-thick square-ground saw blade and a box-joint jig. See *page 21* of the Sept./Oct. '96 *Woodworker's Journal* for details on this technique. We also used a square wood block to help hold the small, narrow pieces perfectly vertical while cutting the kerfs.)

Step 3. Radius the ends of the tray sides as shown on the Exploded View. (We sanded them to shape on our stationary disc sander.)

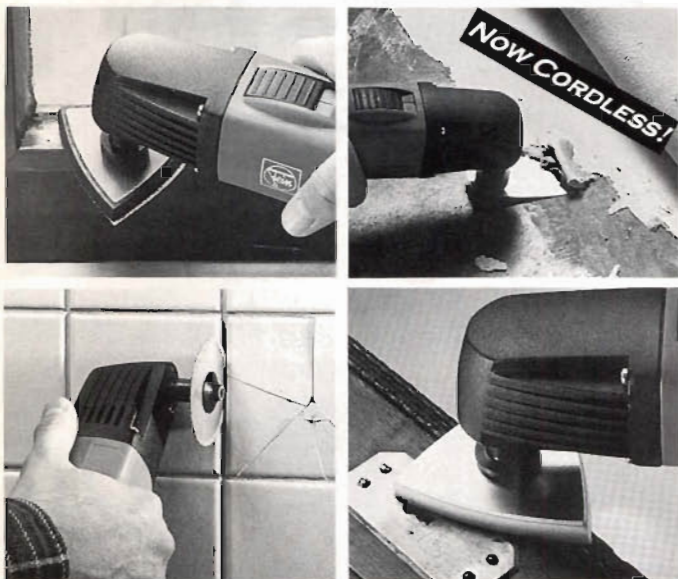
Step 4. Glue, assemble, and clamp the three tray parts. Use a spacer to hold the arms parallel while clamping. Now, square the tray.

Step 5. To make the tray bottom (H), plane a 2½x12" piece of stock to

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$\frac{1}{8}$ " thick. Rip and crosscut the piece to final size, then glue and clamp it to the underside of the tray assembly. After the glue dries, round over all edges of the tray except along the inside edge of the bottom using a $\frac{1}{8}$ " round-over bit.

Step 6. Make two $\frac{1}{2}$ "-diameter, $\frac{5}{16}$ "-thick beads for arm spacers. (We turned ours on the lathe. You can cut them from dowel stock or buy commercially made beads.) Drill $\frac{3}{16}$ " holes through the center of each bead and at the radius centerpoint on the ends of the tray sides.

Step 7. Clamp the tray in position on the chair with the tray sides parallel to the chair arms. Using the existing holes in the tray sides as your guide, drill pilot holes into the outside edges of the back legs. Temporarily drive #6x1" flathead brass screws.

Step 8. Remove the tray from the chair, then finish-sand all parts. Glue $\frac{3}{8}$ " screw-hole buttons into the two counterbored holes in the back legs.

Step 9. Apply a non-toxic finish of your choice. Then, reattach the tray to the chair. 

Photographs: StudioAlex

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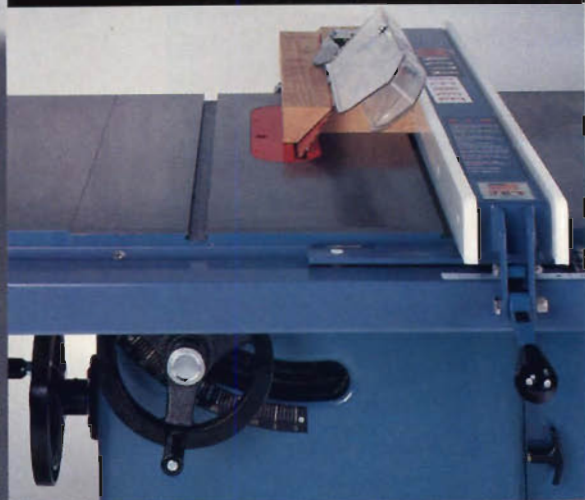
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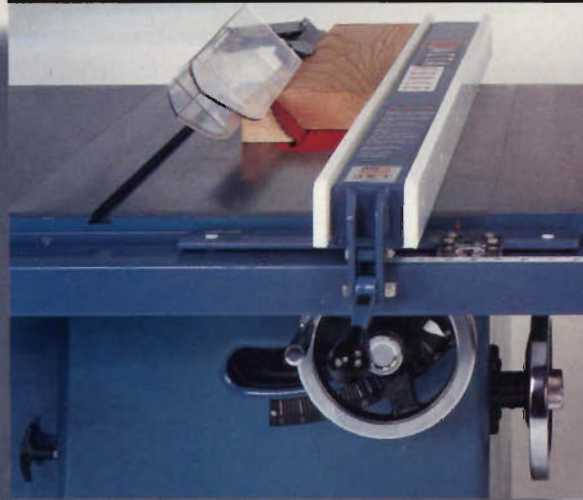
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Turned Candle Holders

by Bob Colpetzer

Turning a detailed and crisply cut spindle can be a challenge in itself. Turning two or more to identical shape and diameter, while maintaining the sharpness of detail, can seem well-nigh impossible. However, as with most "insurmountable" tasks, if we do some preliminary planning and break the job down into smaller steps, we can usually prevail.

I'll present here the basic steps required to turn the small candle holders shown *above* and on *page 47*. These fundamentals of planning, laying out, and turning can be applied to the taller

alternate design (*page 48*) and other spindle-turning projects as well.

Since most mail-order suppliers offer turning squares in 12" lengths, I've designed these holders to make the most efficient use of this stock. A pair of both spindle designs (four holders total) can be turned from two 2x2x12" turning squares and a 3/4x6x21" base blank.

If you're new to turning, or if it's been a while since you've turned spindles, I suggest you review the section "Keys to Safe and Successful Spindle-Turning" on *page 48* before you start.

Prepare the Turning Blanks

Step 1. For the base, cut a 10 1/2" length from a 3/4x6x21" piece. Note: You can use the remainder of this stock for the bases of the alternate design. Joint one edge, rip the piece to 5" wide, then crosscut two 5" squares from it. From 3/4" scrap pine or poplar, cut two backing blocks to the same size as the base blanks. Note: The blanks and blocks should be sound without cracks or weaknesses.

Step 2. Adhere the base blanks to the backing blocks using the paper-joint technique describe in the Pro

Tip below. Then, set them aside to dry overnight.

Step 3. Square the turning blanks. To do this, first joint one face, joint the adjacent edge, confirm squareness with a try square, and then plane the remaining edge and face parallel. Next, square one end of each blank using a miter gauge on the tablesaw. Set a stop, then crosscut a 3"-long section from the squared end of each blank. Since we'll be turning the small holder, set the remainder of the turning square aside for use as the spindle on the alternate design.

Step 4. Draw diagonals on both ends of the turning blanks to locate the centerpoints. On one end, drill a $\frac{3}{32}$ " hole to accept the point of your spur or drive center. Bore a $\frac{3}{4}$ " hole $\frac{3}{4}$ " deep in the opposite end of each blank.

Step 5. Mount a 3" blank between centers on your lathe. Note: I prefer to use a revolving cone center to mount (and properly center) the $\frac{3}{4}$ " hole on the tail stock. If you don't have this accessory, turn a wooden plug as shown in *figure 1* and insert it into the $\frac{3}{4}$ " hole before mounting.

PRO TIP

Paper joints glue up in minutes, hold well, and allow you to separate the parts from the backing blocks easily when finished.

To create a paper joint, first cut pieces of paper (notebook, typing, or copy paper works fine) slightly larger than the blanks. Next, spread glue (white or yellow) uniformly on one face of the backing block and on one face of the base blank. Assemble the two glued faces, sandwiching the sheet of paper between them, then clamp. Let the glue dry overnight.



Next, set the tool rest to the height of, and parallel to, the spindle's centerline. Before you start the lathe, turn it over by hand to verify that the workpiece will clear the tool rest.

Step 6. Set lathe speed at 500 to 800 rpm. Using a $\frac{3}{4}$ " roughing-out gouge, turn the square blank to a cylinder (*photo A*). Stop the lathe, and reposition the tool rest to within $\frac{1}{8}$ " of the cylinder. Set your outside calipers to $1\frac{1}{2}$ ", the largest outside diameter of the finished spindle.

Step 7. Set lathe speed at 1500 rpm. Using a parting tool and calipers, part the cylinder in at least two places to $1\frac{1}{2}$ " diameter (*photo B*). Using the parted depths as a reference, turn the cylinder to $1\frac{1}{2}$ " diameter along the entire length. To do this, use a $\frac{3}{4}$ " spindle gouge and a lathe speed of 1500 to 1800 rpm. Note: Cut away (don't scrape) the waste. Make the final cut light, and move the tool from one end of the cylinder to the other to bring the entire cylinder to a uniform parted diameter.

Step 8. With the lathe stopped, divide the cylinder into logical sections based on the profiles and diameters needed. Mark the two lines with a pencil, rotating the cylinder by hand. (*Figure 2* shows the sectioning I used.) Using a parting tool and caliper, part to the largest diameter in each section. Then, cut away the waste from each section using a $\frac{3}{4}$ " or $\frac{1}{2}$ " spindle gouge and a lathe speed of 1500 to 2000 rpm (*photo C*). Use the heel and point of a $\frac{1}{2}$ " skew to clean up and square the shoulder of each section.



Photo A: Using a roughing-out gouge, form the turning square into a cylinder.



Photo B: Use a parting tool and caliper, part the cylinder in at least two places to establish a $1\frac{1}{2}$ " overall diameter.



Photo C: Mark, then turn the $1\frac{1}{2}$ "-diameter cylinder to form sections 1, 2, and 3.

Figure 1 Turning plug

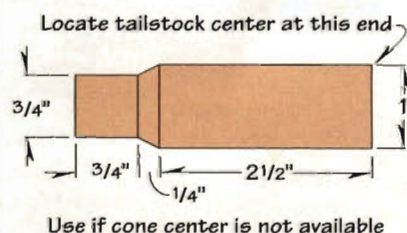
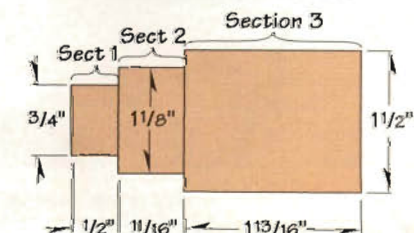


Figure 2 Turn sections to parting depths



Step 9. Turn the $\frac{1}{2}$ "-long tenon to a $\frac{3}{4}$ " diameter. Note: Take extra care to turn this section true, since it must fit a hole drilled in the base. Stop the lathe frequently and check the fit with a vernier caliper (*photo D*). You could also confirm the diameter by removing the spindle and test-fitting it in a $\frac{3}{4}$ " hole drilled in a piece of scrap.

Next, Lay Out and Turn Each Section

Step 1. With the sections established, lay out the parting points of the profiles needed in each section as dimensioned in *figures 3* and *4*. Using a caliper and parting tool, part to the required diameters in each section.

Note: Because of the shape of the cove and the width of the parting tool, you can't part to the finished diameter at the cove's rounded bottom without affecting the profile. I've increased the cove parting diameters on the figures

by $\frac{1}{16}$ " so that you won't risk cutting into the finished cove profiles with the edges of your parting tool. Your final finish cut on the cove will remove the parting slot, round the cove bottom, and bring it to its finished diameter.

Step 2. On section 2 (the first section in from the tenon), form the cove using a $\frac{3}{8}$ " spindle gouge (*photo E*).

Starting slightly to the right of the cove's centerline, cut down and towards the center, rolling the gouge as you make the cut to begin forming the right side of the cove profile. Next, make the same cut to the left of center. Continue making these cuts in sequence until you reach the proper width and cove depth.

Figure 3

Lay out and part sections to depths indicated

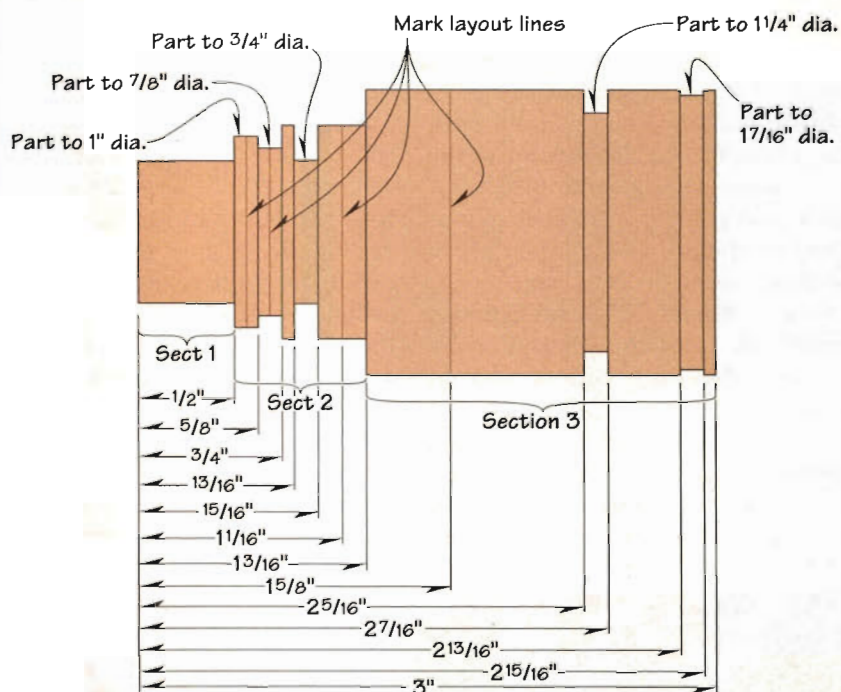
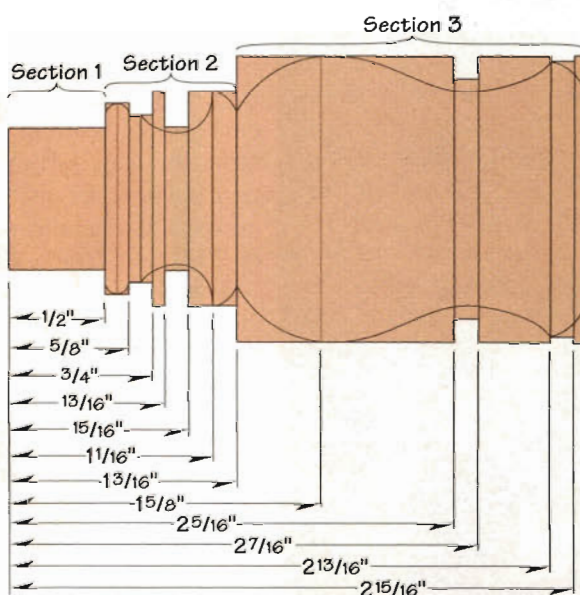


Figure 4

Turn to parting lines and then to profile



Note: Parting diameters for the two coves allow some extra depth as shown, since parting tool edges would cut into finished profile if coves were initially parted to finished diameter.

Photo D: Size the tenon (section 1) to fit the base hole. Author uses a vernier caliper to check diameter as he works.

Photo E: Using a $\frac{3}{8}$ " spindle gouge, form the cove in section 2 by cutting in from either side of the cove's centerline.

Step 3. Scribe a centerline on the flat where the $\frac{1}{8}$ " bead will be formed (immediately to the right of the tenon). Using a $\frac{1}{4}$ " spindle gouge, cut the left side of the bead, then the right. In each case, start the cut on the centerline and roll the gouge toward the bead shoulder.

Note: You'll form the half-bead in section 2 next, but to do this, you'll first turn part of section 3 to its rough profile so you can blend the profiles of sections 2 and 3.

Step 4. In section 3, start forming the bead (which makes up the largest diameter) and the cove using a $\frac{1}{2}$ " spindle gouge. **Note:** Do not cut these to finished depth at this time, but stay about $\frac{1}{16}$ " larger in diameter; this will make it easier to blend the two sections together and establish the correct profile.

Once you've turned the left half of the large bead in section 3 to the shoulder of the uncut half-bead in section 2, use the point of a skew to cut to the point where these two will meet.

Step 5. Using a $\frac{1}{2}$ " gouge with a thumbnail grind, start cutting the half-bead profile in section 2. To do this, cut

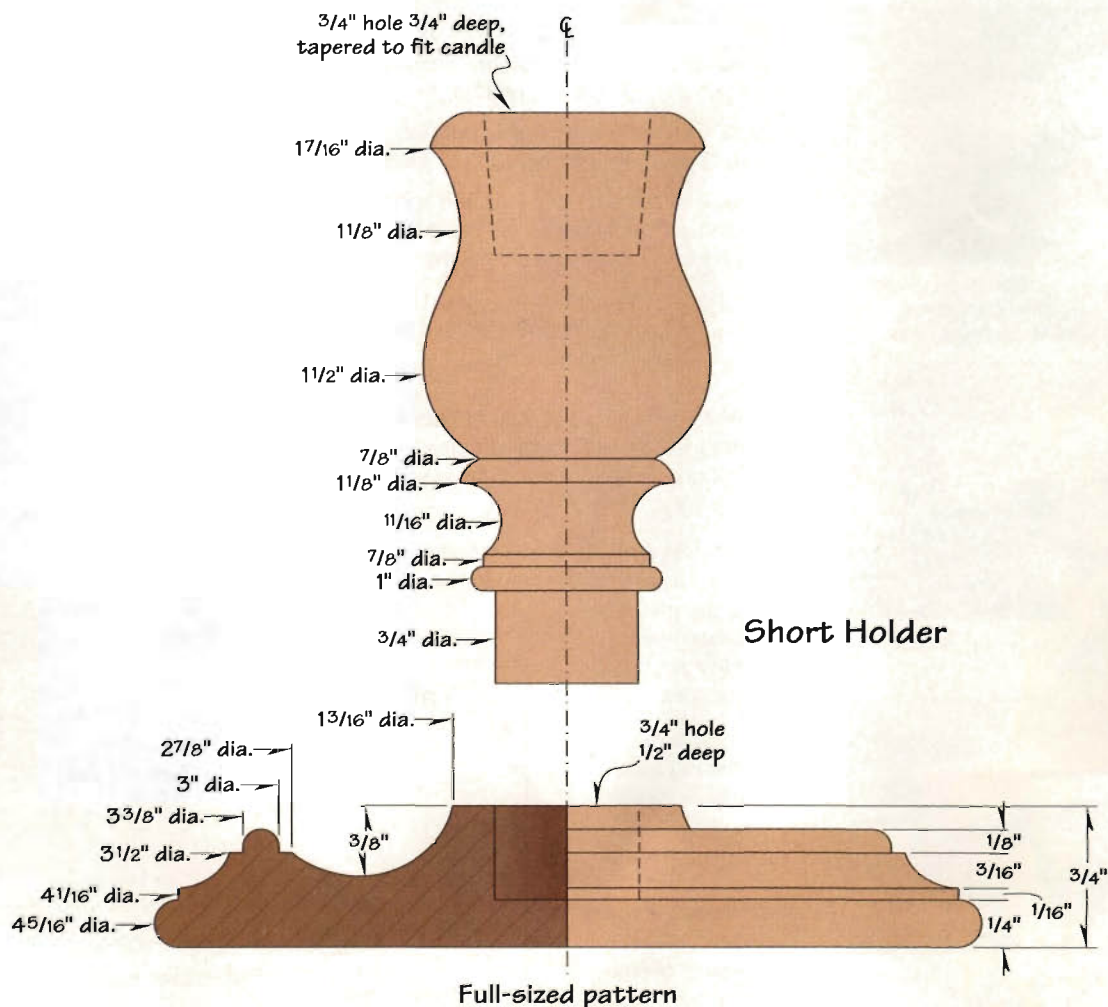
alternately on either side of the point at which you cut to depth with the skew. Continue until you've formed the finished profiles of the half-bead (section 2) and the left half of the large bead (section 3). Next, cut the cove and remaining half of the large bead in section 3 to finished profile, taking care to



Photo F: Turn the half-bead at the end of the spindle (section 3) using a $\frac{3}{8}$ " gouge.



