

1976-1996: 20 YEARS, 120 ISSUES, OVER 1,000 PROJECTS

WOODWORKER'S JOURNAL

Vol. 20, No. 5

September/October 1996

20th Anniversary

SPECIAL ISSUE

**Gluing And
Clamping
BONUS!**

An Easy To Build Beauty Page 26 Coopered Door Cabinet

Plus...

- Anniversary Clock
- Wall Mirror
- Shop "Sideboard"
- Inlaid Knives
- & Much More



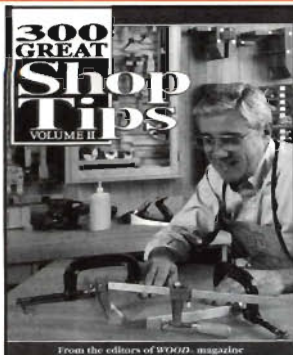
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Shipping thru 9/30/96

10% to 20% OFF (Listed Items)

SUMMER COMBO SALE

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Free with any saw blade or Dado listed & purchased from this ad. You must mention you saw this offer in WOOD® Magazine, when ordering.

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One book per order.
ORDER NOW SUPPLIES ARE LIMITED.

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New specs, 5° Neg. Pts. & flat, runs out less than .002 for perfect, tight, smooth, splinter-free miter joints.

TAKE EXTRA 10% - 20% OFF COMBO SALE!

NEW SIZES AVAILABLE

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Hitachi 8-1/2"x60T5/8"	\$179	\$109
DeWalt 8-1/2" & Ryobi 8-1/2"x60T5/8"	\$179	\$109
Delta 9"x80T5/8"	\$204	\$119
Ryobi-Makita & all 10"x80T5/8"	\$207	\$129
DeWalt, Makita, B&D, Hitachi 12"x80T1"	\$229	\$139
Ryobi-Makita 14"x100T1"	\$266	\$179
Hitachi 15"x100T1"	\$277	\$189

For good general purpose cuts use Woodworker II 30T & 40T or Woodworker I. Use small stiffener where possible.

BUY 1 BLADE OR DADO AT **10% OFF** SALE PRICE, OR
BUY 2ND BLADE AT **20% OFF** (EQUAL OR LESSER VALUE)
15% OFF DADO AS SECOND CHOICE.

WOODWORKER II

ALL PURPOSE RIP & CROSSCUT

WOODWORKER II	LIST	SALE	10%	20%
12"x40T1"	\$183	\$129	\$116	\$103
10"x40T1/8" or 3/32"	\$156	\$119	\$107	\$ 95
8-1/4"x40T 3/32"	\$136	\$ 99	\$ 89	\$ 79
8"x40T 3/32"	\$136	\$ 99	\$ 89	\$ 79

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THE ONE BLADE THAT LEAVES A SMOOTH-AS-SANDED SURFACE!

BUY OUR BEST SELLER 10" X 40T FOR ONLY \$107 OR \$95 ON SECOND BLADE.

RECEIVE WITH EVERY FORREST BLADE OR DADO LISTED, 9 SHARPENING COUPONS WORTH \$5.00 EACH!

TRY A FORREST CARBIDE BLADE TODAY!

Outperformed 36 other premium blades, both foreign and domestic!
WOOD® Magazine test, Sept. '93, pg. 45

WOODWORKER I - CROSSCUT For TABLE and RADIAL SAW

12"x60T1" or 5/8" 1/8"K	\$198	\$139
10"x60T5/8" 3/32"K	\$162	\$129
8"x60T5/8" 3/32"K	\$150	\$109

OTHER SIZES AVAILABLE



ONLY **\$62 or \$50**
NET COST TO YOU AFTER USING SHARPENING COUPONS

I just purchased your WOODWORKER II 3/32 blade, and I AM TICKLED PINK with it. My RYOBI BT 3000 saw acts like it had a 3 H.P. motor in it. Cuts so much **easier** and **quieter** and **smoother**. Don't need my **jointer** or **sander** now.

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**.

Rick Price

NEW DELUXE DADO-KING! AS LOW AS \$184 NET AFTER USING SHARPENING COUPONS

C-4 Carbide Tips — 4 on each chipper with special negative face hoods.

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6" D. 5/8" Bore NEW	\$299	\$269	\$242	\$229
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10" D. 5/8" & 1" Bore	\$389	\$349	\$314	\$297
12" D. 1" Bore	\$499	\$449	\$404	\$382

(Bore up to 1-1/4" Add \$25 — Plus \$5.50 S&H)

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Faster feed rates & absolute splinter control. Stops splintering on OAK/ BIRCH PLY VENEERS & MELAMINE.

SIZES AVAILABLE

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8"x80T1/8" & 3/32" K	\$202	\$169
9"x80T1/8" & 3/32" K	\$207	\$179
10"x80T1/8" & 3/32" K	\$207	\$159
12"x80T1-1/8" K	\$212	\$181

Other sizes available

SPECIAL COMBO SALE EXTRA 10%-20% OFF

Above 1" bore standard.
CARBIDE IS THE HARDEST OF THE C-4 GRADES AND 40% STRONGER, NOT WEAKER! FOR 50% TO 300% LONGER LIFE.



Standard C-2 Carbide (below, left) and FORREST still sharp Oxidation and Corrosion Resistant Sub-Micron C-4 Carbide (below, right). Each shown after cutting 3,500 feet of MDF. Similar results obtained cutting particle board, melamine, and plywood.



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5"	\$24
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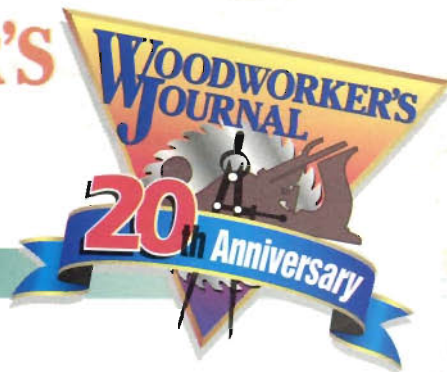
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WOODWORKER'S JOURNAL

Vol. 20, No. 5 September/October 1996



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Build this showcase clock and celebrate our birthday with us

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Dick Coers offers a solution to that last-minute gift dilemma

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A classy cabinet that contributes generously to your storage space and work surface

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10 Techniques: How the How-To Has Changed

Twenty years later, we're still looking for better ways to report the latest woodworking information

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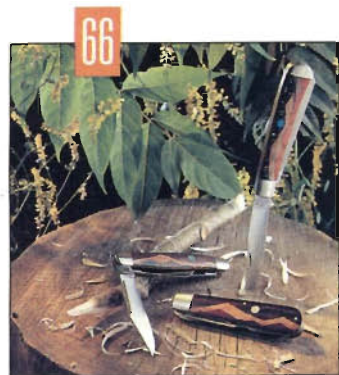
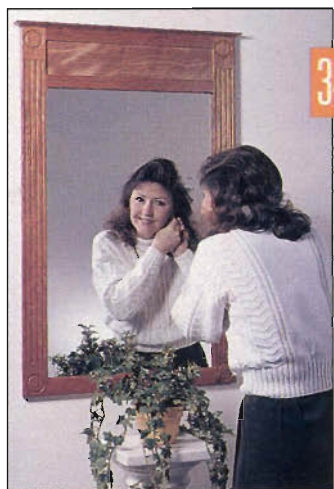
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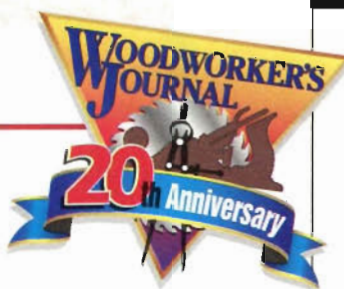
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Cover photo: StudioAlex
Shop: Herman "Bud" Gronewold, Trivoli, Ill.



WELCOME TO OUR BIRTHDAY ISSUE

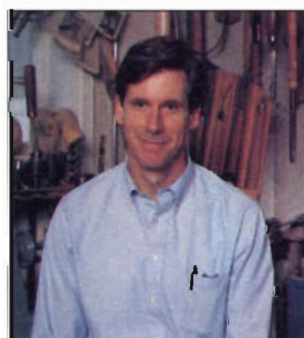
It's always fun to celebrate. In fact, we've been celebrating *Woodworker's Journal's* 20th anniversary in every issue this year. But we've made this—our official “birthday” issue—extra-special, packing it with projects like our handsome 20th anniversary clock, the unique coopered door cabinet you see on our cover, and a highly giftworthy inlaid knife. As a birthday bonus, we've included a 16-page section on gluing and clamping that starts on *page 39*. Author Leon Frechette has compiled the most up-to-date information on these techniques and products you're likely to find anywhere.

Meet Tom Jackson, Our Newest Staff Editor

Tom arrived just in time to help us put the finishing touches on this issue. No newcomer to woodworking or magazines, he's been actively working with and writing about tools, techniques, and home improvement for almost 10 years at several national publications.

Tom not only writes about woodworking but keeps actively involved too. His most recent efforts include a home entertainment center and the outfitting of a library room in his home. He's currently making a hammered dulcimer to complement his guitar and banjo.

Tom will be producing many of our future project, technique, and tool review articles. Watch for them—then let Tom hear from you.



Tom Jackson

Meet Dustin Linstrom, 11-Year-Old Woodworker

It's always a pleasure to hear from readers who are just starting to experience the rewards of woodworking. We were doubly excited when one of those novice reader/woodworkers happened to be 11-year old Dustin Linstrom. (That's Dustin in the photo below.)

Dustin hails from Red Wing, Minnesota, where he's active in the 4-H woodworking program. He reports that his grandfather has also been tutoring him in the shop for about two years. The oak shelf Dustin proudly shows off in the photo is one of his 4-H projects, but he's thinking of trying the Memorabilia Case in our March/April '96 issue for his next venture.



Dustin Linstrom

Charles Sommers

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\$425⁰⁰



G1071

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- 10 spindle sizes
- 25" x 25" table tilts 45°
- Shipping wt.: 345 lb.

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G1257

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- 400-1800 variable SPM
- 2" cut @ 0°, 1" cut @ 45°
- Shipping wt.: 40 lb.

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G1018

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- 8" x 65" bed
- 1 1/2 HP, 220V motor w/ mag switch
- Shipping wt.: 450 lb.

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G1029

2 H.P. Dust Collector

- 1182 CFM
- Handles 2 machines
- Shipping wt.: 140 lb.

\$275⁰⁰

w/ free hose



G1140

6" x 80"

Edge Sander

- 1 1/2 HP, 220V motor
- Vertical & horizontal sanding
- Shipping wt.: 265 lb.

\$450⁰⁰



G1021

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- 2 HP, 220V motor
- Magnetic switch
- Shipping wt.: 475 lb.

\$795⁰⁰ w/ stand



G1079

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- 2 sanding drums
- Shipping wt.: 325 lb.

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(stand optional)



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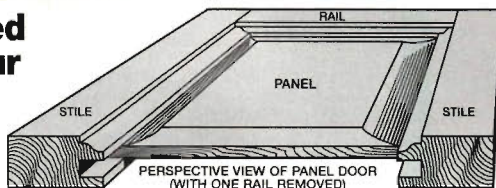
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Save 55% on MLCS Raised Panel Door Sets

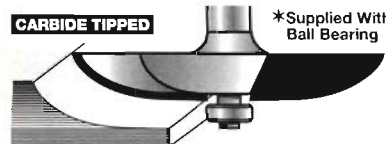
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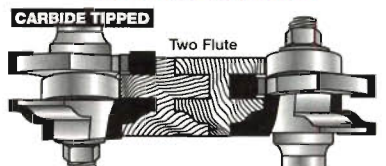


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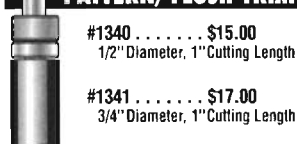
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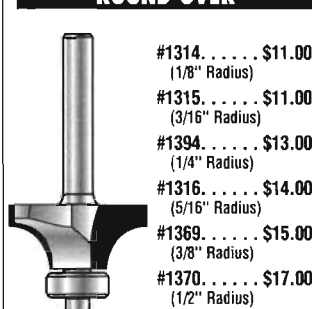
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Editors Top 10 Woodworking Tools
American Woodworker
ISSUE 20



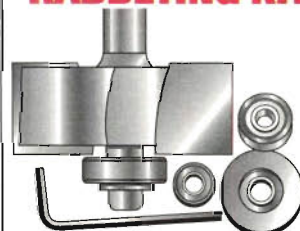
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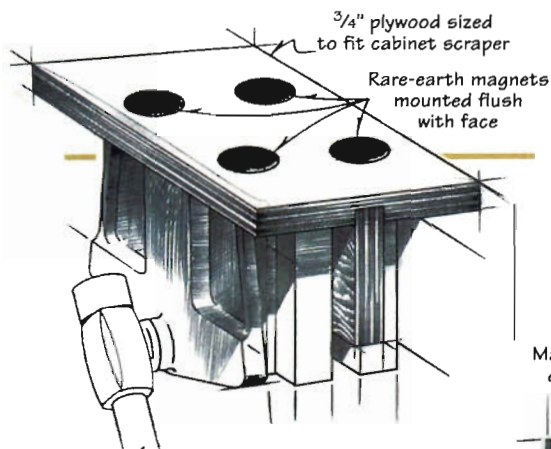
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Magnets Hold Scraper To Sharpening Jig

Here's a convenient way I came up with to hold a scraper for resharpening.

Cut two pieces of $\frac{3}{4}$ " stock the same size as your scraper and drill four holes for the button magnets in the top piece. Center the holes on each corner about $1\frac{1}{4}$ " in from the perimeter and drill them deep enough so the magnets sit flush with the wood. Cut a $\frac{3}{8} \times \frac{3}{4}$ " groove in the underside of the top piece, then glue, clamp, and screw the bottom piece into this groove. Anchor the magnets with epoxy.

To use the jig, clamp the bottom piece in a vise and lay the scraper flat on top. File off the old burr, then repeat on the opposite face. Next, rotate the jig 90° , and reposition the scraper so one edge overhangs the jig slightly. Reclamp the jig with the scraper held vertically, joint the overhanging edge, and then draw out your next burr.

Paul Stotler
Leonardtown, Md.

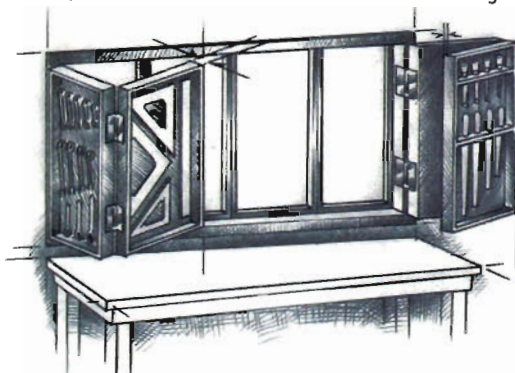
Look To Your Windows For Bonus Storage Space

To give my shop more privacy and create extra storage space, I built a few of these storage "shutters" with perforated hardboard backs. The depth of the boxes equals the depth of the window casing, so they fit flush with the wall.

You can build the shutter frames out of any straight $\frac{3}{4}$ " stock. Cut a

Make shutter frames same depth as window casing

Cut groove for pegboard $\frac{3}{8}$ " from back edge



groove for the pegboard around the inside of the frames about $\frac{3}{8}$ " in from the back edge (so that the backsides of the pegs won't scratch your windows). Rabbet the corners of the frames, join them with glue and screws, and then hinge the frames to the window casing.

Dale Klitzke
Fond du Lac, Wis.

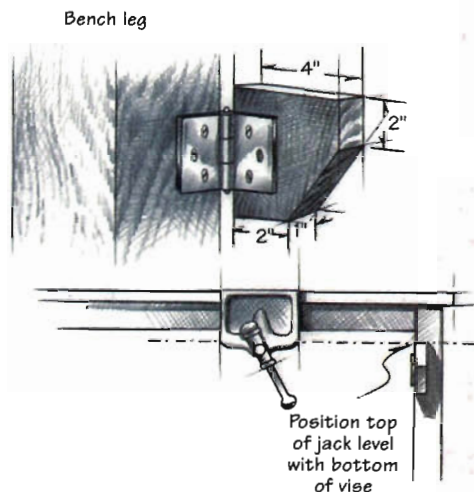
Board Jack Supports Work Clamped In a Vise

When you clamp a long workpiece on edge in a bench vise, the free end won't support much weight or down-

ward pressure. This board jack I designed solves the problem, and it should fit almost any bench.

Cut the board jack to the dimensions shown, or fashion one to suit your own needs. Mount it on the front leg of your bench with a hinge opposite the end with the vise. Position the jack so the top of the block is level with the bottom of the vise. When you need the support, just rotate the block to the front edge of the bench and rest the long edge of the workpiece on the block.

Kevin Hemmingsen
Wabasha, Minn.



Best Tip Tool Winner

For submitting his shop tip, Paul Stotler will receive a Bosch plate joiner, model B1650K. This unit features a 5.8-amp motor, adjustable fence, dust-collection bag, and three-position depth stop. The accompanying kit includes a case, biscuit assortment, and glue bottle.

To be eligible for a free tool or cash award, send your original shop tip ideas (and sketches if necessary) to: Shop Tips Editor, Woodworker's Journal, 2 News Plaza, P. O. Box 1790, Peoria, IL 61656.

We redraw all sketches, so they need only be clear and complete. If you want the material returned, please include a self-addressed stamped envelope.



READER LETTERS



Thanks for your great plans for the Hunt Board (Mar./Apr. '95). I found my copy of this issue with a large black circle around the cover project—a subtle hint from my wife. Seeing that the shelf was a great place to display floral arrangements, heirlooms, etc., I mounted a 20" strip of small incandescent lights under the center drawer area on a beveled piece of hardwood. The resulting glow provides a nice accent.

*CDR Mark Bathrick, USN ("builder")
Marybeth Bathrick ("owner")
Virginia Beach, Va.*

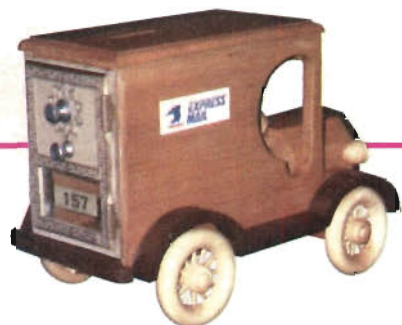
I recently finished the cradle from May/June '85, which I made for my newly born grandson. The parents are really pleased with it. I made it out of red oak, finished it with four coats of "Good Stuff" (made by Bally Block Co.), giving a nice clear finish. I have copies of *Woodworker's Journal* dating back to 1980 and have made quite a number of these projects. Since I am still more or less a beginner, I learn a lot from this wonderful magazine. Wish you a good and happy 20th anniversary. Keep up the good work.

*Tom Halsey
Charlotte, Mich.*



My grandchildren enjoy playing with my Noah's Ark made following Gunther Keil's plans featured in your Nov./Dec. '93 issue. To date, I have made six sets of Gunther's Nativity Scene (Nov./Dec. '92). It is so popular that I have requests for more. I also made his Dinosaur Habitat (Sept./Oct. '94), which my pediatrician son displays in his office. Gunther's projects provide the perfect use for scraps left from my furniture projects. My grandchildren and I would like to see more of his designs.

*Daniel Schiavone
Winchester, Va.*

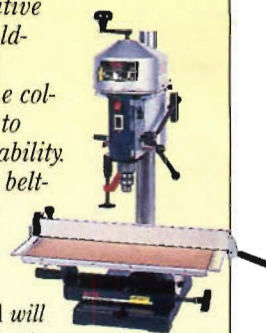


Here's the Mail Truck Bank (Nov./Dec. '95) that I made from cherry and walnut for my four year-old granddaughter. I marked and drilled screw holes for the bronze door prior to assembling. I found it easier to glue the top on after installing the door. I've also made CD Carousels (Jan./Feb. '93) for both of my children using oak.

*Albert Miller
Hickory, N.C.*

Tool Award

For sending a photograph of his project, Mark Bathrick will receive a free Ryobi 18½" wood-drilling system. Unlike most drill presses, which are designed for metal-working, this unit was designed by Ryobi engineers 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.



Woodworker's Journal will award a free tool each issue to a reader whose letter and woodworking project appear on this page. To become eligible for future tool drawings, send us a good, clear photo and a description of a Woodworker's Journal project that you have made. If your letter and photo appear in the magazine, your name will automatically be entered into that issue's drawing. Please address correspondence to: Letters Dept., Woodworker's Journal, 2 News Plaza, P.O. Box 1790, Peoria, IL 61656. Please include your full name, address, and telephone number.

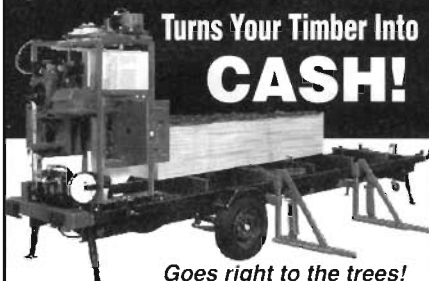
Correction

When introducing American Tool's QUICK-GRIP Micro Bar clamp in our March/April issue, we mistakenly reported that this clamp was available in 10", 20", and 33" jaw sizes. The Micro Bar Clamp/Spreader is only available with a 4½" jaw opening. For additional information contact the company at 414/947-2440.

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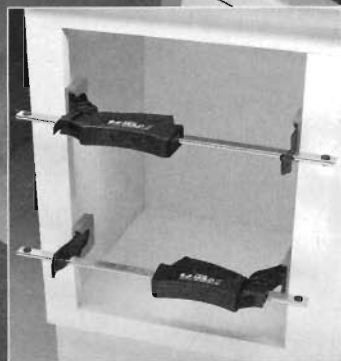
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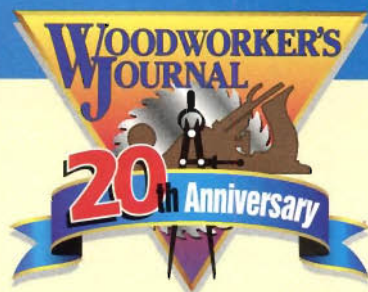


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Twenty Years of Woodworking with *Woodworker's Journal* A Look Back Over the Years

Techniques How the How-To Has Changed



by Charles Sommers

Having worked in my shop for several decades, I've learned these truths about woodworking: 1) there is more than one way to do a particular job; and 2) there's always more to learn. To me, both represent sources of satisfaction to be gained from working wood—you can get as much pleasure from constructing a desk or table as from using and admiring the finished piece. In fact, selecting and perfecting a technique often challenges and rewards me as much as completing the project itself.

To build even the simplest project requires that we learn and refine a great many skills. Some of these are basic, some complex and demanding. I know there are those dyed-in-the-wool purists who wouldn't think of changing from a traditional hand-tool technique to a modern machine-assisted procedure. Others argue—some quite vehemently—that their favorite procedure infinitely surpasses any other. This diversity of opinion demands that we give you both sides of the story, which has resulted in a steady stream of technique articles

and a healthy quantity of feedback from you readers.

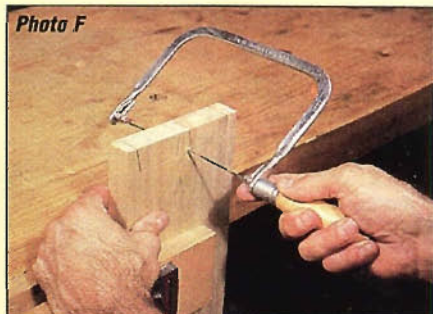
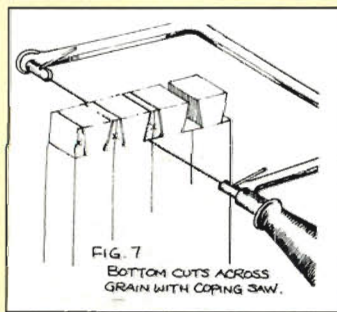
There's another reason for continually reviewing old and new woodworking techniques: our needs and interests change. The right technique for joining that gift tool chest destined for Dad probably won't be the best choice for building the drawers in that half-sized desk you make for your daughter. Similarly, your technique for scraping those case panels will undoubtedly change after you've worked a dozen or more.

A Part of *Woodworker's Journal* History

Keeping our readers abreast of woodworking techniques is one of the founding missions of *Woodworker's Journal*. Since volume 1, number 1, we've regularly devoted more than a few pages of each issue to educating the woodworker—all with the intent of helping you improve your skills and enjoy woodworking more fully.

The "Beginning Woodworker" column, dedicated to inspiring and in-

structing readers in basic woodworking topics, first appeared in the charter issue and continued for many years. Early columns tackled such subjects as log sawing, wood movement and shrinkage, cutting dovetails and mortise-and-tenon joints, blade sharpen-



The adage that "the more things change, the more they stay the same" certainly holds true for much of woodworking. Although Roger Holmes' instructions for hand-cutting through dovetails in our November/December '94 issue were presented with color photographs, he used the same procedure for removing the waste between the tails that we illustrated for readers in November/December '79.

The "Special Techniques" section was added to the magazine to help readers develop their skills beyond the basics. It frequently features techniques that can give your projects the distinctive look of quality craftsmanship.

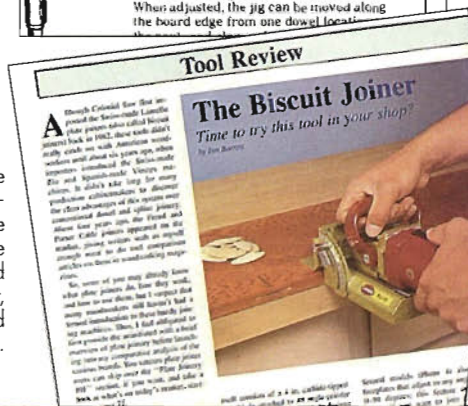
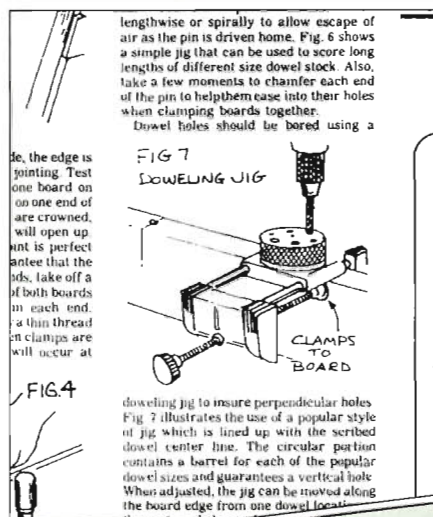
PRO TIP

Cutting performance can be enhanced by grinding the corners off the back edge of band saw blades. Blades that have been rounded in this way can make tighter turns because the corners aren't there to get hung up in the kerf. Round-backed blades are also less likely to damage thrust bearings. To round the back of a blade, set a sharpening stone on the saw table and carefully slide it against the back side of the moving blade. This operation will produce sparks, so be sure to wear eye protection and make sure there is no dust in or around the saw that could be ignited by sparks. (If once saw a table saw catch on fire because someone cut metal on it with an abrasive blade without first cleaning the sawdust out of it.)



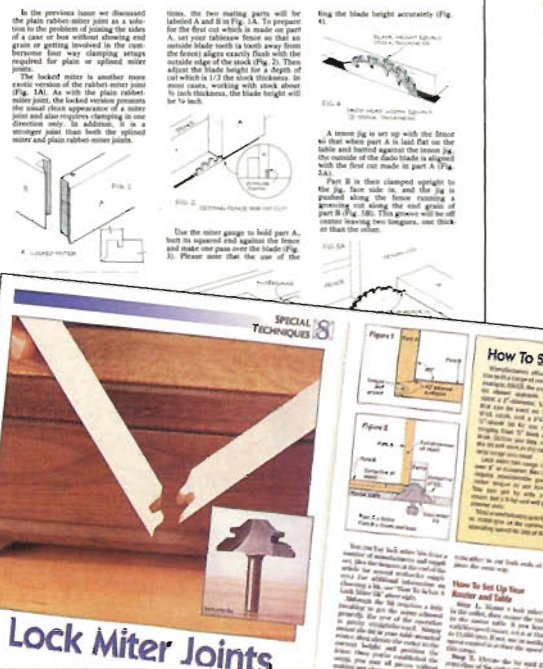
The Pro Tips scattered throughout our how-to articles describe "mini-techniques" that help you execute the job faster, more safely, or more accurately.

Doweling jigs, like the one shown in the March/April 1978 issue, gave the average woodworker a simplified technique for joining wood. But in 1991, the November/December issue introduced readers to biscuit-joining—a faster, friendlier technology that has rendered dowel joinery nearly obsolete.



The tablesawn locked miter joint was the featured technique in our September/October '81 issue, with each step illustrated and described in detail. Bob Colpetzer showed how to make the same joint in the July/August '95 issue, this time using a recently developed lock-miter router bit.

The Beginning Woodworker The Locked Miter Joint



ing, layout procedures, and enlarging patterns, just to name a few.

To meet the increasing demand for such help, those features eventually developed into "Woodworking Basics" and "Special Techniques," banners that permitted even more in-depth treatment of these important subjects. In our last January/February issue, for example, we showed how to make and use the rosette router jig—then used it to enhance our Governor Winthrop floor cabinet with a decorative rosette.

In this issue, you'll find a technical short course on the equipment and technique of vacuum veneering, which we'll put to good use next issue in constructing a Prairie-style lamp. In past issues, the "Special Techniques" section has consistently helped readers to develop new and more advanced woodworking skills, such as inlaying mother-of-pearl, Dutch "turning" on the bandsaw, and making secret drawers and compartments.

We also realized that each of our how-to projects included brief explanations of several mini-techniques—tweaking a tool, for example, or build-

ing a jig to ensure accuracy—techniques that veteran cabinetmakers develop after decades of experience. We started highlighting these tips in tinted "Pro Tip" boxes to make it easy for you to add them to your repertoire of skills, even if you don't build that particular project.

New Skills, New Technology

As woodworkers today, we're very fortunate. We have at our disposal the cumulative expertise of centuries passed down to us by our predecessors—and also the option of bringing highly sophisticated technology to bear on any woodworking problem. I know woodworkers who get a great deal of satisfaction from cutting snug-fitting through dovetails or pegged mortise-and-tenon joints by hand. That's great—that's what woodworking is all about.

The development of power tools, however, has opened up a whole new world of options. Modern technology enables us to work wood with the same degree of perfection that's possible with hand tools. In some cases,

machines have replaced hand tools, but often they supplement them.

In 1977, power miter saws and carbide-tipped saw blades were just coming on the market, and few woodworkers had even heard of biscuit joiners. At the same time, the proliferation of better, bigger, and more specialized router bits began to make itself felt in both home and commercial shops. By combining the new technology with in-depth technical articles, we've helped you to take full advantage of the many innovations of the last two decades.

Looking back through 20 years of issues, you might think we'd have exhausted the possibilities for technique articles by now, but I don't think so. In my travels as editor, I frequently find craftsmen who've come up with new twists or refinements on the old basics. I also know that there are enough clever woodworkers and ingenious tool engineers around this country to keep us all busy (and well-entertained) learning new techniques for at least another 20 years. **WJ**

READERS' INFORMATION EXCHANGE

Does anyone know where I can obtain the router bracket that clamps to the radial-arm saw guard shown on page 214 of Roger Cliffe's book *Radial Arm Saw Techniques*? The Sears bracket in the photo has been discontinued, and I would like to buy a used bracket or similar device.

John Van Hassel
P.O. Box 5205
Helena, MT 59604

Can anyone help me track down the following parts for a Shopcraft model T-67050-23B benchtop wood lathe: the tool rest, tool support arm, and rest support slide?

William V. Casey
22410 T.R. 1203
West Lafayette, OH 43845
614/622-5582

Iwould like to purchase or find out where I can obtain plastic jars about 3" in diameter and 3" high.

Harry Reed
265 Sunset Dr.
Indiana, PA 15701

I'm looking for the manual or parts list for a 1960s-vintage horizontal metal-cutting bandsaw made by Sears. Mine is model 108.22921, but information for model 108.22920 will work. I also need the same information for a Sears model 103.020 table-saw with a tilting table.

Jeff McVey
1810 W. State St. #427
Boise, ID 83702-3955
208/342-8447

Iam making several sets of holders for eating corn on the cob, but I can't find a source for the steel rods that pierce the ends of the corn cob. These should be stainless steel rods (preferably), about the diameter of an ice pick and about 3" in length. Any suggestions?

Don Brown
205 Pine Willow Court
Friendswood, TX 77546
713/482-1805
e-mail: marl@iwl.net

Can someone help me locate an operating manual and parts list for a Sears radial-arm saw, model 113.29350. I'll be glad to pay for postage and copying.

Alfred R. Stewart
174 Middle Island Rd.
Medford, NY 11763-1520

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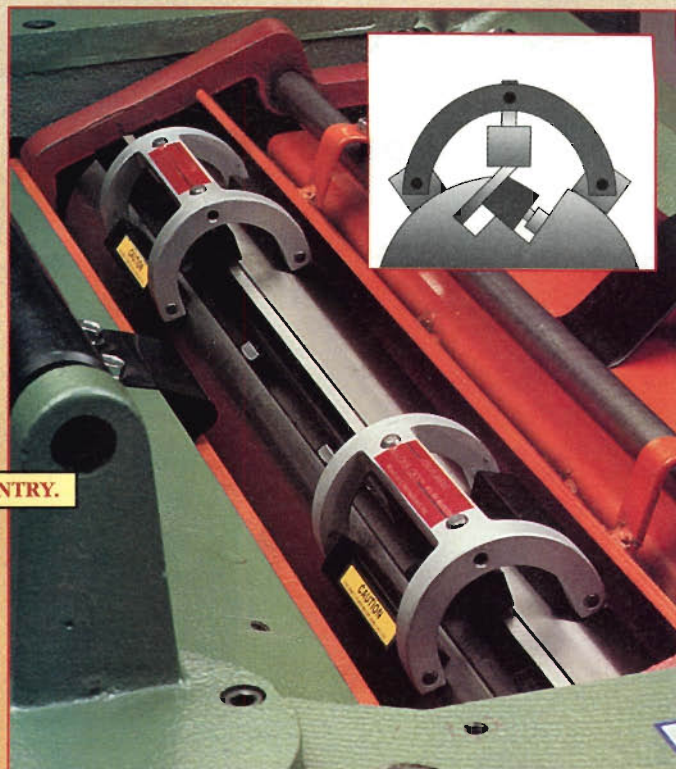
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Vacuum Veneering

It's in the bag

by Tom Jackson

For sheer beauty, few pieces of solid wood can match the dramatic figures and swirling grain patterns you'll find in veneers. But the two traditional methods of applying veneer—hammering it down onto hide glue or flattening it with rows of clamps in a press—are fraught with complications.