Photo G: Compare the two candle spindles and fine-tune them to correct any discrepancies.



KEYS TO SAFE AND SUCCESSFUL SPINDLE TURNING

1 Before turning, remove loose-fitting clothing and all jewelry. Contain long hair.

2 Check the integrity of all workpieces to be turned before mounting them on the lathe.

3 Always turn the lathe over by hand to make certain all parts clear before starting the lathe. Stop the lathe before making any adjustments or changes to the tool rest.

4 Position the tool rest so it fully supports the turning tool at all times.

5 Wear face and dust protection.

6 Assume a natural, comfortable stance with good footing and body balance. Remove any obstacles that may be in your way. Never lean over a revolving lathe.

7 Keep the turning tools sharp at all times.

8 Learn to use the tools to cut rather than scrape profiles.

9 Develop a plan for turning each specific spindle design:

- A.** Divide the spindle into sections based on the required diameters and profiles.
- B.** Work each section separately, but plan how you'll tie or blend one section to another.
- C.** If you'll be turning more than one spindle of the same design, lay out and use parting diameters to establish uniform depths.
- D.** Long or complicated curves should have several parting diameter points so that the exact profile can be duplicated.

10 Follow the same sequence of cuts and procedures to turn duplicate spindles. Record all procedures to ensure that you won't miss any.

11 If possible, turn identical spindles at the same time. The longer the time between turnings, the greater the chance you'll forget exact procedures and sequences.

12 Practice basic spindle turning techniques before tackling the project at hand. I suggest the three turning exercises shown in figure 5 on page 50, for which you can use short sections of pine or other scrap.

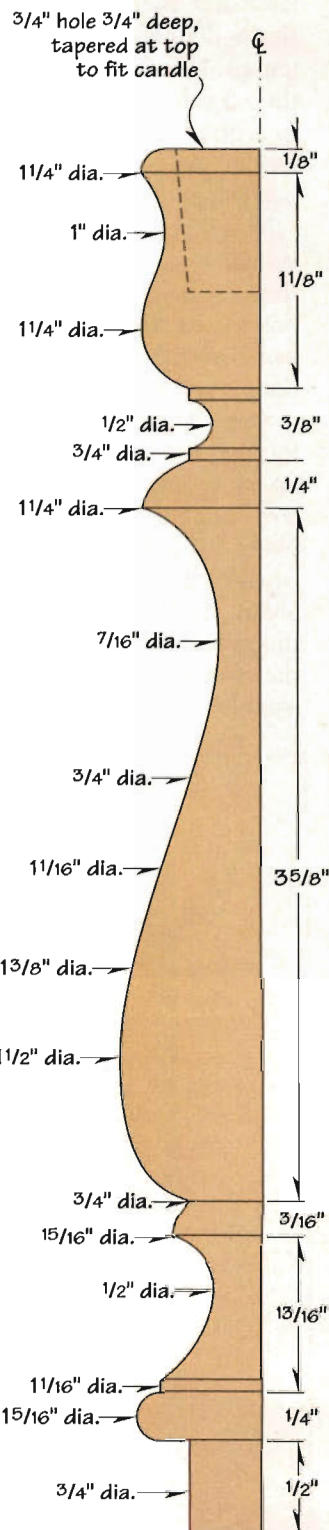
To determine proper position and tool angle required for cutting with the skew chisel, hold the tool to the workpiece and then turn the piece over by hand. Adjust the angle of the tool until the edge of the skew starts to cut a shaving.

Determine the proper cutting angle for the gouge the same way you did for the skew chisel. A proper cutting angle will produce a shaving.

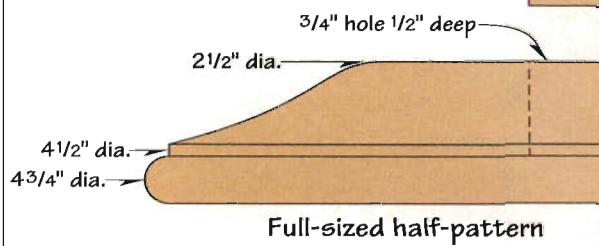
Cut coves with a gouge. Start at the shoulder of the cove and work toward the center. Practice to make smooth, continuous cuts.

Establish the bead shoulder depth using the point of the skew.

Use a gouge or skew chisel to cut a bead. With either tool, start at the bead's center and roll to the shoulder depth.



Tall Holder



blend these to the previously cut half of the bead. Cut the remaining half-bead at the end of the third section using a $\frac{3}{8}$ " gouge (*photo F*).

Step 6. Remove the turning from the lathe without sanding it. Mount your second blank and turn it to the same profile, repeating the steps you used to turn the first. Use the first spindle as a visual guide to help you make the second identical to it (*photo G*). To obtain a perfect match, you may have to remount the first spindle and fine-tune its profile.

Step 7. Once you've matched profiles, slow the lathe speed to about 800 rpm and finish-sand both spindles. Take care that you don't alter the shape or sharpness of the details. Note: If you used chisels to cut the profiles, you should not have to use abrasives any coarser than 180- or 220-grit to start. Sand to 400-grit.

Next, Turn the Bases

Step 1. On each of the two backing blocks that you glued to the base blanks, find and mark a centerpoint. Use this point to lay out a $4\frac{3}{4}$ "-diameter circle on each.

Step 2. Bandsaw the blanks round, cutting along the line. Next, center and mount one of the discs on a 3" faceplate. (I drilled $\frac{1}{4}$ " pilot holes in the backing block, then used #12x $\frac{3}{4}$ " flat-head wood screws to secure it to the faceplate.) Note: Make certain the screws do not crack or weaken the backing block.

Step 3. Mount the assembly on the lathe's head stock and position the tool rest. Turn the lathe over by hand to check clearance. Set the lathe speed at 500 rpm, then, using a round-nose chisel with a sharp burr, turn the edge of the blank/backing block to remove any off-center stock (*photo H*).

Step 4. Increase lathe speed to 1200 rpm, then part to the finished diameter of the blank ($4\frac{1}{4}$ ") using an outside caliper to check diameter. Next, part down into the backing block (next to the paper joint) to a $3\frac{1}{2}$ " diameter.

Step 5. Set lathe speed at 1500 rpm. Using a round-nose tool with a sharp burr, turn away the stock of the backing block to the parting depth ($3\frac{1}{2}$ " diameter) and turn the candle base blank to its finished diameter ($4\frac{1}{4}$ ").

Step 6. Using a ruler and pencil, lay out the candle base profile on the edge and face of the blank (*photo I*). Next, part to the required depths, first on the edge, then on the face. Note: As you work on the face, stop the lathe frequently and check the depths with a scale. Take light cuts and measure often so you don't cut any of the profiles too deep.

Step 7. Turn the edge and face details to their finished profiles. While forming these, use a lathe speed of 1800 to 2000 rpm and reposition the tool rest as needed. Always keep the rest close to the detail you are forming. Note: If you own a set of bowl gouges and can handle them proficiently, use them to cut the finished profile; or, use freshly sharpened scrapers. Just keep the burr sharp on these tools and take light cuts.

Step 8. To complete the base, first insert a three-jaw chuck in the tail stock. Install a $\frac{3}{4}$ "-diameter machine spur bit in the chuck. Set the lathe speed at about 500 rpm, and bore a $\frac{3}{4}$ " hole $\frac{1}{2}$ " deep in the center of the base (*photo J*).

Step 9. Mount the second base assembly on the head stock, then repeat the procedures you used to turn the first, matching the profiles. Then, set the lathe at 800 rpm, and finish-sand both bases. Start with the finest abrasive that will get the job done and finish with 400-grit.

Combine the Spindle and Base

Step 1. With one of the sanded candle bases still mounted on the headstock, apply a thin coat of glue to the inside of the hole and a thin coat to one of the spindle tenons. (I used the glue minimally to avoid any squeeze-out.) Insert the tenon into the hole, then use the tailstock to force the spindle into the base (*photo K*). Allow the glue to dry for a few minutes, then remove the assembly from the lathe. Assemble and glue the second spindle and base the same way.

Step 2. After the glue has dried, remount one of the assembled holders on the lathe, and set the lathe at 1500 rpm. Position the tool



Photo H: Turn the base blank to the proper diameter.

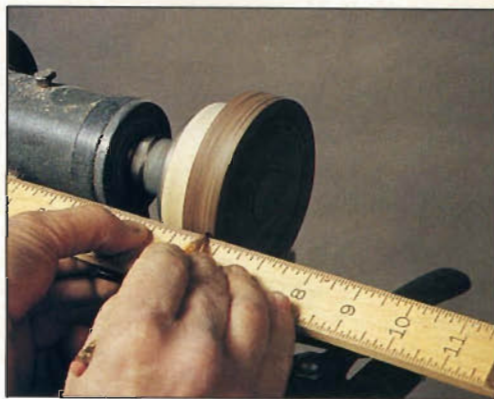


Photo I: Using a pencil, lay out the key diameters and details on the base blank.

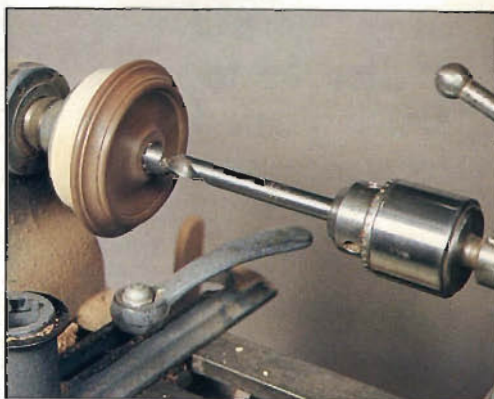


Photo J: To ensure a centered tenon hole, bore the hole before removing the base from the lathe.

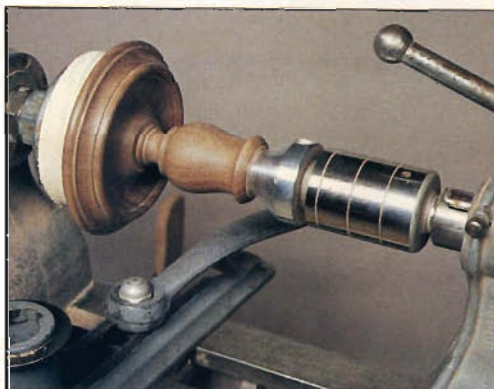


Photo K: Use the lathe to align the spindle to the base when gluing the parts together.

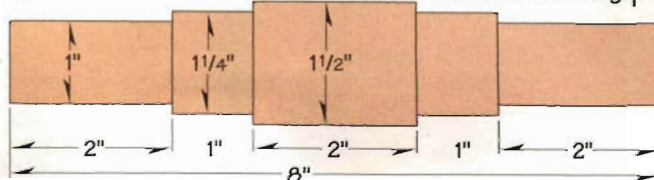


Photo L: Use a side scraper to taper the inside of the candle hole.

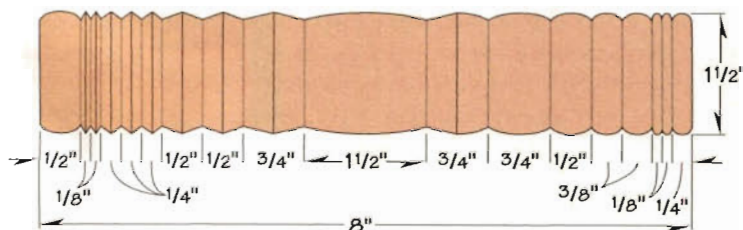
rest across the end of the candle spindle, raising it to the centerline. Using a combination end and side scraper tool, taper the inside of the hole to accept a candle (*photo L*). If you don't have this tool, use a square-nose scraper. Work carefully, taking light cuts, then repeat the procedure for the second candle holder. Note: This procedure works fine on the shorter holders. To taper the hole on the taller candle holders, you may have to support the spindle with a steady rest.

Figure 5

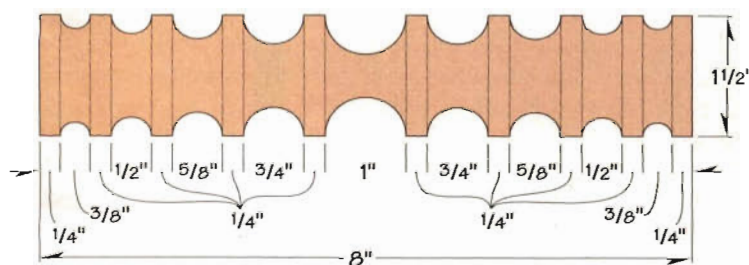
Practice turning problems



Problem #1—Practice cutting straight sections using a gouge or skew chisel and shoulders using a skew



Problem #2—Practice cutting Vs with a skew chisel and beads using a skew or gouge



Problem #3—Practice cutting coves using the proper-sized gouge

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Photo M: After the oil finish has cured, buff the holders to the desired sheen.

Step 3. Separate the holder bases from the backing blocks. To do this, clamp the faceplate in your bench vise, and position yourself on a stool so that your lap supports the candle holder. Using a wide chisel and mallet, chisel along the paper joint between the base and backing block. Tap lightly on the chisel, working completely around the paper glue line. If the joint has not separated by the time you've made one revolution, continue chiseling around it, using

slightly firmer mallet strokes.) Now, remove the remaining paper from the bases.

Apply A Finish

Step 1. Apply your choice of finish. I finished the candle holders shown on *page 44* with two coats of Watco Danish oil. After the second coat cured, I buffed the holders using a wheel charged with tripoli buffing compound, then one with white diamond compound (*photo M*). To give them their final sheen, I loaded a third buffing wheel with carnauba wax. If you prefer a flatter sheen on your holders, apply a third coat of Danish oil. Allow it to cure for several days, then hand-buff to the desired sheen using a soft cotton cloth.

Note: These products are part of the Beall Tool Company's Wood Buff Kit. The kit includes three buffing wheels, bars of tripoli and white diamond buffing compounds, and a bar of carnauba wax. It also comes with an adapter to mount the wheels

on your own motor. (To mail-order, see Sources.) **Wj**

Designer: Author

Lead photograph: Studio Alex

Other photos: By the author

SOURCES

Wood Buff Kit. Includes three buffing wheels; one bar each of tripoli and white diamond compound; one bar of carnauba wax; and a bushing that adapts to either a 1/2" or 5/8" shaft. Price: \$69.95 plus \$4.50 s/h. Order from:

The Beall Tool Co.
800/331-4718

Turning Squares. See catalog, or call for information on sizes and species available:

Constantine
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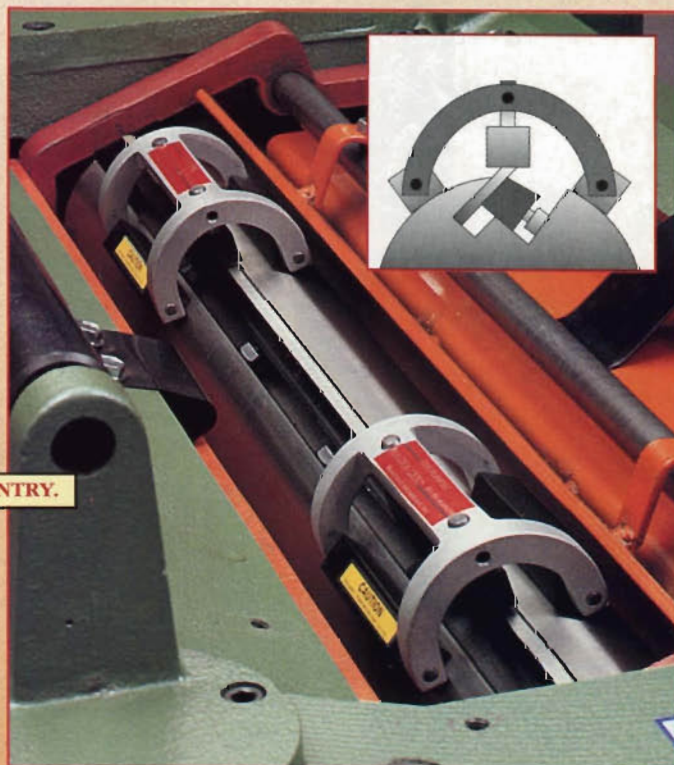
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FRANK LLOYD WRIGHT INSPIRED PRAIRIE LANTERN

For the last century and a half, western artists and craftsmen have drawn inspiration from the subtle beauty and workmanship that inform the traditional arts of Japan. At the turn of the century, Frank Lloyd Wright brought this Asian sense of harmony and proportion to the homes he designed throughout the Midwest. In his *Prairie Lantern*, Dennis French, an art professor at Illinois State University, pays homage to both

the Japanese arts and Wright's American interpretation. The low "roofline" of the shade evokes images of a Japanese tea house, while the soft amber lights bring to mind summer sunsets on the Great Plains. The lantern's black gridwork calls into vivid contrast the colors and patterns of the wood—one of Wright's favorite design motifs. (For more about Dennis, see "Meet the Designer" on page 60.)

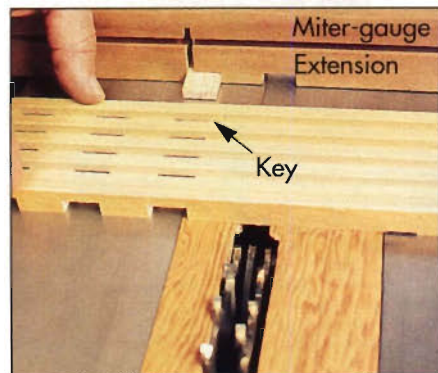
Before You Start

This project looks complicated, but the woodworking is fairly straightforward. You'll need to make the leaded-glass shade or have one made for you. (See page 62 for shade patterns and more information.) The shade and light supports require a bit of metalworking, but it's nothing you can't take care of with a hacksaw, hammer, and metalworking vise.

Prepare the Gridwork

Step 1. Rip two pieces of poplar to $2\frac{5}{16} \times 36$ ", then plane them to $\frac{5}{16}$ " thick. This will give you enough material for the base grid parts (A, B) and the upper grids (C).