Several years ago, however, vacuum-bag veneer presses entered the picture and changed veneering from frightful to nearly foolproof. These systems consist of a pump and a clear plastic bag. You simply put your glued-up substrate and veneer on a platen inside the bag and pump out the air. The ensuing vacuum flattens the veneer onto the substrate with almost 2,000 pounds of pressure per square foot. What's more, the vacuum draws air out of—and glue into—the wood cells for an extremely strong bond.

Unlike other methods, vacuum veneering distributes the pressure uniformly across the work surface. This eliminates bubbles and voids, ensures even glue distribution, and allows you to press veneer onto curved surfaces without having to build matching top and bottom forms.

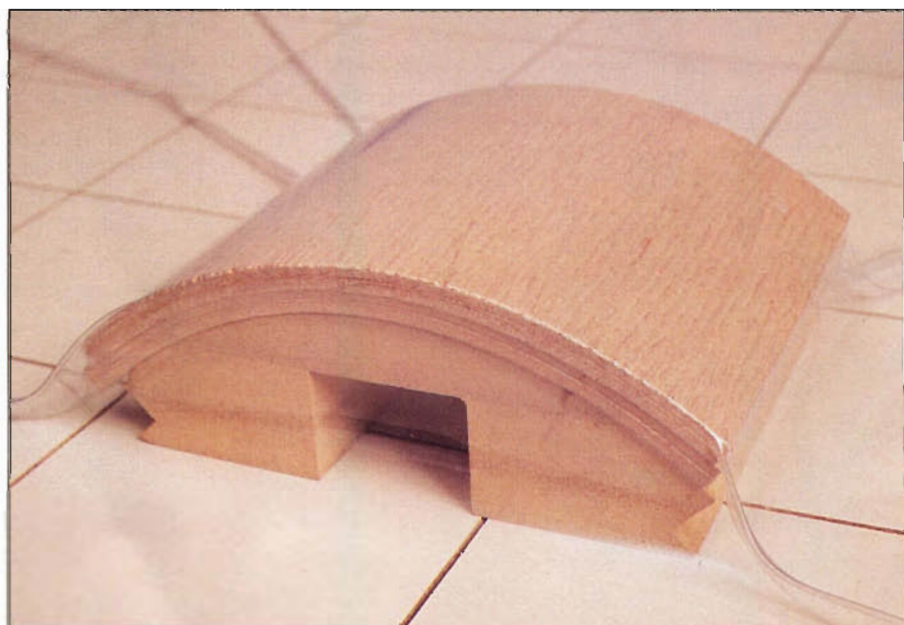
For a vacuum veneering kit—including pump, bag, hose, and gauge—you can spend as little as \$200 or as much as \$1,500. The unit we used for this article retails for about \$800 (*photo A*). There are plenty of options to explore and choices to make, so let's start with the equipment.

Vacuum Pumps: Air-Powered Vs. Electric

In vacuum veneering, there are two ways to remove air from the bag. The less expensive systems feed air from your compressor through a venturi, which creates a vacuum.



To create a curved substrate for veneering, we glued up two pieces of bending plywood, then positioned them over a particleboard form on a gridded, melamine-faced platen inside the bag.



When the vacuum is turned on, the gridwork of kerfs in the platen allows air to be evacuated evenly and thoroughly. Pressure flattens the plywood against the form. The substrate retains its curved shape after the glue cures.

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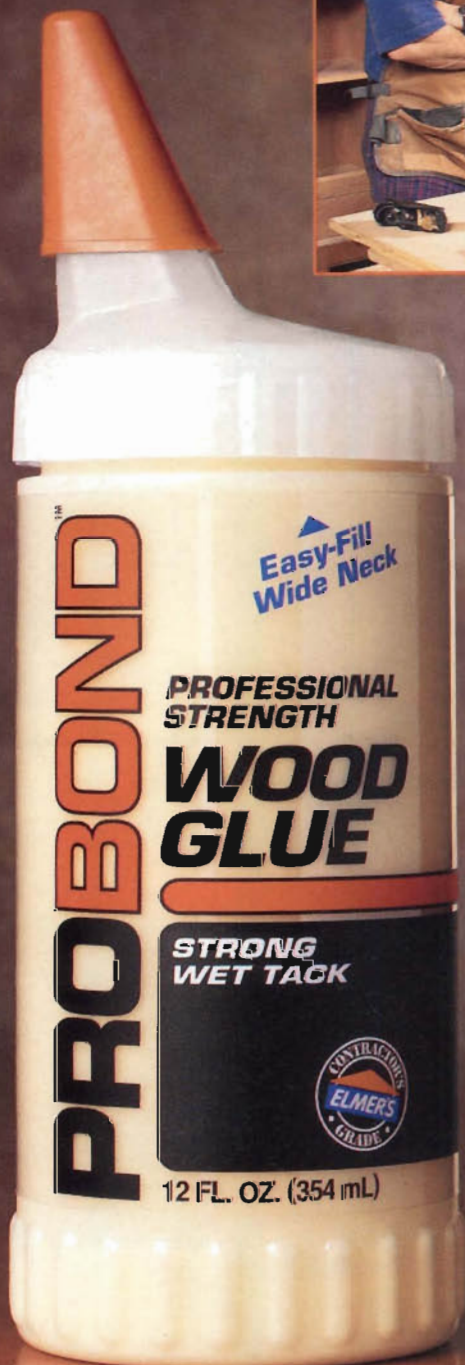
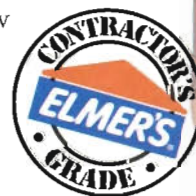
It pours easily. It's sandable and paintable. Plus it's resistant to heat and moisture.

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So next time you need wood glue or wood filler, step up to new ProBond.



The other option, an electric pump, costs several hundred dollars more but evacuates the bag without the assistance of an air compressor. A pump rated at 4 to 5 cfm (cubic feet per minute) of flow capacity will work for most small-shop applications. Top-of-the-line models will pull up to 10 cfm.

If your funds are limited, Quality VAKuum Products offers a compressor-driven system for \$198. The kit includes a venturi, hose, and 27x48" bag. The only drawback to using this system is that you must check the gauge periodically to ensure that the proper vacuum is maintained. Later, if you decide to upgrade, you can buy a controller for just over \$200 that attaches to the venturi and automatically activates the pump. Another entry-level air-powered kit, this one from Vacuum Pressing Systems, offers a larger bag (49x97") and a venturi with an integral controller for \$565. (To contact these firms, see Sources at the end of the article.)

Vacuum Bags: Choose a Size That Fits Your Work

Offered in vinyl or polyurethane, vacuum bags come in sizes from 27x48" on up to 80x126". Polyurethane flexes and wears better than vinyl; a vinyl bag will retain the shape of the object inside it for several hours after you've disconnected the pump. However, polyurethane's performance comes at a price—as much as two to three times the cost of vinyl.

Editor's note:

In the next issue of *Woodworker's Journal*, we'll show you how to match, cut, join, and glue veneers. So you'll have something to test your new skills on, we'll also offer a veneered lamp project. As an additional side feature, we'll show you how to use a vacuum pump from a veneer press to create obstruction-free clamping jigs in the shop.

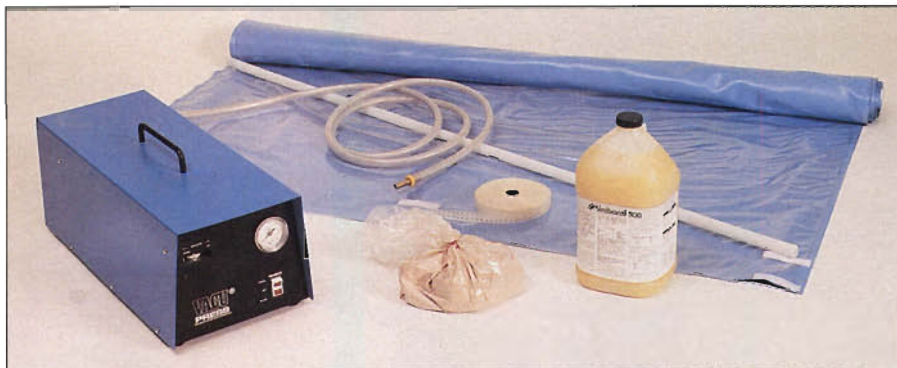
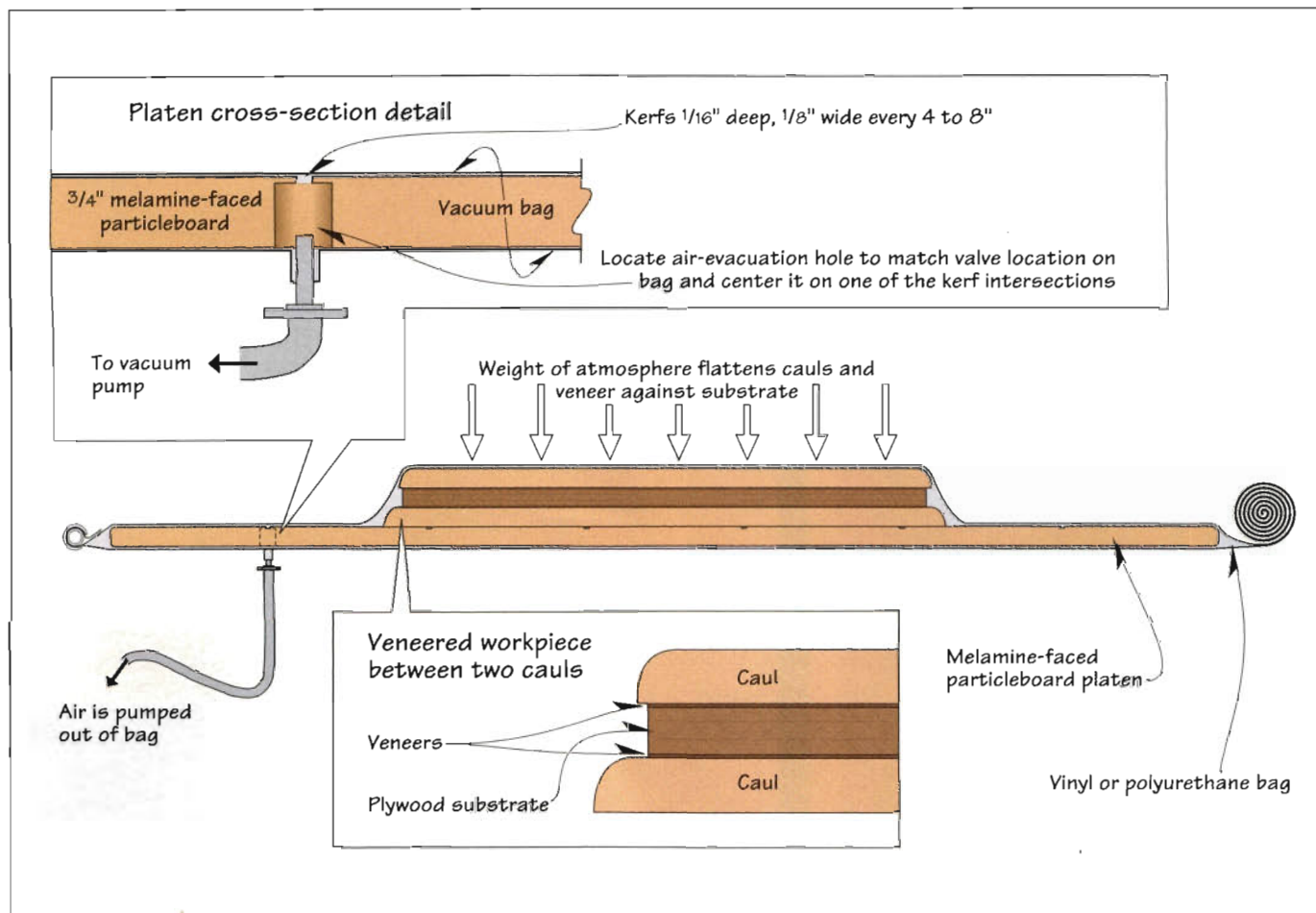


Photo A: The vacuum veneering kit we use, from Vacuum Pressing Systems, is powered by an electric pump and strikes a good balance between performance and affordability. The glue and veneer tape are sold as accessories.



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The size of dust particles is measured in microns. Just to get an idea of how small these particles are, tobacco smoke is rated at .5, or 1/2 micron. Testing has shown that the *CleanAir System* has up to a 98% efficiency rate of removing particles as small as 1 micron. In contrast the typical shop filtration units available can capture only those particles rated at 30 microns or larger.

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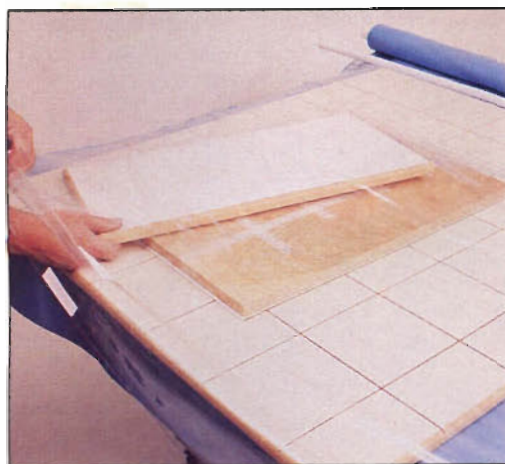


Photo B: The veneer and substrate are sanded between two cauls, which consist of melamine-faced particleboard. A $\frac{1}{8}$ "-thick caul is placed underneath, then a $\frac{3}{4}$ "-thick caul is laid over the veneer to keep it flat and protect it during the vacuum pressing.

Photo C: With the air drawn out of the bag, the weight of atmospheric pressure presses the glued-up veneer between the two cauls. The heavier top caul helps flatten any bow in the platen.



In addition, bags come in thicknesses of 20- and 30-mil. The 30-mil bags resist punctures and abrasion better but cost anywhere from 10 to 50 percent more than 20-mil bags of the same size. Sold separately from the kits, bags run from \$47 (27x48") to almost \$700 (80x126"), depending on the material and thickness.

Given the cost of a system, it's wise to look for a bag big enough to meet your future veneering needs. You can also use one of the bigger bags on small workpieces simply by rolling up one end and sealing it. As for durability, most home and even small professional shops with limited veneering needs can get by with a 20-mil vinyl bag. Spend the extra for polyurethane only if you plan on frequent production runs.

Platens and Cauls: You Make These Yourself

We made the white gridded platen you see in the photos from $\frac{3}{4}$ "-thick melamine-faced particleboard. The melamine makes for easy glue cleanup, but you can also use medium-density fiberboard (MDF), furniture-grade particleboard, or even void-free plywood as a last resort.

Size your platen to fit loosely inside the vacuum bag with plenty of room for your veneer assemblies. If you'll be veneering flat panels, size the platen 2" to 4" smaller than the bag's base dimensions. If you'll be working with curved or tall forms, make the platen small enough so that both it and the form will fit in the bag with room to spare. To avoid snagging the bag, round over the platen's edges and sand them smooth.

The top face of the platen is scored with a gridwork of kerfs that allow air to evacuate evenly around the perimeter of the workpiece. These kerfs channel the evacuated air to a hole you drill in the bottom of the platen. The kerfs should measure no more than $\frac{1}{8}$ " wide and $\frac{1}{16}$ " deep and be spaced 4" to 8" apart. Don't cut too many kerfs or make them too large, as this may cause the platen to bow. To finish the platen, drill an air-evacuation hole in the underside for the stem connector that links the bag to the vacuum hose, as shown in the drawing on *page 16*.

To cover the workpiece and protect it from the platen and bag, make a pair of cauls. Check your caul material beforehand to make sure it's free of voids, which might collapse under vacuum pressure. Sand the caul faces smooth to prevent imperfections from "telegraphing" into the veneer.

For curved work, $\frac{1}{8}$ "-thick bending plywood or melamine-faced particleboard works well. (Bending plywood consists of a thin veneer of maple sandwiched between two layers of lauan mahogany. Your local hardwood supplier should be able to find you some. If you can't find melamine-faced particleboard locally, the laminated paneling sold for use in shower stalls works well.)

For flat work, we prefer an $\frac{1}{8}$ "-thick melamine-faced particleboard beneath

the workpiece and a $\frac{3}{4}$ "-thick panel of the same material on top (*photo B*). The thicknesses are not critical, but the $\frac{3}{4}$ " caul on top helps to overcome any bow that might exist in the platen. As for size, this top caul should not overhang the workpiece by more than $\frac{1}{4}$ " (*photo C*). The bottom caul need only be bigger than the workpiece—beyond that, its dimensions can vary.

Put It All Together and Flip the Switch

Once you've got your equipment together and the platen and cauls cut to size, you're ready to start. Join and tape your veneers and apply glue to the substrate just as you would for a conventional veneer press. Slip the cauls over the veneers and place the assembly in the bag. On large workpieces, you may want to tape the corners of the assembly together to prevent the pieces from slipping or shifting as you put them in the bag.

To seal the end of the bag, use the plastic pipe and C-shaped clip-on channel supplied with the kit. Just roll the open end of the bag around the pipe once and slip the plastic channel over the rolled-up end to hold it tight. Excess bag length on the opposite end can be rolled up to the edge of the platen and held in place with a spring clamp. Now, turn on your pump and let the pressure of the atmosphere do the work for you. 

Photographs: Kevin May

SOURCES

Mercury Vacuum Presses
P.O. Box 2232
Fort Bragg, CA 95437
800/995-4506

Quality VAKuum Products, Inc.
43 Bradford St.
Concord, MA 01742
800/547-5484

Vacuum Pressing Systems, Inc.
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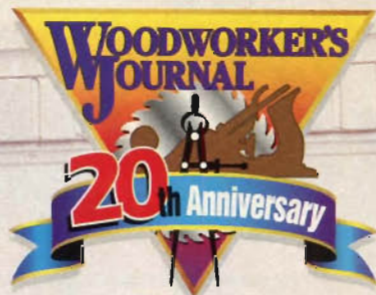
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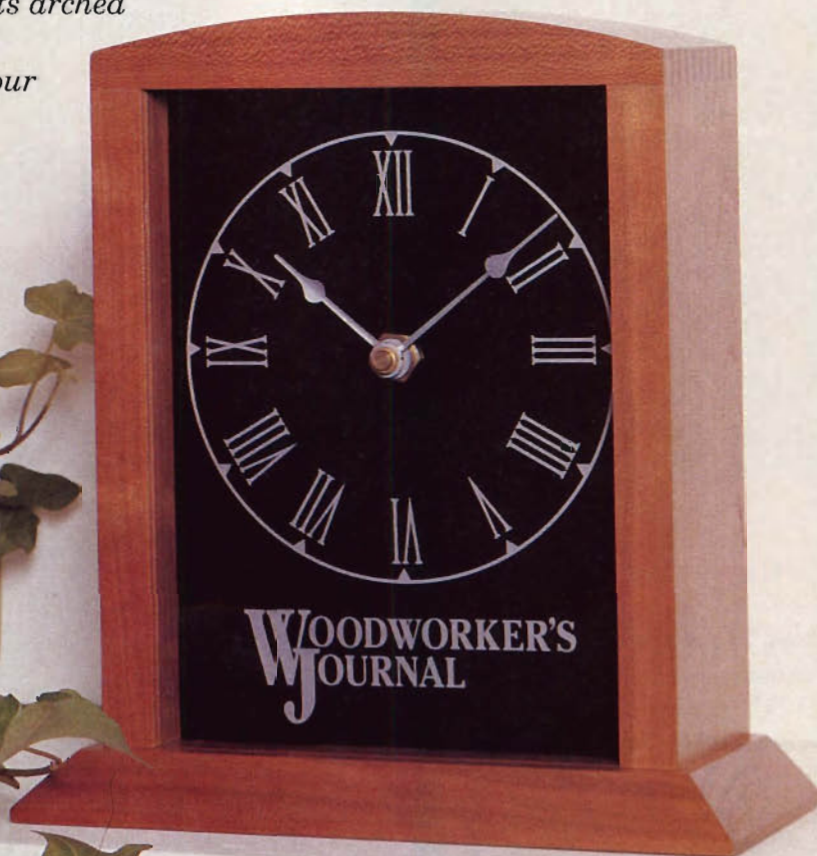
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Prepare the Stock

Step 1. Plane and cut two sides (A), one top (B), and one base (C) to the dimensions listed in the Bill of Materials at *right*. Note: You could start with $\frac{3}{4}$ "-thick stock for the top, but we prefer to start with $\frac{13}{16}$ "-thick material, which prevents the bandsaw blade from breaking out of the cut when you saw the radius. This helps reduce the amount of sanding you'll have to do later.

Step 2. Using a large 45° chamfer bit and your table-mounted router, rout the front edge and ends of the base, working up to full ($\frac{3}{8}$ ") profile in several passes. (See the Front View drawing on *page 23*.) To avoid tear-out, adhere a backing board to the back edge and rout in end-edge-end sequence. (See the Pro Tip *below*.)

PRO TIP

Under the heat and friction of high-speed machining, cherry burns more quickly and easily than most other hardwoods. To minimize the problem, use clean, sharp router bits and saw blades. You may also wish to experiment with your feed rate on a piece of scrap. When routing cherry, make several light passes rather than trying to hog off an entire profile in one pass.

Build A Jig, Then Cut the Box Joints

To cut box joints, first make a box-joint jig for your tablesaw miter gauge. You'll also need a rip blade with square-ground teeth that cuts a $\frac{1}{8}$ " kerf. (We used a Freud LM 72M).

Step 1. To make the jig, first cut a 4x16" miter-gauge extension from $\frac{3}{4}$ " cabinet-grade plywood. Temporarily clamp the extension to your miter gauge so that 6" of it extends to the right of the blade. Elevate the saw blade to cut $\frac{1}{4}$ " deep, and cut a kerf through the extension. Then, unclamp the extension.

Step 2. Starting with a 12"-long scrap for safety, cut a $\frac{1}{8} \times \frac{1}{2} \times 1\frac{1}{2}$ " hardwood key to fit snugly into the kerf you

CLOCK

PART	T	W	L	MTL.	QTY.
A Sides	$\frac{5}{8}$ "	2 $\frac{3}{4}$ "	7 $\frac{15}{16}$ "	C	2
B Top*	$\frac{3}{4}$ "	2 $\frac{3}{4}$ "	6 $\frac{1}{2}$ "	C	1
C Base	$\frac{3}{4}$ "	3 $\frac{5}{8}$ "	8"	C	1
D Back*	$\frac{1}{4}$ "	5 $\frac{5}{8}$ "	8"	CP	1

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

MATERIALS LIST

C—cherry
CP—cherry plywood

SUPPLIES

$\frac{1}{8}$ " double-strength glass; #3x $\frac{1}{2}$ " brass flathead wood screw; #6x $\frac{1}{4}$ " flathead wood screws; finish. (See Sources at end of article for suppliers of clock face and movement.)

cut in the extension. Then, glue the key into the kerf.

Step 3. Using a piece of the $\frac{1}{8}$ "-thick key stock as a spacer, reposition the extension on the miter gauge exactly one spacer thickness ($\frac{1}{8}$ ") to the right of the blade. (See *figure 1*.) Screw the extension to the miter gauge in this position. Elevate the saw blade to cut $2\frac{1}{32}$ " deep, then cut a second kerf in the extension. Test the accuracy of your setup by cutting a sample joint in scrap pieces. Note: We cut the kerfs $\frac{1}{32}$ " deeper than stock thickness so that the fingers will protrude slightly after assembly. This ensures that they'll be long enough and allows a little extra for flush-sanding later.

Step 3. To cut the box joint fingers, stand the clock top (B) on one end against the extension, butt its right edge against the key, and cut the first slot (*figure 2*). Next, move the top to the right so the first slot fits over the key. Cut a second slot. Continue in this manner until you've slotted the entire end of the top. Cut the same sequence of slots in the opposite end of the top.

Step 4. Raise the blade to $2\frac{7}{32}$ " and recut the kerf in the extension. Position the top (B) so that the last slot fits securely over the key. Next, butt the right edge of one side (A) against the left edge of the top as shown in *figure 3*. Cut the first slot (actually a notch) into the edge, then remove the top. Move the side to the right, butting the notched edge you just cut against

Figure 1

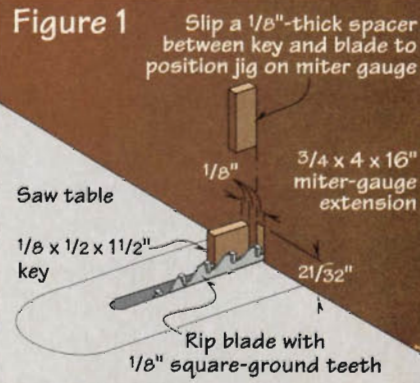


Figure 2

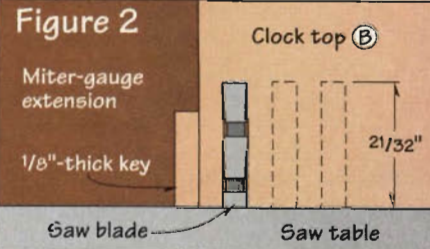
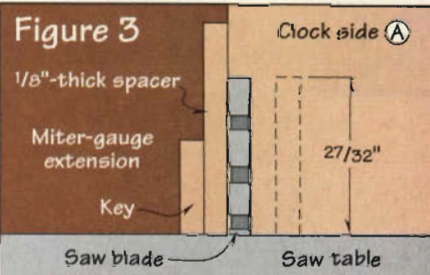


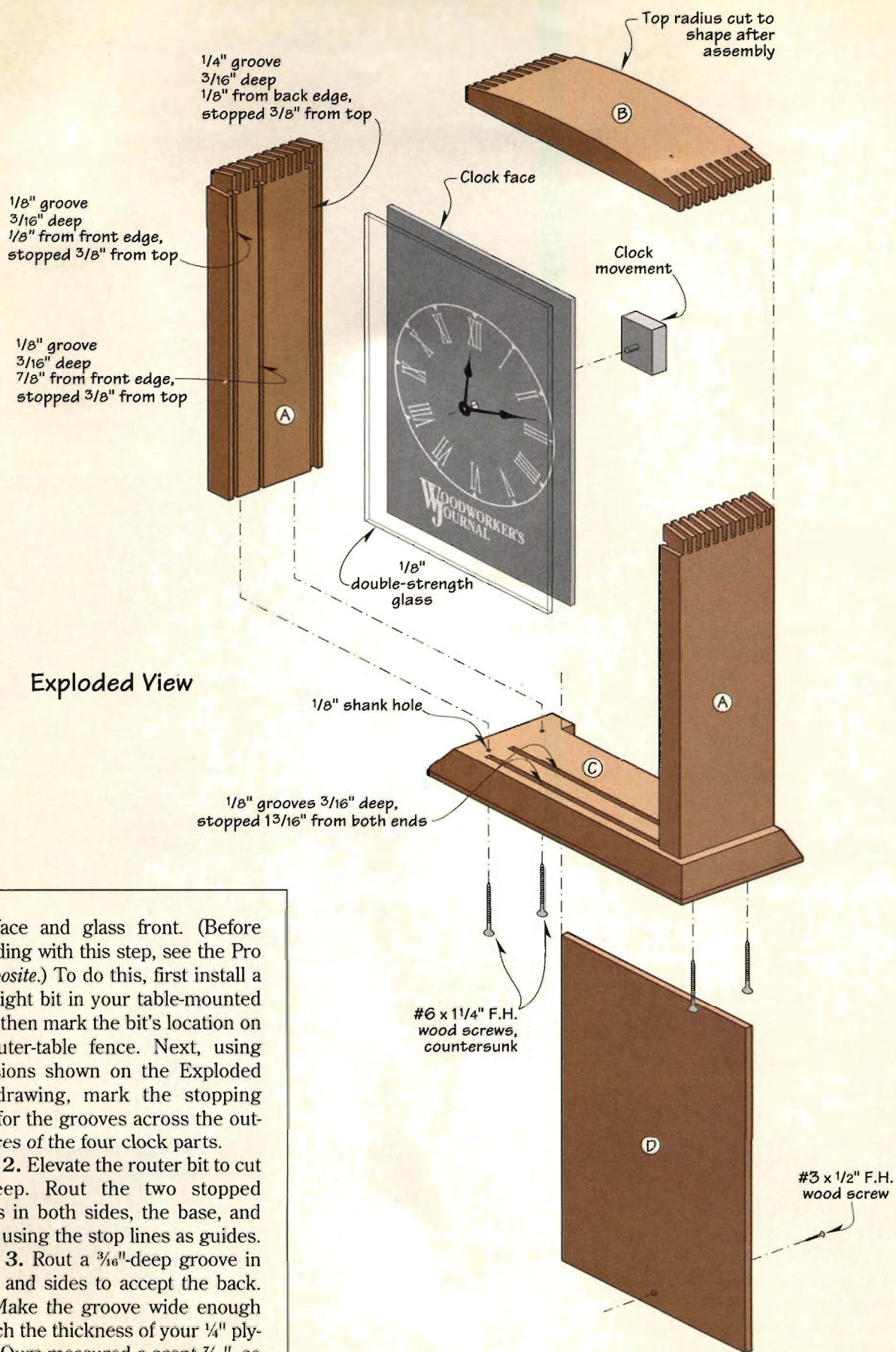
Figure 3



the key, and cut the next slot. Repeat this operation to slot the rest of the side, then slot the second side.

Rout the Grooves

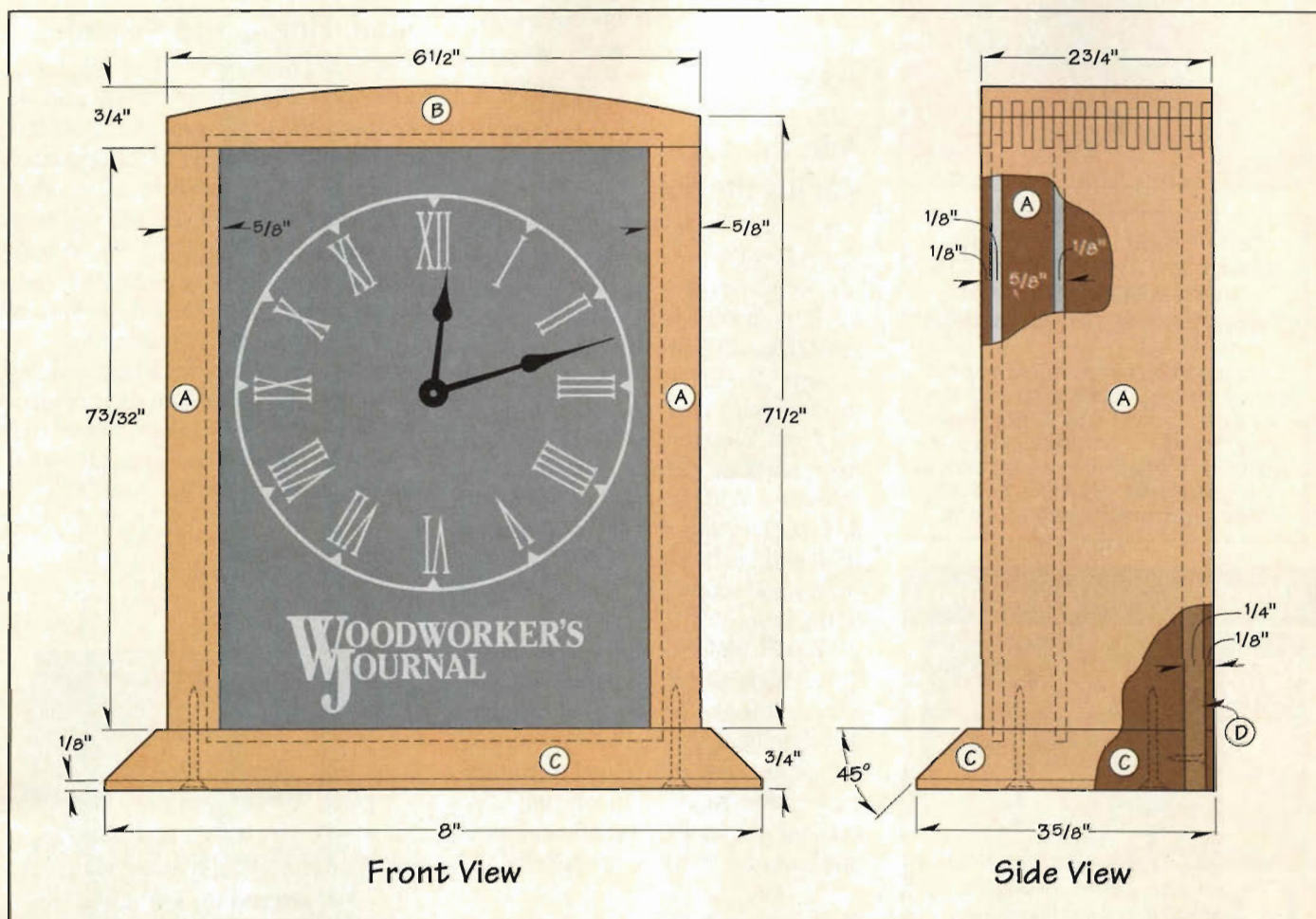
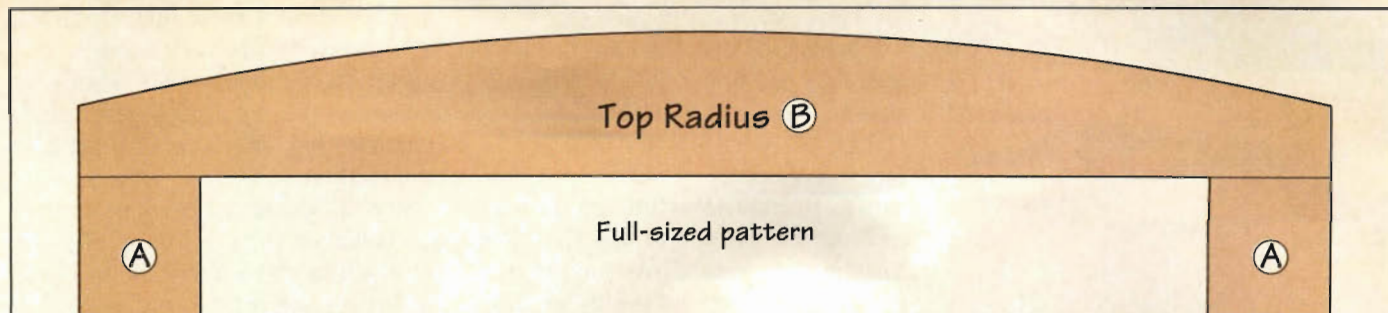
Step 1. Cut the two stopped grooves in the base, sides, and top for the



clock face and glass front. (Before proceeding with this step, see the Pro Tip *opposite*.) To do this, first install a 1/8" straight bit in your table-mounted router, then mark the bit's location on the router-table fence. Next, using dimensions shown on the Exploded View drawing, mark the stopping points for the grooves across the outside faces of the four clock parts.

Step 2. Elevate the router bit to cut 3/16" deep. Rout the two stopped grooves in both sides, the base, and the top using the stop lines as guides.

Step 3. Rout a 3/16"-deep groove in the top and sides to accept the back. Note: Make the groove wide enough to match the thickness of your 1/4" plywood. (Ours measured a scant 7/32", so



PRO TIP

We recommend that you procure the clock face, glass pane, and $\frac{1}{4}$ " plywood for the back before routing these grooves. Measure the thicknesses of these materials carefully. The clock face and most double-strength glass will fit in a $\frac{1}{8}$ " groove, but the $\frac{1}{4}$ " plywood can vary considerably in thickness. You may want to rout test grooves in scrap beforehand to check the fit of the glass and plywood.

we made two passes with the $\frac{1}{8}$ " bit, moving the fence for the second pass.)

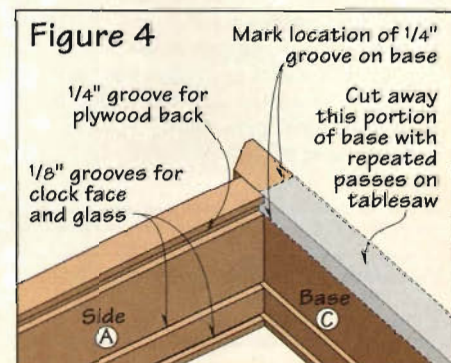
Now, Assemble the Clock

Step 1. Dry-assemble the sides and top, then measure the inside width between the two sides (not including the groove depths). Cut a spacer to this length to keep the sides parallel during subsequent operations.

Step 2. Gently separate the pieces. Apply glue to the mating surfaces of the box joints, then assemble the top and sides. Insert the spacer between the ends of the sides, clamp the assembly, and check it for square.

Step 3. After the glue has dried,

clamp the top/side assembly to the base, centering it from side to side and aligning the grooves. Mark the points (on the base) where the grooves for



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the back intersect the base (*figure 4*). Unclamp the base, then cut the back notch by making multiple crosscuts with a dado head or saw blade.

Step 4. Reclamp the base to the top/side assembly. Drill and countersink four screw holes through the base and into the sides. (See the Exploded View for locations.) Drive four #6x1½" flathead wood screws to join the base and sides. Note: Do not glue these parts—you'll disassemble them later to insert the glass and clock face or to replace the glass if it's ever broken.

Add the Back, Then Radius the Top

Step 1. Measure the back opening (including the ¾"-deep grooves). For the vertical dimension, measure from the bottom edge of the base. Cut the back (D) to fit from ¼" cherry plywood.

Step 2. Slide the back into its groove. Adjust the part to fit if necessary, but keep it snug to prevent gaps from showing between the back and the sides. With the back in place, drill and countersink a hole through the back and into the base for a #3x½" flat-head wood screw. Then screw the back to the base.

Step 3. Make a copy of the full-sized Top Radius pattern on *page 23*, then adhere it to the front face of the clock top. Bandsaw the radius just wide of the pattern line, then sand to the line with a disc sander. Smooth any disc-sanding marks with a random-orbit or finish sander. Remove the pattern.

Prepare the Glass

Step 1. With the clock still assembled, measure the glass opening (including the groove depths). Subtract ⅛" from both the width and length, then have a glass dealer cut double-strength glass to these dimensions. (Ours measured 5½x7⅞".)

Step 2. Drill the hole in the clock face for the clock shaft. (To mail-order the clock face and a recommended clock movement, see Sources at the end of the article.) Using your drill press, center a ⅜" brad-point bit on the cross-hairs at the center of the dial. (We placed a backing board beneath

the plastic clock face, then drilled at high speed, feeding very slowly.)

Step 3. Paint the clock hands silver/grey. (We mounted our hands back face out for the photo but later painted them.)

Step 4. Mount the clock movement and hands on the clock face following the manufacturer's instructions. Install the battery and set the correct time.

Sand, Finish, and Assemble

Step 1. Disassemble the back, base, and top/side assembly. Finish-sand all wooden parts to 220-grit, and break the groove edges lightly with sandpaper.

Step 2. Apply finish to all wooden parts. (Since the cherry will age to a rich red-brown naturally, we simply applied three coats of semi-gloss lacquer, sanding with 320-grit sandpaper to level each coat after it dried.)

Step 3. Slide the clock face and the protective glass front into their respective grooves. Then, slide the back/base assembly into position, and screw the base to the sides. 

Project design: Dick Coers

Photograph: StudioAlex

Produced by: Tom Jackson

SOURCES

Clock Face. *Woodworker's Journal* Roman numeral clock face, silver on black plastic. Price: \$5.00 ppd. Order from:

Woodworker's Journal
800/521-2885 Ext. 5017

Quartz Clock Movement. Battery-powered, shaft-mounted through hole in clock face. Requires one C battery. Ask for kit no. 71273. Price: \$15.95 ppd. Order from:

Klockit
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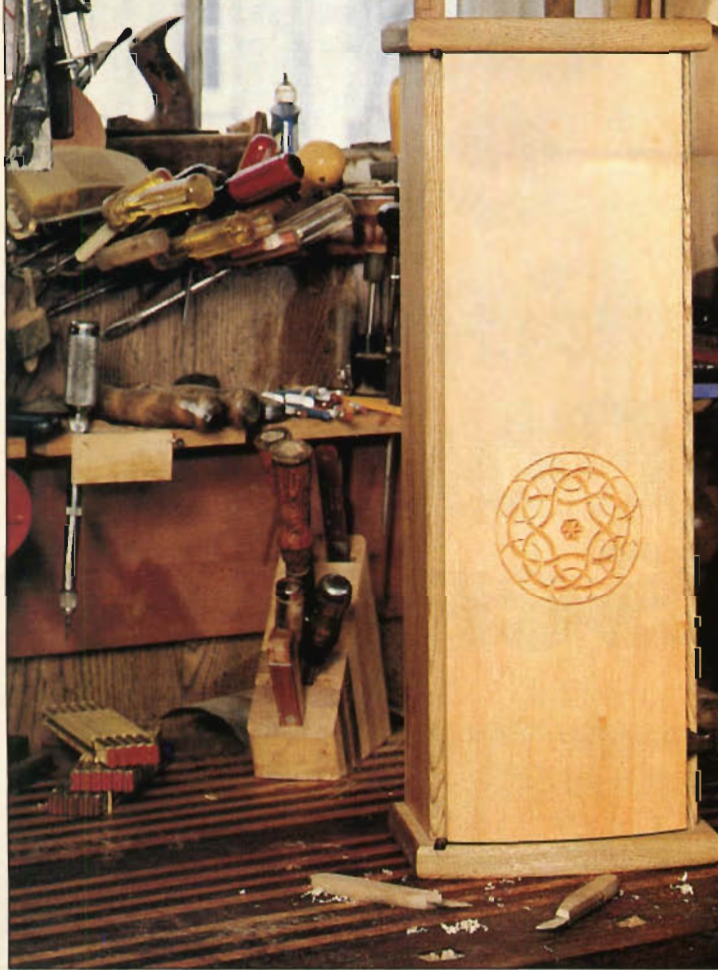
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Coopered Door Cabinet

Door in the round adds a new dimension



Designer Craig Moro recently thumbed through James Krenov's *The Fine Art of Cabinetmaking*, which inspired him to try a coopering project. The result, which we offer here, makes a unique cabinet that adapts to a variety of uses, depending on how you choose to customize the interior. From materials he had on hand, Craig chose an appealing combination of basswood, butternut, and a bit of rosewood. He derived the chip-carved knotwork on the door from a centuries-old Persian design.



Craig designed his cabinet with two drawers and three shelves, but you can easily adapt the interior to any number of uses.

Before You Start

Craig coopered and sized the door first, then fit the cabinet to it. He fine-tuned the fit of the door to the cabinet when it came time to hang it. Craig chose basswood for the door both for its stability and its carvability. If you don't intend to chip-carve the decorative knotwork on your door, you may want to choose a more richly grained material.

Craig used offset knife hinges for hanging the cabinet door. Straight knife hinges or pivot hinges would also work, provided they mount on the ends of the door and remain mostly invisible. If you select brass knife hinges, you may want to choose a wood for the door pull that complements brass. Craig opted for bronze-finish hinges because they go well with the rosewood he used for his pull.

Cooper the Door

Step 1. Face-joint and plane a 10x28" piece of 3/4"-thick basswood to 1/16" thick. Joint one edge, then select the better face and mark it "outside."

Step 2. Tilt your tablesaw blade to 5° from perpendicular. Bevel-rip the following widths in sequence: 1 1/16", 1 3/16", 1 7/8", 1 13/16", and 1 1/16". Note: Bevel the two outside pieces—the 1 1/16" widths—on the *inside* edge only, leaving the outside edge square. (See *figure 1* for an end view of the beveled parts.) For the three interior parts, bevel-rip one edge, then turn the piece end for end (without flipping it over) and bevel-rip the opposite edge. Now, number the parts in sequence and mark the outside face on each.

Step 3. Joint the mating (beveled) edges of all door parts. (Craig set his jointer to remove 1/32" of stock. Rather than attempting to set the jointer fence to match the 85° bevel, he bevel-ripped one edge of a 2x4 carrier board to 85° and adhered each part to it with double-faced tape for jointing.)

Step 4. Make the clamping form and wedges as described in "Making the Clamping Form" on *page 29*. Test-fit the door parts in the form, aligning the ends. Insert opposed wedges along both sides of the form to squeeze the joints tight (*photo A*). Adjust the form's fit as necessary. Varnish and then wax

CABINET

PART	T	W	L	MTL.	QTY.
A Door* **	1/2"	7"	22 1/2"	B	1
B Top/Base*	5/16"	6 1/2"	8 7/8"	BN	2
C Sides*	1/16"	5 1/4"	22 5/8"	BN	2
D Back*	1/4"	6 15/16"	23 1/8"	BP	1
E Shelves*	1/4"	4 3/8"	6 15/16"	B	3

DRAWERS

F Front—small*	1/2"	2 3/8"	6 3/8"	BN	1
G Front—large*	1/2"	4 1/8"	6 3/8"	BN	1
H Back—small*	3/8"	2 3/8"	6 3/8"	B	1
I Back—large*	3/8"	4 1/8"	6 3/8"	B	1
J Sides—small*	1/4"	2 3/8"	4 5/16"	B	2
K Sides—large*	1/4"	4 1/8"	4 5/16"	B	2
L Bottoms*	1/4"	3 5/8"	6 1/16"	BP	2

OTHER

M Door pull*	5/8"	3/4"	1 1/4"	R	1
N Mounting cleats*	3/8"	2 1/2"	6 1/2"	H	2

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

**Part edge-glued from narrower stock.

MATERIALS LIST

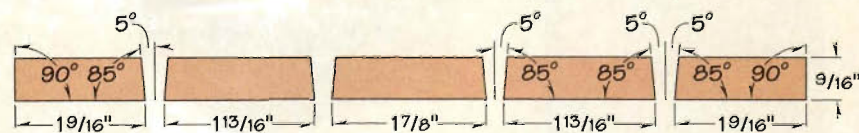
B—basswood
BN—butternut
BP—birch plywood
R—rosewood
H—hardwood

SUPPLIES

5/8" dowel stock; 1/4" dowel stock; oil finish.
(For other supplies, see Sources listed at end of article.)

Figure 1

Bevel-rip the door parts in sequence



the form edges to prevent any glue squeeze-out from adhering it to the door.

Step 5. Apply glue to the mating edges of the door parts and place them in the form. (We started with the middle and adjoining pieces, then added the two outer parts.) Align the ends of the parts, then insert the wedges to apply uniform clamping pressure. Work carefully to keep the door aligned square in the form. Allow the glue to dry for 12 hours.

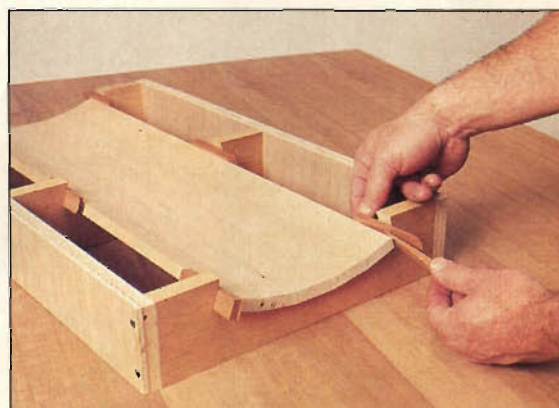
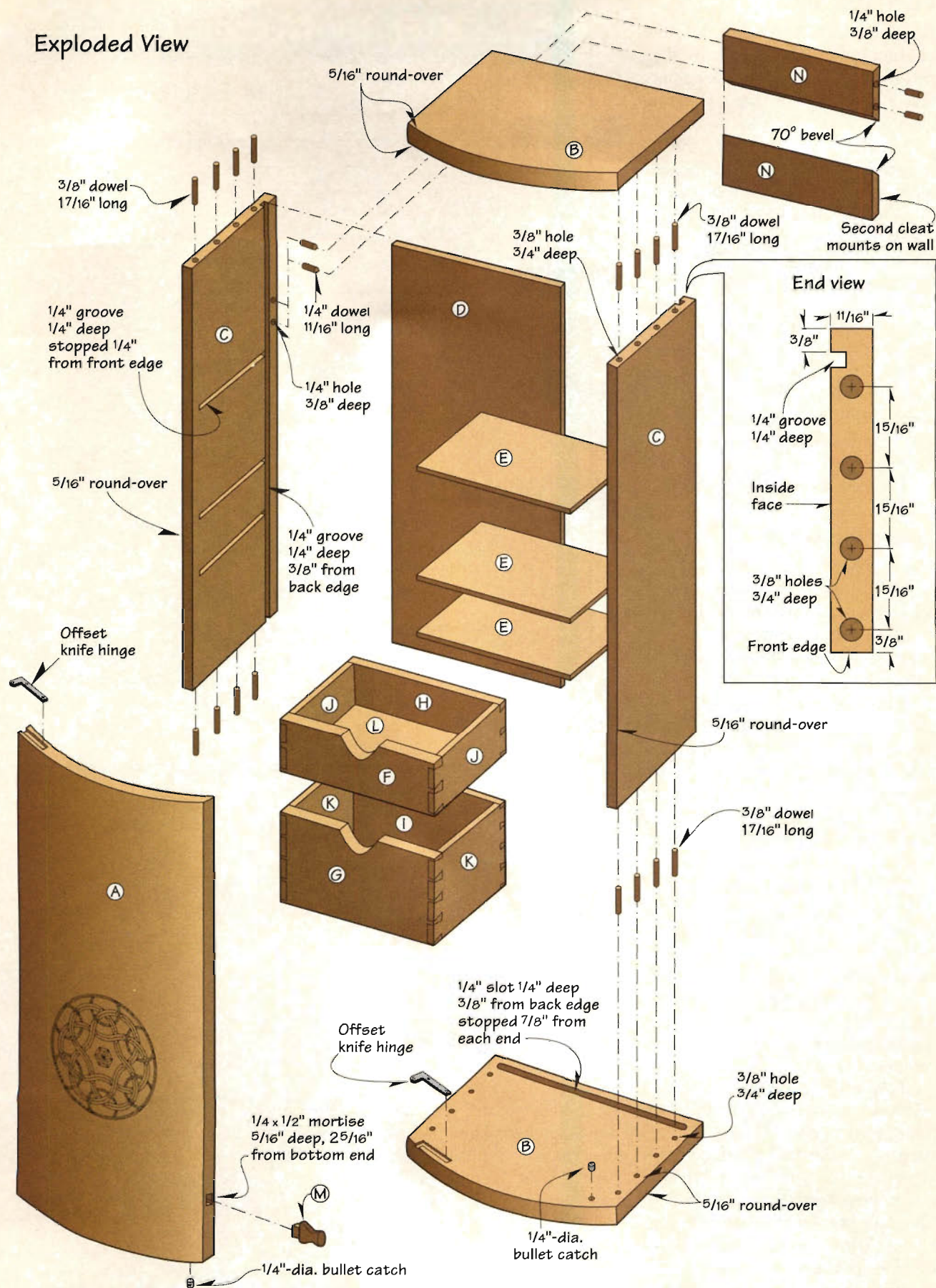


Photo A: Clamp the door parts into the form using opposed wedges, then check to make sure the door is square to the form.

Exploded View



Step 6. To trim the door edges, first remove the door from the form. Next, make a carrier as shown in *figure 2* and *photo B*. Center the door on the carrier and clamp as shown. With your blade set at 90°, rip equal amounts of stock from both edges to 7" final width.

Step 7. Remove any twist from the door edges. If you have an 8" jointer, one light pass should be sufficient. Otherwise, cut two sheets of 100-grit sandpaper into 2"-wide strips, then tape the strips end-to-end in two lines 5½" apart. Next, place the door on the sandpaper strips crown side

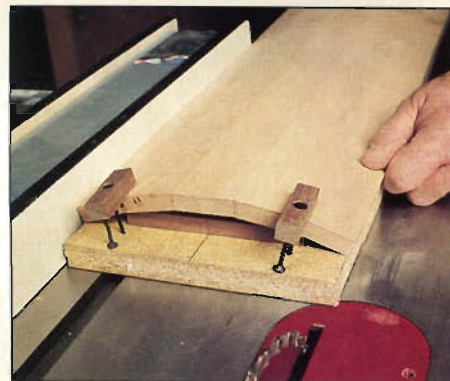
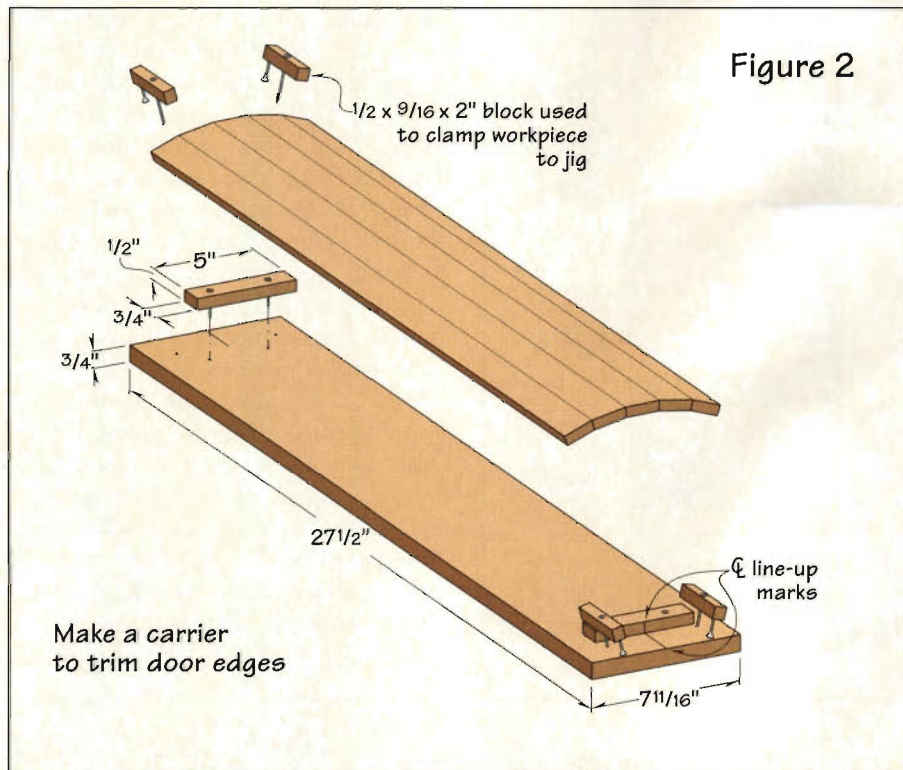


Photo B: Square the door on the carrier and clamp firmly. Note that we sized the cross shims at both ends to support the door under the clamps at the first joints.

Figure 2



up. Applying light pressure, slide the door back and forth along the sandpaper strips until you've sanded away all unevenness and made solid contact all along both edges.

Step 8. Using a sliding cutoff table on your tablesaw (or miter gauge with extension), square one end of the door. Then, crosscut the other end to 22½" long.

Step 9. Plane or sand both faces of the door to remove the facets and create a smooth curvature. A flat plane or sanding block will work fine for the outside face. For the inside face, make a sanding block that roughly matches the door's curvature. Note: You may elect not to remove the tiny facets on the door's inside face.

Making the Clamping Form

Crosscut a 1" length from the same end of all five door parts. Align and edge-glue the cutoffs in sequence using cyanoacrylate glue. Note: You'll use this glue-up to make a template for tracing the coopered arc onto the clamping form blanks.

Cut three 13¼" lengths of 1x4 pine stock. Using the template you just made from the door part cutoffs, center and

trace the arc onto one blank where shown on the drawing below. Using a straightedge, extend the outside facets of the arc to add ½" of width on both edges. Then, square a line from each end of the arc to the top edge of the blank.

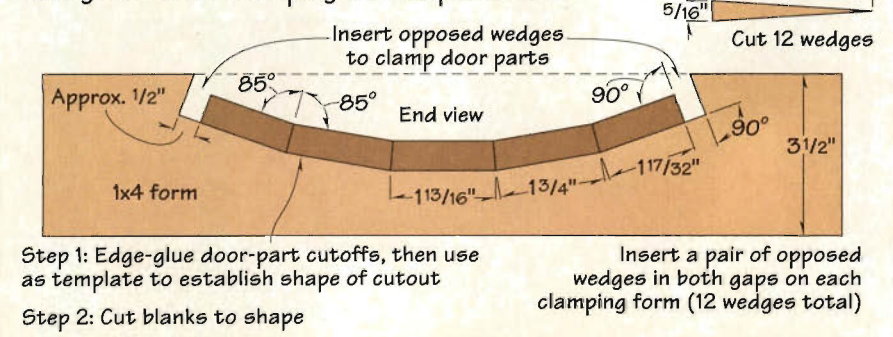
Bandsaw the cutout on the marked blank, staying as close to the line as possible. Note: The cut needn't be absolutely precise. Test-fit the coopered template in the

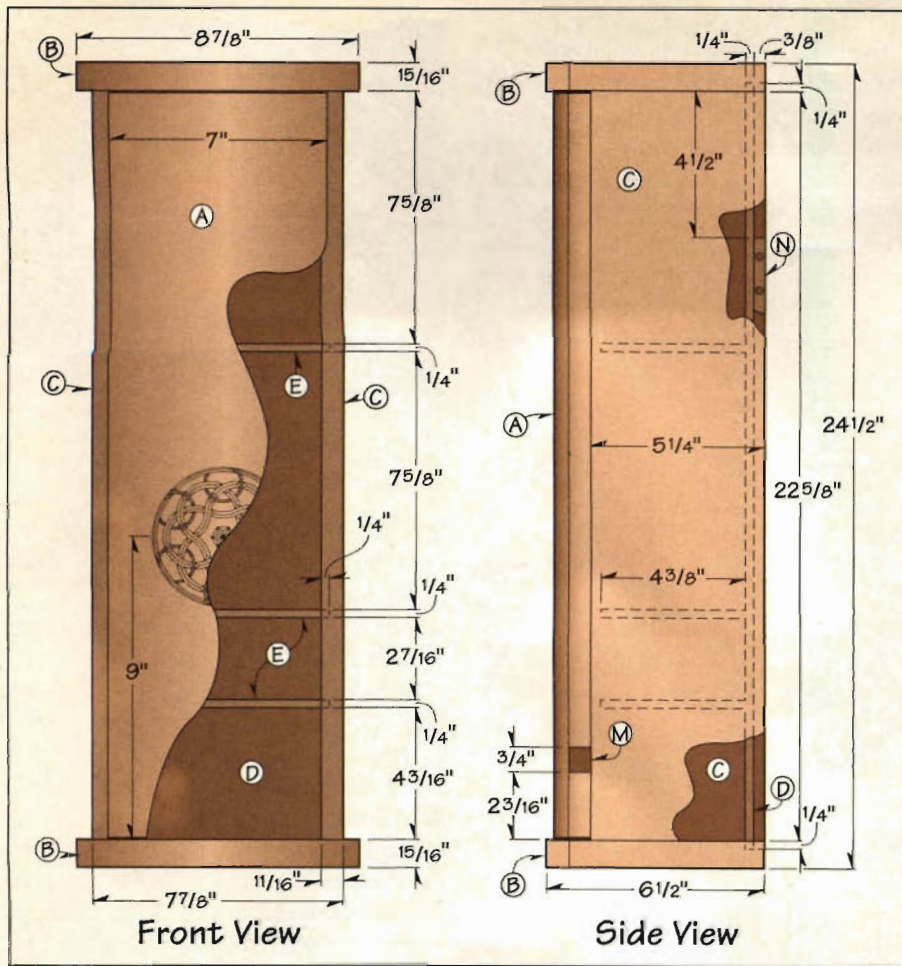
cutout to make certain the door will fit. Now, use this blank as a template to make cutouts in the two remaining blanks. Bandsaw both to shape.

From ¾" plywood, rip and cross-cut two 3½x24" sides. Assemble the forms and sides, placing one form at each end and centering the third between them.

From 1" stock, cut twelve ¾x3" wooden wedges. If necessary, sand the mating edges to ensure that the wedges slide smoothly.

Making forms for clamping the coopered door





Now, Build the Cabinet

Step 1. Face-joint and plane a 7x20" piece of 5/4 butternut stock to 15/16" thick. Joint one edge. From this piece, crosscut the top and base (B) to 87/8" long.

Step 2. Using a set of trammel points, lay out the rounded front edge of the top by drawing a centered 14 1/2" radius that peaks 6 1/2" from the back edge. To do this, temporarily adhere a 9" length of scrap stock to the back edge of the top as shown in figure 3. Scribe the arc on the top blank. Note: This radius does not quite match the door's radius.

Step 3. Stack the top and base blanks using double-faced tape. Bandsaw the front edge to shape, keeping your blade outside the line. Sand to the line using a disc sander, then separate the pieces.

Step 4. To make the sides, face-joint and plane a 5 1/2 x 48" piece of 4/4 butternut to 1 1/8" thick. Joint one edge, then rip the stock to 5 1/4" wide. To determine the length of the sides, add 1/8" to your door length, then crosscut the two sides (C) to this dimension. (Ours measured 22 5/8" long.)

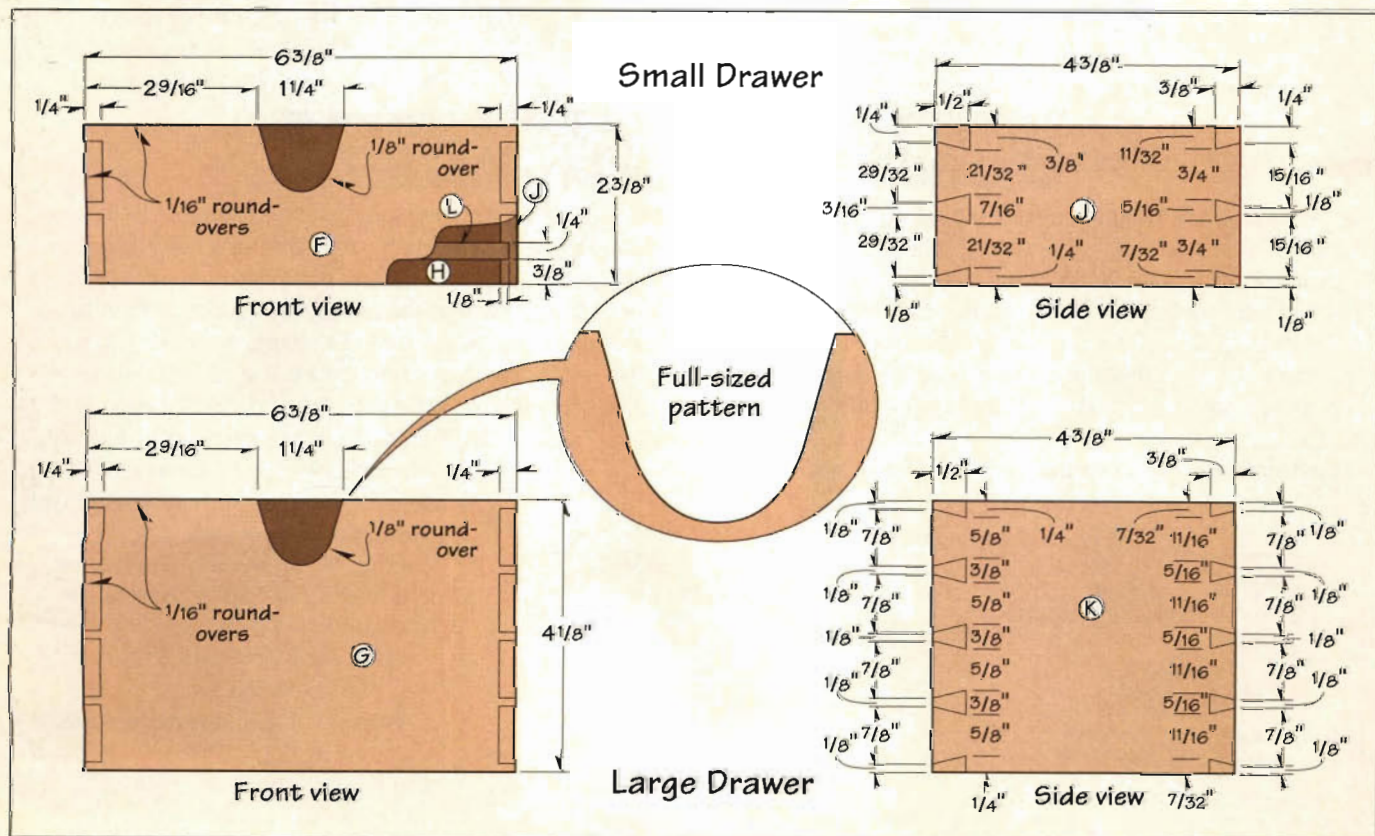
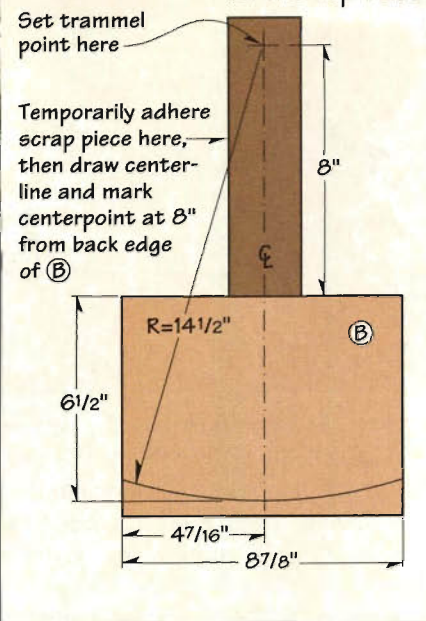


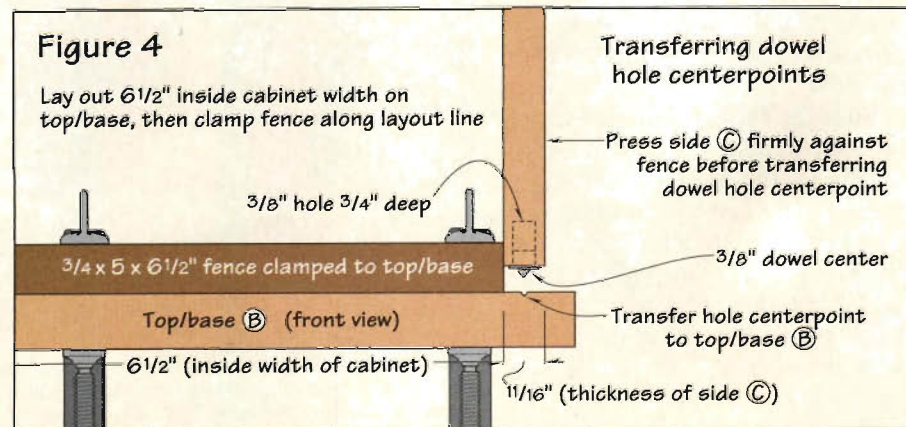
Figure 3 Laying out the radius on the top/base



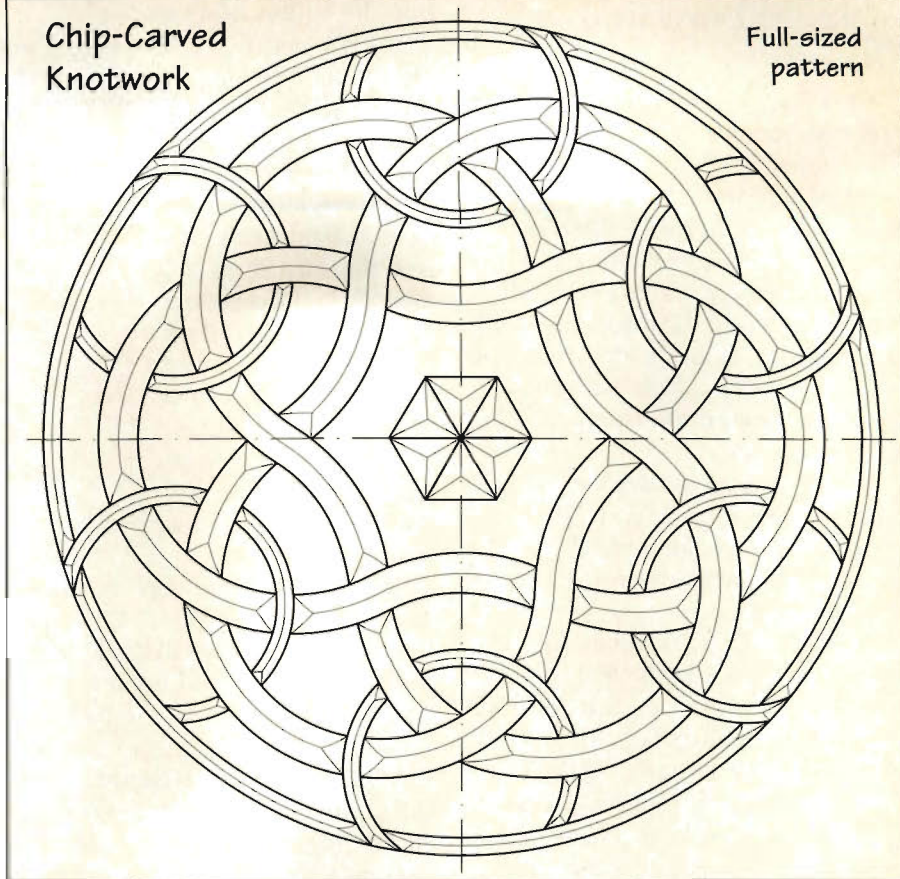
Step 5. Select the outside face on each side and rout a $\frac{5}{16}$ " round-over along the outside front edge of these two parts. Next, round over both ends and the front edge of the top and base (along both faces) in end-edge-end sequence.

Step 6. Using a doweling jig, lay out and drill four $\frac{3}{8}$ " holes $\frac{3}{4}$ " deep in both ends of the sides where dimensioned on the Exploded View detail. From $\frac{3}{4}$ " scrap, cut a $5 \times 6\frac{1}{2}$ " rectangle to use as a fence for transferring the hole centerpoints. Center it on the base from side to side, align the back edges, then clamp it to the base.