Step 2. Using a dado head on your tablesaw (or a straight bit in a table-mounted router), plough $\frac{1}{4}$ " grooves $\frac{1}{4}$ " deep where shown on the end view in figure 1. Note: Set the depth precisely, as this will determine the length of the grid when mitered later.



Step 3. Reset your dado head width to $\frac{3}{4}$ ", and clamp a wooden extension to your miter gauge. Elevate the blade to $\frac{3}{16}$ " and cut a slot in the extension about 8" from the right end. Unclamp the extension, then cut and glue a $\frac{3}{16} \times \frac{3}{4} \times 2$ " hardwood key in the slot. (See photo A.) Position the key $\frac{1}{16}$ " to the right of the blade, and screw the extension to the miter gauge. Note: Be accurate when making this spacing—any error will be compounded and will show up on the end of the grid.

Step 4. Run some test cuts in the end of one of the poplar strips by elevating the blade until it breaks into the $\frac{1}{4}$ " grooves. Crank the blade up an additional $\frac{1}{32}$ " or so—just enough so you won't have to clean up the intersections of the grooves and dados by hand.

Step 5. Cut a $\frac{3}{4}$ "-wide dado across the end of the first strip. Place that dado over the key, then cut the next dado as shown in photo A. Using this procedure, cut equally spaced dados along the full length of both poplar strips.

Step 6. From the two dadoed strips, miter-cut the base grid sides (A) and ends (B) to the dimensions

Photo A: Cut equally spaced dados in the grid by indexing the workpiece with a key glued into a miter-gauge extension.

Builder's Notes

Many of the dimensions on the Prairie Lantern are derived from the size of the base grid, the first assembly you build. Ideally, the grid should measure $8\frac{3}{16} \times 20$ ", but the cutting tolerances may alter assembled dimensions by $\frac{1}{16}$ " or so. That doesn't pose any problems as long as you follow our construction sequence and use your actual grid dimensions to size the parts marked with an asterisk in the Bill of Materials. Also, go easy on the glue, especially where you join poplar to cherry. Otherwise, you'll be stuck with a tedious cleanup and retouching job later.

Dick Coers

listed in the Bill of Materials and shown in figure 2. After you cut the miters, you should have two leftover pieces about 6" long from which to cut the two upper grids (C) later.

Step 7. Wrap 150-grit sandpaper around the edge of a piece of $\frac{3}{16}$ "-thick scrapwood and sand the $\frac{1}{4}$ "-wide grooves in the grid pieces.

Step 8. Lay the grids end to end on a bench with their outside faces up. Tape the mitered ends with masking tape, making sure they contact each other squarely. Next, turn the pieces over and apply white or yellow glue to the miters. Fold the taped pieces into

Exploded View

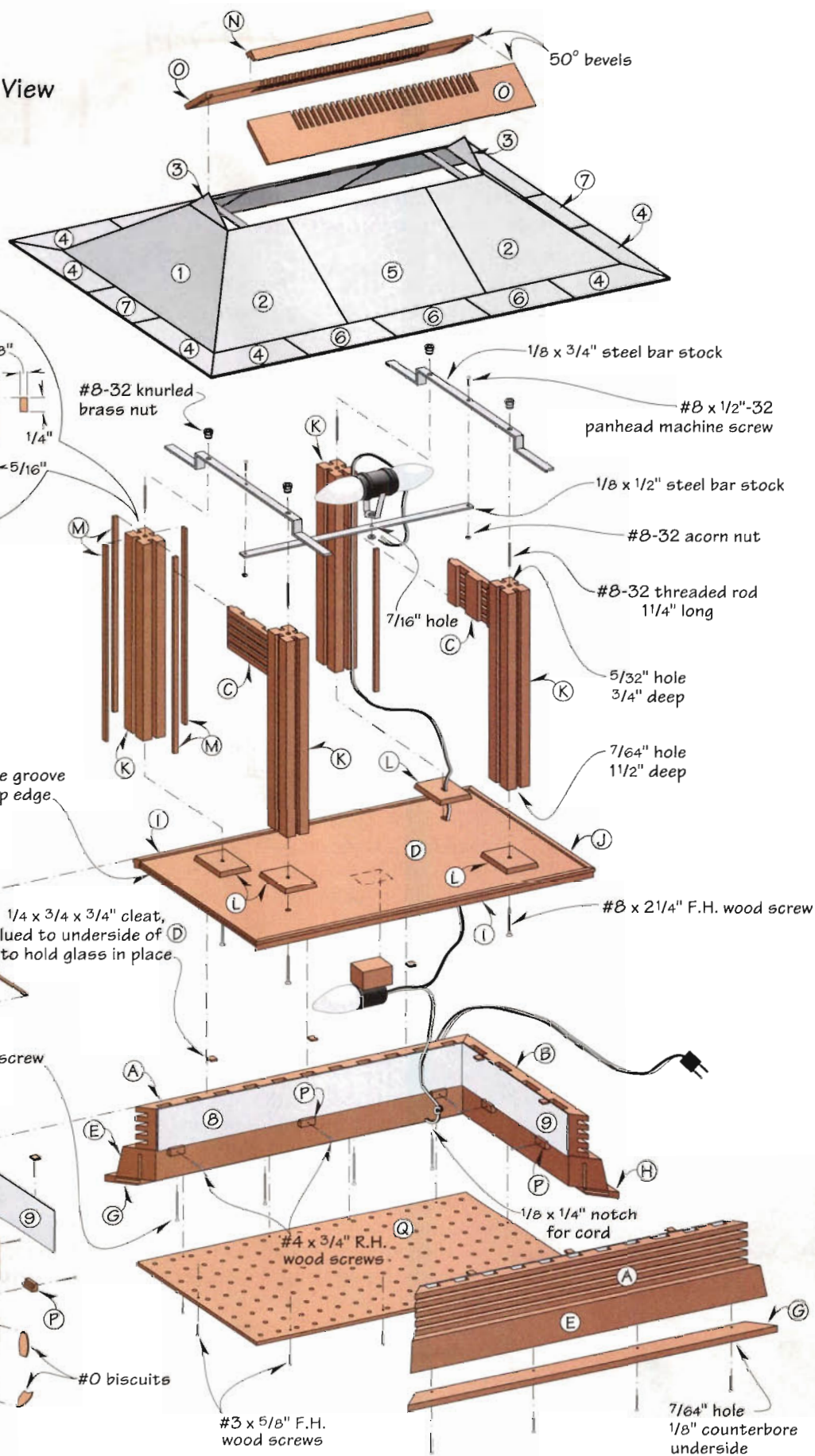
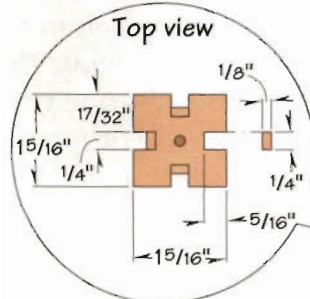


Figure 1 Layout for poplar grid (A)(B)(C)

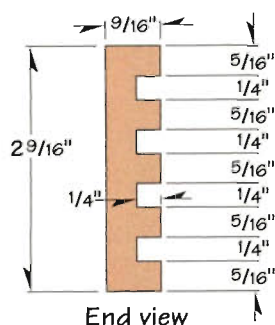
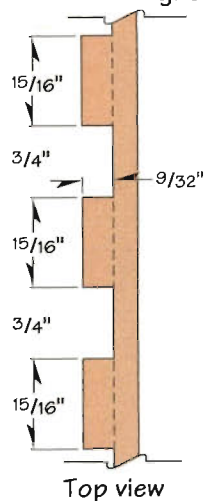


Figure 2 Location of miter cuts on grid

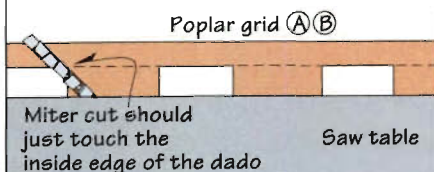
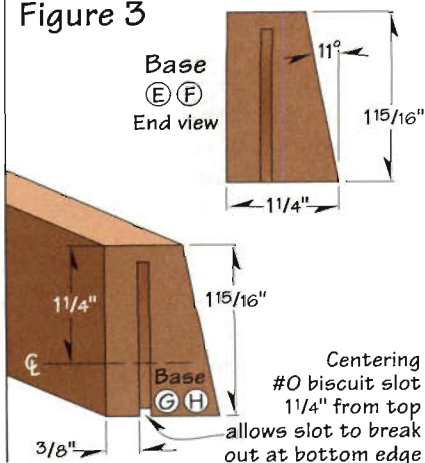


Figure 3



BILL OF MATERIALS

LANTERN

PART	T	W	L	MTL. QTY.
A Base grid-sides	9/16"	2 9/16"	20"	P 2
B Base grid-ends	9/16"	2 9/16"	8 3/16"	P 2
C Upper grid*	9/16"	2 9/16"	4 7/16"	P 2
D Platform*	1/2"	8 3/16"	20"	VP 1
E Base-sides*	1 1/4"	1 15/16"	21 7/16"	C 2
F Base-ends*	1 1/4"	1 15/16"	9 5/8"	C 2
G Base molding-sides*	3/8"	1 1/4"	22 1/16"	P 2
H Base molding-ends*	3/8"	1 1/4"	10 1/4"	P 2
I Platform molding-sides*	5/16"	1/2"	20 1/16"	C 2
J Platform molding-ends*	5/16"	1/2"	8 1/16"	C 2
K Columns	1 5/16"	1 5/16"	11 5/16"	C 4
L Column bases	5/16"	1 7/8"	1 7/8"	P 4
M Column inserts	3/32"	1/4"	11 5/16"	P 16
N Ridge cap	1/2"	1/2"	10 1/2"	P 1
O Ridge	1/4"	2 1/4"	15 3/4"	C 2
P Glass retainers	3/8"	7/8"	1 1/4"	P 10
Q Bottom*	1/8"	7 3/4"	19 1/2"	PH 1

*Parts cut to dimension during construction. Please read all instructions before cutting.

MATERIALS LIST

C—cherry
P—poplar
VP—veneered particle-board or plywood
PH—perforated hardboard

SUPPLIES

Cherry veneer; bird's-eye maple veneer; 1/8"x3/4" steel bar stock; #3x3/4", #4x3/4", #6x2 1/4", #8x2 1/4" flathead wood screws; #4x3/4" roundhead wood screws; #8-32 threaded rod; #8-32 knurled brass nuts; #8x1/2"-32 panhead machine screws; #8-32" acorn nuts; #0 biscuits; 10' SPT-1 black electrical cord; single-socket electrical fixture; twin-socket electrical fixture; feed-through cord switch; wall plug; light bulbs; black lacquer or acrylic paint; finish; glass. (For leaded-glass supplies, see page 62.)

a rectangle, then tape the last joint shut. If needed, apply additional pressure with a bandclamp or bar clamps. Square the assembly.

Veneer the Substrate For the Platform

Step 1. To size the substrate for the platform (D), measure your assembled base grid, then cut a piece of 1/2"-thick medium-density fiberboard (MDF) or furniture-grade particleboard 3/4" longer and wider than the grid.

Step 2. Cut a 3 1/2"x12" piece of bird's-eye maple veneer, then joint the edges to 3/8" wide. Cut and joint two pieces of cherry veneer to 2 3/4"x12". Note: To joint the veneer edges, hold

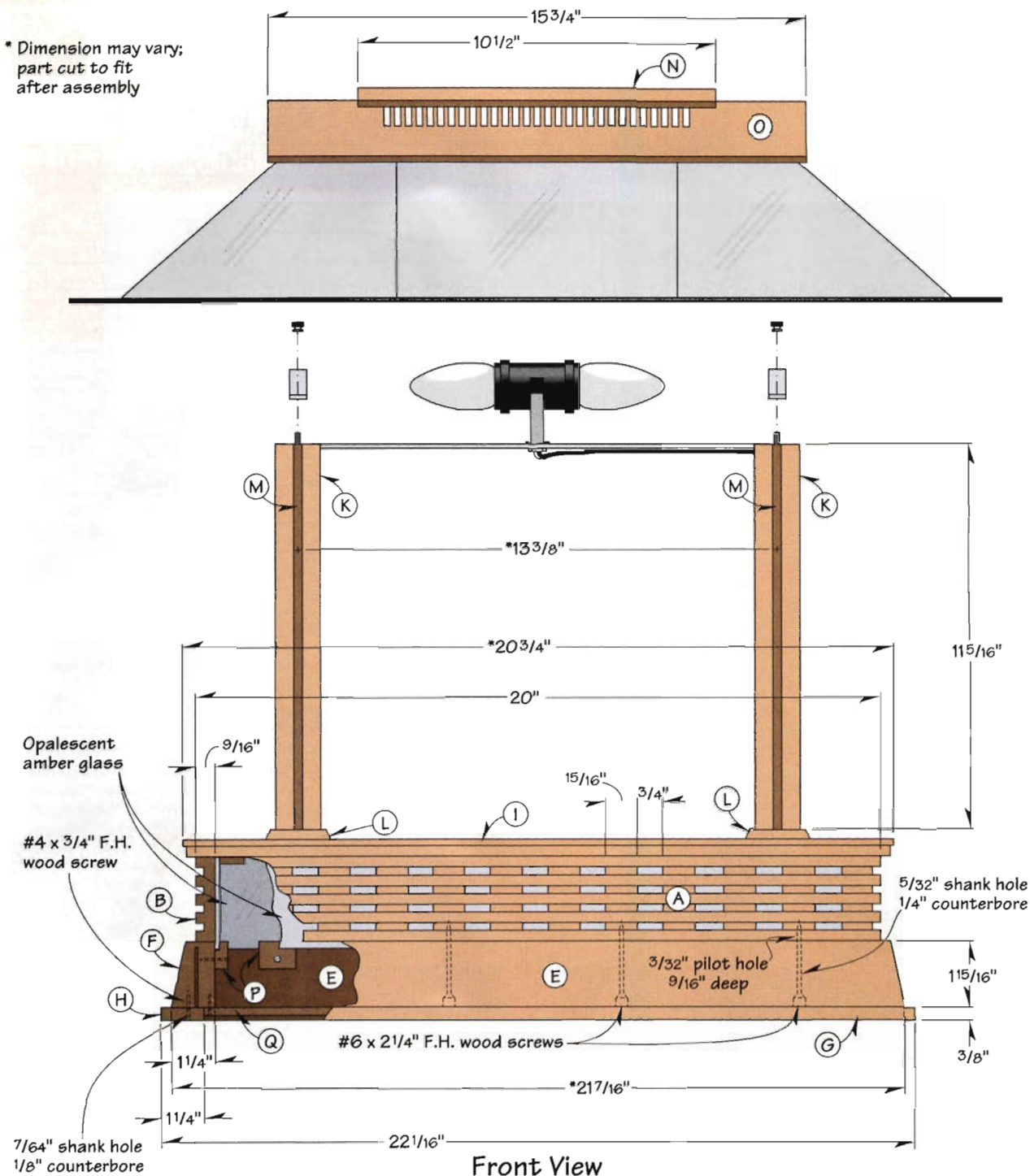
each piece against the jointer fence with a scrap block and pass it over the cutter head for a very light (1/32") cut.

Step 3. Lay out the veneer pieces edge to edge with the maple in the center, then tape the joints with veneer tape. (If you're not familiar with veneering techniques or materials, see the article on page 21.)

Step 4. After the tape has dried, sandwich the veneers between two pieces of scrap plywood, then cross-cut the veneer ends to 10" long using a tablesaw and sliding table fixture.

Step 5. Cut and joint the two additional pieces of cherry veneer to 5 3/4"x8 3/4". Then, butt one edge of each piece against the ends of the previously taped veneers, and tape the

* Dimension may vary;
part cut to fit
after assembly



seams. Also, prepare a single piece of cherry or maple veneer to cover the underside of the substrate. Note: You can use a lower-quality veneer for this face, but you must veneer both faces to prevent the panel from bowing.

Step 6. Roll an even coat of white or yellow glue onto one face of the substrate, then lay the underside veneer on it. Turn the substrate over, apply glue to the opposite face, then lay the cherry and maple veneer assembly

(taped side up) on this face. Now, place protective cauls on both faces of the veneered substrate and clamp the assembly using a vacuum-bag system or traditional veneer press.

Build the Base

Step 1. Joint and plane a piece of $\frac{6}{4}$ cherry to $\frac{1}{4}"$ thick, then cut three $1\frac{5}{16} \times 24"$ blanks for the base pieces (E, F) from it. Next, tilt your tablesaw blade to 11° from perpendic-

ular. Stand the blanks on edge, and bevel-rip one face—not the edge—of each (figure 3). Note: As you set up for this cut, make sure the blade won't reduce the thickness at the bottom edge of the stock. Save the tapered offcuts to use as clamping cauls later.

Step 2. Place the assembled grid on top of the base blanks. Position them so the inside faces of the grid overhang the inside faces of the blanks by about $\frac{1}{32}"$ (for ventilation) as shown on

the lower corner detail of the Side View drawing. Mark the locations of the miters on the base blanks, then miter-cut them to length.

Step 3. Cut slots for #0 biscuits in the mitered ends of the base pieces. Center the length of the slots $1\frac{1}{4}$ " from the top edges of the pieces so the slots break out at the bottom edges as shown in figure 3.

Step 4. Cut a $\frac{1}{4}$ "-wide notch $\frac{1}{8}$ " deep along the bottom edge of one of the base sides to provide an exit for the electrical cord.

Step 5. Glue the biscuits into the slots and clamp the pieces together. To do this, place the 11° offcuts on the outside faces of the base and use them as clamping cauls so the clamps press against a square surface. After the glue dries, remove the clamps and cut the protruding biscuits flush.

Fit the Grid To the Base

Step 1. Lay out shank holes for the screws that fasten the grid to the base. (For locations, see the Front View drawing *opposite* and the Side View at *right*.) To do this, find and mark centerlines (widthwise) on the inside faces of the appropriate $\frac{1}{16}$ " grid segments. Then, position and clamp the grid to the base so that you get an even reveal around all four sides. Note: If the sides of the grid bow in slightly, cut a spacer block and place it in the middle of the frame to keep the sides straight and parallel.

Step 2. Transfer the centerlines from the grid segments onto the bottom edge of the base. Bisect each of these lines $\frac{5}{32}$ " from the inside edge to establish screw-hole centerpoints.