Step 7. Insert dowel centers in the four holes in the bottom end of a side. (See figure 4.) Place the side tight against the fence, align the back



Chip-Carved Knotwork



edges, and press the side down firmly to transfer the hole centerpoints to the base. Repeat this procedure to mark the dowel holes on the opposite side of the base and then on the inside face of the top. Drill these $\frac{3}{8}$ " holes $\frac{3}{4}$ " deep.

Step 8. Using a $\frac{1}{4}$ " straight bit, cut a $\frac{1}{4}$ "-deep groove along the inside face of the sides $\frac{3}{8}$ " in from the back edge. (See the Side View drawing *opposite* and the Exploded View.) Note: Save this setup for the following step.

Step 9. Using the same setup, rout a stopped groove along the inside face

of the top and base as dimensioned on the Exploded View. To start and stop the groove, scribe a pair of layout lines on the back face of each workpiece and a pair of corresponding lines on your router table's fence.

Step 10. Lay out and plunge-rout stopped dadoes for the shelves in both sides. (For locations, see the Front View drawing.) Start the dadoes $\frac{1}{4}$ " from the front edges and rout to the back grooves. Square the stopped front end of each dado with a sharp chisel.

Step 11. Dry-assemble the top, bottom, and sides, temporarily using $\frac{1}{2}$ " lengths of dowel. Check for square and twist. Measure the inside, add the depth of the grooves, and cut the back (D) to fit from $\frac{1}{4}$ " birch plywood.

Step 12. For the three shelves (E), surface a 5×24 " piece of basswood to $\frac{1}{4}$ " thick. Joint one edge, rip it wide enough to fit the dadoes, then cross-cut the shelves to fit. Insert the shelves and back without glue, disassembling the sides, top, and bottom just enough to do this. Check for fit, and adjust if necessary.

Make the Dovetailed Drawers

Step 1. Measure the two drawer openings in your dry-assembled cabinet. Subtract $\frac{1}{16}$ " from the width and depth and $\frac{1}{8}$ " from the length (side-to-side dimension). Using these dimensions, cut drawer fronts (F, G) for the upper and lower drawers from $\frac{1}{2}$ "-thick butternut. From $\frac{3}{8}$ "-thick basswood, cut backs (H, I) for the drawers to the same dimensions. Now, cut two sides (J, K) for each drawer from $\frac{1}{4}$ "-thick basswood stock.

Step 2. Select and mark an outside face on each drawer part. Then, lay out and cut through dovetails on the parts as dimensioned on the Drawer drawing on *page 30*.

Step 3. Dry-assemble the two drawers to check for fit, and adjust as necessary. Measure the interior dimensions, adding $\frac{3}{16}$ " to the width and length for groove depth. (This leaves an extra $\frac{1}{16}$ " of groove depth.) From $\frac{1}{4}$ "-thick plywood, cut two drawer bottoms (L) to these dimensions.

Step 4. Using a $\frac{1}{4}$ " straight bit, rout $\frac{1}{8}$ "-deep stopped grooves (stopping $\frac{1}{8}$ " from both ends) along the inside faces of the drawer sides $\frac{3}{8}$ " from the bottom edge. (See the Small Drawer front view drawing.) Rout identical through grooves along the inside faces of the fronts and backs.

Step 5. Transfer the full-sized Finger Cutout pattern shown on the Drawer drawing to the center top edge of both drawer fronts. Bandsaw and sand the cutouts to shape. Then, finish-sand the inside faces of all drawer parts.

Step 6. Glue, assemble, and clamp the two drawers. After the glue has dried, sand the joints flush. Next, rout the $\frac{1}{8}$ " and $\frac{1}{16}$ " round-overs on the drawers where shown. Then, finish-sand the exterior drawer surfaces.

Now, Hang the Door

Step 1. Position one of the knife hinges on the top end of the door where shown on the Exploded View. (To mail-order hinges, see Sources listed at the end of the article.) Center the hinge between the faces, then

trace its outline using a sharp #3 pencil. (See *photo C* for location.)

Note: The entire hinge arm should lie over the door, while the shorter, pinned segment should clear it completely. Repeat this step to mount the hinge on the bottom end of the door. Mark the depth of the hinge leaf on the edge of the door for both hinges. Carefully score the outline in the end grain with a sharp knife, then use a chisel to score the depth line.

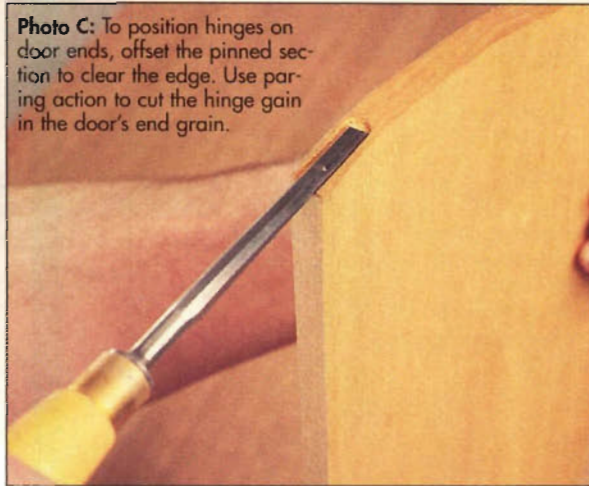
Step 2. Carefully pare the hinge gains to depth using a $\frac{1}{4}$ " chisel. Next, fit the hinges in their gains. Using a Vix bit, drill the screw holes, then temporarily screw the hinges to the door.

Step 3. Lay the dry-assembled cabinet on its back. Tap the top and bottom slightly to loosen them, creating clearance for the hinges. Center the door from side to side in its opening, and insert $\frac{1}{16}$ " spacers top and bottom to center the door vertically. Add $\frac{1}{32}$ " spacers to shim the hinged edge of the door out from the cabinet. (Craig used pasteboard from the back of a note pad.) Now, draw a faint line along the hinged edge to mark the door's location on the edge of the side. Double-check the door's position, then secure it with masking tape.

Step 4. Close the hinges, aligning the two leaves precisely. Trace around the pinned segment of the hinge (as much of it as you can) to establish the hinge's location on the top and base. Remove the door, then remove the hinges from the door.

Step 5. Temporarily disassemble the cabinet. Position the hinges on the top and base, then trace around any parts that you couldn't reach before. Score the hinge gains, this time using a chisel for the straight lines. Cut the gains to depth (*photo D*). Then, drill screw holes and attach the hinges to the cabinet.

Photo C: To position hinges on door ends, offset the pinned section to clear the edge. Use paring action to cut the hinge gain in the door's end grain.



Step 6. Dry-assemble the cabinet and attach the door. Check the door for fit and action. If the door binds as you open it, plane a bit of stock from the back of its hinged edge. Now, remove the door from the hinges.

Step 7. To install the bullet catch, drill a $\frac{1}{4}$ " hole in the bottom end of the door using a doweling jig. (For location, see the detail on the Exploded View.) Tap the spring-loaded half of the catch into the hole, then reattach the door to the hinges. With the door closed, establish and mark the location for the mating half of the catch in the base. Temporarily disassemble the cabinet, then drill the hole in the base using your drill press. Insert the catch, then reassemble the cabinet.

Chip-Carve the Optional Knotwork

Step 1. Transfer the full-sized Knotwork pattern on *page 31* to the door face where dimensioned on the Front View drawing.

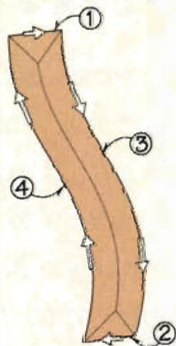


Photo D: Attach hinges to door, position door on cabinet, align both hinge leaves, and mark hinge location on the top and base. Then, cut cabinet gains as shown.

Figure 5 Cutting order and direction for removing each chip

Note: Cut in clockwise direction if right-handed, counter clockwise if left-handed. Make stop cuts ① and ② first. Hold knife at a constant 65° to the chip you're removing.

Note: Cut along thick outer lines only. Thin inner lines indicate contour of the completed carving.



Step 2. Using a sharp chip-carving knife, remove each chip by cutting in the order and direction shown in figure 5. (For additional tips from Craig on chip-carving, see the sidebar on page 41 of the March/April '96 issue of *Woodworker's Journal*.)

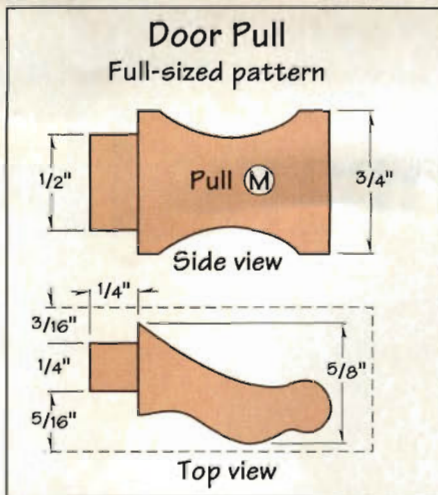
Add the Door Pull and Wall-Mounting Cleat

Step 1. Lay out and cut a centered $\frac{1}{4} \times \frac{1}{2}$ " mortise $\frac{3}{16}$ " deep in the right edge of the door where dimensioned on the Side and Exploded Views. Note: Because of the difficulty of clamping a coopered door, Craig pares out the mortise waste without clamping (which is not difficult in basswood), then squares the corners. If you use a harder wood, clamp the door securely, since you'll need to do more chopping than paring.

Step 2. To make the door pull (M), first cut a $\frac{3}{4} \times \frac{3}{4} \times 6$ " blank from a dark, richly grained wood. (Craig used rosewood.) Cut a $\frac{1}{4} \times \frac{1}{2}$ " tenon $\frac{1}{4}$ " long on one end, locating it $\frac{3}{16}$ " from one face. Test-fit the tenon in the mortise, and adjust as necessary.

Step 3. Transfer the full-sized Door Pull side view pattern shown above to one face of the pull blank. Using a half-round rasp or oscillating spindle sander, form the two arcs along the edges.

Step 4. Transfer the Door Pull top view pattern to the appropriate edge, then bandsaw the profile, staying wide of the line. Carve and/or file the



profile to shape. Sand the pull to 220-grit, breaking the corners only slightly. Glue and clamp the pull to the door.

Step 5. To make the two mounting cleats (N), cut a 5×7 " blank from $\frac{3}{8}$ "-thick hardwood. Tilt your tablesaw blade to 20° from perpendicular, and bevel-rip the blank in half. Measure the width across the back of the cabinet between the sides, then crosscut the cleats to fit.

Step 6. Using a doweling jig, drill two $\frac{1}{4}$ " holes $\frac{3}{8}$ " deep in both ends of the mounting cleat. Note: You'll use the remaining piece for the mating wall-mounted cleat. Insert dowel centers in the holes, then disassemble the cabinet enough to fit the cleat between the back edges of the two sides. (See the Side View for location.) Square the cleat to the sides with its beveled edge down. Then, press both sides firmly to transfer the hole centerpoints. Disassemble the cabinet and drill $\frac{1}{4}$ " holes $\frac{3}{8}$ " deep in the sides.

Step 7. Cut, groove, and chamfer $\frac{1}{4}$ " dowels $\frac{1}{16}$ " long. Glue them into the cleat holes, leaving $\frac{1}{32}$ " protruding.

Assemble the Cabinet, Then Apply Finish

Step 1. Finish-sand the shelves, the back, and the inside faces of the top, bottom, and sides. Next, cut, groove, and chamfer sixteen $\frac{3}{8} \times 1 \frac{1}{16}$ " dowels, then glue them into the holes in the ends of the sides, leaving $\frac{1}{16}$ " protruding.

Step 2. Glue, assemble, and clamp the cabinet. To do this, first assemble the shelves (without glue) into their

dadoes in one side. Apply intermittent beads of glue to the back groove—avoiding the shelves, which must float freely—then assemble the back to the side. Apply glue to the dowels on one end of the cleat and insert them into the holes in the side. Assemble the opposite side to these parts, applying glue as before. Now, glue, assemble, and clamp the top and bottom to the sides and back. Check for square, then allow the glue to dry.

Step 3. Finish-sand all surfaces that still need it to 220-grit. Remove dust with a tack cloth or compressed air.

Step 4. Apply your choice of finish. (Craig mixed two parts tung oil with one part satin varnish, then thinned this blend 1:1 with mineral spirits. He applied three coats to all surfaces, rubbing between coats with a fine flexible abrasive pad.)

Step 5. Drill and countersink two $\frac{1}{4}$ " shank holes centered between the ends of the wall cleat. Attach the cleat (beveled edge up) to the wall in your chosen location, driving a pair of #8x2" flathead wood screws into a stud. Note: If you can't locate the cleat over a stud, use an appropriate wall-mounting fixture. 

Project designer and builder: Craig Moro

Illustrations: Don and Karen Pauli

Photos: Studio Alex

Produced by: Doug Cantwell

SOURCES

Bronze-Finish Knife Hinges.

Steel, offset, $\frac{5}{16} \times 1 \frac{1}{2}$ ". Catalog no. H5805. Price: \$2.20/pair plus s/h. Order from:

Craftsman Wood Service
800/543-9367

Solid Brass Knife Hinges.

Made by Brusso, offset, $\frac{5}{16} \times 1 \frac{1}{4}$ ". Catalog no. 26260. Price: \$13.95/pair plus s/h.

Brass Bullet Catch. Solid brass body with steel ball, $\frac{1}{4}$ " overall diameter. Catalog no. 62075. Price: \$3.50 plus s/h.

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The Woodworkers' Store
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If you find yourself hard up at the last minute for one of those important-occasion gifts, don't despair. Dick Coers, our designer/craftsman, came up with this timely solution the day before he presented it. To avoid clamp-ups and the down time they require, Dick joined the frame using pocket-drilled face-frame screws. His wife was so taken with the design that she hardly noticed the odor of curing lacquer. (Note: This mirror complements the Contemporary Hall Table we presented in our May/June '96 issue, shown in the inset photo.)



Before You Start

If you don't have equipment for pocket-screw joinery, you'll need to acquire it. (See the Sources listed at the end of the article.) The technique itself is simple: You clamp a pocket-hole guide to the end of each rail, then drill steeply angled (15°) holes that enter the face and exit through the end of the rail. The special step bit you use both drills a 1/8" shank hole and counterbores a 3/8" clearance hole in a single operation. You then glue the rails to the stiles and clamp them to bring the faces flush. Using self-tapping, #6 pan-head face-frame screws, you secure the joint in a matter of minutes.

Prepare the Frame Parts

Step 1. Face-joint and plane 4/4 cherry stock to 13/16" thick. Joint one edge, then rip stock for the stiles (A) to 2 7/8" wide, for the bottom rail (B) to 2" wide, and for the top/middle rails (C) to 1 1/2" wide. Using a miter-gauge extension and stopblock for accuracy, crosscut the stiles to 43" long and the three rails to 21" long.

Step 2. To set up for routing the flutes in the stiles, fit your table-mounted router with a 3/8" core box bit and set it to cut 3/32" deep. Set a fence 1 1/8" from the centerpoint of the bit, then mark the location of this centerpoint on the fence with a vertical line.

Step 3. Select and mark a front face on each stile. Next, flip the stiles over and scribe a line across the back of each stile 4" from both ends. (These will be the start- and stoplines for the flutes.) To make the cut, position each stile against the fence, then lower its front face onto the bit slightly inside the (left) startline. Carefully back up, feeding the stile from left to right, until the startline aligns with the bit's centerline as marked on the fence. Feed from right to left until the stopline comes into alignment with the fence line. Note: To avoid burning the stock, lift the stile off the bit as soon as you complete each cut.

Step 4. After you've routed both stiles, turn them edge for edge and rout a second flute in the same face. Next, reset the fence 1/4" from the bit's centerpoint, making sure you keep the fence line aligned with the center of

CONTEMPORARY MIRROR

BILL OF MATERIALS

PART	T	W	L	MTL.	QTY.
A Stiles	13/16"	2 7/8"	43"	C	2
B Rail—bottom	13/16"	2"	21"	C	1
C Rails—top/middle	13/16"	1 1/2"	21"	C	2
D Molding	1/2"	1 1/2"	28 1/4"	C	1
E Panel	1/4"	4 7/16"	21 1/16"	B	1
F Mirror backing*	1/8"	21 1/16"	34 7/16"	HB	1
G Mounting cleats	5/16"	1 7/8"	21"	H	2

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

MATERIALS LIST

C—cherry
B—birch
HB—hardboard
H—hardwood

SUPPLIES

1/4" mirror; #6x1 1/4" self-tapping face-frame screws; #6x1" flathead wood screws; satin lacquer. (For other supplies, see Sources listed at the end of the article.)

the bit. Repeat Step 3, again routing each stile along both edges, to yield four evenly spaced flutes on the front face of each piece.

Step 5. Make a template to rout the decorative circle near both ends of each stile. To do this, install the 3/8" core box bit and a 5/8"-o.d. guide bushing in a handheld plunge router. Next, cut a 6x10" piece of 1/4" plywood or hardboard. Near one corner, lay out and cut a 2 5/8"-diameter circle centered 1 1/2" from both the end and edge. Again, set the router to cut 3/32" deep. Then, remove the disc.

Step 6. Test the setup by clamping the template to a piece of scrap stock and routing several circles, running the guide bushing against the inside edge of the template. When satisfied, clamp the template to one end of a stile, aligning the ends and edges. Plunge the router to depth, and rout in a counter-clockwise direction. Withdraw the bit as soon as you've finished the circle. Repeat this operation to rout the remaining three circles.

Drill Pocket Holes, Then Assemble the Frame

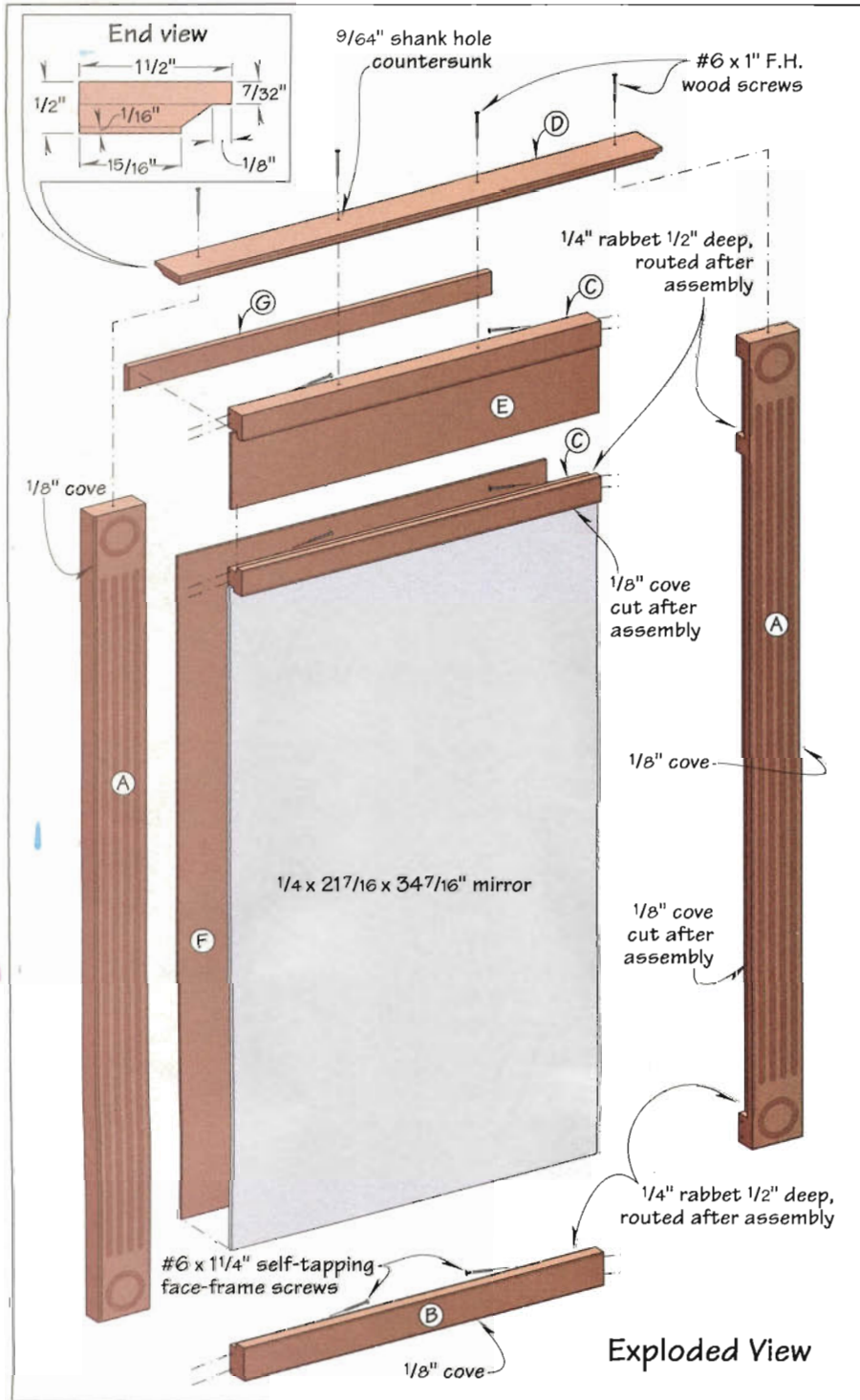
Note: If you'll be acquiring pocket-drilling equipment for this project and using it for the first time, we recommend you read all instructions careful-



Photo A: To drill pocket holes in the rails, clamp a pair of guides to the workpiece, then use 3/8" step drill bit to counterbore and drill shank holes at 15° angle. Note: Holes enter the face, exit the end of the rail.

ly and practice setting up and drilling on scrap stock before working on the mirror frame. (See photo A.)

Step 1. Lay out and drill a pair of pocket holes at each end (back face) of the three rails. (For layout, see figure 1.) Note: Because you'll rabbet each rail along one or both of its back edges and thus lose some of its width, it's crucial that you follow the layouts shown in the figure.



Step 2. Position the middle rail where shown on the Front View drawing opposite. Then, assemble the frame using glue and screws. To do this, work one joint at a time, attaching all three rails to first one stile, then the other. Apply glue, then clamp each rail and stile vertically to align the faces flush (photo B). Note: Some of the pocket-drilling kits on the market include a clamp for this purpose. Drive #6x1 1/4" self-tapping face-frame screws, pulling the stile up snug to the rail.

Step 3. Sand the rail and stile faces flush if necessary. Install a 1/8"-radius cove bit in a handheld router, and rout the outside front edge of the frame along the sides and bottom (not the top). Next, rout around the inside front edge of both the mirror and panel openings.

Step 4. Using a rabbeting bit in your handheld router, cut a 1/4"-wide rabbet 1/2" deep around the back edge of the mirror and panel openings. Square the rabbet corners using a chisel.

Make the Molding, Then Prepare the Panel

Step 1. To make the molding (D), face-joint and plane a 2 1/2x30" piece of cherry to 1/2" thick. Joint one edge, then rip and crosscut the piece to 2x28 1/4".

Step 2. Fit your table-mounted router with a small-diameter panel-raising bit. (We used Bosch's no. 85583M, which has a 1 5/8" overall diameter.) Rout both ends and one edge of the molding blank in end-edge-end sequence, working up to full depth in several passes. (For profile dimensions, see the detail shown with the Exploded View.) Now, rip the back edge of the molding to 1 1/2" wide.

Step 3. Lay out and drill four countersunk 5/64" shank holes along the top face of the molding, centering them 3/8" from the back edge. Locate the two outside holes 2" from the ends and the two inside holes 8" from the outside holes. Now, finish-sand the molding to 220-grit.

Step 4. Clamp the molding to the top end of the frame, aligning the back edges and centering the molding from side to side. Using the shank holes as guides, drill pilot holes for #6x1" flat-head screws. Unclamp, then glue and screw the molding to the frame.

Step 5. Resaw or plane a 5x22" piece of highly figured stock to 1/4" thick. From it, cut the panel (E) to dimension. (Dick used some of the leftover curly birch from the Contemporary Hall



Photo B: Before joining rails to stiles, align faces of mating parts flush using special clamp. Then, drive self-tapping face-frame screws, which eliminate need for drilling pilot holes in stiles.

Figure 1

Layouts for pocket holes

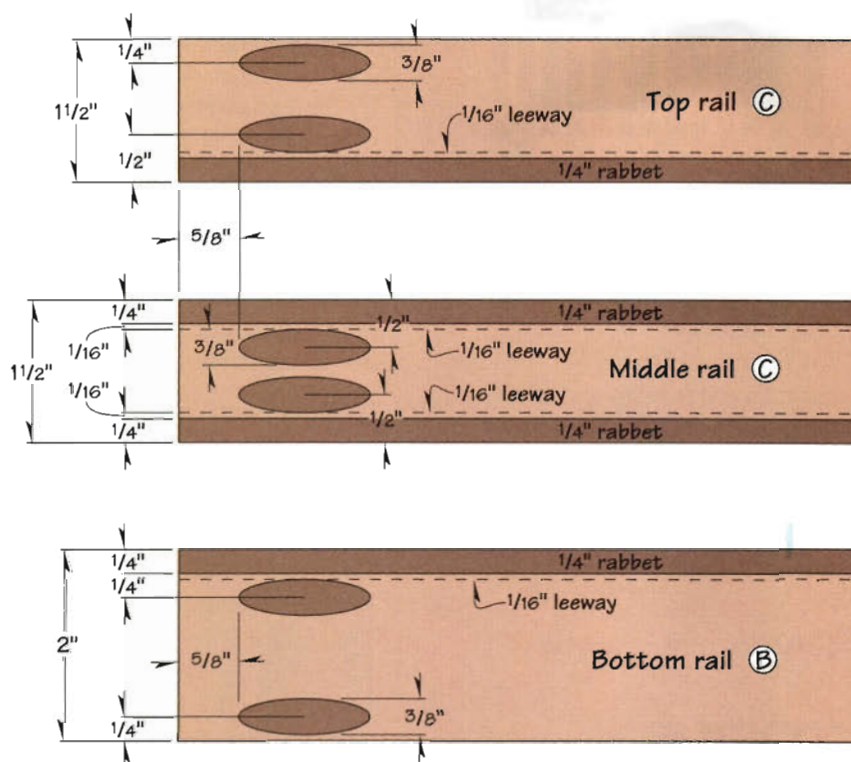


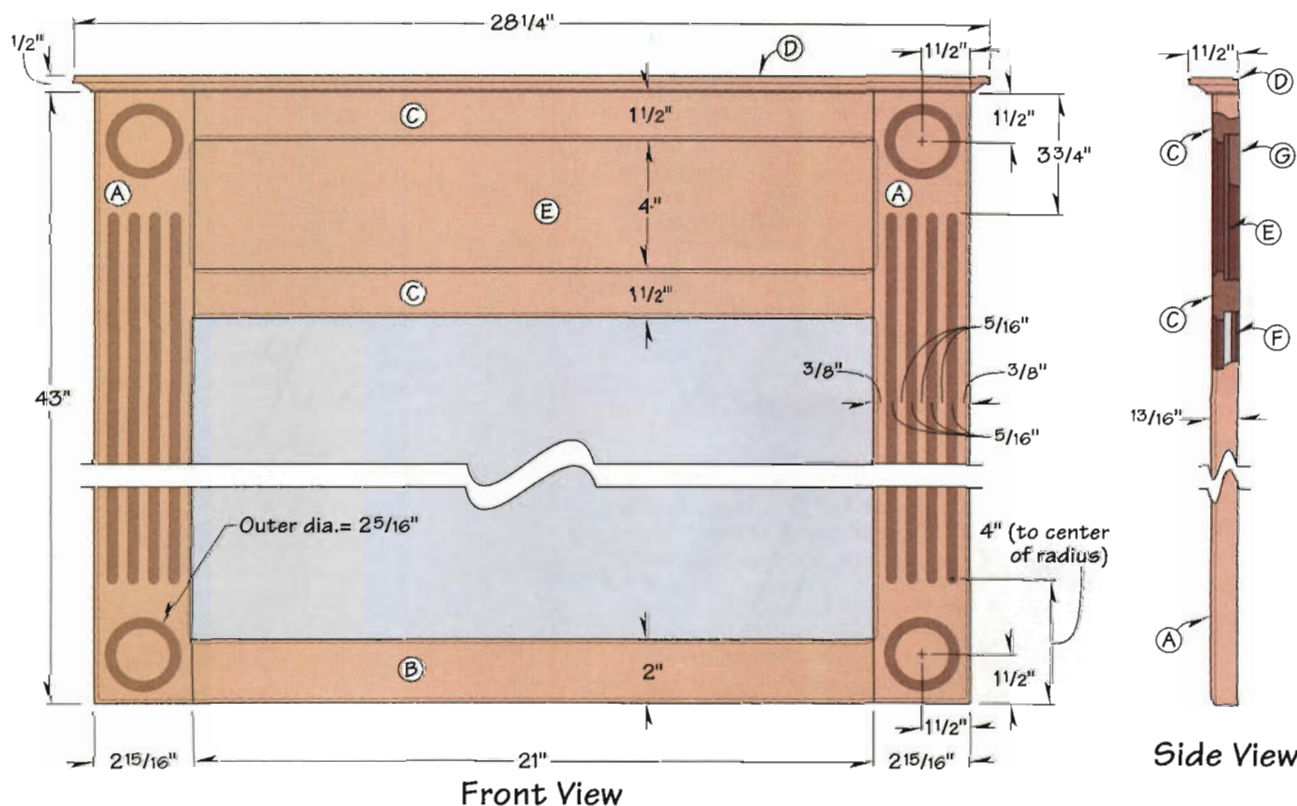
Table so the two pieces would complement each other. You might consider bird's-eye or curly maple, quartersawn sycamore, or lacewood.)

Apply Finish, Then Assemble And Hang the Mirror

Step 1. Sand the panel and frame to 220-grit. Apply your choice of finish. (We sprayed on a coat of lacquer sanding sealer, allowed it to dry, then sanded with 320-grit sandpaper. We then sprayed on two coats of satin lacquer.)

Step 2. Install the panel in its opening using a bead of caulk around the back edge to secure it. (This will allow seasonal movement.)

Step 3. Measure the rabbeted mirror recess in the frame, then subtract $\frac{1}{16}$ " from both the width and length. Have a glass supplier cut a piece of $\frac{1}{4}$ "-thick mirror to these dimensions. Then, cut a backing panel (F) to the same size from $\frac{1}{8}$ " hardboard. Install the mirror, fit the backing in behind it, then press eight brads or glazing points into the frame to secure the backing.



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Step 4. To make the mounting cleats (G), surface a 4x21" piece of hardwood to 5/16" thick, then joint one edge. Tilt your tablesaw blade to 20° from perpendicular, and bevel-rip a 17/8"-wide cleat. Use the waste piece for the wall cleat.

Step 5. Glue and clamp the frame cleat to the bottom edge of the top rail. Note: Apply the glue sparingly so as not to attach the cleat to the panel. Level and mount the second cleat on the wall, preferably in a location that allows you to secure it to two adjacent studs. 

Lead/inset photos: Lynxwiler Photography

Other photos: Kevin May

SOURCES

Pocket Hole Drill Guide System. Includes machined aluminum drill guide, carbide-tipped step bit, adjustable stop collar, allen wrench, Phillips bit, 50 hardwood screws, 50 softwood screws, instructions. Ask for catalog no. 03W65. Price: \$43.50 plus s/h. Drill guide (03W62), step bit (03W63) also available separately. Order from:

Woodcraft
800/225-1153

Kreg Jig Pocket Hole System. Industrial-quality jig includes toggle clamp, hardened steel inserts, HSS 3/8" step drill bit, adjustable stop collar. Ask for kit no. K2. Price: \$119.95 plus s/h. Order from:

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800/447-8638

Adjustable Double Pocket Hole Guide Kit. Includes pair of guides yoked by ruled slide, hardened steel inserts, 3/8" step drill bit with adjustable stop collar. Ask for no. DYSET. Price: \$19.95 plus s/h. Guides (DY48) and step drill bit (DY38) also available separately. Order from:

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Holding Power

Achieve success with proper adhesives and clamps

by Leon A. Frechette

Do you have the patience to construct a piece of fine furniture without adhesives or fasteners? With the proper joinery—keyed, pegged mortise-and-tenon, or fox-wedged joints—you could. Chinese and Japanese artisans assemble beautiful tables and cabinetry without so much as a screw or nail; their precise cuts lock joints together so

snugly that fasteners and adhesives are unnecessary.

Not many of us can emulate their skillful art, and fortunately we don't have to. We now have hundreds of adhesive products at our disposal—so many, in fact, that you have to know more than a little chemistry to understand their compositions and characteristics.

I'll attempt to demystify the

process of selecting an appropriate adhesive for whatever task you have at hand. I'll also explore clamping, since the two subjects go hand in hand. Since it's not just a matter of brushing on the glue and then slapping the pieces together, we'll also review the wood preparation, woodworking joinery, and other techniques needed to ensure successful craftsmanship.

Four Types Of Adhesives

Adhesives can be organized into four broad categories: synthetic resins, thermosets, contact cements, and the natural-protein glues. Turn the page for a closer look at each of these groups.

I. Synthetic Resins

This group, something of a catch-all, includes resin-based adhesives that, to one degree or another, are thermoplastic—i.e., they tend to soften when heated and harden when dried and/or cooled. The products you'll most likely encounter from this class include PVAs (polyvinyl acetate, aliphatic resin, and cross-linking), hotmelts, and acrylic resins.

Polyvinyl Acetates

You probably have at least one PVA product—white or yellow—sitting on your workshop shelf. These water-based adhesives actually break down into three groups: white (polyvinyl), yellow (aliphatic), and cross-linking polyaliphatic emulsions. They're non-flammable and have little or no odor.

The white polyvinyl acetate, familiar to most of us as Elmer's Glue-All, ranks as the traditional general-purpose favorite. As a woodworking adhesive, however, it has too much flexibility, especially evident in the rubbery consistency it develops during sanding. The friction quickly heats the glue line, causing it to rise and clog the paper.

Yellow aliphatic resin, or "carpenter's wood glue," has a greater viscosity than the white adhesives and often includes a dye, making it easier to match the wood being joined (*photo A*). Aliphatic resins also offer better sandability than white glue, greater moisture resistance (though they're not rated as "water-resistant"), stronger wet tack or "grab," and better resistance to creep.

"Creep" refers to an adhesive's tendency to stretch under load. As glued woods expand and contract at differ-

ent rates, a flexible adhesive stretches, allowing each piece to move independently. A swollen or sunken joint indicates glue-line creep. Yellow glue has been improved but not perfected in this respect. Still, it remains the most popular and versatile woodworking adhesive.

Cross-linking polyaliphatics include weather- and water-resistant adhesives. They're not rated as "waterproof," however, and shouldn't be used for joints that must withstand frequent or continuous immersion in water.

You'll find these products available in yellow and natural wood colors. Some of them, such as Elmer's Weather-Tite from Borden, also contain wood fibers for better stain absorption. (See *photo A*.) Cross-linking adhesives provide roughly the same open time as yellow aliphatic resin but develop greater bond strength.

Franklin International formulates Titebond Wood Molding Glue specifically for molding and trim work. It has a thick, no-run consistency, offers a very brief open time, and sets very rapidly—desirable characteristics for that type of woodworking. (See *photo A*.)

Garrett Wade engineered its PVA Laminating Glue specifically for veneers. It will not bleed through veneer pores to the finish side and thus won't interfere with finishing. I found the product a little on the thin side, although this makes it easy to spread.

PVA adhesives must lose moisture through evaporation in order to cure. For a strong bond, the wood should have a moisture content of 6 to 12 percent, with 8 percent considered ideal. As with most adhesives, 70°F provides optimum working conditions.

PVAs clean up easily with warm water. Do not use them in a structural application without screws or some type of mechanical assistance. These adhesives have a fairly long shelf life.

Hotmelts

Hotmelt adhesives liquefy with heat and solidify as they cool. You buy them in sticks (solid form) in various diameters, lengths, and colors (*photo B*). The adhesive dispenses from a glue gun that melts the stick at temperatures ranging from 193° to 380°F. The adhesive sets very quickly—in 10 to 60 seconds depending on the product.

Because of their poor penetration, thick glue line, and low strength, hotmelts have few woodworking applications. They do, however, prove useful for a few operations, such as temporary assembly and tacking. Forget about trying to sand these adhesives—instead, use a utility knife or chisel to trim away excess.

Acrylic Resin

This unique adhesive bonds particleboard edges to a surface of thermofused melamine board (*photo C*). If you've worked with melamine, you know that you must rout away the melamine layer to create any kind of a satisfactory bond using conventional adhesives. Acrylic resin, however, provides sufficient bond (without removing the melamine) to supplement mechanical assistance (screws).

Acrylic resin requires no special surface preparation, and it remains flexible even after curing for 24 hours. You can apply the adhesive to both porous and non-porous materials, and it requires only light (15 lbs.) clamping pressure.



Photo A: The polyvinyl acetate (PVA) family includes cross-linking polyaliphatics (left) and thixotropic PVAs (center and right).



Photo B: Stanley offers a variety of hotmelt adhesives and glue guns. The red gun is the Dualmelt (GR80DT); sitting on the 2x4 is the Cord Free (GR90C) unit.



Photo C: There's no glue failure here. When the joint was broken apart, the acrylic resin adhesive pulled the melamine surface with it.

II. Thermoset Resins

Two-component adhesives in this group, when mixed together, trigger a chemical reaction that generates heat and starts the curing process. One-part thermoset products use moisture to activate the curing.

Resorcinol

Two-part resorcinol glue withstands continuous water immersion, which makes it acceptable for marine applications. The product actually mimics the cellular structure of wood; tiny strands of cellulose that make up the walls of the cells bind together with a natural cement called lignin. The resulting bond is strong and durable.

The two components must be mixed at a 1:4 (by weight) ratio. To mix, you add part A, the tan powder catalyst, to part B, the purple liquid resin, then stir for 5 to 10 minutes. Note that the adhesive will discolor wood and show a dark-colored glue line.

When the two parts combine, resorcinol contains ethanol and formaldehyde. The heavier-than-air vapors can collect in low areas and may ignite. Formaldehyde can cause allergic reactions as well as sensitization of the skin and respiratory system. For safety, use this product in a well-ventilated room, and wear hand and eye protection when working with it.

Urea-Formaldehyde (plastic resin)

Catalysts in urea-formaldehyde powder activate with the addition of water. It must be mixed by weight: 6 parts water to 10 parts powder.

You need apply the mixture to only one surface, but the joint should be clamped as soon as you've applied it. Clamping time decreases at higher temperatures, but allow 13 hours at 70°F. If the glue joint will be under stress, clamp for at least 24 hours. This adhesive has only fair gap-filling ability.

This product is more water-resistant than any of the PVA adhesives, but it's not considered waterproof. Its lengthy open time makes it a good choice for veneering. Like resorcinol, plastic-resin glue contains formaldehyde, so observe the precautions.

Epoxy

Epoxy bond both porous and non-porous materials. The two components, a resin and a hardener, mix together in a 1:1 ratio, producing a chemical reaction that generates curing heat (*photo D*).



Photo D: Epoxy is widely available in syringe-type dispensers that help ensure a 1:1 mixture of resin and hardener.

Epoxy doesn't shrink, so it makes an effective gap filler. Apply the mixture to both surfaces to be joined. Because epoxy products cost so much, you'll find it best to use them only in situations where other adhesives won't work. They have a strong odor and may cause skin and eye irritation, so use them with care.

You can buy two epoxy formulas—polyamide- and mercaptan-curing. The polyamide offers a one-hour open time and the glue-up needs to be clamped (lightly, to avoid starving the joint) for at least two hours. You can increase tensile/shear strength by 25 percent (about double that of quick-set epoxy) by placing the glue-up in a heat box at 150 to 180°F for two hours.

Performance can be manipulated by altering the mixture from the usual 50:50 ratio to 60:40. Adding more hardener provides a stronger but more brittle bond, whereas increasing the percentage of resin yields a more flexible bond that withstands greater impact.

Mercaptan-curing formulas—the “quick-set” epoxies—provide a 5-minute open time and need to be held or clamped for about 10 minutes. The adhesive reaches full strength in 12 to 24 hours at room temperature.

Polyurethane

Polyurethane adhesives were developed in Europe as an alternative to epoxies. Although fairly new to the U.S., they've been used on the continent for over 20 years.

Contact with moisture triggers the adhesive's curing process. It requires an 8 to 20 percent moisture content in the surrounding wood to achieve a high-strength bond. In fact, manufacturers recommend dampening one of the mating surfaces (the non-glued one) to ensure a strong bond.

Polyurethanes form an inflexible joint. Bonded pieces will expand and contract together, the rigidity of the glue joint allowing little or no creep.

Gorilla and Excel are the most widely distributed glues of this family (*photo E*). Gorilla Glue resembles honey both in color and consistency and has an open time of about 20 minutes.

Although the adhesive foams as it cures, it does not, in spite of appearances, fill gaps very effectively. Squeeze-out can be cleaned up with denatured alcohol or with a scraper. The glue-up will be waterproof and solvent-free.

Excel behaves and looks similar to Gorilla Glue. The product has a slightly thinner consistency, probably because the formula contains 5 percent solvent to help it penetrate wood pores.

The manufacturer's literature describes this product as a “gap filler,” but the label cautions that



Photo E: Gorilla Glue and Excel polyurethanes require 8 to 20 percent moisture in the surrounding wood to cure properly.

“gaps on structural bonding should not exceed 0.1 mm.” It can fill very small voids, but both epoxy resin and resorcinol fill gaps more effectively. The glue line also looks darker than the natural wood look produced by Gorilla Glue.

Both firms claim their products can be used to bond exotics and other oily woods. I suggest you experiment with samples first. On any stock, dampening the surfaces slightly with water before gluing with these adhesives will improve results.

Characteristics of Woodworking Adhesives

The four charts list basic characteristics of adhesives, cements, and glues to help you select the right product for your next project. I've derived the

SYNTHETIC RESINS

Type (color)	Brand	Form	Gap-Filling	Creep Resistance	Minimum Temp. °F	Open Time	Closed Time	Clamping Time
Polyvinyl acetate (PVA) (white)	Elmer's Glue-All	Liquid	Poor	Poor	60	3 min.	5 min.	30-45 mins.
Polyvinyl acetate (PVA) (white)	3M Wood Glue #6007	Liquid	Poor	Poor	70	30 sec.	1-2 min.	15 mins. cure time or 6 hrs.
Aliphatic (PVA) (light amber and brown)	Elmer's Carpenter's Wood Glue	Liquid	Fair	Fair	70	3 min.	10 min.	30-60 mins.
Aliphatic (PVA) (cream and light brown)	Franklin Titebond Wood Glue	Liquid	Fair	Fair	50	5 min.	15 min.	10-30 mins.
Aliphatic/thixotropic (PVA) (light brown)	Garrett Wade Laminating 202 GF	Liquid	Fair	Fair	70	5 min.	10 min.	Overnight
Thixotropic (PVA) (beige)	Franklin Wood Molding	Liquid	Fair	Fair	55	3-5 min.	10 min.	Use with mechanical fastener
Cross-linking (PVA) (honey gold)	Franklin Titebond II	Liquid	Better	Better	55	5 mins	15 min.	1 hour
Cross-linking (PVA) (light tan)	Elmer's Weather-Tite	Liquid	Better	Better	60	3-5 min	10 min.	1 hour or more
Hotmelt (color varies)	Stanley Fastening Systems	Solid	Excellent (but no structural strength)	Poor	193-380	10-60 secs.	None	Finger pressure until cool
Acrylic resin (white)	Roo Industries RooClear	Liquid	Fair	Poor	70	20 mins.	20 mins.	1 hour
Proprietary resin (trade secret) (clear)	3M Super Strength Adhesive #6004	Liquid	Poor	Poor	70	15-30 secs.	30 secs.	2 hrs. Cure time 24 hrs.

HOW TO APPLY ADHESIVES

Apply enough adhesive to make a uniform glue line under pressure. Thin glue lines yield stronger joints, but if you apply too little glue or too much pressure, you'll starve the joint.

Porous surfaces, such as end grain, absorb some of the adhesive. To compensate, apply a second coat to these areas once you have allowed the maximum open-assembly time.

Difficult-to-glue oily and exotic woods can be bonded if you take a few extra steps. Wipe one or both bonding surfaces with lacquer thinner prior to applying the adhesive. Coat surfaces to be joined with adhesive within a half-hour after the surface has been planed, jointed, or sawn. Try not to rush the open assembly time.

Depending on the adhesive used, it can be applied with your finger, a brush, or mechanical devices such as those shown at right. Applicators can speed the process and deliver a uniform adhesive spread.

Want to get into a debate? Ask woodworkers when to remove glue squeeze-out. I prefer to let the squeeze-out dry, then scrape it off. Holding back 1/4" from the edge when you apply glue may help minimize the amount of squeeze-out you'll get. A light squeeze-out tells you that you have applied a sufficient amount of glue.

When applying glue, I immediately remove excess adhesive with a damp warm sponge, then dry the wood with a clean, dry white

information in the charts from manufacturer's recommendations, technical data sheets, and my own personal experience.

Cleanup Solvent	Advantages	Disadvantages	Shelf Life	Characteristics/Uses
Water	Non-toxic	Flexible, prone to creep; not water-resistant.	1 year	Porous and semi-porous materials: canvas, leather, fabrics, cork, cardboard, and paper.
Water (immediately)	Moisture-resistant	Product cannot be stained.	1 year	Porous and semi-porous materials: wood, particleboard, and veneers.
Water	Non-toxic; strong wet tack	May set too fast for complex assembly.	1 year	Hard and soft woods. Less creep and some water resistance.
Water	Non-toxic; strong wet tack	May set too fast for complex assembly.	Over 1 year	Hard and soft woods. Heat and solvent resistance and easier to sand. Less creep.
Water	Non-toxic; thin mixture	May set too fast to complete project.	1 year	Formula is on the thin side: great for veneering work, but you need to keep moving when using this product.
Water	Non-toxic	No runs or drips.	Over 1 year	Porous and semi-porous materials: wood to natural fabrics or leather.
Water	Water-resistant	Not for continuous immersion.	Over 1 year	Ideal for exterior use. Good creep resistance.
Water	Water-resistant; no runs	Not for continuous immersion.	1 year	Formula contains wood fibers; better for sanding and staining. Good creep resistance.
Scrape	Quick-drying	Not for use in structural applications.	Varies	Use to support other glue applications or for temporary assembly. Wide variety of hotmelts are available to match special applications.
Wet: water. Dry: denatured alcohol	Non-toxic and nonflammable	Slow set—4 hours.	1 year	Dry, the product is impervious to water (manufacturer claims). Great for bonding a particle-board edge to a melamine surface. Cures in 24 hours.
Acetone	Good for non-porous materials	Extremely flammable; use in well-ventilated area.	6 mos.	Recommended for use on glass, china, fabric, leather, wood, and some plastics. Cures in 24 hours.



Mechanical devices help ensure thorough and even glue application (l to r): a roller applicator; a 5 1/2" glue spreader and storage container for use on larger surfaces like veneers; an all-purpose applicator with metal tip for use in dowel holes and biscuit slots.

cloth. Even this method is not always foolproof. If you don't get all of the glue residue, it will show up after the project has been stained, and then it's a real job to take care of.

Two new products have recently entered the market that will help you spot unwanted glue stains. **Spotlight**, made by the Spotlight Co., is an additive you can mix into your glue.

You then expose the project to a black light. Like a white shirt in a disco, any glue left on the wood surface fluoresces under an ultraviolet light. Blacklite, a new glue available from Woodworker's Supply, comes with the fluorescing agent already mixed in. The firm also sells the Smartlite, a handheld ultraviolet fixture (that works even in a lighted environment); you can use to detect the fluorescing agent.



Blacklite (center), a new aliphatic glue marketed by Woodworker's Supply, has an additive that fluoresces under ultraviolet light. The Smartlite (bottom) works even in a lighted environment.

THERMOSET RESINS

Type (color)	Brand	Form	Gap-Filling	Creep Resistance	Minimum Temp. °F	Open Time	Close Time
Resorcinol-formaldehyde (dark purple and tan)	Dap Weldwood Resorcinol	2-part liquid and powder	Excellent	Excellent	70	30 mins.	30 mins. (pot life—4 hrs.)
Urea-formaldehyde plastic resin (amber)	Dap Weldwood Plastic Resin	Powder	Better	Excellent	70	30 mins.	30 mins. (pot life—4 hrs.)
Epoxy regular (clear and amber)	Elmer's Epoxy Cement	2-part liquid	Excellent	Excellent	60	Must be used within 1 hour	—
Epoxy quick-set (clear and yellow)	Elmer's Epoxy Cement	2-part liquid	Excellent	Excellent	60	Must be used within 5 minutes	—
Polyurethane (honey)	Gorilla Glue	Liquid	Fair	Excellent	70	5-10 mins.	20 mins.
Polyurethane (honey)	Ambel's Excel Wood	Liquid	Fair	Excellent	70	5-10 mins.	20 mins.
Cyanoacrylate (CA) low-viscosity (clear)	Borden Krazy Glue Original	Liquid	Poor	Excellent	70	—	—
Cyanoacrylate (CA) low-viscosity (clear)	Loctite Quicktite	Liquid	Poor	Excellent	70	—	—
Cyanoacrylate (CA) low-viscosity (clear)	Garrett Wade Satellite City Hot Stuff Original	Liquid	Poor	Excellent	70	—	—
Cyanoacrylate (CA) semi-viscous (clear)	Garrett Wade Satellite City Hot Stuff Super T	Texture of syrup	Excellent	Excellent	70	—	—
Cyanoacrylate (CA) semi-viscous (clear)	Borden Krazy Glue Wood	Texture of syrup	Poor	Excellent	70	—	—
Cyanoacrylate (CA) gel (clear)	Borden Krazy Glue Skin-Guard	Texture of cold honey	Excellent	Excellent	70	—	—
Cyanoacrylate (CA) gel (clear)	Loctite QuickTite Gelmatic	Texture of cold honey	Excellent	Excellent	70	—	—
Cyanoacrylate (CA) gel (clear)	Satellite City Special T	Texture of cold honey	Excellent	Excellent	70	—	—

Clamping Time	Cleanup Solvent	Advantages	Disadvantages	Shelf Life	Characteristics/Uses
8-10 hrs.	Scrape when dry or water when wet	Waterproof; marine and structural usage	Use with precautionary measures; vapors may ignite.	1 yr.	Not recommended for use under 70°; moisture content should be between 8 and 12 percent.
13 hrs.	Scrape when dry or water when wet	High strength and sands easily	Emissions are potential health risk.	1 yr.	Ideal for veneer and cabinet work.
Keep surfaces together for 2 hrs.	Acetone	Waterproof	Toxic; use with precautionary measures.	6 mos.	Very strong tensile shear strength. Good gap filling.
Keep surfaces together for 2 hrs.	Acetone	Waterproof	Toxic; use with precautionary measures.	6 mos.	Quick set loses some of its tensile shear strength and water resistance. Good gap filling.
1-4 hrs.	Acetone	Waterproof	Not for use in structural application.	6-12 mos.	Good creep resistance and bonds well with oily and exotic woods. Biscuits and dowels can assist in structural application.
4-12 hrs.	Acetone	Waterproof	Not for use in structural application.	6-12 mos.	Good creep resistance and bonds well with oily and exotic woods. Biscuits and dowels can assist in structural application.
Finger pressure 30 secs.	CA debonding agent	—	Not for use on wood, paper, leather, or foam.	2-6 mos.	Ideal for metal, vinyl, china/ceramics, and most plastics.
Finger pressure 15-30 secs.	CA debonding agent	—	Not for use on glass, polypropylene plastic, or foam rubber.	2-6 mos.	Manufacturer recommends use on porous and non-porous materials.
Finger pressure 3-10 secs.	CA debonding agent	—	Use with adequate ventilation.	2-6 mos.	Manufacturer recommends use on clean, closely fitting parts.
Finger pressure 10-25 secs.	CA debonding agent	—	Use with adequate ventilation.	2-6 mos.	Manufacturer recommends this product for filling small gaps.
Finger pressure 30 secs.	CA debonding agent	—	Use with adequate ventilation.	2-6 mos.	Product was specially formulated to work on wood's acidic surface.
Finger pressure 30 secs.	CA debonding agent	—	Use with adequate ventilation.	2-6 mos.	Specially formulated to prevent bonding of skin.
Finger pressure 5-180 secs.	CA debonding agent	—	Use with adequate ventilation.	2-6 mos.	Special dispenser for better control of glue application.
Finger pressure 20-50 secs.	CA debonding agent	—	Use with adequate ventilation.	2-6 mos.	Depending on materials, repositioning of pieces may be possible.

CONTACT CEMENTS

Type	Brand	Form	Gap-Filling	Creep Resistance	Minimum Temp. °F	Dry Open Time	Dry Bondable Time
Neoprene Solvent-Based (tan)	DAP Weldwood Contact Cement	Liquid	Poor	Poor	65	15-20 mins.	Up to 3 hrs.
Neoprene Water-Based (opaque blue-green)	Elmer's Contact Cement	Liquid	Poor	Poor	65	20-40 mins.	Up to 2 hrs.
Acrylic Water-Based (white)	Elmer's SAF-T Contact Cement	Liquid	Poor	Poor	75	20-40 mins.	Up to 2 hrs.
Contact Adhesive	3M 90 High Strength Spray Adhesive	Spray	Poor	Poor	70	Tack range 1-10 mins.	Press together while tacky
Contact Adhesive	3M Craft & Workshop Spray Adhesive (Super 77)	Spray	Poor	Poor	70	Tack range 30-45 mins.	Press together while tacky

GLUES—NATURAL PROTEIN

Type (color)	Brand	Form	Gap-Filling	Creep Resistance	Minimum Temp. °F	Open Time	Closed Time
Cold hide (amber)	Franklin Hide Glue	Liquid	Fair	Good; a little better than Titebond II	72	10 mins.	30 mins.
Hot hide (semi-transparent yellow)	Behlen Ground Hide Glue	Dry ground	Fair	Good	145	3-5 mins. for assembly	—
Hot hide (semi-transparent amber)	Behlen Pearl Hide Glue	Dry pearl	Fair	Good	140	3-5 mins. for assembly	—
Fish (light caramel)	Lee Valley Fish Glue	Liquid	Fair	Good	70	1 min.	1-1½ hours

Clamping Time	Cleanup Solvent	Advantages	Disadvantages	Shelf Life	Characteristics/Uses
50 lbs. of rolling pressure	Thinner	Good penetration	Use with precautionary measures; highly flammable.	1 yr.	Permits quick production. Heat- and water-resistant when dry. Good for veneering and installing plastic laminates.
50 lbs. of rolling pressure	Water	Easy to clean up and nonflammable	Use with precautionary measures.	1 yr.	Slow evaporation of water. Non-porous materials should be roughed prior to cement application. Porous materials may need a second coat. Water-resistant when dry.
50 lbs. of rolling pressure	Water	Non-toxic and nonflammable	Depending on humidity, could have a longer drying time and poor penetration.	1 yr.	Slow evaporation of water. Changes from white to colorless and crystal-clear after drying.
None	Solvent	Variable spray 1-3"	Use with precautionary measures and adequate ventilation.	1 yr.	A 3-minute drying time is recommended when bonding plastic laminates. Able to bond polyethylene, polypropylene, and veneers.
None	Solvent	Easy to use	Use with precautionary measures and adequate ventilation.	1 yr.	For bonding most lightweight materials: cloth, cardboard, Styrofoam, plastic, and other foams. Also known in the industrial market as Super 77.

Clamping Time	Cleanup Solvent	Advantages	Disadvantages	Shelf Life	Characteristics/Uses
1 hr. (4 hrs. if humidity is high)	Water	Already premixed	Not as strong as its counterpart, the ground/pearl hot hide glue.	Over 1 yr.	Can be used to create a "crackled" effect on wood surfaces to make something new look antique. Reversible glue.
2-3 hrs.	Water	For restoration or reproduction work	Poor heat and water resistance; has to be heated in a glue pot. Requires working experience to understand this glue.	Indefinite	Quick-setting and great for interior work. Moist heat will soften glue. Glue sets fast—speedy assembly required for a good bond. Reversible glue. Keep both the material you are gluing and the work environment on the warm side.
2-3 hrs.	Water	For restoration or reproduction work	Poor heat and water resistance; has to be heated in a glue pot. Requires working experience to understand this glue.	Indefinite	Has about the same bonding strength as that of the ground version. For clarity purposes, it is a cleaner glue with better-looking glue line. Moist heat will soften glue. Glue sets fast—speedy assembly required for a good bond. Reversible glue. Keep both the material you are gluing and the work environment on the warm side.
12 hrs.	Water	For restoration or reproduction work	Low resistance to water	2 yrs.	Can be used on glass, ceramic, metal, wood, cork, paper and leather. To restore initial tack, remoisten with water. Reversible glue.

Cyanoacrylates (CA)

CAs can be your best friend or—if you bond your fingers together—your worst nightmare. They do work great for bonding solid surfaces or for sandwiching manmade/wood products between solid surfaces. In some instances, in fact, they can be a real project saver.

CAs come in three different formulas, each of which has its uses (*photo F*). The low-viscosity has a watery consistency and wicks readily into joints and cracks. It bonds within 3 to 30 seconds, depending on the materials being joined. The semi-viscous formula, which bonds in 10 to 30 seconds, has a thicker, syrupy consistency. The slow-cure formula has a honey-like viscosity and bonds more slowly (60 to 90 seconds), depending on the materials and the specific product.

The semi-viscous and slow-cure CAs will fill small gaps where parts don't match perfectly. The slow-cure offers a little more time for positioning parts after contact.

You can speed CA bonding by applying a spray accelerator. (See *photo F*.) Apply the glue to one surface, the accelerator to the other, and then press the two together. Or, apply the glue sparingly to both surfaces, join them together, then spray the joint lightly with accelerator.

A microscopic layer of moisture on the surface of the materials activates CA adhesives. The natural moisture in wood speeds curing, which eliminates the need for clamps, tape, or tacks.

CA bonds reach maximum strength in 24 hours. The joints do not withstand much in the way of direct impact or high temperatures. You can soften

CAs with acetone (and separate bonded fingers with fingernail polish remover or special CA solvents). As a precaution, keep one of the solvents on hand whenever you use CAs.

You can double the short (6-month) shelf life of these adhesives by placing unopened bottles upright in the freezer. Let the product reach room temperature (70°F) before using. CAs will cure at temperatures between 50° F and 104° F, but the 70°F temperature produces the best results. Make sure you use these products with adequate ventilation, and avoid inhaling the vapors, which can irritate the eyes as well as the lungs.

Borden offers CAs (Krazy Glue) for just about any application you might have in mind. One of the firm's newest products, the Skin-Guard formula, will bond almost anything *but* skin. Loctite Corporation offers its Quicktite Gelmatic dispenser. It has control points on the sides for your thumb and forefinger that provide good control for dispensing glue from the nozzle (*photo G*).



Photo G: The Quicktite Gelmatic dispenser. The case cover protects the tube from damage.

III. Contact Cements

You'll find neoprene and acrylic formulas in this group. The neoprene products have either a solvent or water base, whereas the acrylics are strictly water-based. Contact cements, in my opinion, rank as some of the most hazardous adhesives on the market today—but they also take care of certain gluing jobs better than any other product.

The original solvent-based products, when combined with certain other chemicals, release harmful and flammable vapors. Always use them in a generously ventilated area, and make sure you turn off any appliances that have a pilot or open flame. The solvent vapors from contact cements can travel along the floor to the source of ignition.

SUNKEN JOINTS

Sunken joints generally occur with water-based adhesives where the wood in the vicinity of the glue line swells, leaving a small hump. Sanding or machining across this area makes it flush. That's good, but unfortunately, once the moisture in the wood equalizes, the leveled glue area usually shrinks, leaving a depression. We often cause the problem by working with the material too soon after gluing or by not allowing the glue to cure thoroughly.

To prevent sunken joints, you can:

- Let the glue cure longer
- Use faster-drying adhesives
- Consider using less adhesive so there's less squeeze-out during clamp-up
- Work in room temperatures above 70°F or consider a hot box (depending on the size of your piece) to speed curing

Contact cements perform best if the substrate, finish product, and adhesive have been at room temperature for at least 72 hours. This also helps prevent shrinkage at the edges and seams.

If you're looking for environmentally safe contact cements, check out the neoprene- and acrylic latex-based products from Elmer's. These water-based cements have the same adhesive characteristics as solvent-based products. However, they are nonflammable and have a mild odor similar to that of latex paint. The neoprene product has a short open time, while the latex-formula SAF-T is more user-friendly and less hazardous to the environment.

3M makes two spray adhesives that bond paper and foam to wood: 90 High-Strength Adhesive and Super 77 Craft & Workshop Spray Adhesive. For strong bonds, spray a light coat on both surfaces and allow two to five minutes of drying time. Porous surfaces may require a second coat. Both products are flammable, so observe the usual safety precautions and work in a well-ventilated area.

IV. Natural Protein Glues

Animal-based products have been used by woodworkers for centuries (*photo H*). If you restore or reproduce old furniture, animal glues should be



Photo F: Cyanoacrylates (l to r) Quick Tite (Loctite), Krazy Glue (Borden), Hot Stuff Special "T" Ultra, and Hot Shot Accelerator (Garrett Wade/Satellite City).

on your shelves to help contribute period authenticity to your work.

All three forms of hide glue—ground, pearl, and the new liquid—are made from cooked animal hides. The resulting adhesive material is drained off, filtered, and evaporated, then the

dry solids are ground and packaged. The newer liquid formulas have an anti-gelling agent added to prevent them from solidifying as they cool.

Hide glue works best on woods at room temperature. Work quickly with this glue—it has an open time of only two to three minutes. A hide-glue joint can be debonded with steam or hot water.

Hot glue works in two stages. First, it sets to a gel after contact with the air and bonding material. Then, the water (mixed with the granules earlier) evaporates, which causes the glue line to harden.

Some woodworkers claim that the glue will absorb an oil-based stain just like wood because of the natural protein in the hide. Others

believe that the liquid formula has less holding power than the granules. If either of these claims has a critical bearing on your project, I recommend you test it in your own working environment before you proceed. Because of their water-solubility, these glues shouldn't be used for exterior jobs.

Liquid fish glue is made from washed fish skins cooked to a concentrated broth. Manufacturers add a deodorant for cosmetic reasons and also a bactericide to prolong shelf life and protect the cured glue line.

Because of its superior initial tack, fish glue has been used to quick-fix splinters and other superficial defects. While the glue resists most solvents, joints require a protective finish because the glue is water-soluble.



Photo H: For furniture restoration, consider using the natural protein glues. Glue pot in the center is from Lee Valley Tools.

HOW TO TEST YOUR ADHESIVE

If you use the correct adhesive and apply it properly, failures will occur in the wood, not the glue joint. A good glue joint will actually be stronger than the wood surrounding the glue line! You can test joints yourself to prove that you have selected the correct adhesive for your application.

Test for these stresses: tensile, shear, cleavage, and peel. To do this, use the same materials and adhesives that you plan to use on your project, and allow the adhesive to cure according to the manufacturer's instructions.

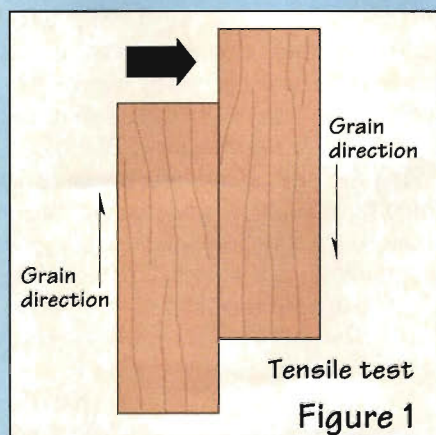
Tensile Test

Glue two blocks together face to face with their ends offset (*figure 1*). After curing, secure the tester in a wood vise with the glue joint free. Using a hammer, smack the upper block away from you. If it breaks on the glue line, you have a bad glue joint.

You have a good bond if the sample breaks somewhere other than along the joint or if it pulls away portions of the wood surface.

Shear Test

Glue up a similar pair of blocks for the tensile test. Secure the sample in a vise, but leave space between the higher block and



What broke loose—the wood surface or the glue line? The parts will likely break apart easily with this edge-to-face grain glue-up. Normally, dowels or biscuits would be used to add mechanical strength to such a joint.

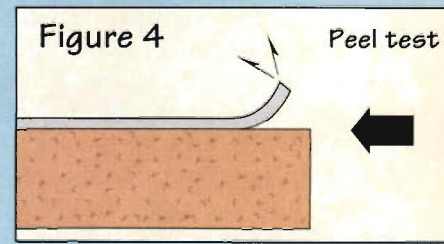
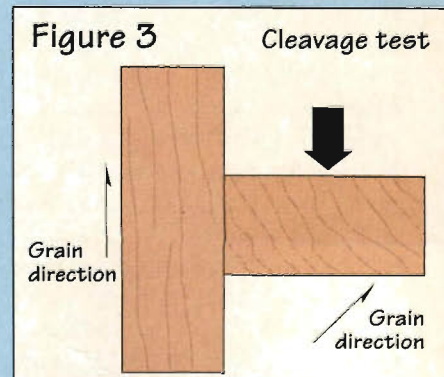
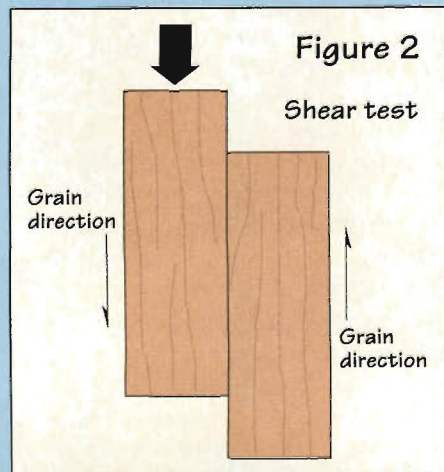
Peel Test

This test evaluates the bond of veneers and plastic laminates. After the glue has cured, try lifting a corner (*figure 4*). If you have a good bond, the material will break and/or split when you try lifting it.

the vise (*figure 2*). Smack down on the end grain of the upper block. If the blocks are properly bonded, you'll have difficulty breaking them apart. If the wood breaks, rather than the joint, you have a good bond.

Cleavage Test

Glue the edge of one block to the face of another to form a T-shaped sample (when viewed from the end grain). Place the top of the T in the vise so the tail rises above it (*figure 3*). Smack down on the tail of the T.



Stock Preparation

It is not enough just to apply an adhesive and clamp the pieces together. You also need to know and understand the woodworking operations required to attain quality glue joints. In the end, your preparation of the bonding surfaces will be just as critical as the choice and application of glue in *determining* whether a project will "stay stuck."

As already mentioned, moisture plays a big role in determining how glues and materials will behave. Generally, stock moisture content should be between 6 and 12 percent, with 8 percent near-ideal for most adhesives. A constant ambient air temperature of approximately 70°F also helps by preventing warping and dimensional changes. When possible, bring materials into the shop at least one week before working them.

Even for temporary storage, regardless of how short, stack your materials above the floor using stickers to reduce cupping and twisting. Lay boards flat and interleave with 1x2" strips to permit air circulation among the boards. Use heavy blocks on top of the pile (centered over the stickers) to help stabilize the upper pieces.

Bonding surfaces should be uniformly flat where they make contact. With most glues, the thinner the glue line, the stronger the bond, assuming that you didn't play Hercules with the clamps and starve the joint by squeezing out most or all of the glue.

Generally, 100 to 150 pounds per square inch (psi) of clamping pressure will be sufficient for softwoods, 300 psi for hardwoods. One acrylic resin product, RooClear, requires only 15 pounds of pressure, easily achieved with most bar/pipe clamps.

To determine correct clamping pressure, look for a uniform glue squeeze-out line (*photo I*). Remember, we clamp primarily to bring the joint together snugly and hold it in place until the glue develops enough strength to do so. Excessive pressure may strain the clamp, bow the material, and weaken the joint.

Apply uniform clamp pressure along the joint's entire length. Use plenty of clamps, and space them no more than

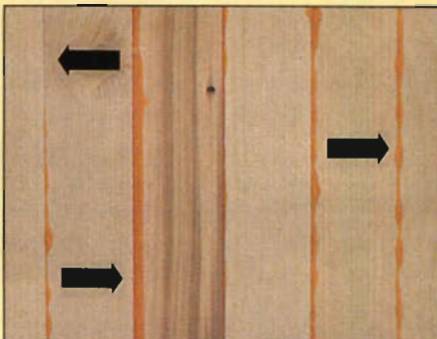


Photo I: A 2x2" lamination. The upper arrow points to an area where there is no squeeze-out—a sign indicating that not enough adhesive was applied. The lower arrow points to a heavy glue line, indicating 1) the adhesive was applied too heavily, 2) too much clamp pressure was applied, 3) and/or the project was assembled too fast. In this case, too much adhesive and overlay hasty assembly were the culprits. The third arrow points to a desirable squeeze-out line.

8" apart (preferably closer) and to within a few inches of each end. If you don't have enough clamps, use a clamping pad to help distribute the pressure. Also, consider breaking down a large assembly into smaller subassemblies that don't require as many clamps. Or, consider it time to bite the bullet and add more clamps to your collection.

If you have to release pressure to move or replace a defective piece (before the glue has set), reapply glue to guarantee the bond before rejoining. A thorough inspection of the pieces and a dry run of the assembly will eliminate most surprises of this kind.