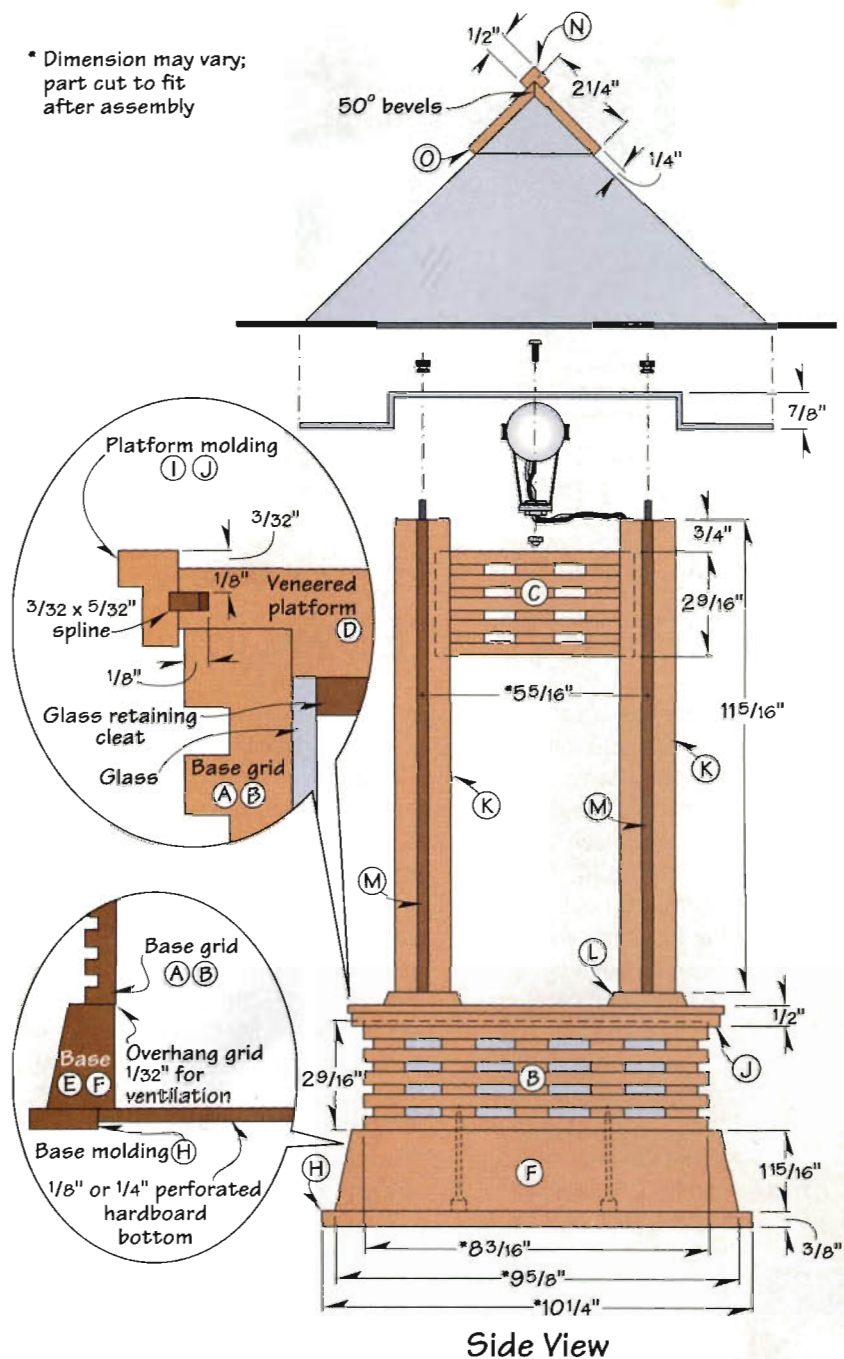
Step 3. Remove the clamps, and lay the base upside down on the drill-press table. Drill $\frac{5}{32}$ " shank holes all the way through the base using a backing board to minimize chip-out. Counterbore the holes $\frac{1}{4}$ " deep.

Step 4. Reclamp the base to the grid, and adjust it for an even reveal. Using the shank holes as guides, transfer the hole centerpoints using a $\frac{5}{32}$ " brad-point bit. Remove the clamps and drill $\frac{5}{32}$ " pilot holes $\frac{9}{16}$ " deep in the bottom of the grid where marked.

Make the Base Molding

Step 1. To prepare the stock for the base molding (G, H), plane a 36°

* Dimension may vary; part cut to fit after assembly



length of poplar to $\frac{3}{8}$ " thick, then rip two $1\frac{1}{4}$ "-wide strips from it. Measure the base, then add $\frac{1}{2}$ " to both the width and length. Now, miter-cut two side (G) and two end (H) moldings to these lengths.

Step 2. Cut #0 biscuit slots in the mitered ends of the moldings. Center the slots $1\frac{1}{8}$ " from the outside tip of the miters. Note: The slots will break out at the inside edge.

Step 3. Glue the biscuits into the slots and clamp the four moldings together. After the glue has dried, trim the protruding biscuit ends flush.

Step 4. Clamp the molding to the base so that you have an even reveal around the perimeter. Drill centered shank and pilot holes for #4x $\frac{3}{4}$ " wood screws to a depth of $\frac{7}{8}$ " where shown on the Exploded View. Then, counterbore the shank holes $\frac{1}{8}$ " deep.



DANA-THOMAS HOUSE

ONE OF FRANK LLOYD WRIGHT'S BEST-PRESERVED LEGACIES

Much of Dennis French's inspiration for the Prairie Lantern came from the Prairie-style homes such as this one that architect Frank Lloyd Wright designed for socialite Susan Lawrence Dana. The historic Dana-Thomas house in Springfield, Illinois, is considered the best preserved of Wright's early designs and still contains 98 percent of its original Wright-designed furnishings.

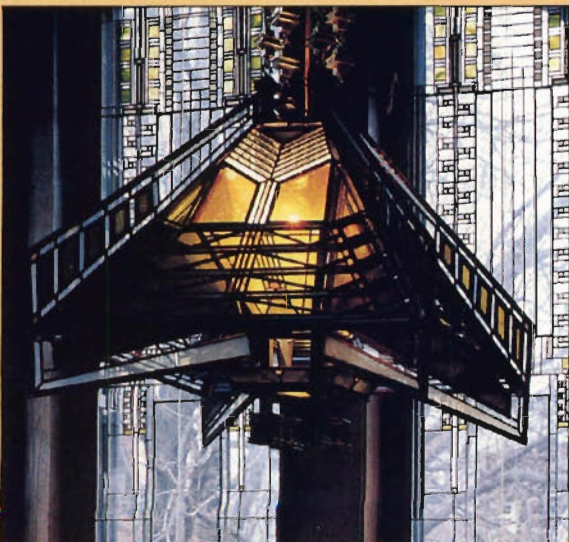
The architect began work on the house in 1902, designing more than 100 pieces of white oak furniture and 250 art-glass doors, windows, and light panels in addition to the structure itself. The house was completed

in 1904 and dedicated with a series of parties over the Christmas season.

Besides functioning as living quarters, the Dana-Thomas house served as a multi-stage setting for a variety of art pieces and social events. Stairways were designed to dramatize Ms. Dana's grand entrances at parties. Ledges were built for exotic flower arrangements, and special balconies were added to accommodate performing musicians. Terra cotta sculptures by Richard W. Bock grace the entry and reception hall, and the dining room showcases the only surviving George Niedecken mural in any Wright house.

The Dana-Thomas house, located at 301 East Lawrence Avenue in Springfield, is owned and operated as a state historic site by the State of Illinois. You may tour the home Wednesday through Sunday, 9 a.m. to 4 p.m. Groups of 10 or more should call ahead for reservations. For information, call 217/782-6776.

The Butterfly Chandelier: One of Wright's unique fixtures in the Dana-Thomas house.



Dress the Platform and Trim the Edges

Step 1. Remove the veneer tape and any glue bleed-through on the veneered platform. Next, transfer the dimensions of the base grid to the platform using the center of the maple veneer as your reference point.

Step 2. Cut the platform just wide of the layout lines so that it overhangs the grid by about $\frac{1}{32}$ ". Note: This will allow the platform molding to clear the grid once the grid is painted. Then, cut a rabbet around the perimeter of the platform where shown in *figure 4* and the upper corner detail on the Side View drawing.

Step 3. To make the platform molding (I, J), plane a 1x36" piece of cherry to $\frac{1}{2}$ " thick. Joint one edge straight, then rip the piece to $\frac{3}{4}$ " wide. Next, using a .090" thin-kerf blade, rip the $\frac{3}{64}$ "-deep spline grooves where shown in *figure 5*. Rout the $\frac{3}{8}$ " groove in the center, and then rip the piece down the middle to yield two strips.

Step 4. Elevate the thin-kerf blade to $\frac{1}{8}$ " and set the fence $\frac{1}{8}$ " from the blade. With the top face of the platform *against* the fence, rip a spline groove around the four edges.

Step 5. Rip two 36"-long pieces of spline stock to $\frac{3}{32}$ " wide. Then, rip the stock just thick enough (about $\frac{3}{32}$ ") to create a sliding fit in the kerfs you just cut into the platform and molding.

Step 6. Miter-cut the spline and molding pieces (I, J) to fit, then glue and clamp them to the platform. (We glued one edge at a time to prevent alignment problems.)

Make the Columns And the Ridge Cap

Step 1. Machine the four columns (K) to the dimensions listed in the Bill of Materials. Then, using a dado head, rip centered $\frac{1}{4}$ " grooves $\frac{5}{16}$ " deep in all four faces of each column.

Step 2. Stand the columns on end and orient the face grain in the same direction on all four. Mark the ends so you can recreate this orientation later. On the column that will house the electrical cord, rip a second groove $\frac{3}{16}$ " wide and $\frac{1}{8}$ " deep centered in the $\frac{1}{4}$ " groove. To center the

Step 4. After the glue has dried, thread the electrical cord through the hole in the platform. Then, screw the columns and bases to the platform.

Step 5. Glue and clamp the upper grids between the columns. Work carefully to avoid tearing and scuffing the paint on the grid ends during assembly. (We scored the front face of each grid with a fine, sharp crafts knife.) Use a spacer block to prevent the clamps from bowing the grids, and square the grids to the columns.

Step 6. Build the leaded glass shade. (See the patterns and notes for this procedure on *page 62*.)

Make the Shade Ridge

Step 1. Cut the two pieces for the shade ridge (O) to the dimensions listed in the Bill of Materials. To do this, tilt your tablesaw blade to 40° from perpendicular, and bevel-rip one edge of each.

Step 2. Lay the ridge pieces on the two gable ends of the leaded glass shade, and adjust them to get an equal reveal on both ends. Next, mark the location of the gable ends on the underside of the ridge pieces. Rout 1/8" dados 1/8" deep stopped 1/8" from the outside edge of the ridge where marked.

Step 3. Lay the ridge pieces with the bevels facedown and the beveled edges touching. Tape them together with masking tape laid lengthwise



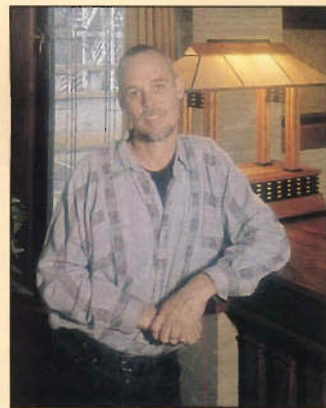
Photo B: Use a slotted V-block with a key to get clean, uniformly spaced cuts in the shade ridge (O).

MEET THE DESIGNER

A few years ago, Dennis French, Associate Professor of Jewelry and Metals Design at Illinois State University at Normal, decided to push himself in a new artistic direction. His forays into wood and glass construction led to the Prairie Lantern we share with you here, as well as a body of work Dennis calls "Illuminants," also the title of his one-man show at ISU's University Gallery.

A soft-spoken man, Dennis tends to understate when discussing his own work. Of the Prairie Lantern he says, "I wanted to design a large table lamp that would use cherry and black lacquer, and a leaded glass shade with colors that would complement these structural components. Another goal was to create a source of ambient light that would somehow convey a strong spirituality. My design derives from Japanese architecture as well as the work of Frank Lloyd Wright."

The gallery parapet of the Dana-Thomas house, where we photographed Dennis with his lamp, is usually lit by the Butterfly Chandelier suspended overhead, one of Wright's most celebrated stained-glass designs.



Lantern designer Dennis French with his original in Frank Lloyd Wright's Dana-Thomas house.

along the joint line. Turn the pieces over and apply a light film of glue to the beveled edges. Fold them together, then wrap tape around both ends and the middle to hold the joint tight until the glue dries.

Step 4. Cut the 29 kerfs in the ridge. To support the ridge during this operation, cut a 1 3/4 x 3 1/2 x 14" block of scrap. Joint and plane the block to ensure that it is flat, straight, and square in all dimensions. Then, tilt your tablesaw blade to 40° from perpendicular, and bevel-rip a V-groove down the middle as shown in *figure 9*.

Step 5. Mount a carbide blade with square-ground teeth on your saw and set it perpendicular to the table. Clamp the block to your miter gauge, then raise the blade to 1" and cut a kerf through the block 4" from the right end. Next, rip a key that fits the length of the kerf (*photo B*). The key should fit snugly but not tightly.

Step 6. Position and screw the block to your miter gauge so that the next cut falls exactly 3/16" from the keyed slot. Elevate the blade to 1 7/16" for this second kerf. Note: Be careful not to overcut the kerf; if you have to lower the blade back down to kerf the workpiece, the stock will not be supported adequately to prevent chip-out. Now, run a few test cuts in scrap stock to check the depth and spacing. Using a pencil, extend the kerf lines to the top and across the top edge of the V-block to help position the first cut.

Step 7. Mark the location of the first (centered) kerf on the shade ridge. Remove the key, and align the marks on the workpiece and fixture. Cut your first slot through the center of the ridge. Now, reinsert the key in the V-block, place the slot you just cut over the key, and cut the next slot. Continue until you've cut 14 slots to the left of the center slot. Then, turn the ridge around and cut 14 more slots, starting with the key in the center slot and moving the ridge to the right.

Step 8. Sand the ridge to 220-grit, then glue and clamp the painted poplar ridge cap to it, centering the cap along the length of the ridge.

Clear-Coat the Lantern

Step 1. Finish-sand all unpainted wooden surfaces to 220-grit. Also, lightly break any sharp edges.

Step 2. Reassemble all of the wooden parts, then spray the lantern with three coats of clear lacquer (or use the finish of your choice).

Build Steel Supports For The Light and Shade

Step 1. To make the I-shaped light support, first cut 1 1/4"-long studs from #8-32 threaded rod, and install them in the tops of the columns. To do this, place a small amount of epoxy in the bottom of each hole, then screw in the studs until they hit bottom.

Step 2. To build the shade support, cut two 14"-long pieces of 1/8x3/4" steel bar stock. Drill two 3/16" holes in each piece equidistant from both ends that will fit over the threaded studs. Then, bend a pair of 7/8" right-angle offsets on each end that fit snugly over the two columns. (See the Side View drawing.)

Step 3. Measure and cut a piece of the same bar stock to span the length between the two shade supports. Drill 3/16" holes through the center of the supports and the ends of the long piece so you can join the three with panhead machine screws. Drill a 7/16" hole in the center of the long bar for mounting the electrical socket.

Step 4. File or deburr any rough edges on the steel, and clean the pieces with mineral spirits. Next, prime the parts with a metal primer, including the heads (but not the threads) of the panhead screws and acorn nuts. Then, spray all of these parts with black lacquer or black acrylic paint from a spray can.

Now, Assemble and Wire the Lamp

Step 1. From leftover poplar, machine 10 glass retainers (P) to the

dimensions shown in figure 10. Also, cut an equal number of 1/4x3/4x3/4" cleats to hold the top of the glass where shown on the Side View detail.

Step 2. Turn the lantern upside down. Determine the size of the glass panels needed, and have them cut to final size. (We used the same opalescent amber-colored glass as used in the shade so the lighting would appear similar in color.) Install the glass and glass retainers. Also, glue the cleats to the underside of the platform directly above the glass retainers.

Step 3. To secure the shade ridge to the leaded glass, fit the stopped dadoes on the underside of the ridge over the gable ends of the leaded glass shade. If the ridge does not sit flat against the glass, file the solder or chisel wood from the underside of the ridge to fit over any irregularities in the solder. Mark the point where the ridge touches the glass with masking tape. Remove the ridge, and apply a small bead of black acrylic latex caulk along the glass just above the tape line. Remove the tape, then press the ridge down onto the caulk. Clean up any squeeze-out with a damp cloth.

Step 4. Center the shade on the supports so that it overhangs equally on both sides of the lantern. Then, solder the ends of the shade supports to the solder line on the shade where shown on the Side View drawing.

Step 5. Attach a single-socket electrical fixture to the underside of the platform. Space it 2" or so from the platform face with a block, and center the bulb. Next, mount a twin-socket electrical fixture on the steel bar that spans the shade supports where shown on the Front View. Connect the fixtures and electrical cord. (We covered the wire splices with plastic shrink tubing.) Then, wire a feed-through cord switch into

Figure 9

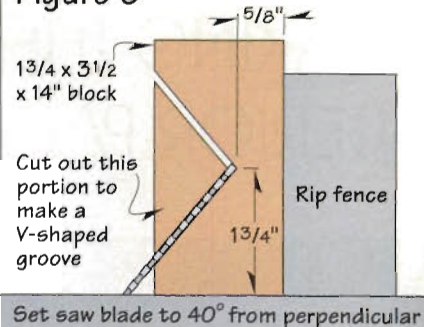
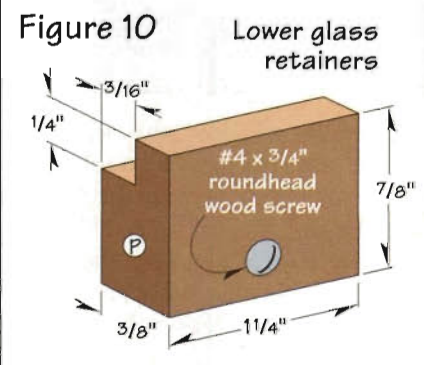


Figure 10



the cord at a convenient position, add a wall plug to the end of the cord, and tie a strain-relief knot in the line to prevent the cord from pulling through the base hole. Note: You may want to add a heat deflector above the bulb in the lower fixture. Also, secure the cord to the steel bar with electrical tape to conceal it as much as possible.

Step 6. Invert the lantern and measure the bottom opening. Cut the bottom (Q) to fit from 1/8"- or 1/4"-thick perforated hardboard. Install bulbs in the fixtures, screw the bottom to the bottom edge of the base, and mount the stained-glass shade on the columns. **WJ**

Project design: Dennis French

Lead photo, Dana-Thomas house interior:

StudioAlex

Dana-Thomas house exterior: Doug Carr

Other photos: Kevin May

Produced by: Tom Jackson

**WOODWORKER'S
JOURNAL**

E-Mail Address: wwjmag@aol.com

Are you a fan of Frank Lloyd Wright?
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MAKING THE LEADED GLASS SHADE AND INTERIOR PANELS FOR THE PRAIRIE LANTERN



If you've worked with leaded or stained glass in the past, you shouldn't have much trouble with the "hipped roof" design of this project, although it may challenge you a bit more than putting together flat glass panels.