For panel-gluing, I found that the Plano Vertical Glue Press by AIM Tools provides all-surface clamping contact. I attach this unit to my workbench, then slide each clamp box on the track to where it's needed. I adjust the lower linking arm assembly (clamp dog) to proper width for the project, while the overall system automatically adjusts for the lamination's thickness (*photo J*).

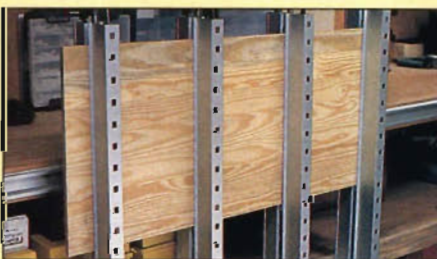


Photo J: The Plano Vertical Glue Press works great for gluing up panels where space is limited. With everything tightened, you can still move the entire system along its track.

If you plan to bond materials with the following surface characteristics, machine the surfaces until they are smooth and uniform:

- Tooth marks and/or burns
- Rough bandsawn edge
- Uneven sanded edge
- Chips
- Raised, fuzzy, or torn grain
- A rippled edge or surface
- Partial, loose, or missing knots

Some imperfections may be caused by the machine or the operator. Using poorly set or dull saw blades, feeding stock too quickly or slowly, using dull or improperly adjusted or dull knives in the cutter head, or feeding stock through a planer or jointer against the grain can each contribute to these imperfections.

Experienced woodworkers routinely test-fit their glue-ups to make sure that gluing surfaces match. If a bonding surface has bowed, straighten it first—don't rely on clamps to force a piece straight. You may get it to hold, but the joint will have a high probability of failure. A good planer, jointer, or router (used with a clamped down straight-edge) makes excellent cuts that will ensure good bonding surfaces.

Knots require special attention. If possible, remove that section of the board. If you can't avoid using it, remove the knot and fill the void with a dowel or peg.

ASSEMBLY TIME

Assembly time refers to the open and closed time of the adhesive, as shown in the charts on *pages 42-47*. *Open assembly* is the period between application of the adhesive to the bonding surfaces and the time when the pieces must be bonded.

Closed assembly time refers to the time after the bonding surfaces have been joined during which the pieces can still be repositioned (before the adhesive "grabs"). These two times tell you just how long you have to safely work with your pieces. They're fairly specific to each product, so it's important to time your more complex dry-assemblies to make sure you can finish the glue-up within the assembly time specified for the adhesive you intend to use.

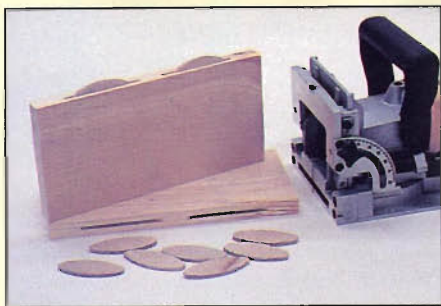


Photo K: Select a plate joiner (biscuit cutter) that is comfortable to use and provides all the options you need to complete your project. The model pictured is the DW682 by DeWalt.



Photo L: Porter-Cable's Tru-Match system (shown upside down) includes models 42190 (subbase) and 43692 (bit). Look closely at the subbase and notice the two different levels this gives the true match you'll need. If you plan to use such a system, purchase an extra base so you don't have to keep changing the subbase.

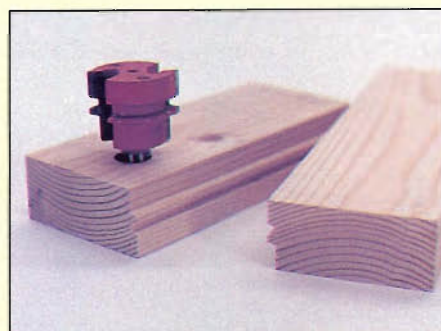


Photo M: The reversible glue joint increases bonding surface which helps to strengthen the edge joint.

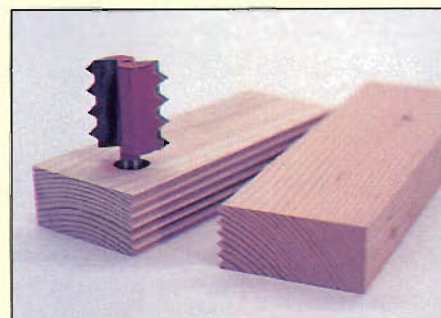


Photo N: The raised panel "V" joint bit creates a strong but hardly noticeable joint.

Supporting the Bond

Always support edge- or end-grain glue joints with some type of mechanical assistance—biscuits, splines, dowels, pins, metal fasteners, or bonding surfaces machined with a special edge-jointing system. These devices reinforce the glue joint and hold the assembly together as one uniform piece.

Mechanical Assistance For Edge Joints

Biscuits—Made from compressed beechwood, they swell slightly in the slots when wetted by the glue. You'll find three sizes widely available (#0, #10, and #20), but other sizes can be mail-ordered.

For optimum strength, locate biscuits 2" in from the ends and 5 to 6" apart (*photo K*). Also use them to join or reinforce corner, miter, butt, center wall, and frame joints.

Edge-Joining System—If you choose not to use biscuits to support your joint, perhaps the Tru-Match system by Porter-Cable will work. With an existing router, a P-C subbase, and a ½" shank carbide-tipped solid surfacing bit, you can achieve a nearly invisible joint. This system allows you to make a pass at each bonding surface without adjusting the bit (*photo L*).

Reversible Glue Joint—This joint can be made with a router bit (Freud no. 99-031, shown in *photo M*) installed in a table-mounted router. With the material surfaced to a uniform thickness, align the bit with the center of the edge's width. Reverse the boards for a perfect glue joint.

Raised Panel "V" Joint—This interesting joint was specially designed for use on raised panels (*photo N*). However, its joining surface is angled (not vertical like a standard finger joint), making the joint line less noticeable. The bit (Freud no. 99-038) does not have to be centered: just raise or lower it ⅞" to rout the mating edge.

Mechanical Assistance For End-Grain And Frame Joints

Finger Joints—An excellent way to reinforce an end grain-to-end grain application (*photo O*). You need a miter gauge with a hold-down clamp to make

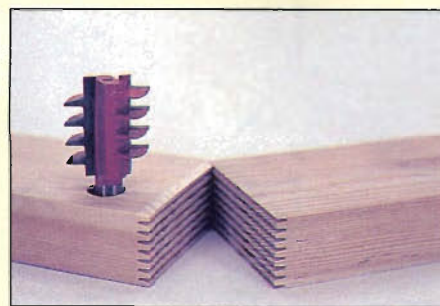


Photo O: No matter how you look at it, end grain-to-end grain requires some type of mechanical assistance to strengthen the bond. This finger joint is one dependable way.

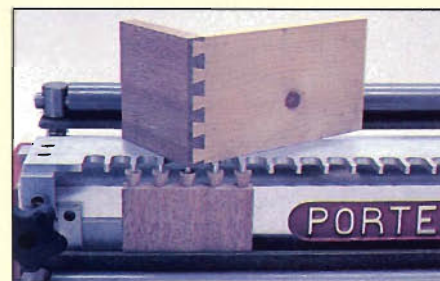


Photo P: A router and precision dovetail machine like Porter-Cable's Omnijig can save valuable woodworking time.



Photo Q: Working in a commercial cabinet shop's assembly line, I built face frames using a pocket-hole cutter, a handy device that didn't slow down the production line. Consider the Pocket Cutter by Porter-Cable (shown), the Kreg Jig, or one of the other guides now available.

the cut. I made the finger joint shown in the photo using a router and Freud no. 99-037 bit.

Dovetail Joints—Dovetail joints work great for drawers and many other kinds of assemblies because they lock the joined parts and can withstand stress and abuse (*photo P*). You can make the joint using a saw and chisel, a routing jig like the Porter-Cable Omnijig shown, or a dovetail machine.

Pocket Holes—Until a few years ago, this type of joinery was rarely used in home workshops because of tool cost. Now, however, affordable pocket-drilling tools have become available (*photo Q*). Porter-Cable's



Photo U: To assemble this tiny rocking chair, I used the ultralight Micro Bar Clamp/Spreader by Quick-Grip (American Tool).

model 550 pocket cutter, for example, cuts the pocket and drills a pilot hole in one operation. The less costly Kreg Jig produces similar pocket cuts but at a slower pace.

Typically, you cut the pocket holes by drilling into the blind or hidden face of the material. You apply glue to the bonding surfaces, then drive screws through the pockets and into the joining piece to produce an instant bond.

Mortise and Tenon—We find this joint widely used in construction of fine furniture. To cut the more difficult

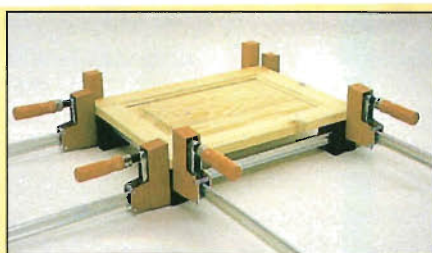


Photo V: The Bessey KP Framing System (American Clamping Corp.) can make panel door assembly a snap. Corners lock together with plastic blocks that help to keep the entire frame square and true.

mortises, you can attach a mortising accessory to a drill press; use a drill, chisel, and hand saw; cut them with a mortising machine; or, use a plunge router and jig.

Dowels—They've been widely used for face-frame butt joints, although dowel holes can be hard to align and difficult to drill freehand. The better doweling jigs ensure a reasonable degree of accuracy when used with a handheld portable drill. I've found Stanley's Model 04-059 an inexpensive and easy-to-use unit.



Photo X: Pinch dogs (Lee Valley Tools) come in different sizes. They can be used across any glue joint regardless of the shape of the two pieces.

You can buy pre-cut dowel pins ranging from $\frac{1}{4}$ " to $\frac{1}{2}$ " in diameter and $1\frac{1}{4}$ " to $2\frac{1}{2}$ " in length, with either straight flutes or spiral grooves. You won't find a consensus as to which dowel makes a better joint anchor, but I prefer the straight flutes.

Waddell makes a dowel pin with spiral grooves and two straight flutes opposite each other. This configuration allows glue to travel between the flutes to fill the grooves, ensuring a strong bond.

For good measure, I spread glue on the pins as well as in the holes. If dowels fit too tightly, heat them in a warm oven (low heat) to dry and shrink them enough to fit in the hole. (Safety precaution: Allow the oven to heat, then turn it off. Repeat if necessary. Check the dowels frequently.) Once they soak up some glue, the dowels

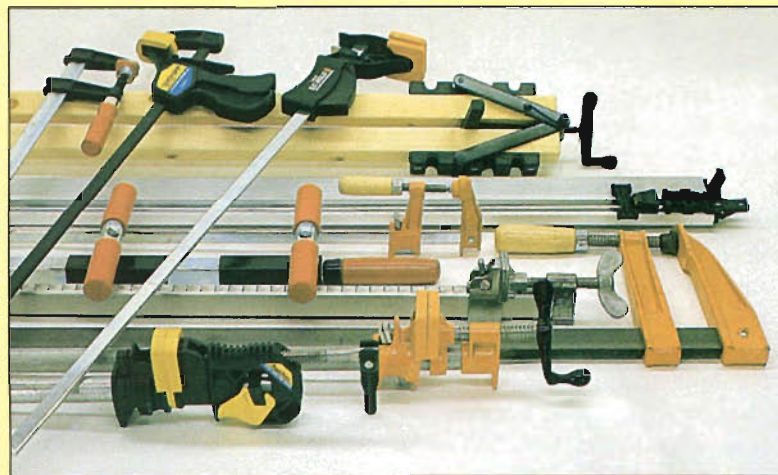


Photo W: Starting from the front:

- The PowerPress (American Tool) fits over a $\frac{3}{4}$ " pipe, but the pipe doesn't need threads on the ends.
- The next two are by Adjustable Clamp Co.: the Pony #50 $\frac{3}{4}$ " pipe clamp and the Jorgensen #4700 with its 7"-deep jaw.
- An aluminum clamp by Universal Clamp Corporation. The UC-900 series comes in 24" to 72" lengths.
- The Box Clamp KS, by Gross Stabil, can be used on framed boxes, either square or non-parallel surfaces.
- The orange steel bar clamp, with its $2\frac{1}{2}$ "-deep jaw, is from the 3700 series by Adjustable Clamp Co.
- Tru-Grip flat aluminum clamp. The Back-To-Back Bench Clamp BB series is by Griset Industries. The bottom jaws can be clamped to a workbench or sawhorse while upper jaws securely hold your workpiece.
- Make the wooden clamp using 2x2s or 2x4s and components from Woodcraft. A 4-Way Equi-Pressure Clamp, #03J22, eliminates center buckling when gluing large panels.

The three clamps on top include (left to right):

- A sliding-arm bar clamp by Bessey, a regular-duty unit with a $2\frac{1}{2}$ "-deep jaw.
- The one-handed Quick-Grip bar clamp by American Tool.
- The E-Z Hold II Bar/Spreader Clamp (3400 series) by Adjustable Clamp Co., also a one-handed clamp.

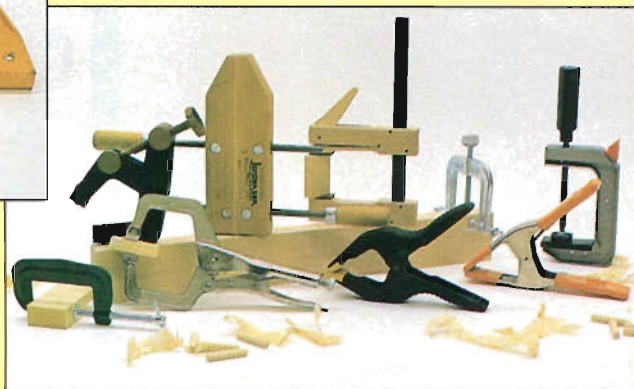


Photo Y: It's not enough to have just bar clamps. You still need a handful of the following clamps (lower row, left to right):

- A steel C-clamp (Stanley Tools).
 - The Crescent locking C-clamp (Cooper Industries).
 - 3" Quick-Grip spring clamp (American Tool).
 - The series 3200 Pony steel spring clamp (Adjustable Clamp Co.).
 - Aluminum quick-release C-clamp (Sears/Craftsman).
- Upper row (left to right):
- A plastic cantilever-type clamp (PPC-3) from Reid Tool Supply Company.
 - The J series adjustable handscrews (Adjustable Clamp Co.).
 - The Cam Clamp from Woodcraft.
 - The 3-way edging clamp by Adjustable Clamp Co.

will swell again and create a tight bond.

Lap Joint—This joint works well for face frames and similar joints. To form the bonding surfaces, you simply plow the pieces to be joined to half their thickness. Depending on how steady your hand is, you can cut them with a handsaw or use a tablesaw or router. If you choose, you can reinforce the joint with a dowel or pin.

Matching Stile and Rail—Frequently used on panel doors, these joints are cut with a matched pair of router bits. One bit cuts the detail and slot (sticking) along the inside of the frame on both rails and stiles. (The slot accepts the panel once it has been routed to fit.) The second bit cuts the rail ends (cope) to mate with the sticking profile.

Clamps

As you already know, clamps play a critical role in achieving a good bond. Before selecting clamps for your shop, give the matter some serious thought to make sure you end up with the products and quantities that will best suit your needs.

Bar and Pipe Clamps

No shop should be without bar clamps—they're a woodworker's backbone. I personally like to have at least four of the same size, or two of the same size and another pair either shorter or longer. Some craftsmen have a prefer-

ence for the handscrew style; others like the squeeze handle. You can get accessories to turn the bar clamp into an edge, centerweight, or laminating/veneering clamp. Some of these clamps come small enough to handle projects as unique as the one shown in *photo U*, while others fit a special purpose such as the raised panel door shown in *photo V*. Those intended for general clamping are shown in *photo W*.

Pipe clamps are simple; you buy a pair of jaws, then screw inexpensive $\frac{3}{4}$ " black pipe into them. You choose the length; or, interchange lengths as needed; or, couple lengths to breach the reach.

You can buy accessories for attaching the pipes to a bench (either the front edge or the top) or to a wall to create a horizontal and/or benchtop clamping system. You can even make pipe clamps into a veneer press.

Wooden, C-, and Spring Clamps

These are the true workhorses in most shops. They take up the slack where bar and pipe clamps leave off.



Photo AA: No shop should be without the following strap/web clamps (left to right):

- The Bessey strap clamp (American Clamping Corp.) is a self-contained unit. Using the corner pieces, you can clamp a hexagon frame at 120°, a frame at 90°, or an octagonal frame at 135°.
- The Quick-Adjust Band Clamp (Sears/Craftsman). Pull the band tight and "fine-tune" the pressure with the handle.
- The last two are from Adjustable Clamp Co. The center: #6230 is a 2" pre-stretched 30' long canvas strap. The other: #88124 Clamp Mate Ratchet Band Clamp. The blue 1" nylon strap is 15' long.



Photo BB: The new VAS 23 Vario Angle Strap Clamp from Bessey (American Clamping Corp.) holds compound miters and other angular joints. Its four tilting pressure plates adjust from 60° to 180°. Equipped with a 23' strap, the unit self-locks once pressure is applied.

When you laminate a tabletop, for example, the glue-wetted pieces will slide in all directions. A handscrew, C-, or even a spring clamp placed directly over the joint at the end of the pieces will hold them together while you tighten down the main clamp. A fence staple, corrugated fastener, or pinch dogs (*photo X*) tapped into the end grain over the joint will accomplish the same thing. You'll find many different styles of handheld clamps on the market, all helpful in holding material in place while you work it (*photo Y*).

Hold-Down and Bench-Top Clamping Accessories

I find these clamps especially helpful around the drill press and table-saw. They also turn a workbench into a clamping/visé table for han-

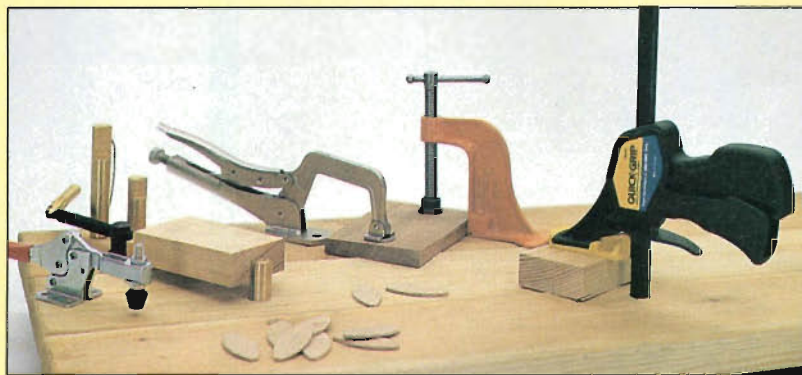


Photo Z: Need a second pair of hands? Hold-down or hold-in-place clamps can sure help:

- A horizontal toggle clamp can be mounted anywhere to hold the workpiece. TC-227-U from Reid Tool Supply Company.
- Veritas Round Bench Pups and the Wonder Pup (Lee Valley Tools). For thicker material, use the Round Bench Dogs or $4\frac{1}{2}$ "-tall Wonder Dog.
- The Crescent table clamp #CP11TC (Cooper Industries) can be screwed to a surface. It has a swivel jaw pad.
- The orange hold-down clamp 1623 (Adjustable Clamp Co.)
- The Quick-Grip hold-down clamp (American Tool) extends through the work surface and into an assembly mounted on the underside.

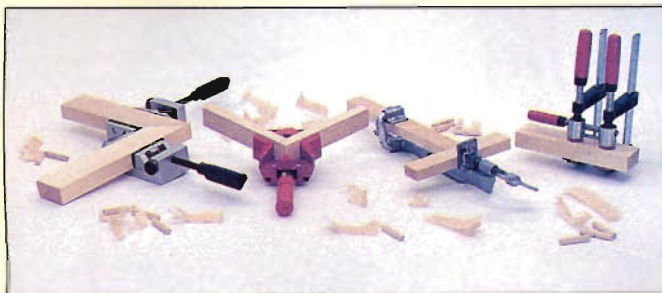


Photo CC: Sometimes, putting frames together can be a real struggle without a second pair of hands. The following work great (left to right):

- The Quick-Release 90° clamp (Sears/Craftsman) for 90° and 45° and cabinet corner joints.
- The Bessey Angle Clamp WS3 (American Clamping) is built for heavy-duty use. Purchase the TK6 table clamp if you want to mount the angle clamp on a workbench or sawhorse.
- The UC-76 (Universal Clamps) works great for pulling a frame together (as shown).
- The Miter Clamp GSP 8 (Gross Stabil) is shown on a lap joint. Apply downward pressure, tighten the horizontal clamp, and watch the joint pull in.

dling any shape of workpiece. By drilling a series of holes or bolting (depending on the product), you can be set up in a matter of minutes (*photo Z*).

Band/Web Clamps

Unusual, irregular, or odd shapes—even simple triangles, rounds, or squares—are best surrounded with a web clamp. If you do a lot of round work, consider a steel band clamp.

Manufacturers continually add new features that enable web clamps to accommodate different shapes (*photos*

or do a lot of cabinet work, you can never have too many of these around. They come in just about any style you could possibly need—from the simplest to the complex, the inexpensive to expensive. *Photo CC* shows a sampling of what's available today. They're specialty tools, so choose those that fit your special needs.

Vacuum Press

If you plan to do laminating or veneering work, consider a vacuum press

AA, BB). When buying, remember that both light- and heavy-duty versions are available. Having two on hand can be a pretty good idea—you never know when you'll need an extra one.

Frame Clamps

If you build frames

(*photo DD*). A unit like the one shown provides uniform pressure over the entire project for a flat, smooth finish. These systems hold difficult and complex shapes in place until the glue sets, using no mechanical clamps and thus eliminating dents and scratches.

A Final Note

When you go to buy clamps, look for plastic protective pads on all parts that contact the workpiece. (They should at least be available as an option.) Also, look for ball-joint swivels on the steel pads; these will give you fewer problems than crimped swivels. C-clamps should show no deflection when pressure is applied, and don't buy any clamp that feels flimsy or uncomfortable to use. 

About the author: Leon A. Frechette has more than 20 years of experience in construction, remodeling, and related woodworking fields. His fifth book, *Accessible Housing* (McGraw-Hill, Inc.), was published earlier this year.



Photo DD: The vacuum press shown is by Quality VAKuum Products, Inc. It's one of several units available.

SOURCES

Borden, Inc.

Home and Professional
Product Group
800/848-9400

Franklin International

Adhesives & Sealants
Group 800/347-4583

Garrett Wade Co., Inc.

800/566-9525 catalog

Loctite Corporation

800/323-5106

Stanley Fastening Systems

800/228-0567

Roo Industries, Inc.

RooClear
503/588-0788

The Gorilla Group

Gorilla Glue
800/966-3448 (24 hours)

AmBel Corporation

Excel 800/779-3935

3M Do-It-Yourself Division

800/364-3577

H. Behlen & Bros.

518/843-1380

Lee Valley Tools

800/871-8158

AIM Tools

Plano Vertical Glue Press
800/665-0900

Colonial Saw Co.

Lamello Biscuits
909/390-5465

DeWalt Industrial Tool Co.

800/433-9258

Porter-Cable

800/487-8665

Freud

800/472-7307

Stanley Tools

800/648-7654

American Tool Co., Inc.

800/866-5740

Waddell Manufacturing Co.

800/433-1737

Universal Clamp Corp.

800/780-1311

Sears/Craftsman

Contact your local Sears
store or call 800/377-7414
for catalog

Woodcraft

800/225-1153

Woodworker's Supply Inc.

800/645-9292

Quality VAKuum Products

800/547-5484

Spotlight

800/933-7963

Adjustable Clamp Co.

312/666-0640

American Clamping Corporation

800/828-1004

Gross Stabil Corp.

800/671-0838

Griset Industries, Inc.

Tru-Grip 800/662-2892

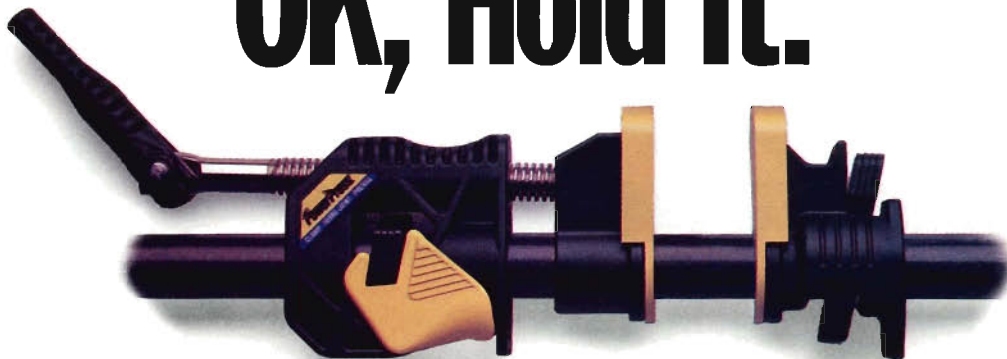
Reid Tool Supply Co.

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Cooper Industries

See your local hardware
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OK, Hold It.



Now Spread 'Em.



The innovative POWER PRESS™ Pipe Clamp, from the makers of QUICK-GRIP® Bar Clamps, is more than just a pipe clamp. By simply reversing the two movable clamping sections, it quickly becomes a spreader. Perfect for all kinds of woodworking applications, the POWER PRESS Pipe Clamp can do anything a regular pipe clamp can do, only faster. It works on both threaded and unthreaded pipe. And two rubber pads keep gripping surfaces from marring your work. The most versatile pipe clamp to hit the shelves, the POWER PRESS Pipe Clamp is going to revolutionize the way you work.

Look for it wherever quality tools are sold.



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A "Sideboard" For the Shop

*Furniture Worthy Of
Your Workspace*



Our woodshop here at the Journal used to look respectable enough, but since staff craftsman Dick Coers installed this capacious and handsomely trimmed cabinet, the place looks almost dressed up. We actually had trouble filling its eight drawers and two large cupboards, but, as the photo will attest, we found an immediate use for the 20 square feet of additional work surface.

Before You Start

In designing the cabinet, Dick kept simplicity of construction foremost in his mind. To avoid complex joinery and clamp-ups, he used pocket-drilled face-frame screws and biscuits. (If you haven't tried pocket-hole joinery, see the Contemporary Hall Mirror article that starts on page 34 of this issue.)

Dick minimized the hassles of hanging doors and drawers by using adjustable European-style hinges and

standard drawer slides. He banded all exposed edges on the $\frac{3}{4}$ " plywood parts with $\frac{1}{8}$ "-thick walnut, which hides the $\frac{1}{8}$ " gap between doors and drawers and highlights the cabinet's lines. (See photo *above*.) Note: The initial dimensions listed in the Bill of Materials do not include this $\frac{1}{8}$ "-thick banding.

You'll need four sheets of $\frac{3}{4}$ " birch plywood, one $\frac{1}{2}$ "-thick sheet of the same, and two sheets of $\frac{1}{4}$ "-thick hard-

wood plywood. (For the 1/4", Dick used less expensive lauan. See the Pro Tip below.) We've shown nominal plywood thickness dimensions on the drawings, but keep in mind that most plywood you buy will have been milled at least 1/32" less than its nominal thickness.

PRO TIP

To economize on your 3/4" plywood without sacrificing much in the way of quality, ask your hardwood dealer for *shop-grade* plywood. It may have minor flaws here and there on the faces, but you'll probably save 10 percent over the cost of cabinet-grade stock.

Before you lay out locations for the dividers (D) on the cabinet bottom (B), measure the actual thickness of your 3/4" plywood. As you'll notice on the Front View drawing on page 62, we specify dimensions for the four cavities that are based on the nominal plywood thickness of 3/4". However, in building the cabinet, Dick adjusted these cavity widths to compensate for the actual 23/32" thickness of our plywood. To do this, he widened the cavities to 22 3/8" and 22 13/16" respectively. If your plywood measures differently, adjust these widths accordingly.

For your drawer bottoms, check the actual thickness of your 1/4" plywood and cut the bottom grooves to that width. When you cut dadoes and rabbets for the drawer joints in your (nominally) 1/2"-thick plywood, adjust their depth to leave a full half of the nominal thickness intact. For example, if your plywood actually measures 15/32" thick, reduce the depth of the rabbets and dadoes to 7/32" to leave a full 1/4" of stock thickness. This way, you won't reduce the outside drawer width.

Prepare and Edge-Band the Main Cabinet Parts

Step 1. From your first three sheets of cabinet-grade 3/4" birch plywood, cut the top (A), bottom (B), and two ends (C) to initial dimensions as shown on the Cutting Diagram on page 60.

BILL OF MATERIALS

CABINET

PART	T	W	L	MTL.	QTY.
A Top*	3/4"	30 7/8"	95 3/4"	BP	1
B Bottom*	3/4"	28 7/8"	92 3/8"	BP	1
C Sides*	3/4"	29 1/8"	31 3/4"	BP	2
D Dividers*	3/4"	28 7/8"	31"	BP	3
E Stretchers—center front**	3/4"	2 1/2"	22 3/4"	W	2
F Stretchers—side front**	3/4"	2 1/2"	22 5/16"	W	2
G Stretchers—center back**	3/4"	3 1/2"	22 3/4"	H	2
H Stretchers—side back**	3/4"	3 1/2"	22 5/16"	H	2
I Back**	1/4"	31 3/4"	92 7/8"	BP	1
J Base—front	3/4"	5 1/2"	87 7/8"	BP	1
K Base—sides	3/4"	5 1/2"	27"	BP	2
L Base—back**	3/4"	5 1/2"	86 3/8"	BP	1
M Base—stretchers**	3/4"	5 1/2"	25 1/2"	BP	3

DRAWERS AND DOORS

N Fronts/back—deep***	1/2"	8 3/4"	20 13/16"	BP	12
O Sides—deep***	1/2"	8 3/4"	25"	BP	12
P Fronts/back—shallow***	3/4"	29 1/8"	31 3/4"	BP	2
Q Sides—shallow***	1/2"	4 1/2"	25"	BP	4
R Bottoms—deep***	1/4"	20 3/4"	24"	HP	6
S Bottoms—shallow***	1/4"	21 3/16"	24"	HP	2
T False fronts—deep*	3/4"	10 3/16"	23 3/8"	BP	6
U False fronts—shallow*	3/4"	5 3/4"	23 3/8"	BP	2
V Doors*	3/4"	23 1/8"	25 3/16"	BP	2
W Pulls**	3/4"	5/8"	6"	C	10

*Parts cut to these dimensions initially, then edged with 1/8"-thick walnut to finished dimensions. Please read all instructions before cutting.

**Parts cut to final size during construction.

***Adjust dimensions if needed to allow clearance for drawer slides.

MATERIALS LIST

BP—birch plywood
W—walnut
H—hardwood
HP—hardwood plywood
C—cherry

SUPPLIES

#6x1 1/4" face-frame screws; #8x3/4", 1", 1 1/4", 1 1/2" flathead wood screws; #20 biscuits; finish. (For other supplies, see Sources at end of article.)

Step 2. To avoid wasting the remainder of sheets 1 and 2, cut six blanks as shown on the Cutting Diagram, then edge-join them to make the three dividers (D). To do this, arrange the blanks into pairs for best grain match, then mark the mating edges and matching faces. Use your tablesaw to slot the mating edges for splines as dimensioned in figure 1. Note: Orient the faces of the mating blanks identically when slotting.

Step 3. From 1/8"-thick hardboard or solid stock, cut three 1 1/8"x31" splines. Glue, spline, and clamp the three pairs of blanks as shown in figure 1. After

the glue has dried, cut the dividers to 28 7/8"x31" initial dimensions, positioning the joint as close to the back edge of the divider as possible.

Step 4. To make the edge-banding, face-joint and plane a piece of 4/4 walnut (at least 6" wide and 8 1/2" long) to 13/16" thick. Rip 1/8"-thick edge-grain strips from it.

Step 5. Band the front edge of the bottom, ends, and each divider, keeping the bands centered as much as possible on the edges. Band both ends of the top, then band the top's front edge, overlapping the end bands. Note: When sizing the band-

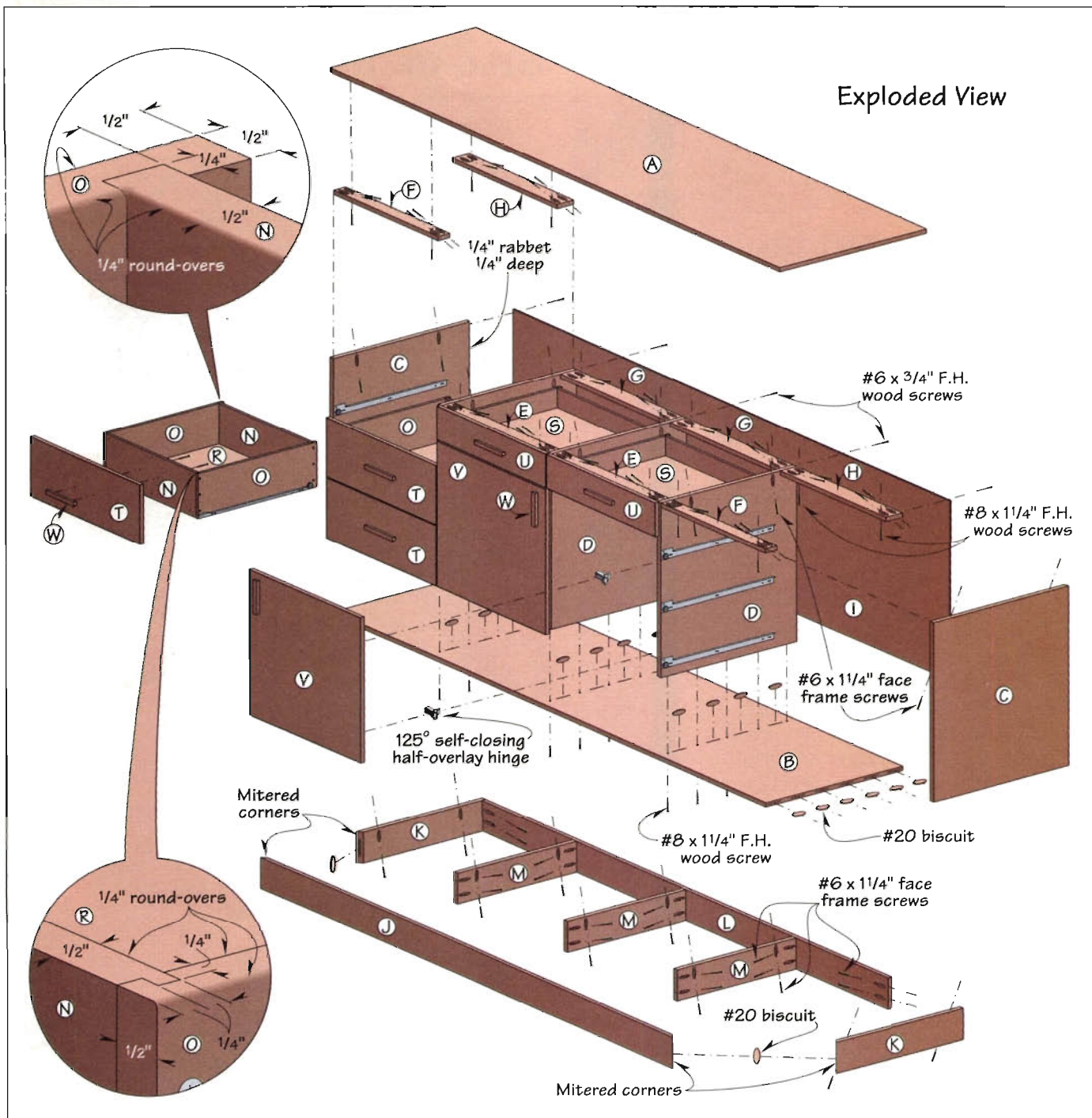
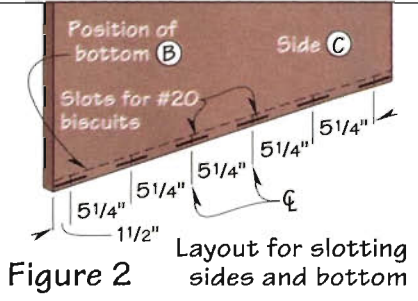
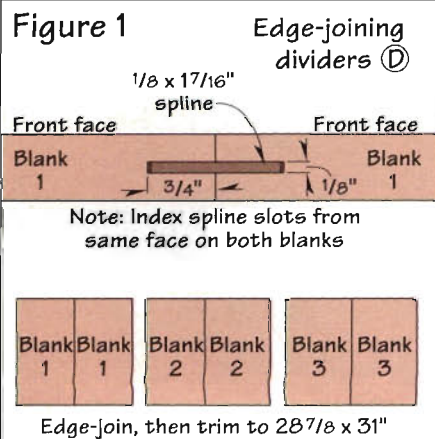


Figure 1



using a backsaw. (For more tips on edge-banding, see Bob Colpetzer's article, "Edging Plywood," on page 20 in our July/August '96 issue.)