The key to success in building the shade is to cut all of the multiple pieces exactly the same. To ensure this, make templates for pieces 1 through 7 as dimensioned on the drawing *below* and in the Bill of Materials. Then, use the templates to lay out and cut each piece.

You'll need $\frac{1}{4}$ "-wide copper foil and lead solder to join the angled pieces. To prevent the melted solder from running down the slopes of the angled joints, put the parts to be joined in a shallow cardboard box. Block them into position with scrap-wood or wads of newspaper, and tilt

the box so that the joint lies level. Then, apply solder to the foil. The flat panels at the bottom of the shade are held in place by a U-cap zinc came that surrounds the perimeter.

If you've never built a leaded or stained glass project, your library or bookstore should have the resources to familiarize you with the tools, materials, and techniques. (Also, see the article starting on *page 14* of our Nov./Dec. '95 issue, in which our consultant, Anita Roth, walks you through the basics of glassworking. For information on mail-ordering materials, see the Source listed below.)

BILL OF MATERIALS

SHADE

PART	T	W	L	MTL.	QTY.
1	$\frac{1}{8}$ "	See drawing		OA	2
2	$\frac{1}{8}$ "	See drawing		OA	4
3	$\frac{1}{8}$ "	See drawing		OA	2
4	$\frac{1}{8}$ "	See drawing		OB	8
5	$\frac{1}{8}$ "	5 $\frac{1}{4}$ "	8"	OA	2
6	$\frac{1}{8}$ "	1 $\frac{1}{2}$ "	5 $\frac{1}{4}$ "	OB	6
7	$\frac{1}{8}$ "	1 $\frac{1}{2}$ "	4 $\frac{3}{4}$ "	OB	2
8*	$\frac{1}{8}$ "	2 $\frac{1}{2}$ "	19"	OA	2
9*	$\frac{1}{8}$ "	2 $\frac{1}{2}$ "	6 $\frac{3}{4}$ "	OA	2

*Size is approximate. Cut to fit the inside dimensions of the base grid on the lantern.

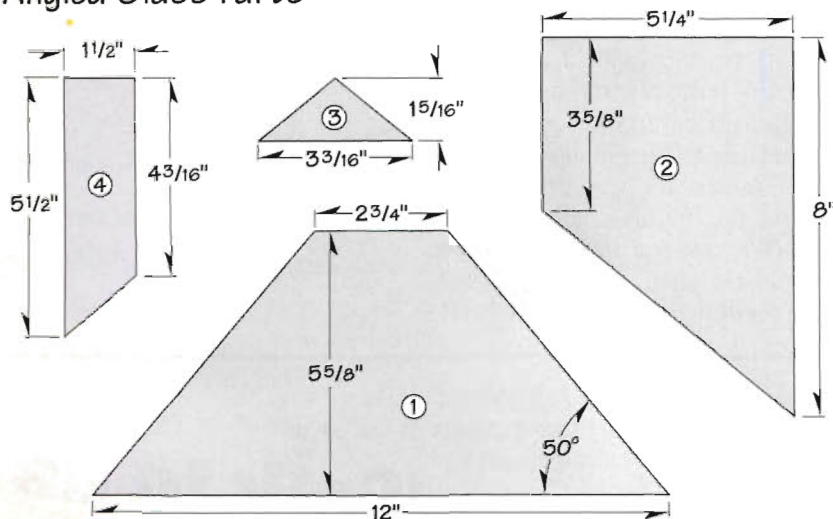
MATERIALS LIST

OA—opalescent amber glass
OB—opalescent black glass

SUPPLIES

Lead solder; U-cap zinc came; $\frac{1}{4}$ "-wide copper foil.

Angled Glass Parts



SOURCE

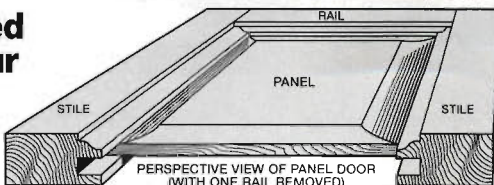
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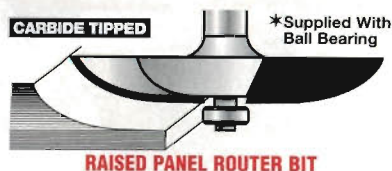
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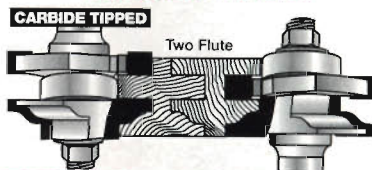


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(1/4" Radius)

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First, Build Three Frames

Step 1. To prepare stock for the two sides and door, joint and plane a 5x72" piece of 4/4 cherry to 3/4" thick. Then, rip and crosscut the stiles and rails (A, B, C, D, E) to the dimensions listed in the Bill of Materials.

Step 2. Install the coping cutter from a stile-and-rail bit set in your table-mounted router. Adjust it to the correct height for 3/4"-thick stock, testing the setup on scrap stock of this thickness. Then, using a backing board to minimize tear-out, carefully rout both ends of the six rails (C, E).

Step 3. Switch to the sticking cutter, and adjust for correct height by matching it against the cope you cut on the rail ends. Rout the sticking profile on the inside edges of the six stiles and six rails. (See the Pro Tip below.) If you've never routed cope-and-stick joints, read the instructions for the Umbrella Stand project starting on page 29 of the March/April '96 *Woodworker's Journal*.

Step 4. Dry-assemble the two side frames and the door. Adjust the fit as necessary. Then, glue and clamp the three assemblies, check for square, and allow the glue to dry.

Step 5. Unclamp the sides and door. Fit your handheld router with a rabbeting bit, then rout a 3/8" rabbet 3/8" deep along the inside back edges of the three frames to accept the glass panels. Square the rabbet corners with a chisel.

Note: If your sticking bit cuts a slot slightly deeper than 3/8" as ours does, you'll end up with a slight lip along the shoulder of the rabbet. However, this won't interfere with the glass panes and stops you'll install later.

PRO TIP

We used a two-piece stile-and-rail set (Freud no. 99-260). If you use a set with a different profile, you may need to adjust the length of the rails. To determine this, measure the difference between the cope cutter diameter and its bearing diameter. If your difference measures more or less than 1/16", adjust the length of the rails accordingly.

BILL OF MATERIALS

CABINET

PART	T	W	L	MTL.	QTY.
A Stiles—side back*	3/4"	1 3/4"	21"	C	2
B Stiles—side front*	3/4"	1 1/8"	21"	C	2
C Rails—side*	3/4"	1 1/2"	6"	C	4
D Stiles—door*	3/4"	1 1/2"	21"	C	2
E Rails—door*	3/4"	1 1/2"	10 1/4"	C	2
F Top/base	3/4"	7 3/8"	11 5/8"	CP	2
G Trim—Top front*	1"	1 1/16"	14"	C	1
H Trim—Top sides*	1"	1 1/16"	8 7/16"	C	2
I Trim—Base front*	3/4"	7/8"	13 3/8"	C	1
J Trim—Base sides*	3/4"	7/8"	8 1/4"	C	2
K Hanging cleat*	3/4"	1 3/16"	11 5/8"	C	1
L Glass stops—stiles*	9/32"	5/16"	18 7/8"	C	6
M Glass stops—side rails*	9/32"	5/16"	4 15/16"	C	4
N Glass stops—door rails*	9/32"	5/16"	10 3/16"	C	2
O Back*	1/4"	11 5/8"	20 3/16"	CP	1

GLASS PARTS

P Side panes*	3/32"	4 7/8"	18 13/16"	SG	2
Q Door pane*	3/32"	10 1/8"	18 13/16"	SG	1
R Shelves*	1/4"	6 1/16"	10 13/16"	PG	3

*Parts cut to final size during construction. Please read all instructions before cutting.

MATERIALS LIST

C—cherry
CP—cherry plywood
SG—single-strength glass
PG—plate glass

SUPPLIES

#4 x 1/2" brass flathead wood screws;
#20 biscuits; stain (optional); finish.
(For other supplies, see Sources at end of article.)

Step 6. Using a sliding cutoff table with a stop (or a miter gauge and extension), trim a tiny amount of stock (1/32" or less) from the edges of the side frames to square and equalize them. Then, sand the faces of all joints flush.

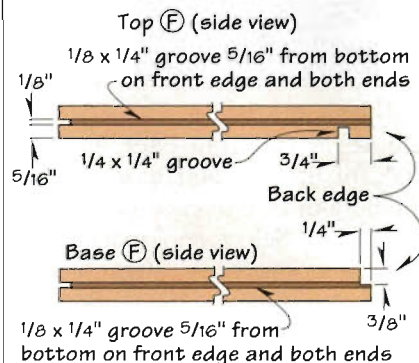
the bottom face of the top as dimensioned in figure 1. Then, cut a rabbet along the top back edge of the base as dimensioned in the same figure.

Make the Top and Base, Then Add the Trim

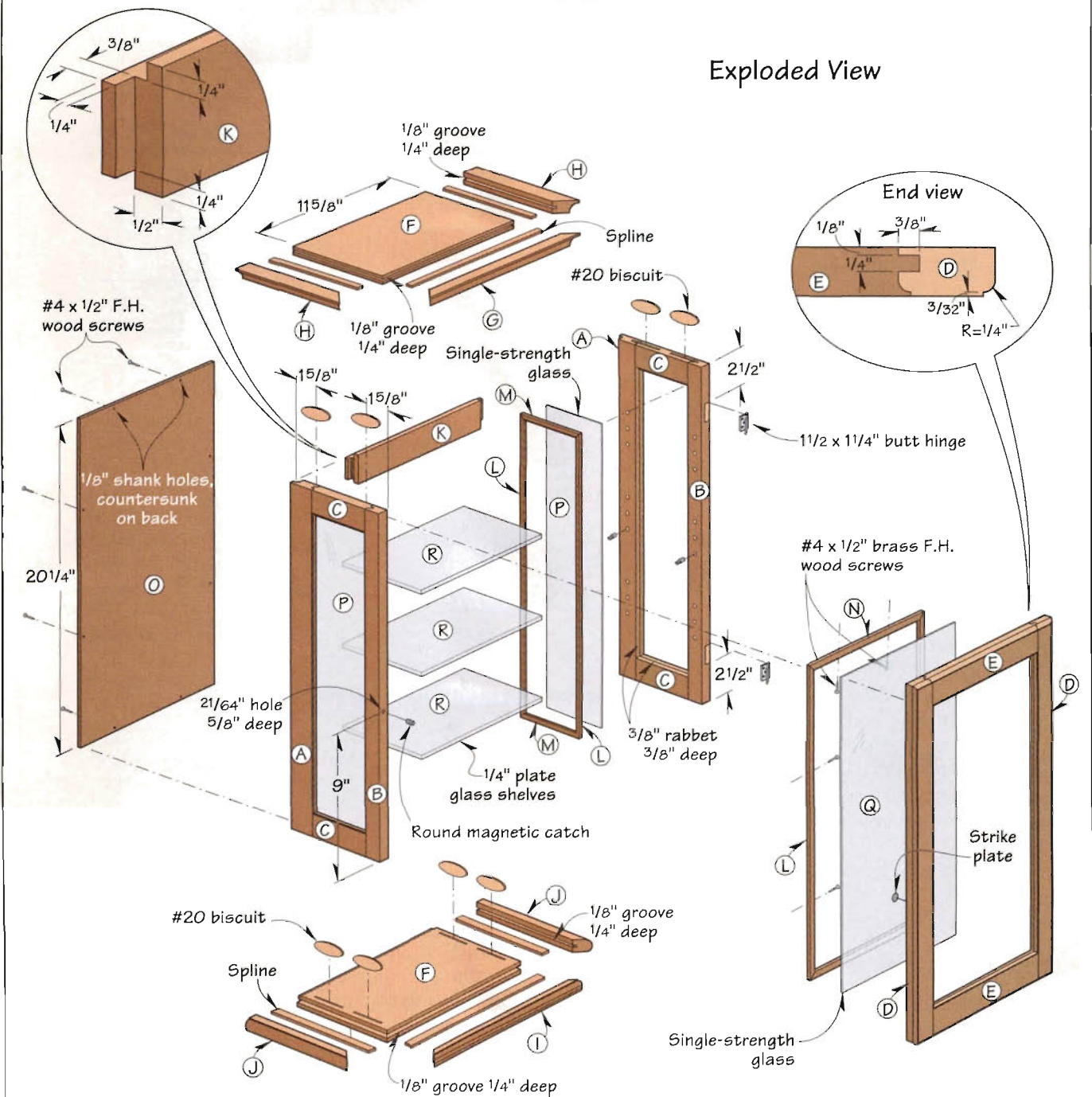
Step 1. To make the trim, plane a 1 3/16 x 36" piece of cherry to 1" thick and a 7/8 x 36" piece to about 1/4" thicker than the actual thickness of your 3/4" plywood base.

Step 2. From 3/4"-thick cherry plywood, cut the top and base (F) to dimension, then mark the better face of each piece "interior"—you'll want these faces to show on the inside of the cabinet. Cut a groove in

Figure 1 Locations of grooves and rabbets in top and base



Exploded View



Step 3. Fit your tablesaw with a 1/8"-thick rip blade. Set the rip fence 3/16" from the blade. Cut a 1/4"-deep groove in the front edge and both ends of the top and base, keeping the bottom face of each part against the fence. Select and mark a bottom face on each strip of trim stock, then. Holding the marked face against the fence, cut an identical groove along one edge. (See the Pro Tip *opposite*.)

Step 4. Fit your table-mounted router with a 1/4" cove bit, and set it to cut 3/16" deep. Rout a cove on the top inside edge of the 1 3/16"-wide top trim where detailed on the Front View drawing *opposite*.

Step 5. From scrap hardwood, rip about 6' of 1/8 x 1 5/32" spline stock. (You could also use 1/8" tempered hardboard.) Next, crosscut the top trim pieces (G, H) to rough length in side-front-side sequence. Hold part

G against the front edge of the top, and mark the top's length on it. Then, miter-cut both ends of the front trim piece (J). Miter a piece of spline to fit, then glue, spline, and clamp the front trim to the top. Miter the front ends of both side trim pieces (H), but leave the back ends about 1" long to serve as guides for subsequent routing. Glue, spline, and clamp the side trim to the top and front trim.

Step 6. Place the top on your router table with the top face down. Using a $\frac{1}{4}$ " bull-nose (half-round) bit or a $\frac{1}{8}$ " round-over bit (making two passes), rout a half-round along the top outside edge of the trim where shown on the Front View detail. Make a test cut using a scrap of equal thickness to check the height of the bit. Also, guide the workpiece with a fence even if you use a piloted round-over bit, as the bit will not have sufficient bearing surface on the second pass.

PRO TIP

One of the best ways to dress up any plywood edge is to wrap it with solid wood trim. Splines help reinforce and align the pieces, but if the spline grooves are more than a few thousandths of an inch out of alignment, you'll have a difficult time sanding the offset faces flush after glue-up.

To avoid this headache, stick with three simple rules:

- First, don't move the fence. Cut the spline grooves in both the plywood and the trim with the fence locked in the same position.

- Second, mark the faces of each plywood and trim piece "top" and "bottom," and keep the same face of all parts against the fence as you cut the grooves.

- Third, keep this orientation consistent as you glue the trim to the plywood. That way, even if your grooves are not perfectly centered, they'll align with each other and keep the trim registered flush with the plywood.

Step 7. Switch to a $\frac{1}{2}$ "-radius core box bit. (A $\frac{1}{2}$ " piloted cove bit will also work if you remove the bearing.) Using the fence, rout the cove where shown on the Front View detail.

Step 8. Cut the three base trim pieces (I, J) to rough length in side-front-side sequence. Then, repeat the procedure described in Step 5 to spline them to the base, again leaving the back ends of the side pieces long for routing.

Step 9. Using a $\frac{1}{4}$ " round-over bit, rout the profile on the base as detailed on the Side View drawing. Elevate the bit to add a $\frac{1}{8}$ " shoulder along the top edge. Again, make test cuts on a scrap piece to set the bit height. Now, cut the side trim flush with the back edge on both the base and top. Sand the trim profiles to 220-grit. (We wrapped a length of $\frac{1}{2}$ " dowel with sandpaper to sand the cove.)

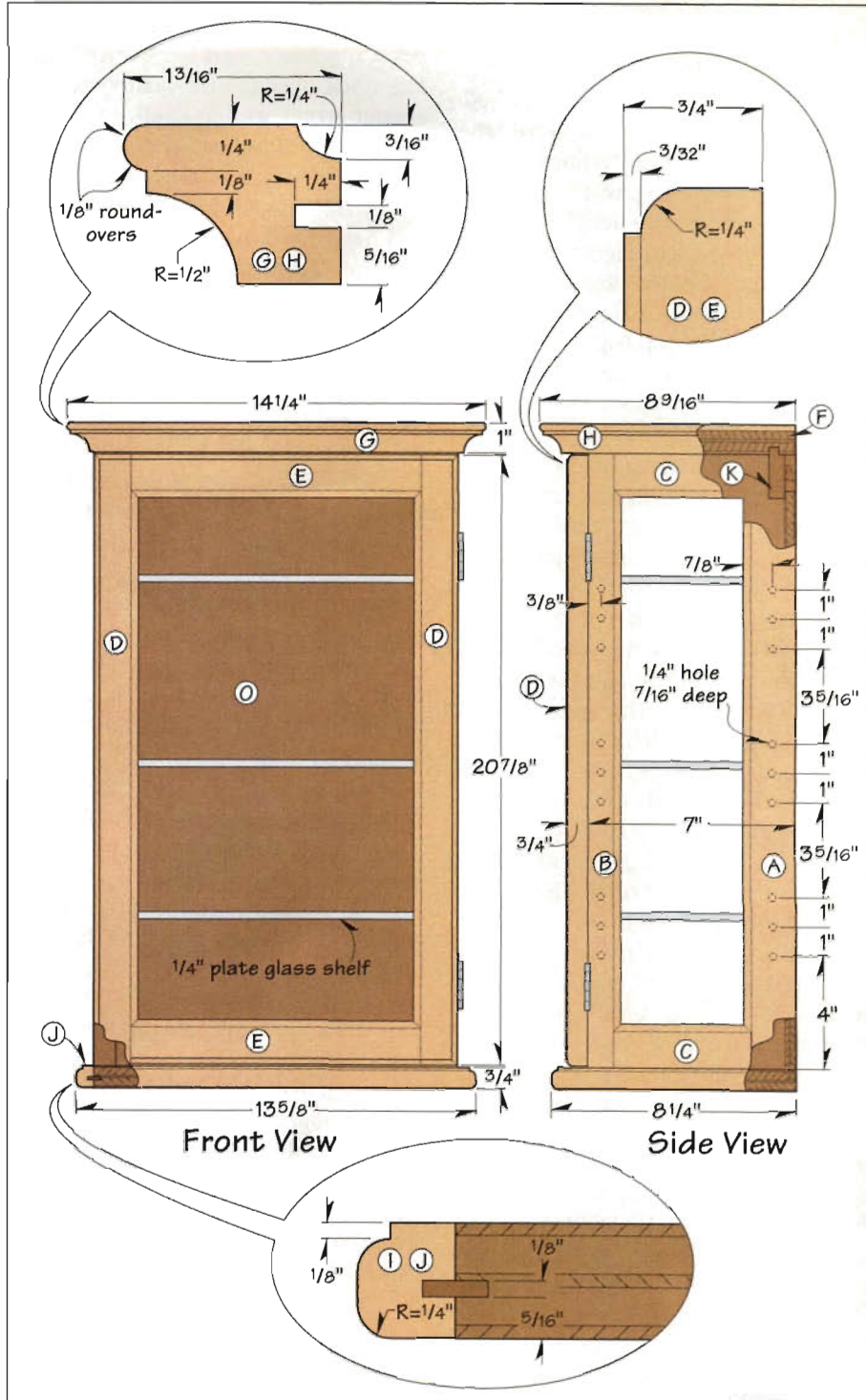
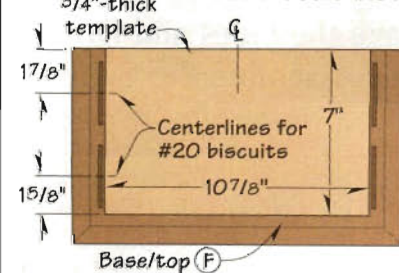


Figure 2 Using a template to cut biscuit slots



Prepare the Cabinet Parts

Step 1. Cut the template shown in *figure 2* from $\frac{3}{4}$ "-thick scrap plywood. Find and mark a centerline across the width, then lay out centerlines for #20 biscuit slots where shown.

Step 2. Center the template on the underside of the top, aligning the back edges, and clamp it in place. Then, cut the four biscuit slots. Repeat this procedure to slot the top face of the base.

Step 3. Use the template to mark the mating biscuit locations on the bottom and top ends of the sides. Then, cut the slots. (To do this, we placed the frames inside face down and clamped the back edges.) Now, rout a $\frac{3}{8}$ " rabbit $\frac{1}{4}$ " deep along the inside back edge of the sides to accept the back and hanging cleat.

Step 4. Dry-assemble and clamp the cabinet with biscuits, then check for square. To make the hanging cleat (K), cut a $1\frac{1}{2} \times 12$ " blank from $\frac{3}{4}$ "-thick cherry, then crosscut it to fit snugly between the top ends of the sides.

Step 5. Cut a $\frac{1}{2}$ "-deep rabbit across each end (front face) of the cleat where detailed on the Exploded View. Note: Although we call out a $\frac{3}{8}$ " width for these rabbets, "sneak up" on the final shoulder cuts to make the shoulders fit snugly between the sides—a loose fit will show inside the cabinet.

Step 6. On the top edge of the cleat, cut a rabbit wide enough to form a $\frac{1}{4}$ "-long tongue to fit into the groove on the underside of the top. Again, sneak up on the cut to produce a snug-fitting tongue. Along the bottom edge of the back face, cut a rabbit $\frac{1}{4}$ " deep where shown.

Step 7. Lay out two keyhole slots on the back face of the cleat centered 2" from the ends. Install a keyhole bit in your plunge router, and rout the slots. Dry-fit the cleat to check for fit.

Glaze the Sides and Door, Then Assemble the Cabinet

Step 1. To make the glass stops (L, M, N), surface a 5×22 " piece of cherry to $\frac{9}{32}$ " thick, then joint the edges. Tilt your tablesaw blade to 10° from perpendicular, and bevel-rip a $\frac{3}{16}$ "-wide strip from both edges. (See *figure 3*.)

Set the blade back to perpendicular, reset the fence, and flip your remaining stock over (so the acutely angled corner won't wedge itself under the fence). Rip another strip from both edges. Repeat this procedure, alternately ripping and bevel-ripping, until you have eight usable strips.

Step 2. Measure the rabbeted glass recesses on the inside faces of the sides and door. Miter-cut both ends of the glass stops (L, M, N) to fit.

Step 3. Subtract $\frac{1}{16}$ " from both the width and length of the rabbeted side and door recesses you measured in Step 2. Cut single-strength glass panes (P, Q) to these dimensions. Have a glass dealer cut the three shelves (R) to size and polish the edges.

Step 4. Temporarily assemble the glass panes and stops in their respective frames. Then, lay out and carefully drill countersunk shank and pilot holes through the stops and into the frames, keeping the bit perpendicular to the beveled edge of the stop. (See the detail on the Exploded View. We used a combination countersink and pilot bit to drill these holes in one step.)

Step 5. Disassemble the cabinet and cut two hinge gains (to fit your hinges) in the front edge of the right side where dimensioned on the Exploded View. (We routed our gains to a depth equal to the thickness of the hinge leaf using a piloted mortising bit and a shopmade template. To order hinges and other hardware, see Source at the end of the article.) Square the corners of the gains using a sharp chisel.

Step 6. Lay out and drill $\frac{1}{4}$ " holes $\frac{3}{16}$ " deep for shelf supports in the

inside faces of the sides where dimensioned on the Side View drawing. To do this, use a brad-point bit and drill press.

Step 7. Finish-sand the inside faces of the sides, top, base, and hanging cleat. Dry-assemble the parts with biscuits to check for fit, then adjust as necessary. When everything fits, glue, biscuit, and clamp the top and base to the sides. (To check for square, we measured diagonally from corner to corner using pointed story sticks.) Then, glue and clamp the hanging cleat to the top and sides.

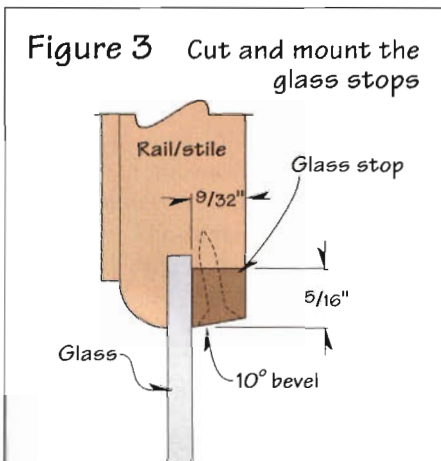
Step 8. After the glue has dried, measure the rabbeted back opening. Cut the back (O) to fit from $\frac{1}{4}$ " cherry plywood. Temporarily insert the back in its recess, then drill two evenly spaced, countersunk shank and pilot holes for $\#4 \times \frac{1}{2}$ " screws along both edges and ends.

Hang the Door, Then Apply the Finish

Step 1. Measure the door opening on the cabinet front. Rip equal amounts of stock from both door edges to make the door identical in width to the cabinet. Then, trim equal lengths from both door ends to create $\frac{1}{16}$ " of clearance at the top and bottom.

Step 2. Install the hinges in the cabinet gains. (We used a Vix bit to drill the holes.) Position the door in its opening using $\frac{1}{16}$ " spacers at the top and bottom. Center the template you made earlier on the edge of the door, then rout and square the hinge gains. Drill screw holes in the door (again using a Vix bit), then drive the screws to attach the hinges.

Step 3. Lay out mating holes on the back face of the door and the front edge of the cabinet side for the magnetic catch. (For location, see the Exploded View.) Remove the door from the hinges and the hinges from the cabinet. Then, using your drill press, drill holes for the catch (in the cabinet) and strike plate (in the door) as specified by the manufacturer. Note: We chose not to install a knob on our door. If you'd prefer to have a knob, lay out and drill a hole for it at this time in one of the door stiles.



Continued on page 71

WOODWORKER'S JOURNAL Holiday Gift Guide



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Powermatic Model 1170 Drill Press

Powermatic just introduced the Model 1170 Drill Press. The 17" drill press carries a 1-hp., single phase, 115/230-volt motor, a unique safety key switch, and ¾" chuck. You can buy the 1170 with either a woodworking or metalworking 12x12" cast-iron table and elevating mechanism. Both tables rotate and tilt 45°. The model 1170 also features a cast-iron head and base, a 16-speed step-pulley, and a depth-stop system for repetitive drilling. Also available in 14" bench and floor versions. For more information, call 800/248-0144.



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New Powermatic 14" Band Saw

Powermatic's Model 044, 14" Band Saw is their latest addition to the Artisan line. Model 044 features a 1-hp. single phase, 115/230-volt motor, dynamically balanced wheels, and a 9" cutting capacity. The newly designed 15x15" cast-iron table tilts 45° right and 15° left. Both guides utilize two ball-bearing side guides and a ball-bearing back-up guide to reduce blade friction. An integral dust collector hook up comes standard. For more information, call 800/248-0144.



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Step 4. Using a 1/4" round-over bit set to cut a 3/32" shoulder, rout around the outside front edge of the door in end-edge-end-edge sequence. (See the detail on the Exploded View.)

Step 5. Sand all surfaces that still need it to 220-grit, and break any sharp corners. Remove the sanding dust, then apply your choice of finish. (To even up the color of the solid stock and plywood, we stained the cabinet with Zar #117 Cherry. We then sprayed on three coats of semi-gloss lacquer, sanding between coats with 400-grit sandpaper.)

Step 6. Install the glass in the door and sides, and screw the glass stops in place. Attach the back and door, then install the magnetic catch, shelf supports, and shelves. 

Project design: Bob Colpetzer

Lead photograph: Lynxwiler Photography

Illustrations: Cad Art

SOURCE

Hardware Kit. Includes two 1 1/2 x 1 1/4" polished brass ball-tip pin hinges (no. 25809); twenty 1/4" brass pin-style shelf supports (no. 30437); 7/16"-dia. round magnetic catch with strike plate (no. 29280). Ask for kit no. 21569. Price: \$9.95 ppd. Order from:

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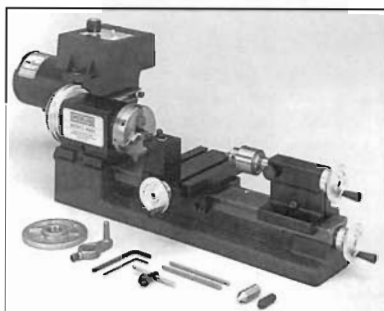
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NEW TOOL ROUNDUP

We search the woodworking trade shows to find the new 1997 tool introductions

Thickness Planer Solves Snipe Problems

A new 12½" benchtop thickness planer from Sears Craftsman features four precision-ground steel columns that stabilize the cutter head to produce snipe-free planing for most operations.

The 14-amp, 2-hp (maximum) motor drives the 8,000-rpm cutter head. Chain-driven, rubber-covered infeed/outfeed rollers feed stock at 26 fpm. The unit will handle stock up to 6" thick and 12½" wide with a ⅜" maximum depth of cut per pass.

Other features on the new planer include folding infeed/outfeed extension tables, two extension support rollers, top-mounted work-return rollers, a cutter height scale, and built-in carrying handles.

Sears Craftsman 12½" Thickness Planer model 23378, \$430.

Sears, Roebuck & Co. (See your nearest Sears store.)

Craftsman Thickness Planer model 23378



Milwaukee ½"
Drill/Driver model
0501-20

Milwaukee Introduces New Cordless Drill Family

Milwaukee Tools has unveiled two 12-volt variable-speed drill/drivers in ⅜" and ½" capacities (models 0501-20 and 0502-20).

According to the manufacturer, the drill motors, powered by new 2.0 amp-hr ni-cad batteries, develop 220 in.-lbs. of torque. Unique dual-terminal batteries can be coupled to the drills in either of two positions—one for better tool balance, one for more work clearance.

Other features include dual speed ranges, keyless chucks, choice of T- or pistol-grip handles, pulse-charging technology for charging batteries to full power in 20 minutes, a 19-position torque clutch, and soft-grip pads for handle comfort. Both drills may be purchased in a kit that includes a second battery pack, a charger, and a steel carrying case.

Milwaukee 12-Volt Drill/Driver models 0501-20 and 0502-20

**Milwaukee Electric Tool Corporation
800/414-6527**

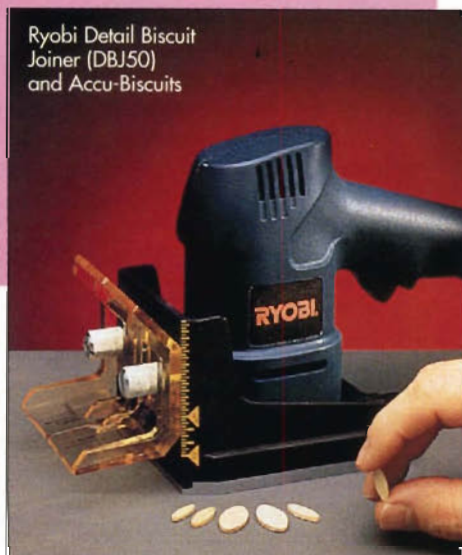
Biscuit Joiner Handles Small Projects

For strong, durable joints, more and more woodworkers are turning to biscuits. That option now extends to smaller-scale woodworking projects with Ryobi's recent introduction of a detail biscuit joiner.

The firm's pint-sized DBJ50 joiner cuts slots for biscuits as small as ⅜". Ryobi has also released its new Accu-Biscuits in three sizes for use with this unit: the R-1 (⅜" long), the R-2 (¾" long), and the R-3 (1" long). (Compare these to the 1⅜" length of the #0 biscuit, which is the smallest used with standard biscuit joiners.)

Ryobi's diminutive joiner works like its full-sized counterparts, cutting elliptical slots into mating workpieces for the thin wood biscuits. It has a calibrated see-through fence to help you guide the workpiece and keep it square with the cutting blade. Powered by a 3.5-amp motor, it uses a 1½"-diameter cutter and comes with a 10' cord. Price: about \$69.

**Ryobi Power Tools
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Ryobi Detail Biscuit
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DeWalt DW321K jigsaw

Two New Orbital Jigsaws

Whichever your jigsaw preference—top handle or barrel grip—DeWalt has you covered with its new DW321K top-handle unit and DW323K barrel-grip saw.

These otherwise identical machines feature variable speed and orbital-cutting action to adjust for cutting conditions. Both are equipped with a unique quick-release, tool-free blade clamp system that allows blade-changing without wrenches and accepts either "T" or universal shank blades. The saws also employ a keyless beveling shoe that pivots up to 45° in either direction and slides front to back.

Powered by a 5.8-amp motor, each saw incorporates switch-limiting variable speed settings of 500 to 3100 orbits per minute and a 1"-long blade stroke. You'll also find ball- and roller-bearing construction and a newly designed counter-balance system to reduce vibration and user fatigue.

DeWalt Top-Handle (DW321K) and Barrel-Grip (DW323K) Jigsaws

DeWalt Industrial Tool Co.
800/433-9258

Freud's New Stacked Dado System

If you're looking for a hard-working, fine-cutting, versatile dado set, investigate Freud's new Super Dado System. The company claims that this set cuts smooth bottoms and splinter-free side walls in everything from veneered plywoods and laminates to solid wood.

According to Freud, its engineers have combined new tooth geometry and tooth-cutting technology to produce a shorter, thicker tooth that reduces drag in the cut and increases the number of sharpenings possible. The teeth are ground with a negative angle. Outside blades are made of thicker, extra-stiff plate steel with 12 bevel-ground teeth and 12 raker teeth.

To solve the problems associated with undersized plywoods, they've included a $\frac{3}{32}$ "-thick chipper that lets you cut matching-width dadoes without shimming. Freud offers the dado set in 6"- and 8"-diameter versions.

Freud Super Dado System
SD508 (8"), \$344.20;
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Freud SD508 Super Dado System



Makita 12-volt, $\frac{1}{2}$ "
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model 6313DWAE

Cordless Drill/Drivers Feature Latest Battery Technology

Tool makers continue to expand their cordless drill offerings. Makita's five newest models provide a glimpse of where power-tool designers are heading.

The manufacturer offers its new variable-speed drill/driver in 9.6-volt, 12-volt, and 14.4-volt T-handle versions with either $\frac{3}{8}$ " or $\frac{1}{2}$ " keyless chucks. All units feature two speeds forward and reverse, 17 torque settings, externally accessible brushes for easy replacement, and 2-amp rechargeable batteries. The drills range in weight from 3.8 to 4.4 pounds.

Makita sells the drill/drivers in a kit that includes two batteries, two Phillips/slotted bits, a battery charger, and carrying case. A one-year limited warranty protects against defects in parts and workmanship.

Makita Cordless Drill/Driver models 6203DWAE, 6123DWAE, 6313DWAE, 6233DWAE, 6333DWAE.

Makita USA Inc.
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Southwire Glo-Plug

Glo-Plug Confirms That Power Is On

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Continued on page 74

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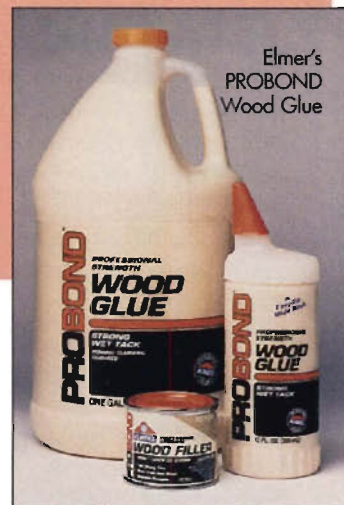
New Woodworking Glue

Elmer's has just announced release of a new professional-strength wood glue to be marketed under the firm's trade name **PROBOND**. An aliphatic-type adhesive, the new formula provides a strong wet tack that sets in just 15 to 25 minutes with minimal clamping. Once dry, the glue is sandable and paintable.

Elmer's will market the adhesive in 12-ounce and 1-gallon packages. The smaller container features a wide neck for easy refilling and an offset spout for quick glue dispersion.

Elmer's **PROBOND** Wood Glue

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DeWalt Offers Premium-Grade Saw Blades

DeWalt now markets a new line of 10" and 12" carbide-tooth blades designed for cabinetry and fine woodworking. The line includes blades for tablesaws, miter saws, and sliding compound miter saws.

The new blades come in 40-, 48-, and 60-tooth models. According to the firm, oversized carbide teeth will provide up to 50 percent longer cutting life and sustain up to 15 resharpenings.

DeWalt Premium Woodworking Saw Blades

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Continued on page 76

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PRO TIP

The width of profile cut by your panel-raising bit determines the final size of the crown. To calculate the crown's width and length, set up the bit to route the profile. Make a test cut on scrap wood. Measure the width of the crown. To calculate the crown's length, measure the length of the bit (rail plus stiles), then subtract the width of the bit's profile (to allow for a 1/4" reveal at each end). To calculate the crown's width, add the width of the bit's profile to the test cut, then add 1/4" for the reveal.

When working with narrow pieces, you start with a piece wider for safer hand routing operation, then rip it to final width later.



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Continued from page 74

Enlarged and Enhanced Router Table

Porter-Cable recently unveiled a new, upgraded version of its popular all-metal router table. The new model 698 sports a larger (19"x16 1/2") tabletop, longer (12 1/2") legs to accept large routers, a quick-adjusting split-fence system, 3/8"-diameter bit capacity, a front-mounted power switch, a 3/4" miter gauge, and built-in dust-collection capability.