Step 6. Using a handheld router and flush-trim bit, trim the banding flush along the edges on both faces. Note: To provide adequate support for the router base, we suggest you make the simple support shown in the Pro Tip on page 23 of that same issue. To do this, simply joint and then rabbet one edge of a flat 2x4.

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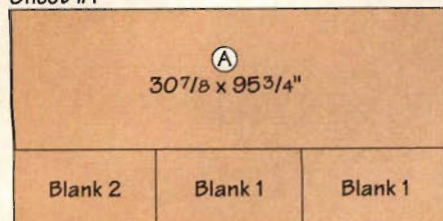
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Sheet #1

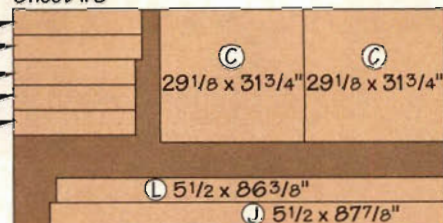


Cutting Diagram

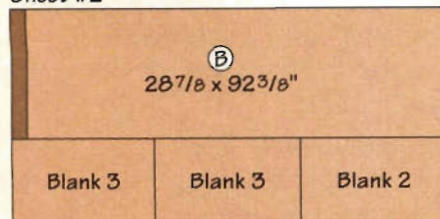
(K) $5\frac{1}{2} \times 27$ "

(M) $5\frac{1}{2} \times 25\frac{1}{2}$ "

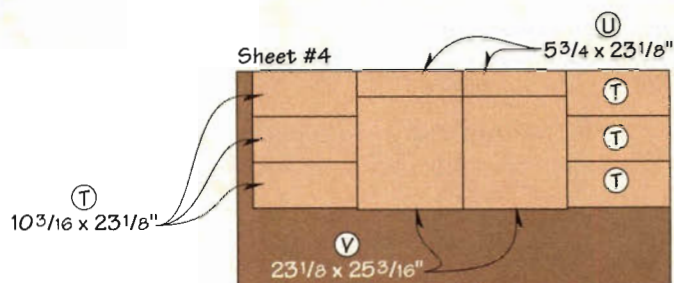
Sheet #3



Sheet #2



Sheet #4



Assemble the Cabinet

Step 1. Lay out and cut mating slots for #20 biscuits in the inside face of the sides and along the ends of the bottom. (For layout, see *figure 2*.) Next, using either a router or tablesaw, cut a $\frac{1}{4}$ " rabbet $\frac{1}{4}$ " deep along the inside back edge of each side to accept the back.

Step 2. Cut mating biscuit slots in the bottom ends of the dividers and the top face of the bottom. To do this, use the shop-built T-square and dimensions shown in *figure 3*. Next, drill shank holes for #8 screws centered between the slots where shown on the same figure. Turn the bottom over and countersink the holes on the underside. Then, dry-assemble the dividers

to the bottom using biscuits. Align and square the parts, then use the shank holes as guides to drill pilot holes in the dividers.

Step 3. Using three pipe clamps at least 9' long, glue, biscuit, and clamp the sides to the bottom. (To do this, we inverted the ends and dividers on a level floor, placed the inverted bottom on them, and applied the clamps. To square the assembly, we measured its length at the top and bottom and made the dimensions match.) Note: Be careful not to overtighten your clamps—this could bow the assembly. After the glue has dried, remove the clamps, then glue, biscuit, and screw the dividers to the bottom.

Step 4. To make the eight stretchers (E, F, G, H), rip eight linear feet each of $\frac{3}{4} \times 2\frac{1}{2}$ " walnut and $\frac{3}{4} \times 3\frac{1}{2}$ " hardwood. (Dick used poplar.) Next, measure the inside distance between the sides and dividers and between each pair of dividers, then crosscut (to length) the front stretchers (E, F) from the walnut and the back stretchers (G, H) from the hardwood.

Step 5. Using a pocket-hole drilling guide, drill two pocket holes at each end of the eight stretchers. Note: Stagger the hole locations slightly so that the screws in the opposed pairs of stretchers will not collide when you drive them into the dividers. (See the Exploded View for locations. For

PRO TIP

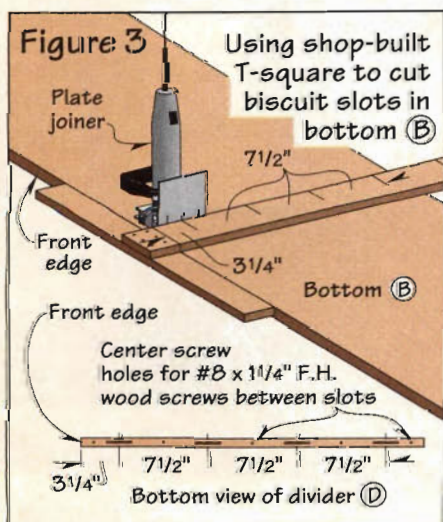
For pocket-hole joinery with plywood, use "washer-head" face-frame screws. They have a built-in washer to maximize the panhead's bearing surface and threads that provide better holding power in plywood.

instructions on pocket-hole joinery and mail-ordering information, see the Contemporary Hall Mirror article starting on *page 34*.)

Step 6. From scrap, cut a pair of spacers to accurately position the stretchers flush with the top ends of the sides and dividers. Place a spacer beneath the end of each stretcher to hold it in position as you glue and screw it to the divider (or side). Drive #6 x $1\frac{1}{4}$ " self-tapping face-frame screws. (See the Pro Tip above.)

Step 7. Measure the opening for the back (I). Cut the back to size from $\frac{1}{4}$ " plywood, then attach it to the sides, bottom, dividers, and back stretchers using #6 x $\frac{3}{4}$ " flathead wood screws.

Step 8. To attach the top (which you won't do until later), drill two countersunk shank holes for #8 wood screws through the bottom face of each stretcher. Then, drill two pocket holes through the top end of each side and divider where shown on the Exploded View.



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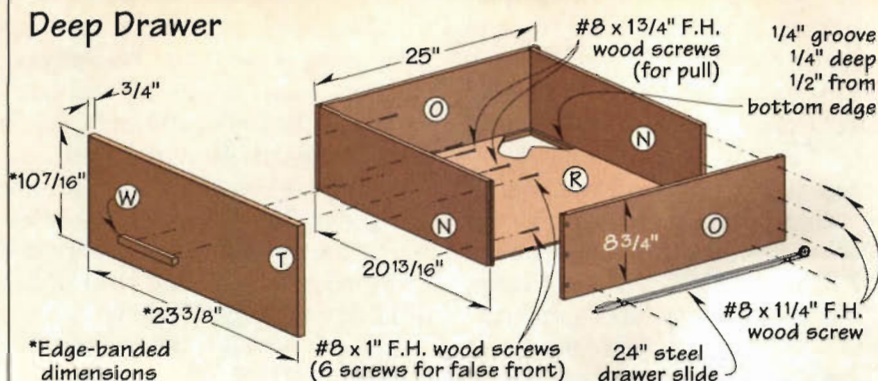
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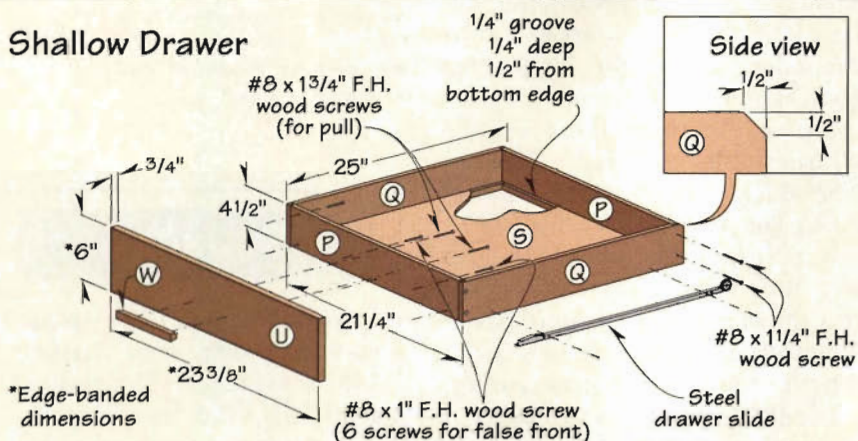
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Deep Drawer



Shallow Drawer



mating dado in the front end of each drawer side.

Step 4. Measure the thickness of the plywood you'll use for the drawer bottoms. Cut a groove that matches this thickness along the inside faces of all drawer parts where dimensioned on the Drawer drawing. To do this, make two passes with your table-saw. Note: If you plan to load the drawers with heavy materials, consider positioning the groove higher in the drawer to provide more support for the bottoms.

Step 5. Dry-assemble one deep drawer and one shallow drawer. Measure the interior of each, then add $\frac{7}{16}$ " for groove depth to both width and length. Using these dimensions, cut six deep drawer bottoms (R) and two shallow drawer bottoms (S).

Step 6. Glue, assemble, and clamp the eight drawers. The plywood bottoms don't need to float in their grooves, so glue them in place. Drive #8 x $1\frac{1}{4}$ " flathead wood screws where shown to reinforce the joints.

Step 7. Using a $\frac{1}{4}$ " round-over bit, rout the top inside edge of each drawer. (See the detail shown on the Exploded

View.) Then, round over the top outside edge of each drawer side.

Hang the Drawers, Then Add False Fronts

Step 1. Mount the slides on the drawer sides according to the manufacturer's instructions. (Dick mounted his slides along the bottom edges. For mail-order information, see Sources at the end of the article.)

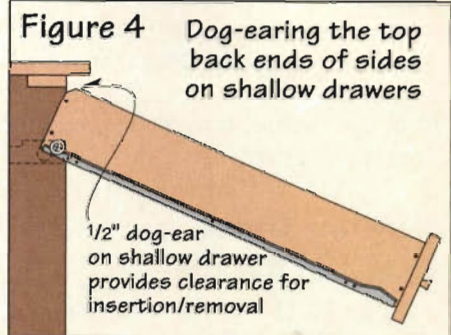
Step 2. Position and attach the cabinet slides to the cabinet dividers and sides. Note: Use spacers to ensure accurate location. Dick spaced the slides (the same ones we've listed in Sources) for the deep drawers $\frac{1}{4}$ ", $10\frac{1}{16}$ ", and $20\frac{3}{4}$ " respectively from the cabinet bottom. He used $25\frac{1}{4}$ " spacers to position the shallow drawer slides. Note: To use the spacer technique, you must install the deep drawers in top-middle-bottom sequence.

Step 3. Install the drawers in their slides and check for fit. Adjust as necessary. Note: To achieve maximum drawer depth in the shallow drawers, Dick deliberately exceeded the clearance specifications for the slides,

ending up with $\frac{7}{16}$ " clearance at the top of these two drawers instead of the specified $\frac{3}{4}$ ". To gain the clearance needed for inserting and removing these drawers, Dick dog-eared the top back ends of the drawer sides where shown on the Shallow Drawer detail and figure 4.

Step 4. From your fourth sheet of $\frac{3}{4}$ " birch plywood, cut six deep-drawer false fronts (T), two shallow-drawer false fronts (U), and two doors (V) to the initial dimensions listed in the Bill of Materials. Note: To maintain grain continuity across the face of the cabinet, cut the parts in sequence as shown on the Cutting Diagram and mark their respective positions.

Step 5. Edge-band the false fronts and doors with walnut. Band the horizontal edges first, then overlap them with the vertical bands. Using a $\frac{1}{8}$ " round-over bit and a handheld router, rout the banded edges along both faces



and corners of the top, dividers, bottom, and sides. Rout the front faces of the false fronts and doors.

Step 6. Attach the top to the cabinet. To do this, invert the top, then recruit an assistant to help set the inverted cabinet on it. Center the cabinet from side to side and align the back edges. Mark the cabinet's location, then remove it. Set it right side up, and position the top on it. Drive screws through the stretcher holes to secure the top. Now, pocket-screw the cabinet to the top using the holes you drilled earlier in the dividers and sides.

Step 7. Lay out and drill six regularly spaced, countersunk shank holes through the inside face of each drawer front (not the false front) to attach the false front to the drawer. (For approximate spacing, see the Drawer drawings.) Make a template for drilling pull holes, centering two holes in it for #8

screws 3½" apart. Center the template on each false front and drill the two holes. Note: Save this template for use on the doors. Countersink the pull holes on the inside faces.

Step 8. Insert all eight drawers into their slides. From scrap material, rip several ¾"- and ⅝"-thick spacers and crosscut them approximately 18" long. Position a false front on one of the top deep drawers, spacing it ⅝" from the cabinet top. Align its outside edge flush with the cabinet edge, then drive a pair of 1½" screws through the pull holes in the false front and into the drawer front. Check the alignment and spacing. If good, open the drawer and drive #8x1" flat-head screws through the drawer front and into the false front.

Step 9. Remove the two screws from the drawer-pull holes in the false front. Then, drill those holes all the way through the drawer front. Countersink them on the inside face of the drawer front. Now, repeat steps 8 and 9 for all remaining drawers. Note: Space all four of the drawers across the top ¾" from the cabinet top; space the other drawers ⅝" apart.

Hang the Doors, Then Add the Pulls

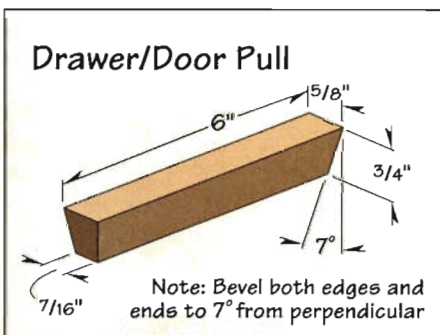
Step 1. Using the template you made earlier, drill two countersunk shank holes for #8 screws through the inside door faces for attaching the pulls. (For centerpoint locations, see the Front View.)

Step 2. Using European-style half-overlay hinges, hang the two doors. To do this, lay out and drill

35mm (1⅜") holes in the inside door faces centered 3" from the top and bottom. (Follow the manufacturer's specifications for positioning the holes with respect to the edge.) Install the hinge cups in the holes.

Step 3. Position the baseplates in the cabinet, centering them 3" and 22⅞" respectively from the *bottom edge* of the cabinet bottom. (Again, follow the manufacturer's instructions to position the baseplates front to back.) Next, hang the doors, adjusting the baseplates to space the doors ⅝" from the drawers and from each other. Adjust the hinges for good alignment and action.

Step 4. To make the ten pulls (W), surface a 4x25" piece of cherry to ¾" thick. (See the Pull drawing below.) Tilt your tablesaw blade to 7° from perpendicular, then bevel-rip three ⅝"-wide strips on both edges. With the same blade setting, bevel-cut both ends of the pulls to 6" long. Using the template you made earlier, drill centered pilot holes ½" deep in the narrow face of each pull. Finish-sand the pulls to 220-grit, but don't attach them until after you've applied finish.



Step 5. Sand all exterior surfaces to 220-grit, then remove the dust with compressed air. Apply your choice of finish to all surfaces including the pulls. (We sprayed on three coats of satin polyurethane, sanding between coats with 320-grit sandpaper. After the finish has dried, attach the pulls to the drawers and doors using #8x1¼" and #8x1¼" flat-head screws respectively. 

Photograph: Kevin May

Project design: Dick Coers

Produced by: Doug Cantwell

Miter saw: Makita model LS1211

Miter saw fence: Biesemeyer T-Square®

Miter-Saw Stop System

SOURCES

Drawer Slides. Heavy-gauge steel, 24" long, epoxy-coated, self-closing, require ½" clearance each side, 100 lbs. capacity, screws included. Catalog no. 878-323. Price: \$5.50/pair plus s/h. Order from:

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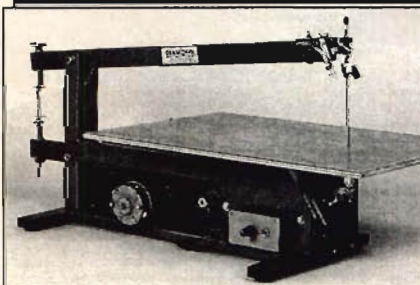
Half-Overlay Hinges. European-style, made by Blum; 125° opening, three-way adjustable, nickel-plated, snap-closing. Catalog no. 40832. Price: \$10.45/pair plus s/h. Order from:

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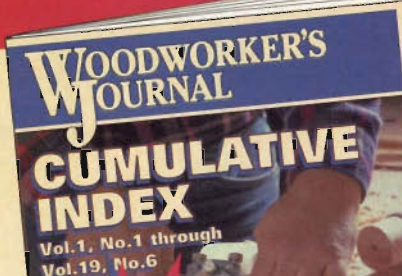
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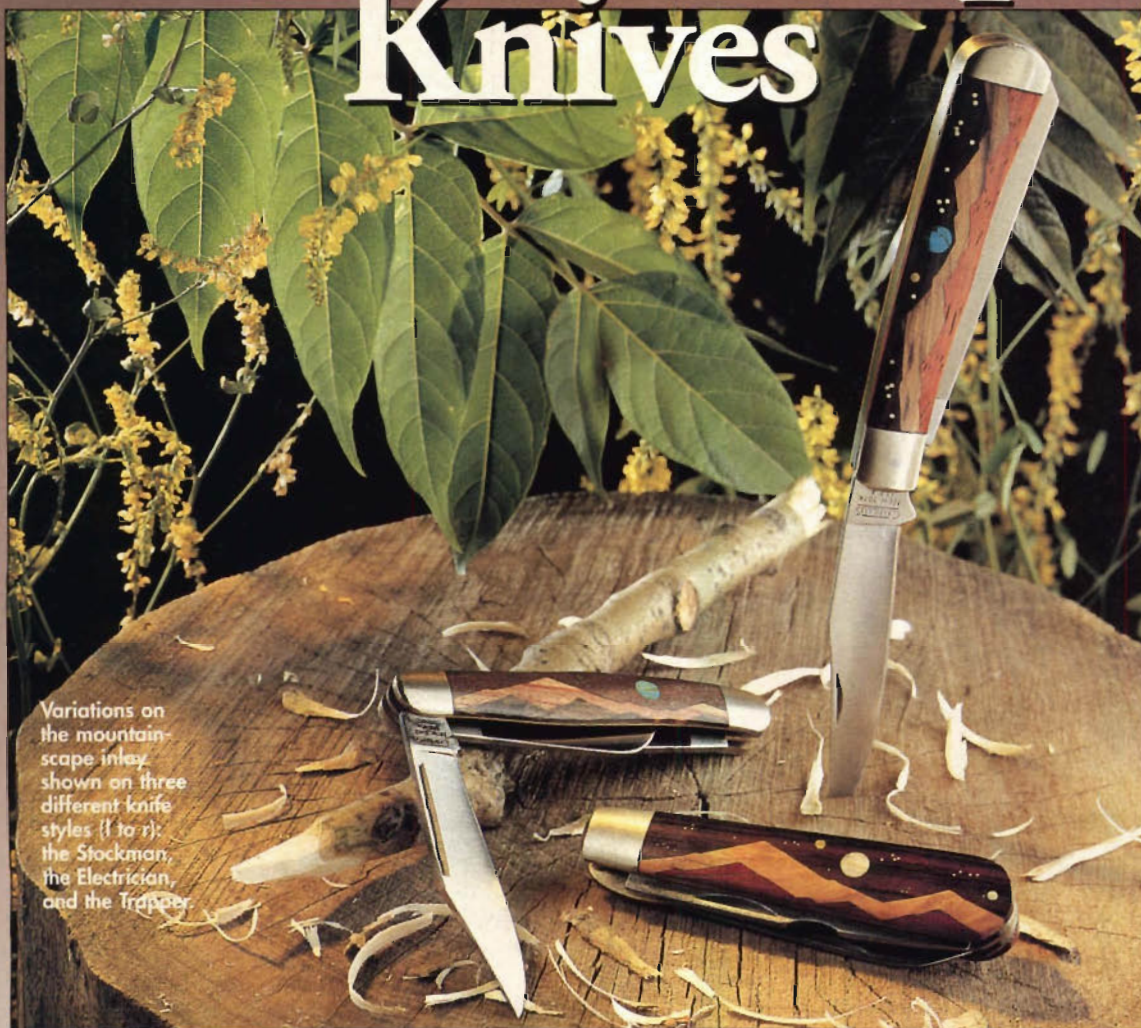
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Inlaid Mountainscape Knives



Variations on the mountainscape inlay shown on three different knife styles (l to r): the Stockman, the Electrician, and the Trapper.

For 16 years, Ed and Brenda Schmiedicke have developed a line of inlaid accessories and cutlery, which they exhibit and sell at some of the better juried craft shows throughout the country. Their folding knives with inlaid mountain scenes usually sell out first. We include this pad marquetry project here as a holiday gift idea that you'll find easy to make in any quantity. (For more about Ed and Brenda, see "Meet the Designers" on page 69.)

Before You Start

As you'll note in the step-by-step photographs, the Schmiedickes use some specialized sanding equipment to make their knives, but they report that a 1" belt sander with a removable platen will work adequately for all operations. (A 4" stationary belt sander, however, will expedite some of the shaping work.) They recommend J-weight abrasive belts, if you can find them, for their flexibility.

You'll also need a scrollsaw and a no. 5 blade, a drill press, and a pin vise to handle the tiny no. 72 wire bit you'll need to drill holes for the piquéd sterling-silver "stars." (To mail-order a power pin vise that you can chuck into your drill press or a swivel-head hand-drilling vise, see Sources at the end of the article.)

To improve the appearance of glue lines, the Schmiedickes add a tiny drop of brown or black epoxy coloring agent to their quick-set epoxy for all opera-

tions as they mix the two parts together. This product, made by Evercoat and available at most paint stores, can interfere with the epoxy's curing process, so they recommend you use it very sparingly.

Ed and Brenda have put together two different kits for this project, both of which include a choice of three knife models (as shown in the lead photo). You can order the bare-bones kit (knife blank, sterling silver wire, and $\frac{1}{4}$ " turquoise stone) or a more complete kit that includes the knife blank, wood slabs, laminate, drill bits, sterling wire, and stone. (See Sources.)

Make the Drilling and Sanding Template

Step 1. Cut a 1"-wide piece of plastic laminate or other hard, thin material to use as a template. Measure the space between the bolsters on your knife blank, and cut the template $\frac{1}{2}$ " longer than this recess (*photo A*). Open the knife blades and wrap them with masking tape to protect yourself.

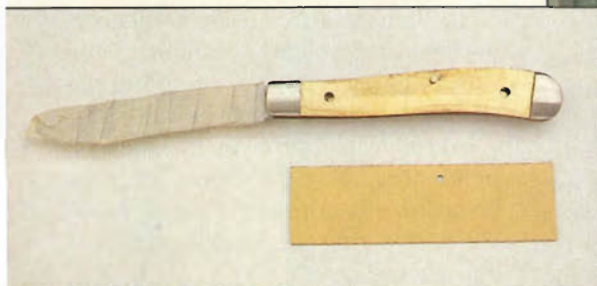


Photo A: Tape the knife blades for safety, then cut a template blank from scrap laminate and drill a hole through it for the back-spring pin.

Step 2. Center the knife handle on the template, overlapping the bolsters by approximately $\frac{1}{4}$ " at each end. Make sure the back-spring pin is at least $\frac{3}{16}$ " from the top edge of the template. Mark the pin's location on the laminate. Then, drill a hole for the pin using a no. 44 bit in your drill press. Note: The Electrician knife blank requires two pin holes.

Step 3. Fit the template over the knife blank, inserting the back-spring pin into its hole. Carefully mark the points along both edges where the bolsters intersect the template (*photo B*). Then, remove the template and sand the ends to fit snugly using a 1" belt sander, test-fitting the template as you

work. (We used a 120-grit belt.) Note: The template should fit snugly enough to allow no movement. If you selected the Electrician knife blank, make sure the template fits snugly between the one bolster and the two pins.

Step 4. Press the template into position on one face of the knife blank, and

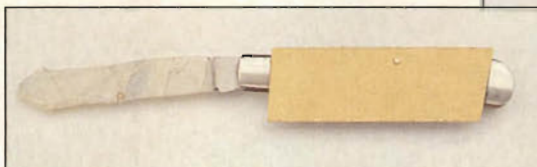


Photo B: Insert the back-spring pin through the template hole, mark the bolster locations, then trim the ends to fit snugly between the bolsters.

sand the edges to match the contours of the blank using an 80- or 100-grit belt (*photo C*). Be careful to stop sanding as soon as you contact metal. Your template should now match the shape of the knife handle insert (*photo D*). Note: On the Electrician knife blank, sand around the back end of the knife handle as well.



Photo C: Sand the template edges to match the knife contours. Be careful not to oversand and remove any knife metal.

Prepare the Mountain Scene Inserts

Step 1. Choose three highly figured and/or colored hardwoods that contrast well with one another. From each, cut a $\frac{3}{16} \times \frac{7}{8}$ " slab long enough to overlap both bolsters by $\frac{1}{4}$ " (*photo E*).

Step 2. Stack and bind the three slabs tightly using masking tape. Adhere one strip of tape lengthwise

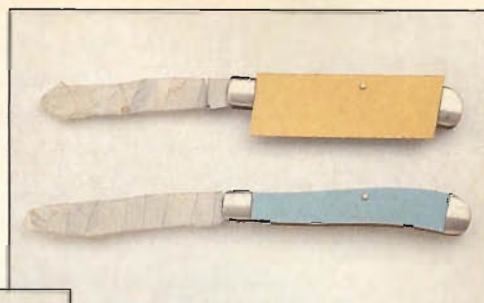


Photo D: The trimmed and sanded template (bottom) should precisely match the handle recess on the knife blank.

around the ends and three strips widthwise around the edges (*photo F*). Next, center and trace the template outline onto one face, including the pin location, to outline the area in which your mountain scene must fit. Transfer one of the mountainscape patterns shown on *page 68* to the taped stack, or draw a scene of your own choosing. Remember to leave enough sky area for the $\frac{1}{4}$ "-diameter moon and the back-spring pin (which will resemble a smaller moon or planet on the assembled handles.).



Photo E: Select three woods that contrast in grain or color or both. Cut a $\frac{3}{16}$ "-thick slab from each wood large enough to generously cover the knife handle recess.

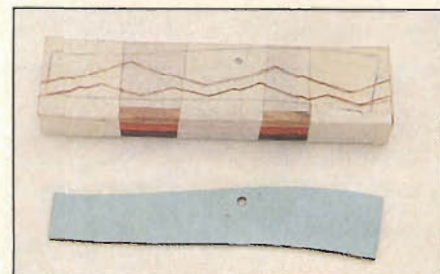
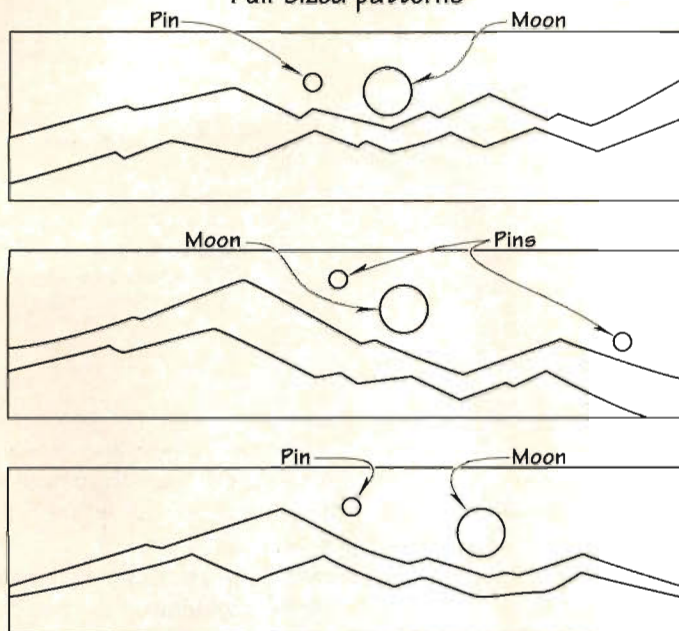


Photo F: Stack and bind the three slabs using masking tape, then trace the template's outline onto one face. Transfer the mountain scene pattern so that it fits within the template outline.

Three Mountainscape Variations

Full-sized patterns



Step 3. Cut the mountain sections to shape using a scrollsaw and no. 5 blade (photos G, H). Note: Don't attempt to cut a hole for the moon. You'll drill that hole in a later step.

Step 4. Remove the tape from each section. Mix and match the pieces from each slab to form three versions of your mountain scene,

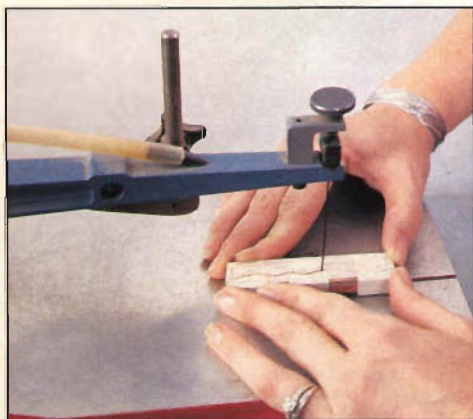


Photo G: Scrollsaw the mountain sections to shape using a no. 5 blade.

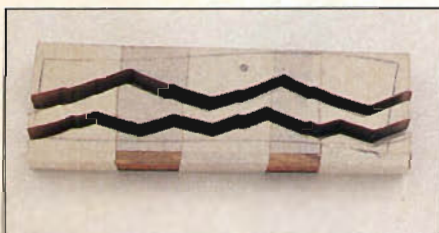


Photo H: Scroll-sawn mountain sections still bound with tape. Note pencil-marked locations of back-spring pin and moon in sky area.

arranging them for best contrast (photo I). Choose the two you like best, then flip one of them end for end to book-match them. (We select one version with a dark "night" sky, then inlay the turquoise moon in that scene.) Temporarily tape the back-side of both scenes with masking tape for now to keep them intact.

Step 5. Apply a dark-tinted, quick-set epoxy to the mating edges of your landscape pieces, then clamp them (photo J). To do this, use a binder clip

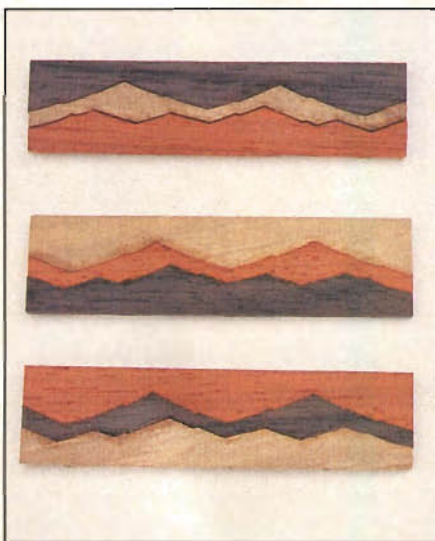


Photo I: Remove tape, then mix and match pieces from the three slabs to form three mountainscapes. Select the two you like best, including one with a dark "night" sky.



Photo J: Epoxy and spring-clamp the mountainscapes, using binder clips and scraps of laminate on the ends to keep them flat.

and small scrap of laminate at each end to hold the faces flush, then apply spring clamps to the edges. Allow the epoxy to cure for 30 minutes.

Step 6. Sand both faces of the two glue-ups to remove epoxy squeeze-out, taking care to keep the faces flat. To do this, use a stationary belt sander or adhere a sheet of 100-grit sandpaper to a flat surface.

Fit and Then Assemble the Inserts To the Knife

Step 1. Book-match the two scenes, then stack them with the night-sky version on top. Note: The mountains on the book-matched scenes will occupy the same relative position in the stack. Lay the template on top of the stack, centering it over the landscape (photo K). Make sure you include a bit of sky area above the mountain peaks and allow enough sky for the 1/4" moon and back-spring pin. Bind the template and stacked inserts with masking tape, then trace the template outline onto the stack.

Step 2. Using a no. 44 bit in your drill press and the template hole as a guide, drill a hole for the back-spring pin through the stacked inserts.

Step 3. Sand the ends of the stacked scenes flush with the ends of the template using a 100-grit belt (photo L). Note: Once again, make sure you don't

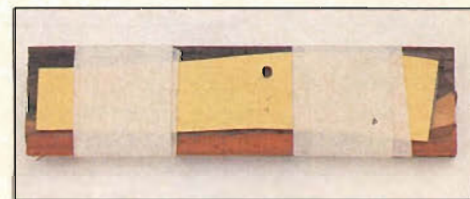


Photo K: Sand the backs of the glue-ups flat, then book-match and stack them. Position template to locate back-spring pin and moon in sky area, then bind the three parts with masking tape. Drill the pin hole through both inserts at this time.