The firm also sells the new table with a 1 1/2-hp, 23,000-rpm, 10-amp router (model 697). The router incorporates sealed ball bearings and comes with both 1/4" and 1/2" collets and an auto-release feature that prevents bits from freezing in the collet.

Porter-Cable Router Table (model 698), about \$140. Table with router (model 697), about \$250.

Porter-Cable
800/487-8665

Porter-Cable Router Table
model 697



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Three Specialized Router Tables by Jim Barrett

While researching router tables for my two reviews, I found three models that didn't fit the category of either "benchtop" or "floor" model. (See my reviews of these two categories starting on page 68 in July/August '96 and on page 72 in September/October '96.) However, since these three perform very specific functions that may be valuable to you, I'll review them briefly for you here.

DeWalt DW6900 Router Table and Accessory Kit

This tiny table was designed for use with DeWalt's DW614 and DW615 plunge routers. Its 8 $\frac{3}{4}$ x 9 $\frac{1}{2}$ " metal tabletop mounts on four 12"-long legs and includes a narrow but tall vertical fence with a pressure-clamp assembly that holds the workpiece against the fence. You can also mount the clamp to apply downward pressure for certain routing operations.

To attach either of the DeWalt routers to the table, you slide the router's two fence bars through holes on the underside of the table and secure them with four plastic knobs. The fence remains stationary; you adjust the router bit's position from front to back in crossfeed fashion by simply turning a horizontal fine-adjustment screw. The elongated table slot will accept bit profiles of up to 1 $\frac{1}{2}$ " in diameter.

If you remove the legs, the tabletop and fence assembly can be used as a large right-angle base to support freehand edge-routing of large panels or surfaces. The table/fence can also be secured horizontally to a bench (using the two C-clamps provided) for horizontal routing operations if designed.

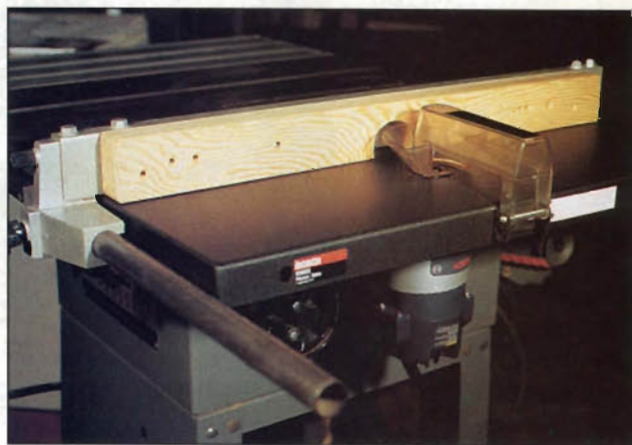
The kit also includes a setup for template-routing curved shapes (with the fence removed) and a trammel bar for making circular routing cuts using just the router.

As a table, the tiny unit doesn't provide enough support to accurately rout long or wide stock. It definitely should be secured to a bench (using the leg clips provided) or to a large, firmly anchored piece of plywood. Although this table works only with the two DeWalt routers, it greatly expands their capabilities.

DeWalt DW6900 Router Table and Accessory Kit, about \$200.

Bosch Router Table (model 93905)

If your shop space is limited, the Bosch router table will definitely ease the crowding—it doesn't use up any floor space. It's actually a heavy-gauge stamped-steel extension wing that mounts on the side of most 27"-deep tablesaws (notably, Delta and Sears), replacing the table's right extension. A steel mounting plate attached to the underside of the unit (with four wing nuts) has 36 pre-drilled holes that will



Bosch Router Table

accept a variety of routers with bases of up to 7 $\frac{1}{2}$ " in diameter. With all of these holes, the steel mounting plate resembles a piece of Swiss cheese, but it's thick enough to support the largest routers.

The table also includes brackets and hardware to mount most jigsaws as well as the firm's dust-extraction system. Topside, you'll find a clear plastic bit guard and a removable plastic table insert. (I'd like Bosch to provide a larger selection of insert sizes for the unit.) The table also comes with a notched wooden subfence that you simply attach to the outside face of the table-saw's rip fence.

If you already own a good tablesaw and router, this durable, inexpensive accessory provides plenty of support for basic table-routing operations on large stock with almost any size of router. With the router bit removed, the table doubles nicely as an extension wing for the saw.

**Bosch Router Table (model 93905), about \$150.
Woodcraft, 800/225-1153**



DeWalt DW6900 Router Table

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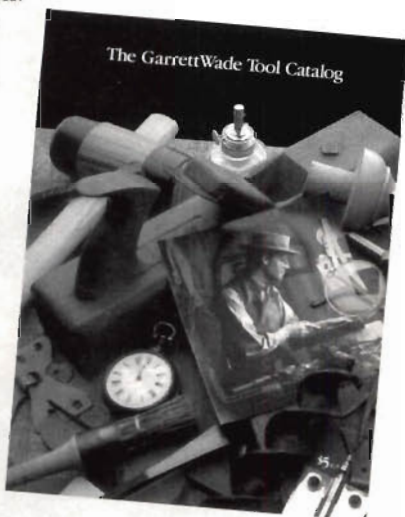
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Continued from page 77

Woodworker's Supply Drill-Press Router Table

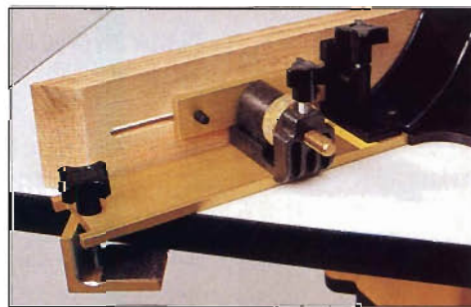
Here's another candidate to consider if you have to work in a cramped shop space—the drill-press table from Woodworker's Supply. The die-cast aluminum frame fits most cylindrical columns without machining. You simply place the Y-shaped yoke around the column and turn the knob. This allows you to clamp the frame to the column at any desired working height. Insert a guide pin into the drill's chuck, and you've converted it to an inverted pin-routing system. Note: We've used this table in the *Woodworker's Journal* shop in this mode to rout plaques that will be featured in a future magazine project.

The 3/4x16x24" laminated table bolts to the die-cast frame from the bottom side. The 8 1/4x8 1/2" fiberglass-filled ABS plastic mounting plate has a removable 4 1/4"-diameter ring, which in turn holds a 2 1/2" ring. Porter-Cable-styled guide bushings snap into this smaller ring for quick mounting.

The aluminum bar fence incorporates a 3" dust-collection port, dual hardwood subfences, and an adjustable bit guard. (See photo above and below.) Both independent subfences have 2" lateral and up to 1" front/back adjustability.



Woodworker's Supply Drill Press Router Table and Fence



Back view of the Drill Press Router Table fence

Woodworker's Supply offers the full system including table, mounting plate, guide bushings, and adjustable fence (\$229); a router-table package (\$159); or the individual components: table only (\$69.95); table with baseplate and rings (\$99.95); fence assembly (\$99.95); baseplate, inserts, and start pins (\$39.95); guide bushings (\$29.95). **WJ**

Woodworker's Supply
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SHOP TEST

HITACHI 10" Dual Slide Compound Miter Saw (Model C10FS)

by Rob Cook

Twenty-five years ago, I bought my first woodworking machine, a radial-arm saw. Big mistake. Eventually, I replaced it with a tablesaw, but this brought with it the less-than-exciting prospect of trying to crosscut long boards and make compound cuts on narrow stock. Over the years, I tried a number of solutions, each one slightly better than the last. Then they created the sliding compound miter saw.

Since that breakthrough, I've worked with several versions of this

machine, both single-beam and double-beam. When asked to wring out the newest 10" model from Hitachi, I was ready and willing.

What You Get

The saw arrived almost fully assembled. I removed it from the box, set it on my bench to attach the fences and hold-down—and the whole unit tipped over backward. Good reminder to read the owner's

manual first! If you don't plan on mounting the saw permanently on the bench or tabletop, be sure you attach the kickstand to stabilize the base first thing.

When you open the instructions, allow yourself time to read them more than once. I found the English very literal, the grammar a bit sloppy, and some of the parts nomenclature a bit odd.

A quick look showed the saw's finish to be exceptional. The paint had been uniformly and completely applied, the aluminum parts were cleanly cast, and the flat surfaces had been well machined. All parts fit properly, and I found no missing bolts, broken parts, or jagged edges.

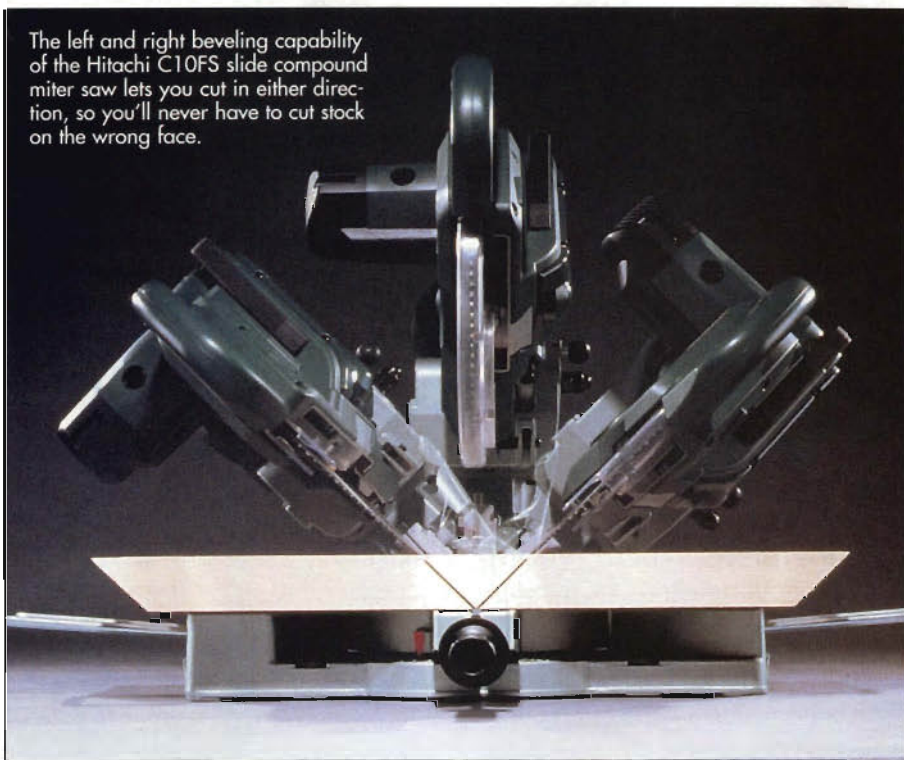
I prefer to check the mechanicals out before I plug in the cord, which gives me a chance to get a feel for the tool early on. As with the saw's 8½" predecessor, the sliding motion on the twin beams was even and controlled. The beams ride on ball bushings with oiled felt seals. Vertical movement of the head was also smooth through its entire arc. The designers have thoughtfully incorporated a double lock nut for adjusting out any slop that develops. A heavy wound spring lifts the motor/saw head easily.

The conventional one-finger, trigger-type switch located under the handle requires you to push a safety button before it will depress. I had no trouble operating this switch combination, but a lefty might find it slightly awkward. To make the tool inoperable for safety purposes, you remove the button. I'd have preferred a red button or some other bright color—the black one was sometimes hard to find when I wanted to use the saw.

Saw settings were accurate right out of the box—no tweaking required. The well-marked miter scale has positive detents at the key miter positions

Continued on page 80

The left and right beveling capability of the Hitachi C10FS slide compound miter saw lets you cut in either direction, so you'll never have to cut stock on the wrong face.



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Hitachi Miter Saw

Continued from page 79

of 15, 22½, 31.6, 35.3 and 45° left and right. They've even marked the slope indicators (rise over run) from 1/10 up to 10/10 for you carpenters.

The bevel indicator was more difficult for me to read, but it does have detents at key angles (30 and 33.9°) and positive stops at 45° left and right. This made reading the indicator less critical than I at first thought it would be.

Some of the detent angles may seem odd to you, but you'll need the more unusual ones to cut crown molding. Slide compound miter saws really shine at this task, and the C10FS made easy work of cutting both the 38° and the 45° crown styles. For example, to cut 45° crown, I simply laid the stock flat on the saw and cut the left and right

should you want to form quick dados. Note, however, that the saw cannot be used with a dado head.

I like the two-piece sliding fence and the unique adjustable chip guard. Both made it safer and simpler to stabilize and work small pieces on the saw. By adjusting the chip guard to support the stock, you can minimize splintering and eliminate the need for a zero-clearance fence for all but the smallest workpieces. This chip guard also made it easier to align the workpiece with the blade before cutting. On those rare occasions when you need to use the full available cutting width, you'll find it necessary to remove the sliding fences.

Accessories include a dust-collection bag and a vise-type hold-down



The saw's unique chip guard can be adjusted forward or backward to support the workpiece and minimize splintering and chip-out. The see-through blade guard retracts out of the way as you lower the head.

miters at 35.3° and the bevel at 30.

Cutting capacity on these saws is always critical, and here the C10FS holds its own. I measured 12¼" cross-cutting width at 0° in 3½"-thick stock. Setting the saw at 45° bevel and 31° miter, I was still able to work a 10"-wide board 1¾" thick. You can crosscut a 4x4 at both 90 and 45°.

Refinements Worth Noting

To control cutting depth, the engineers have provided an adjustable wing nut and bolt mounted just ahead of the pivot hinge. You can set it to cut uniform-depth kerfs or grooves

for clamping the workpiece to the saw's table. The dust bag worked well, although I found that a 2" vacuum hose fits snugly over the outlet. This would be the preferred dust-evacuation system in my shop.

The 10-amp, 3800-rpm motor powered the 10" carbide-tipped blade adequately through my tests (which included 8/4x6" pieces of red oak) with hardly a noticeable slowdown. A replaceable poly V-belt drives the blade. Hitachi has incorporated electronic speed-control circuitry to help maintain constant blade speed, and there's an overload feature to pro-

tect the motor. Soft-start electronics reduces the start-up torque kick to a barely discernible twitch. Motor and cutting noise were loud but not as ear-piercing as with some saws of this type that I've used.

The 40-tooth, $\frac{3}{32}$ "-thick Hitachi blade supplied with the saw made acceptably clean, smooth, and splinter-free cuts, even in melamine. The retracting blade guard rises automatically into the blade housing and out of the way to clear the workpiece as you lower the head. Made of clear plastic, the guard allows you to keep your eye on the blade at all times.

The C10FS lists for \$1,627, but you'll find it street-priced at about \$750 through some of the larger home centers and woodworking mail-order catalogs.

My Verdict

If you're thinking of adding a miter saw to your shop, here's one you definitely should look at. Evaluate the added capabilities of the "dual compound" feature in terms of how you'll use the tool. How important is it for you to have a saw that can bevel in either direction so you never have to cut stock on the wrong face? How desirable will it be to leave long, heavy stock on the table to make the next cut so you don't have to flip it in

a close or confining shop? How valuable is it to have the increased cutting capacity offered by the sliding head?

You can buy cheaper miter saws. But, as with most tools, I believe the more versatility you can buy in a unit, the more value it will yield over the long term. *WJ*

Photographs: Hitachi, the author

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SAW SPECIFICATIONS

Model.....	Hitachi C10FS
Blade.....	10" diameter
Motor.....	10-amp, 3800 rpm
Crosscut at 90°.....	3 $\frac{1}{32}$ " x 12 $\frac{3}{32}$ "
Cutting depth at 90°.....	4"
Cutting depth at 45° bevel.....	1 $\frac{1}{2}$ "
Miter range.....	Left: 45° Right: 57°
Bevel range.....	Left: 45° Right: 45°
Dimensions.....	20 $\frac{21}{32}$ " x 41 $\frac{1}{8}$ " x 22 $\frac{3}{32}$ "
Weight.....	44.1 lbs.

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Sunburst Mirrors, Slant-Back Cupboard, Folding Deck Table, Two Toy Dragsters, Colonial Barbecue Tray, Workbench Helper, Harvest Table, Oak Plate Rack; *Articles:* Hard-to-Find Woodworking Items; Rasps; Safety; Workshop Finishes Pose Risks; Making the Dovetail Wedge; Knock-Down Hardware.

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English Garden Set May/June '90



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Weaver's Chest Jan/Feb '90



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Early American Pine Hutch, Child's Windsor Chair, Universal Table Saw Jig, Convertible Step Stool/Chair, Finger-saving Plastic Bag Handle, Acrobatic Bear Folk Toy, Kids' Kitchen Playcenter, Easy-build Bookshelves; *Articles:* Amps vs. Horse-power; An Introduction to Chairbuilding; Vacuum Turning; Tool Review: Benchtop Table Saws.

Vol. 16 No. 6 Nov-Dec '92 (Item #9211)

Gov. Winthrop Slant-front Desk, Futon Bed/Couch, Low-cost Router Table, Toy Livestock Truck, Heirloom Jewelry Box, Scroll-sawn Nativity Scene, Early American Doll Bed, Router-built Wall Cabinet; *Articles:* Stick and Cope Doorbuilding; Linenfold Carving; Tool Review: High-end Scroll Saws.

Vol. 17 No. 3 May-June '93 (Item #9305)

Country Pie Safe, Collapsible Basket, Intarsia: Humpback Whale, Classic Jewelry Chest, Skittles Game, Porch/Yard Swing, Handsaw Caddy, Shaker Wall Cabinet; *Articles:* Doweling Jigs, Taming the Hand Scraper; Shoptest: Porter-Cable's Pocket Hole Cutter.

Vol. 17 No. 4 Jul-Aug '93 (Item #9307)

Early American Corner Cupboard, Gossip Bench, Band Saw Cutoff Table, Roaring 20's Sports Car, Passyseat Napkin Holder, Aerobic Step, Desktop Bookshelf, Cherry Letterbox w/Mountain Scene Relief Carving; *Articles:* How to Buy Wood; Incised Lettering; Choosing and Using Sharpening Stones; Shoptest: The Inera Jig System.

Vol. 17 No. 5 Sep-Oct '93 (Item #9309)

Intarsia: American Eagle, Blockfront Chest, Super Box Joint, Old Fashioned Farm Table, Sunset Rider Desk Set, Scroll-sawn Bunny Puzzle, Quilt Crane, Magazine Slipcases; *Articles:* Pennypincher's Clamp Organizer; How to Flatten Rough Stock; Faux Antique Cracked Finish; Tool Review: Benchtop and Mini Lathes; Shoptest: Safe-T Planer by Wagner.

Vol. 17 No. 6 Nov-Dec '93 (Item #9311)

Old-Time Icebox, Contemporary Jewelry Box, Windowpane Mirrors, Miter Gauge Fence, Toys (Boat, Helicopter & Truck), Noah's Ark & Scroll-sawn Animals, Victorian Wall Shelf, Kids' Modular Furniture Set, Santa Carving; *Articles:* How to Rip and Crosscut on the Table Saw; Getting Started in Carving; Turning Bricklaid Bowls; Shoptest: Laguna Tools Mortising Table; Tool Review: Random-Orbit Palm Sanders.

Vol. 18 No. 3 May-June '94 (Item #9405)

Through-Dovetail Jig, Woody Wagon Toy, Intarsia: Bad Puppy, Oval Collapsible Basket, Cherry Coffee Table, Salt & Pepper Shaker Set; *Articles:* Fine Tuning Your Band Saw; Tool Review: Benchtop Band Saws.

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Keller Journeyman Dovetail Jig

By Bob Colpetzer

Already well-known for its Pro Line series of dovetail templates, Keller and Company of Petaluma, California, recently introduced the Journeyman 1500, designed specifically for the home or small-shop woodworker.

Unlike the Pro Line jigs, which have separate aluminum templates for routing the pins and tails, the Journeyman jig uses a single, high-density phenolic plate. One edge has template fingers for the tails machined into it, while the opposite edge serves as the pin template. To use the jig, you simply mount it on a shop-made backing block.

Besides the template, Keller supplies a $\frac{7}{16} \times \frac{3}{4}$ " 7° carbide-tipped dovetail bit and a $\frac{7}{8} \times \frac{3}{4}$ " carbide-tipped straight bit fitted with a shank-mounted, $\frac{5}{8}$ "-diameter pilot bearing.

Although the jig measures only 15" long, you can use it on stock of any width simply by shifting the jig after routing the section. It accepts stock of $\frac{1}{8}$ " to $\frac{3}{4}$ " thickness but won't allow you to gang-route multiple workpieces or rout curved work.

The firm offers a couple of optional accessories that increase the jig's versatility: a box-joint bit for cutting box and knuckle joints, and a small bit set for cutting narrower and better-proportioned dovetails in stock less than $\frac{3}{8}$ " thick. (See *photo A*.) According to Keller reps, an adjustable clamping kit will be available soon. (See my design for an optional backing board with adjustable clamps in "A Shop-Made Backing Block and Clamps" on *page 84*.)

Jig Setup a Snap

I've set up my share of tools and jigs, and by the time I get to page 10 of a 40-page manual, I usually start wondering whether I really need the tool in the first place. This was not the case with the Journeyman jig—setting it up could hardly have been simpler. The instructions were clear, concise, and easy to follow.

To set up the jig, I made the backing board and fastened the template to it. Keller has thoughtfully scribed a line on the plate's bottom that simplifies alignment. With the edge of the backing board positioned squarely on this line, the jig will cut almost perfect dovetails and pins with no further

Continued on page 84



The Keller Journeyman 1500 jig cuts through dovetails in a wide range of stock thicknesses as well as in angled and compound-angled parts.

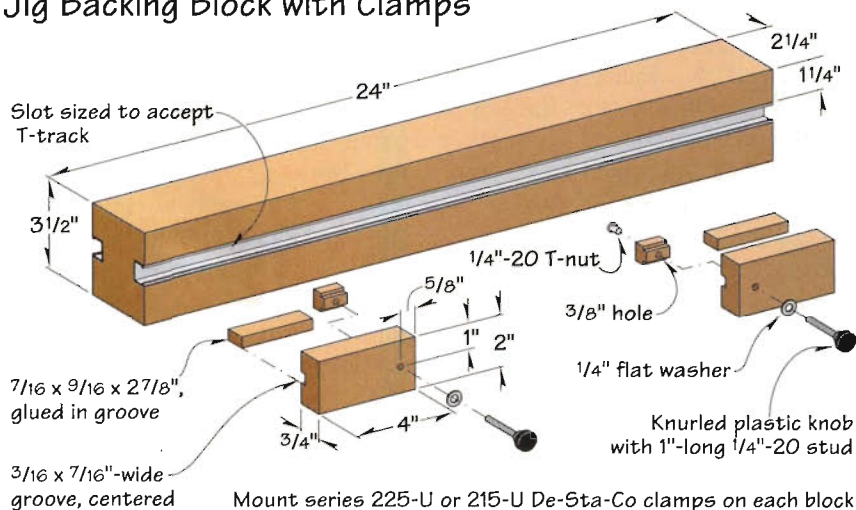
A Shop-Made Backing Block and Clamps

One of the liberties I took after using the Journeyman 1500 a few times was to change the design of the backing board. First, I made it 6" longer than recommended. I also cut $7/16 \times 13/16$ " grooves into both faces $1\frac{1}{4}$ " from the top, then inserted a 24" length of metal T-track into each groove. (See the drawing below.)

Next, I made the two 4"-long clamp base blocks shown in the drawing. I attached a De-Sta-Co toggle clamp to each base block and fabricated the adjustable stops using T-nuts and knurled plastic knobs. This allows me to position and tighten the clamp blocks anywhere along the faces of the board.

These simple changes make it possible to clamp parts quickly to the jig with minimal hassle. The clamp blocks work especially well with smaller workpieces. They also serve as indexing stops, enabling me to position the tail or pin stock at the same place each time. I can remove the toggle clamps quickly to work wider pieces, and the longer backing board provides more room for auxiliary clamps if needed.

Jig Backing Block with Clamps



adjustment. I say "almost" because I'm the kind of guy who has to fine-tune every setup to get a precise fit between pins and tails.

Once I had fine-tuned the jig, I found that no other adjustments were needed. I'll probably have to fine-tune it again to compensate for bit-sharpening or if I switch to the optional smaller bits.

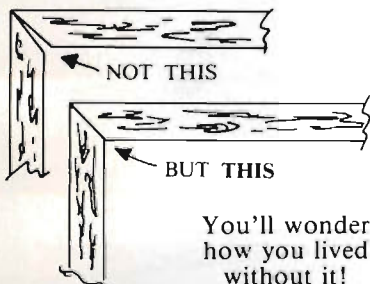
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How It Worked For Me

Flawless is how I would describe the jig's performance—cutting dovetails and mating pins couldn't be easier. I didn't have to follow complicated procedures, readjust to compensate for varying stock thicknesses, or deal with movable parts that need tightening or get lost. Using the Journeyman is so straightforward that I've never had to refer back to the manual or found it necessary to relearn the setup procedure if I haven't worked with the tool for a while.

To make a complete dovetail joint, you first set up the jig to cut the tails. Install the dovetail bit in a handheld router and set it to cutting depth—same thickness as the pin stock, not the tail stock you are routing—plus $\frac{1}{2}$ " to compensate for the thickness of the jig plate. Position and clamp the straight fingers of the template on the end of the stock to be routed. Then, rout the tails by running the piloted bit around the fingers of the template. To repeat cuts in identical pieces, you simply set a stop at the end of the first piece, then position each piece against it.

To rout the mating pins, scribe the relative position of one pin socket on the end of a pin piece using an already-cut tail piece as a guide. This is much the same procedure you'd follow to hand-cut dovetails, except that you need mark only one pin socket on one piece.

Next, align the angled fingers of the template with the scribed pin lines, and then clamp. Because you form the pins with a straight bit that has a same-diameter pilot bearing, you cut out only the areas between the template fingers.

To calculate pin-cutting depth, add $\frac{1}{2}$ " for the thickness of the template to the thickness of the tail stock. Use an indexing stop to cut multiple pieces.

Cutting angled and compound-angled dovetails with the jig proved equally simple and straightforward. The technique was the same as for the straight dovetails described above, except that you need to make a shim-wedge for the angled dovetails (although not for compound-angled dovetails). You needn't make any other adjustments to obtain perfect joints.

The template cuts equally spaced pins on $1\frac{1}{4}$ " centers, but you can also

use it to cut variably spaced dovetails for a hand-cut look. You form these pretty much the same way as if you were hand-cutting them, except that you use the router and jig rather than a chisel. Lay out and cut the dovetails first. Next, scribe tail positions onto the pin stock. Then, place the pin template over each set of scribed pins, and rout away the waste.

The Bottom Line

The Journeyman performed as advertised. I was particularly impressed with the jig's precision machining and the quality of the bits and bearings supplied in the kit. Best of all, the

Continued on page 86



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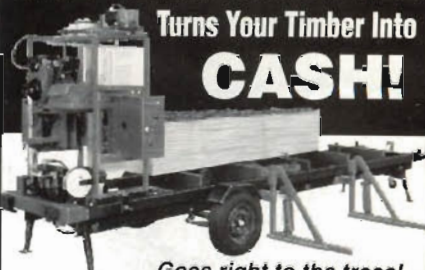
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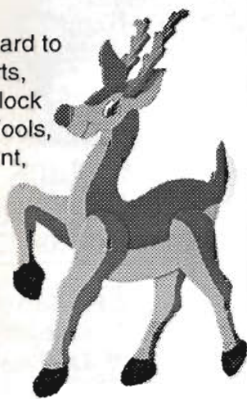
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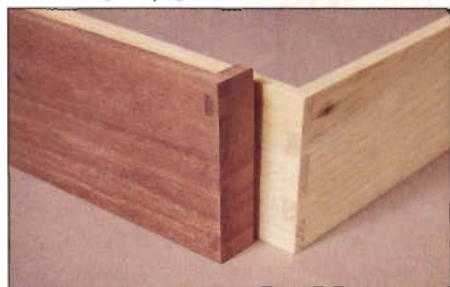


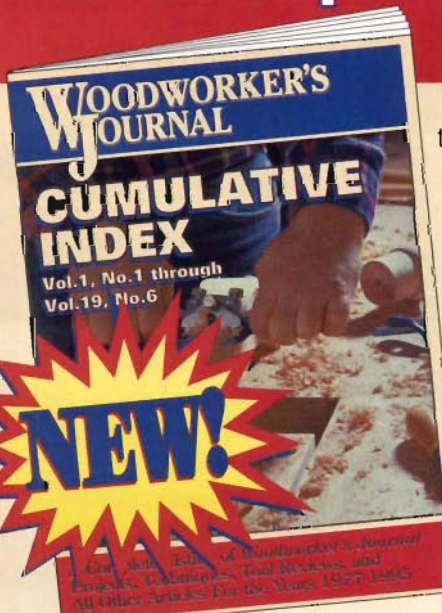
Photo A: The jig's standard bit set will cut dovetails in stock as thin as 1/8", although the optional small bit set forms better-proportioned tails and pins in thin stock. The joint on the left was cut with the small bits, the joint on the right with the standard set.

jig cuts dovetails and pins that fit perfectly time after time. I can't remember ever using a dovetail jig that was as simple to set up or as pleasant to use.

If you admire the look of through dovetail joints but have been reluctant to lay out the money for a jig, the Journeyman may fit your needs and budget. It currently sells for \$139.00 and comes with a one-year warranty and 30-day money-back guarantee.

Keller Journeyman no. 1500. Keller & Co., 1327 I Street, Petaluma, CA 94952; telephone: 707/763-9336. WJ

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Tormek SuperGrind Sharpening System

by James Boelling



Tormek SuperGrind system provides safe whetstone grinding and honing for a wide variety of cutting tools. The system comes with an adjustable universal tool support, grinding wheel, and leather honing wheel.

To become familiar with the Tormek system, I read the handbook supplied with the kit and watched the video tape several times. I found the video very informative—it shows the wide variety of tools the system can accommodate and the appropriate attachment to use for each sharpening operation. The handbook struck me as well-illustrated and easy to follow.

I did, however, have trouble mentally converting the metric dimensions listed in the handbook to inches when adjusting the attachments to specification. This is a critical step in the sharpening procedure, and having the English equivalents printed in the text where you need them would have eased the brain strain.

hold tools. Once I got the hang of its operation, I enjoyed very good, consistent results.

I found I had to stand when sharpening chisels with the straight-edge jig. I suggest positioning the machine at a height that's comfortable for you and that allows you to see clearly what you're doing. It's also best to empty the tank after each session to keep the residue that remains suspended in the water from clogging the grinding surface and building up on the stone.

The Angle Master, a plastic guide supplied with the system to help you set edge angles, worked great for setting the height of the universal support. I would prefer that the support itself were 3" longer. At its present length, the support makes it fairly easy

Preparing and Learning To Use The System

The machine was easy to set up. I found it helpful to place a piece of carpet and a layer of old cloth towels under the tank to sop up spilled water. Water spills happen, especially when you're first learning how to work the tools over the stone.

I used the Tormek to sharpen wood chisels, plane irons, turning tools, 10" planer knives, fillet knives from the kitchen, hatchets, scissors, hedge clippers, grass shears, a sickle, and a number of other house-

to travel off the stone and dub the corner of the tool. I found it best to stay on the stone while grinding, then slide the jig off the support to inspect the tool.

My Observations

I had an easier time handling long-bladed chisels on the sharpener than short ones. I also found it more accurate to double-check the angle of the tool with a small square than to rely on the jig's stop bar.

As with the chisels, sharpening larger plane irons was straightforward, although working with small irons proved challenging. Seating them securely in the jig helped prevent chatter and loss of control when they contacted the stone. The flat support jig worked best for handling the small irons that I sharpened.

For safety, I removed the leather honing wheel when working tools like the sickle, shears, scissors, and fillet knives. This helped me avoid accidentally touching the wheel with the tool handles, which might've caused a sudden, unexpected movement of the tool, possibly a loss of control, and perhaps a cut or other injury.

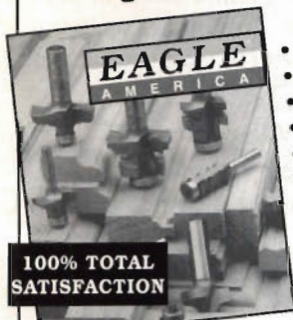
The leather honing wheel does a good job of polishing a tool's edge. Just make sure you alternate the sides to work off the grinding burr evenly.

I used the straight-edge jig (SVH-60) to sharpen several turning tools but found it less comfortable than using the flat platform jig or simply freehanding off the support itself. It works with some gouge shapes, but I had a hard time maintaining the original shape on tools that had variously curved blades.

[Editor's note: Tormek introduced a new fingernail gouge jig (SVD-180) in June 1996. With it, you can grind gouges to this shape almost effortlessly (*photo A*). You can set the edge

Continued on page 88

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Continued from page 87

Photo A: A new fingernail gouge jig (SVD-180) provides full mechanical support for grinding a fingernail profile on bowl and spindle gouges. Once set up, the jig will produce the same grind repeatedly.



length and angle you want, then grind the same edge repeatedly using the same setting. In our tests, this unique jig worked very well, producing uniform grinds that would be difficult for an experienced sharpener to replicate freehand on other equipment.]

The planer knife jig (SVH-320) proved to be very accurate (*photo B*). The micro-adjust knobs really do allow fine adjustment. I was able to sharpen 10" knives to razor sharpness with it.

The Bottom Line

The machine runs quietly with virtually no vibration and can be set up almost anywhere. I wouldn't, however, recommend tightening the grinding wheel as instructed on the yellow insert sheet—it made it too hard to remove the wheel later.

From a safety standpoint, I found the system hard to beat. The slow speed eliminates the usual eye hazards. Because the process takes a fair amount of time, I suggest you grab a chair or stool for most grinding jobs.



Photo B: The planer knife jig (SVH-320) attaches to the universal support. To use, simply clamp the blade in the holder, set the grinding length and angle, test and adjust the setup, then grind.

Tormek provides a stone-truing tool that works well for putting the stone back in shape concentrically. You should use it to true the wheel during initial setup, whenever you change wheels, and whenever the wheel appears unevenly worn or out of round.

I did have some problems with the stone grader (SP-650). Try as I might, I couldn't get it to change the stone from normal grit aggressiveness (220-grit) to a finer grade (1000-grit). I'm not sure how critical this is; nowhere does the manufacturer specify which texture to use for sharpening a particular tool.

I find slow-speed wet-grinding to be time-consuming. However, as a trade-off, this does give you a greater margin of error. The Tormek yields a truly keen edge, but it takes a healthy amount of time to reach that point.

If you're just touching up a chisel, for example, the task will be relatively simple and fast, provided the tip hasn't been deeply nicked or rounded out of square. However, if you have to do serious corrective work on the Tormek, plan to spend some time. I concluded that I could save considerable effort by removing the major defects with the bench grinder first, then finish the cutting edge on the Tormek.

If you want truly sharp cutting tools and will go to the effort to keep them sharp, you'll find this machine invaluable. The Tormek also proved to be a good general household sharpening station. I don't consider it a replacement for my dry bench grinder, especially if the tools are seriously out of shape. However, once you have them in decent shape, you can then use the Tormek to keep them honed. Only occasionally will you need to revisit the bench grinder.

At its current street price of \$390, the Tormek is one of the most costly sharpening systems on the market. The individual jigs, designed for use with specific tools, must be purchased as accessories and thus add to the initial investment. 

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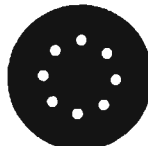
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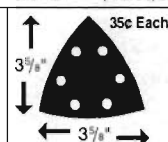


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LIST OF ADVERTISERS

A & I Supply.....page 76
American Clamping Co.....page 84
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Arrow Fastener.....page 71
Berea Hardwoods Co.....page 33
Cherry Tree Toys.....page 86
Computer Business Services.....page 50
Craft Supplies U.S.A.....page 18
Davis Instruments.....page 85
Delphi Stained Glass.....page 50
Delta International Machine Co.....page 8
Dremmel.....page 7
Eagle America.....page 88
Econ Abrasives.....page 76
Elmers Products.....page 11
Enviro-Safety Products.....page 9
Fein Power Tools.....page 42
Forrest Manufacturing Co.....page 2
G and W Tool Inc.....page 80
Garrett Wade.....page 78
Gilliom Manufacturing.....page 86
Gudeman Enterprises.....page 81

Grizzly Imports.....page 5
Hut Products for Wood.....page 71
Jet Equipment & Tools Inc.....pages 43, 92
Keller & Co.....page 80
Laguna Tools.....pages 26, 81, 85
Leigh Industries Inc.....page 7
McFeely's.....page 7
Micro Fence.....page 80
Minuteman.....page 26
MLCS Ltd.....page 63
Oneida Air Systems Inc.....page 74
Osborne Wood.....page 74
Performax.....page 78
Phillips Brothers Supply.....page 18
Pootatuck.....page 84
Ryobi America.....page 20
Skil/Bosch Corporation.....page 91
Timberking Tools.....page 85
Total Shop.....page 17
Viel Tools Inc.....page 18
Wetzler Clamp Co.....page 85
Woodcraft Supply.....page 88

Woodline Arizona Inc.....page 6
Woodmaster Power Tools.....page 50
Woodstock International Inc.....page 51

HARDWOOD SHOWCASE - page 33
Gilmer Wood Co.
Heritage Building Specialties
Niagara Lumber & Wood Products
Sheerwoods
West Penn Hardwoods

HOLIDAY GIFT GUIDE - pages 69, 70
Adjustable Clamp Co.
Chem Rex Inc.
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MARKETPLACE - page 89
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