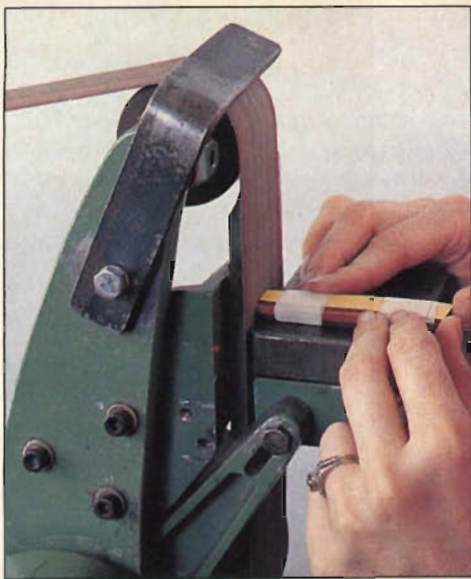


Photo L: Sand the ends of the mountainscape flush with the ends of the template. Be careful not to sand away any of the template. Check for fit in the knife blank recesses.

oversand. Stop sanding as soon as the belt makes contact with the template. Now, separate the stacked inserts and test-fit them in their recesses on the knife blank.

Step 4. Position the template on your night-sky landscape, and select a location for the inlaid moon. Note: Locate it far enough from the top edge of the scene to ensure that you won't sand through to the moon when you contour the handles to the knife. Set your drill press at low speed, and drill a 1/4" hole through the workpiece using a brad-point bit.

Step 5. Apply quick-set epoxy to the edges of the turquoise moon, then insert it into its hole. Remove excess epoxy from the back of the workpiece, then allow the epoxy to cure. Sand the back of the landscape flat if necessary.

Step 6. Check the back-spring pin on your knife blank to make sure that it protrudes equally from both faces. Dry-assemble the inserts to their respective sides of the knife blank to check for fit. Adjust the length and/or the shape of the ends if necessary.

Step 7. Apply quick-set epoxy to the back of one insert, and spring-clamp it to the knife blank (*photo M*). Apply two clamps to the inside face of the knife liner on that side, then clamp the opposite edge by applying clamps across the back spring of the knife. Note: Do not clamp across both

liners—this could bend them permanently. Before the epoxy hardens completely, gently peel off the squeeze-out that has adhered to the back spring. Also, remove any squeeze-out from inside the liners at this time. Now, repeat this procedure for the opposite side of the handle. Allow two hours for thorough curing.

Add Stars To Your Night Sky, Then Finish the Handle

Step 1. Using the no. 72 bit and a pin vise, drill a random pattern of holes for stars in your night-sky insert. Note: Do not drill through the knife liner.

Step 2. Dip the end of a short length of 26-gauge sterling-silver wire into quick-set epoxy. Insert this end into one of the star holes, then clip it off near the surface with a pair of wire nippers. Repeat for all holes, then allow the epoxy to cure.

Step 3. Using a 100-grit sanding belt, carefully sand the edges of the landscape inserts to match the contours of the handle (*photo N*). Stop sanding as soon as you contact metal.

Step 4. Using a light touch so as not to leave heavy scratches on the



Photo M: Epoxy and clamp the mountainscape inserts to the knife blank one at a time. On the bottom edge, clamp insert to the knife liner on that side. On top edge, clamp across back spring.

bolsters, begin sanding the faces of the inserts to remove excess wood and epoxy (*photo O*). To do this, use the platen on your stationary belt sander, and sand with the grain



Meet the Designers

Ed and Brenda Schmiedicke of Albuquerque started out as custom furniture- and cabinetmakers who inlaid many of their pieces with landscape scenes. In 1980, they pooled this inlay experience with other skills they had acquired—bronze-casting, metalworking and tempering, and wire piqué—and began producing high-quality accessories, which they exhibited and sold at a number of juried craft shows.

After several friends requested custom inlaid knife handles, the Schmiedickes experimented with their own line of handles, embellishing them with stone inlays and piqué. The inlaid knives caught the attention of both judges and spectators and have since become one of the mainstays of their craft-show business.

While Ed has refined his skills as a bronze caster, Brenda has in recent

years designed and created completely handmade sheath and folding knives. One of only a handful of women who work in this art form, she decorates these commissions with her unique style of piqué, often spending two or three months on a single knife.

The Schmiedickes currently exhibit at a dozen shows annually throughout the U.S. Their talents have been recognized by the Mitchell Museum in Illinois, the Tulsa International Mayfest, and the Summerfair of Cincinnati, which awarded them the Schiff-Kreidler-Shell Award.

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Photo N: Sand edges of the two inserts to match contours of knife. Be careful not to sand away any metal.



Photo O: Using a 100-grit belt, carefully sand insert faces nearly flush with bolsters to remove excess epoxy, wood, and turquoise.



Photo P: Remove platen from belt sander, change to 120-grit belt, then gently round insert faces and bolsters. Sand up to 220- and then 320-grit to achieve a satin-smooth finish.

until the inserts are nearly flush with the bolsters.

Step 5. Remove the platen from your belt sander, and install a 120-grit belt. Gently round the handle and bolster faces, but keep the two edges square and between $\frac{1}{32}$ " and $\frac{1}{16}$ " thick (*photo P*). Switch to a 220-grit and then a 320-grit belt to achieve a satin-smooth finish on the wood, moon, pin, and bolsters.

Step 6. Remove all dust from the inside and outside of the knife using compressed air. Seal the wooden inserts with two coats of satin polyurethane, rubbing each coat after it dries with a fine nylon abrasive pad. Then, apply paste wax and buff the handle to a low sheen with a clean cotton cloth. **W**

Lead photograph: Lynxwiler Photography

Other photographs: Pat Berrett

Produced by: Doug Cantwell

SOURCES

Basic Knife Blank Kit. Includes first-quality U.S.-made knife blank with stainless carbide steel blades and brass liners, 6" of 26-gauge sterling silver wire, and one $\frac{1}{4}$ "-diameter turquoise stone. Specify Stockman, Trapper, or Electrician. Price: \$38 ppd.

Complete Knife Blank Kit. Includes knife blank as above, 6" of 26-gauge sterling wire, $\frac{1}{4}$ " turquoise stone, three $\frac{3}{16} \times \frac{7}{8} \times 3\frac{1}{2}$ " contrasting, highly figured woods; no. 44 and no. 72 drill bits; 1x6" piece of plastic laminate. Specify knife style as above. Price: \$48 ppd. Order either kit from:

Ed and Brenda Schmiedicke
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BUYER'S GUIDE TO ROUTER TABLES: PART 2

STATIONARY ROUTER TABLES

We evaluate 12 tables

by Jim Barrett



Floor-standing router tables typically are sold as individual components—tabletop, fence, mounting plate, and leg set.

Last issue, I reviewed benchtop router tables designed primarily for smaller-scale projects and/or limited shop space. If none of the tables described there suits your needs, you'll probably find the right one in this review. These tables accommodate larger routers and workpieces. They also require more shop space.

Unlike the benchtop versions, which usually sell as a complete package with table, fence, legs, and built-in accessories, these larger tables generally sell as individual components. CMT and Woodhaven, for example, offer tabletops, leg sets, mounting plates,

and fences separately. This way, you can buy only the parts you need or want. Note, however, that some manufacturers discount if you buy a complete setup.

Tabletops (complete with a mounting plate and sometimes a miter slot) range in price from \$80 to about \$130, depending on size, quality, and features. A manufactured fence, complete with a dust port and bit guard, can set you back about the same amount.

For optimum accuracy, it's probably best to stick with the matched components. You can, however, mix and match certain components and acces-

sories from different companies—something to keep in mind as you contemplate purchases. To make it easy to put together a complete system, many manufacturers offer accessories such as miter gauges, stops, feather boards, hold-downs, and remote switches to round out their systems—plenty of options to assemble a first-class table.

For this review, I tested the 12 systems described in detail starting on page 78. Before looking at specific models, I'll point out some basic features you'll want to look for in the main table components.

Tabletops. Most floor-model router tables have tops made of medium-density fiberboard (MDF) faced on both sides with either plastic laminate or melamine. As a rule, you'll find the high-pressure plastic laminate surface more durable and less prone to scratching than the melamine.

Some tables use a vinyl T-molding or plastic laminate around the edges. The molding helps protect the table's edge both from dings and from surface delamination caused by moisture penetration. I prefer tables with radiused (rounded) corners. They're less likely to cause you injury should you bang your hip against a corner.

Table sizes range from 19x24" to 32x48". Obviously, the larger tables will provide better support for large workpieces, but larger tables also have a greater tendency to warp or sag under the weight of heavier routers unless adequately supported. (See my comments in the individual write-ups.)

Mounting Plates. Most tables use removable mounting plates made of clear acrylic plastic, polycarbonate plastic (Lexan), or phenolic resin (brown or black in color). The AIM table (*page 78*) has an aluminum plate. Vermont American provides a melamine-coated MDF plate (the same material used on the table and fence shown on *page 87*). Several of the companies offer you a choice.

Each type of plate has its pros and cons. Acrylic plates provide good rigidity for supporting heavier router

and also enable you to see beneath the table, which facilitates bit-changing and makes it easier to spot excessive dust buildup. However, this material tends to be brittle and may crack if you should accidentally drop the plate or strike it with a heavy object.

Clear polycarbonate, a softer material, won't crack but may sag under the weight of a heavy router. Thick phenolic resin has the rigidity of acrylic and won't crack or craze, but you can't see through it.

Aluminum plates provide the best support for their relative thickness. However, they tend to be more expensive than the plastic composite materials and don't allow you to see what's going on under the table. While the MDF plate on the Vermont American table offers good support, I found it prone to scratches and nicks, especially around the edges.

In addition to the material, the thickness and overall size of the plate determine how well it will support a router. The larger the plate and router insert hole, the thicker the plate must be to prevent sagging.

I prefer a plate large enough that you can secure a router to it and then slip the router down through the opening in the table. With some tables and certain routers, this requires removing the router's handles. I also like a center hole that's large enough to accept the big 3/4"-diameter panel-raising bits I use. (Holes typically range from 1 3/4" to 4" in diameter.)

The better plates provide plastic in-

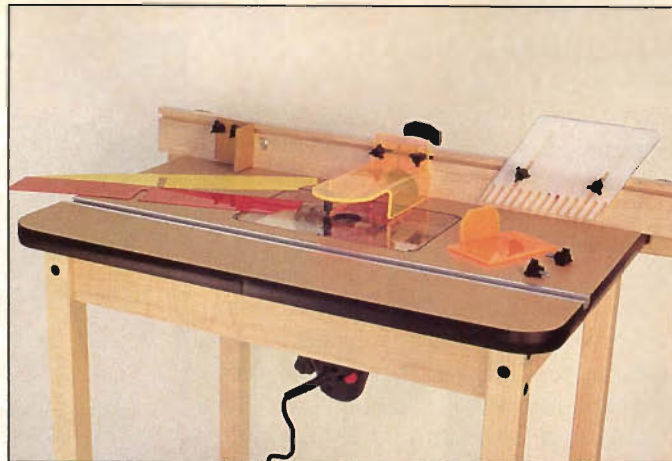


Photo B: Most fences accept a variety of standard and optional accessories. Shown here on the Eagle America fence: plastic feather board, stop, dust-collection port with adapter, jointing shims (for offsetting outfeed fence), freehand routing guard (attached to fence), finger guard, and starting pin.

sert rings, which let you reduce the hole diameter to more closely match the size of bit you're using. This provides better stock support and also reduces sawdust accumulation on the router. A few of the plates will accept template bushings as well. I prefer a plate that has leveling screws or other devices on all four sides so you can quickly and easily adjust the plate flush with the table surface.

To mount a router, you typically remove its subbase and use it as a template for drilling countersunk holes in the mounting plate. Then, you attach the router to the plate using the router's mounting screws. With the thicker plates, you may have to buy longer screws to mount the router. (Available at most hardware stores.)

On most tables, the mounting plate is centered in the table. A few manufacturers offset the plate toward either the rear of the table or one end. With the opening offset toward the rear, as on the AIM table, you gain more support area in front of the bit. A rear or side offset also facilitates the use of jigs such as the JoinTech or Incra Jig Ultra. However, the best setup for you will depend on the type of routing you do.

Some tables have miter-gauge slots, others don't. Several of the manufacturers claim that milling a slot in a laminated MDF table weakens it structurally, allowing it to warp or sag more readily. Others tell me that a slot has little effect on this.

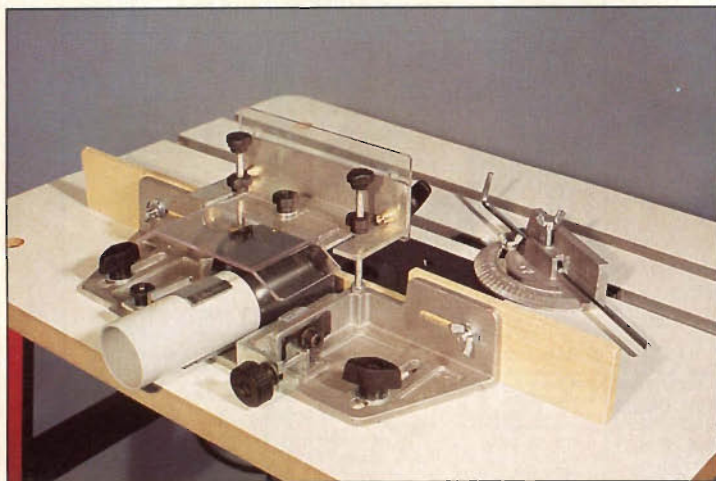


Photo A: The Freud table features adjustable infeed and outfeed fences with offset capability, a dust port, clear finger guard, and micro-adjusting fence. Miter gauge shown also comes with the table.

A number of firms mount an aluminum track in the slot for smoother miter-gauge operation. Using a miter gauge in a plain, routed slot in the MDF table will work for a while, but the material isn't particularly durable and will eventually wear down, resulting in a sloppy fit. Eagle America, Hartville, Garrett Wade's FastTrack, and Woodhaven offer aluminum tracks that accept clamps, horizontal feather boards, homemade jigs, and various other accessories. If your favorite table doesn't come with a track, simply install one yourself.

Fences. A good fence provides easy, precise adjustment. It should also accept wooden subfences, bit guards, feather boards, hold-downs, stops, dust ports, and other accessories.

Several of the fences I tested simply clamp to the table edges at both ends; others use holes or slots in the table for mounting. Most fences now come standard with a dust port and a clear plastic

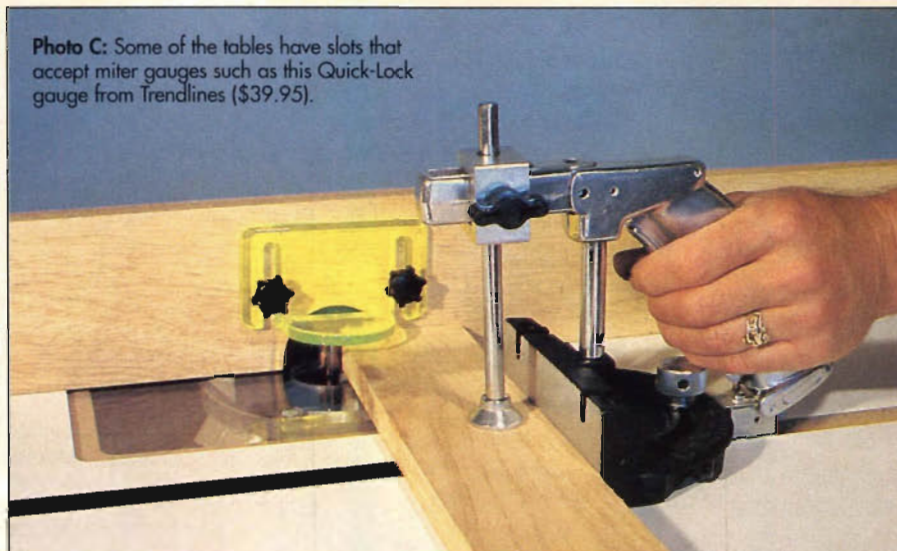


Photo C: Some of the tables have slots that accept miter gauges such as this Quick-Lock gauge from Trendlines (\$39.95).

bit guard. When you shop for a fence, determine which features come standard with a particular model and what the company offers in the way of accessories. Also, keep in mind that you can sometimes fit one company's fence to another company's table.

I prefer a split fence with individually adjustable infeed and outfeed subfences. This arrangement allows you to set the outfeed fence slightly ahead of the infeed fence to support the stock when you make full-profile cuts or joint board edges.

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, up the bit to route the profile. Make a test cut on scrap. Measure the width of the crown.

To calculate the crown's length, measure the length of the rail plus stiles, then the width of the bit's (to allow for a 1/8" reversal). To calculate the width, add the width of the crown to the width of the rail, then add 1/8" for the reversal.

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



Tables such as the Eagle America pictured on page 80 provide a set of jointing shims. You place the appropriate shim between the fence and subfence on the outfeed side for simple jointing operations. You could also attach a shim of roughly the same thickness as the stock you're removing to the outfeed fence.

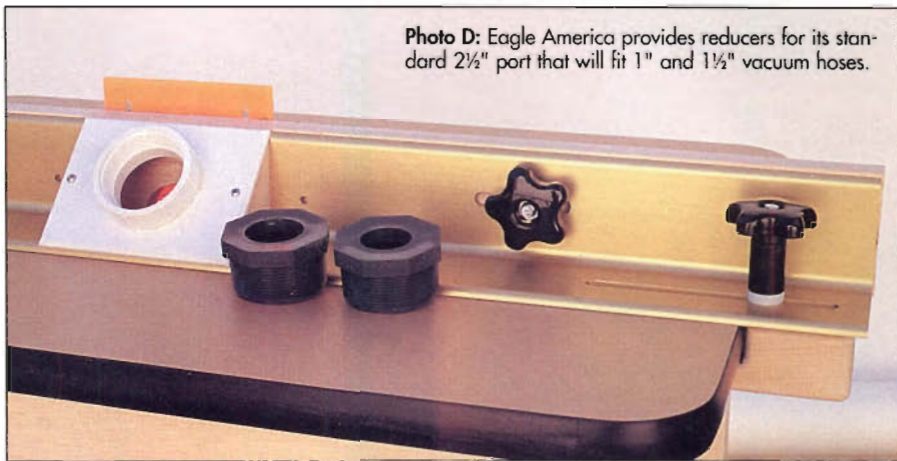
I prefer that the split fences adjust laterally as well to accommodate the size of bit I happen to be using. If a fence doesn't adjust, make your own zero-clearance subfences and let the bit cut its own profile into them.

Generally, I look for metal fences. Metal won't swell or warp with changes in humidity like wood or plywood.

Dust Collection. Routers generate bushels of wood chips and dust. Aside from the hazards they pose to your health and your shop, chips and dust

can also gum up a router motor and bearings. Using a dust collector and properly fitted insert ring will remove virtually all of the dust generated. Many of the fences come equipped with a dust port or can be fitted with one optionally.

Photo D: Eagle America provides reducers for its standard 2½" port that will fit 1" and 1½" vacuum hoses.



Bases. Most companies offer leg assemblies for their tables, made of steel or wood, or cabinet bases, such as the one on the AIM (page 78) and on the Hartville model. The Rousseau table has a unique, scissors-type folding leg set, as described on page 86.

Continued on page 78

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A Closeup Look At The TableS

AIM Tools Deluxe Router Table

The mounting plate on this generously sized table has been offset to the rear to provide plenty of space in front of the bit for routing large panels or cabinet doors. The aluminum mounting plate supports the heaviest routers with no sag. In addition, the plate's replaceable plastic insert accepts most standard template bushing kits.

The sturdy, one-piece extruded-aluminum fence has twin slots on the top, front, and back (six in all) for attaching a variety of accessories with standard carriage bolts. The table and fence will also accept the Incra and JoinTech jigs, allowing a full range of travel for both devices.

The standard fence has a 2½" dust port and clear plastic bit guard (not shown). Although cleverly designed, the fence was a bit cumbersome to adjust (with its two clamping knobs located inconveniently on the underside of the table) and didn't slide as smoothly as those on the other tables.

I like the optional base cabinet, which is made of ¾"-thick MDF. It provides solid table support and gives you two pull-out

shelves for storing ½"- or ¼"-shank router bits. All dadoed cabinet parts assembled easily with the self-tapping screws provided. Adjustable leg levelers made setup easy.

I did run into a snag when fitting the mounting plate into the tabletop. I had to trim back a small projecting lip around the edges of the opening in order to inset the plate flush with the table surface. The manufacturer told me that the table was designed this way intentionally so a user could trim the opening to a custom fit. This wasn't mentioned in the assembly instructions.

Table size:	1½x30x32"
Table material:	Plastic-laminated MDF, plastic T-edging
Mounting plate:	¾x11x11", aluminum
Fence:	3½x36", extruded aluminum
Dust port:	Standard 2½"
Table height (w/ base):	33¼"
Prices:	\$299 (as shown, with cabinet); tabletop, \$99; fence kit, \$99; table/fence \$179; plans and assembly hardware for cabinet shown, \$14.95.



CFW 32-GT Router Table and 33-GF Fence

Made by Caribou Tools, this sturdy table/fence combo has thoughtfully designed features that make it exceptionally easy to adjust and use. The fence has a one-piece aluminum angle with adjustable brackets that clamp to each end of the table. With these brackets, you can mount the fence side to side or front to back on tables up to 32" long.

The one-piece angle supports two aluminum subfences. Both adjust laterally with large, easy-to-reach knobs. You can set the outfeed fence up to ¼" ahead of the infeed fence for jointing or making full cuts. The subfences have been slotted for attaching wooden facings, feather boards, and other aftermarket accessories using hex-head bolts. The fence comes with a dust port, bit guard, and stop,

as shown in the photo. Because of its simplicity, durability, and ease of adjustment, this fence ranked as one of my favorites.

The MDF top, which has rounded corners and plastic T-edging, is surfaced on both sides with a thick, high-density plastic laminate. The thick phenolic mounting plate sits on four large leveling bolts that attach underneath the table. I found the plate quite easy to adjust.

The basic setup includes the table and fence only—Caribou does not offer a leg set or base. (The leg set shown in the photo below belongs to the Woodhaven table but fits this one nicely as well). Accessories include plastic feather boards and blank phenolic mounting plates (with a centered pilot hole to expedite mounting the router and cutting the insert hole).

Table size:	1½x24x32"
Table material:	Plastic-laminated MDF, plastic T-edging
Mounting plate:	¾x9¼x11¾", phenolic
Fence:	3x36" (max.), aluminum
Dust port:	Standard 2½"
Table height (with base):	N/A
Prices:	Table, \$119; fence, \$119.





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WOODSMITH MAGAZINE

CMT offers a large, sturdy table and fence system. With additional tweaking, it would make a durable routing workhorse in any woodworking shop.

The basic steel leg set assembles into a sturdy support base. Crossbraces are not supplied—you will need to add your own to keep the table from racking from side to side under load. Floor levelers were not provided, so you'll need to make your own.

The generously sized MDF tabletop is surfaced on both faces with plastic laminate. T-edging protects the edges and radiused corners. The mounting plate sits almost dead-center in a rabbeted opening.

The ¼x9x12" black phenolic mounting plate has a 4" opening to accommodate large bits. Two step-down insert rings provide 2½" and 1¼" openings. You'll find two pre-drilled holes for the starter pin but no provi-

sion for leveling the mounting plate in the table's rabbet.

The fence system consists of a 24"-long cast-aluminum housing that incorporates a 3"-o.d. dust-collection port. Two 9½"-long slots in the tabletop and two 3¼"-long slots in the base allow positioning of the fence 9" behind and 3" ahead of the router's centerpoint. Carriage bolts with 2"-diameter knobs hold the fence in place. Even with the large knobs, I found it a bit cumbersome to move the fence and set it precisely.

Both of the 4½x15" plywood subfences move 2" laterally but there is no provision for moving them either forward or backward independently. The clear acrylic guard has slots to accommodate lateral movement of the subfences. However, to raise or lower the guard, you must first unscrew and then reattach it at the desired height.

Table size:	1¼x24x31½"
Table material:	Plastic-laminated MDF, plastic T-edging
Mounting plate:	¼x9x12", phenolic
Fence:	4½x35" (max.), aluminum with plywood subfences
Dust port:	3"
Table height (with base):	33¼"
Prices:	Table, \$79; insert, \$40; fence, \$64; leg set, \$36; package, \$199.



Eagle America Router Table System

Eagle America offers a 24x32" tabletop with your choice of centered or end-centered mounting plate. You can also order the table with or without an aluminum miter-gauge track and choose one of four laminate colors (white, brown, blue, or grey).

The fence uses a one-piece anodized aluminum angle bracket with split and slotted maple subfences that accept a variety of accessories. You can mount the fence across either the length or the width of the table using end-mounted wooden clamping brackets.

The wooden subfences adjust laterally to make a larger or smaller bit opening, and you can offset the outfeed subfence with plastic jointing shims. (See photo B on page 73.) The fence comes with a plastic bit guard and a removable 2½" dust port. In addition, you can buy horizontal and vertical feather boards, a miter gauge, stops, dust-port reducers (1¼" and 1½"), a freehand routing guard, remote foot switch, miter-gauge track inserts, and adhesive rulers.

The sturdy maple leg set bolts together in minutes with hex-head knock-down fittings. It also has built-in leveling feet. The table comes with a ¾"-thick polycarbonate mounting plate fitted with allen-type set screws for leveling. The company also sells the same type of plate in black phenolic.

The mounting plates tend to be thicker than most router subbases, so you'll need longer screws to attach the router. Eagle America sells these screws for most routers, or you can pick them up at a local hardware store.

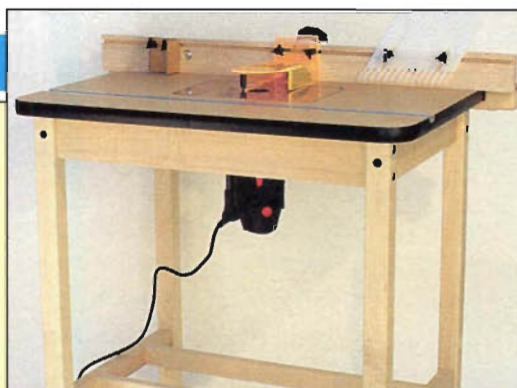


Table size:	24x32x1¼"
Table material:	Plastic-laminated MDF, plastic T-edging
Mounting plate:	¾x8x11¼", polycarbonate
Fence:	3x37", aluminum and wood
Dust port:	Standard 2½"
Table height (with base):	34¼"
Prices:	Complete (top, fence, legs), \$279.99; top (without track), \$119.99; with track, \$129.99; fence, \$129.99; leg set, \$129.99.

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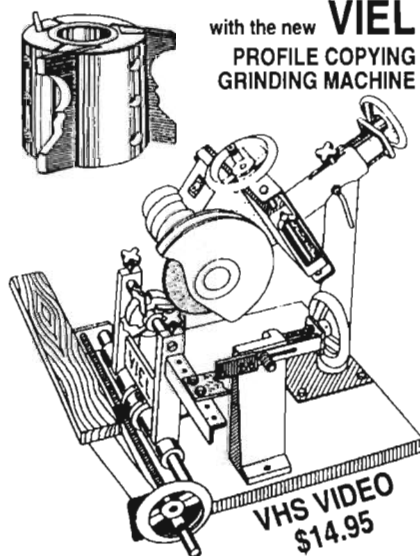
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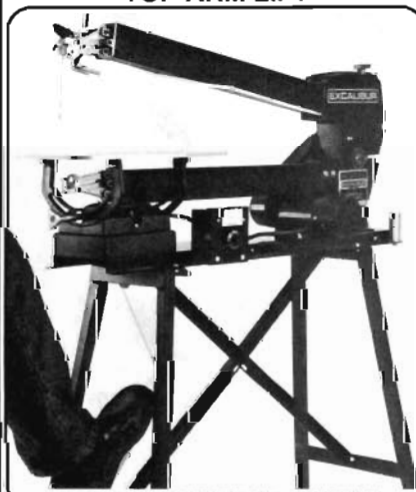


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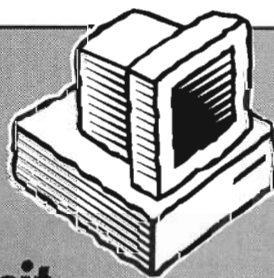
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FastTrack Router Table System

Designed by woodworker/writer Mark Duginske and sold by Garrett Wade, this system uses a one-piece extruded aluminum fence that slides on two tracks that are inset into the table ends. This provides a super-smooth, full travel range from front to back and even diagonally if desired. You can also mount the fence on a conventional miter gauge to serve as an extension, or mount it from front-to-back on the table.

The fence has integral T-slots that accept plastic feather boards, a flip-down stop, and a micro-adjuster (all available from the manufacturer) as well as homemade wooden subfences, jigs, and other fixtures, using standard $\frac{1}{4}$ "-20 hex-head bolts. Unfortunately, the fence has no split or offset capability, so you'd have to attach an infeed or outfeed wooden subfence or use shims to provide the offset.

The table (manufactured by Woodhaven) arrives with the fence tracks installed. The phenolic insert plate has four leveling bars. You also get a plastic bit guard, starting pin (for freehand routing), and an aluminum miter-gauge slot that accepts a $\frac{3}{4}$ "-wide miter-gauge bar and other accessories. Garrett Wade offers an optional hardwood leg set (also made by Woodhaven).

You can buy the basic components separately or as a package. The fence kit includes a bit guard and $2\frac{1}{2}$ " dust port, the aluminum FastTrack rails, hardware, and instructions for retrofitting it to other laminated MDF tops.

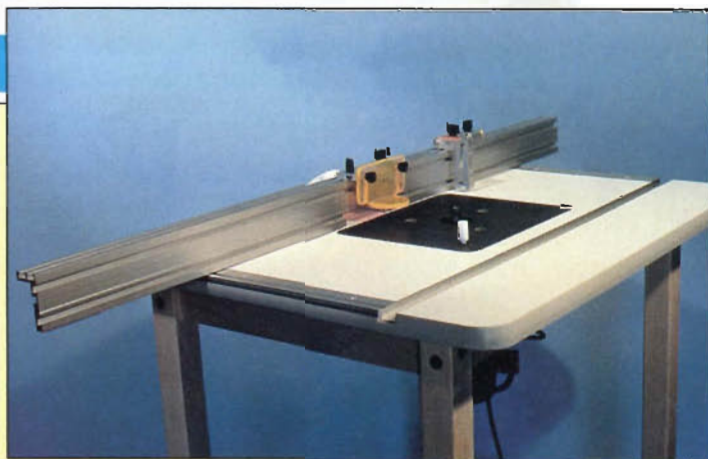
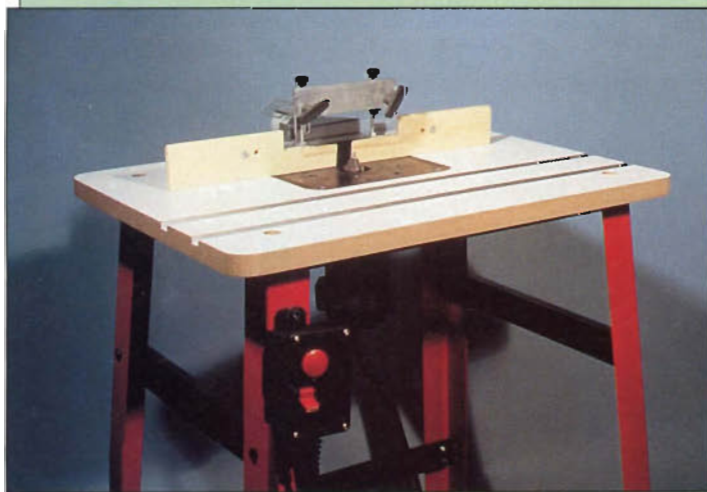


Table size:	$1\frac{1}{2} \times 24 \times 32$"
Table material:	Plastic-laminated MDF, plastic T-edging
Mounting plate:	$\frac{3}{8} \times 9\frac{1}{4} \times 11\frac{1}{4}$", phenolic
Fence:	$2\frac{3}{4} \times 48$", aluminum
Dust port:	Standard $2\frac{1}{2}$"
Table height (with base):	37"
Prices:	Table with fence, \$259.95; fence only, \$139.90; leg set, \$109.90.
(See Garrett Wade catalog for other accessories.)	

Freud BF3 Router Table



This brand-new table has several nice features, including an exceptionally sturdy steel leg set, a nifty split-fence system with a built-in dust-collection port, a bit guard, and a micro-adjustment knob for fine-tuning the fence position. (See photo A on page 73.)

The split fence has two independently adjustable aluminum angles with attached wooden subfences. The fence proved to be one of the most accurate and easy to use of the lot, but I'd replace the short wooden subfences with more substantial ones that reach all the way across the table.

You'll find the tabletop and its mounting plate smaller than most. With larger routers, you'll need to remove the side handles in order to drop the router through the table opening (or hold the router from underneath the table while screwing it into the plate—a real hassle). The fixed handles on my Sears EZ router interfered with the underside of the table, so I had to switch to a Bosch 1604A in order to test it.

On the plus side, the heavy leg set provided more than enough support for the small table, such that I doubt the table will warp or bow. Twin miter-gauge slots enable you to position the miter gauge close to the work to support small pieces or farther away for routing larger work. A miter gauge (shown) comes with the unit.

The standard $\frac{3}{4}$ " slots accept a variety of accessories, including horizontal feather boards, available from Freud. The table isn't as large as most of the others, but Freud supplies a very complete, versatile, quality system.

Table size:	$1 \times 19\frac{3}{4} \times 26\frac{1}{2}$"
Table material:	Melamine-coated MDF, no edging
Mounting plate:	$\frac{5}{16} \times 6\frac{1}{4} \times 9\frac{1}{4}$"
Fence:	$2\frac{3}{8} \times 21\frac{1}{4}$" (max.), aluminum, wood
Dust port:	Standard $2\frac{1}{2}$"
Table height (with base):	$33\frac{3}{4}$"
Price:	\$280 (complete, as shown).

Hartville/Hart Design Router Table System

This classy system includes a conventional 1x24x32" plastic laminated MDF top (no miter slot), a one-piece extruded aluminum fence (with dust port and finger guard), a sturdy steel cabinet with a built-in remote switch, and a pull-out shelf that holds 40 router bits.

The table sports a phenolic plate with a removable plastic insert and leveling screws. The fence accepts shop-made wood subfences, as well as feather boards, stops, hold-down clamps, and the Incra Jig, all available from Hartville. The company also offers fold-down extension wings for the table (to extend the overall length to 68"), and a sturdy roller base for the cabinet. You can also buy all of the above-mentioned items separately. Also, if you don't want to pay the price for the steel cabinet, Hartville also sells the same table and fence setup with a steel leg set for about \$130 less than the cabinet version.

Table size:	24x32x1 1/4"
Table material:	Plastic-laminated MDF, plastic T-edging
Mounting plate:	3/4 x 7 3/4 x 11", phenolic
Fence:	3x24", aluminum
Dust port:	Standard 2 1/2"
Table height (with base):	34 3/4"
Price:	\$349 (complete); top only, \$79.95; fence, \$89.95; cabinet base, \$199.



RBI Router Table Model 1830

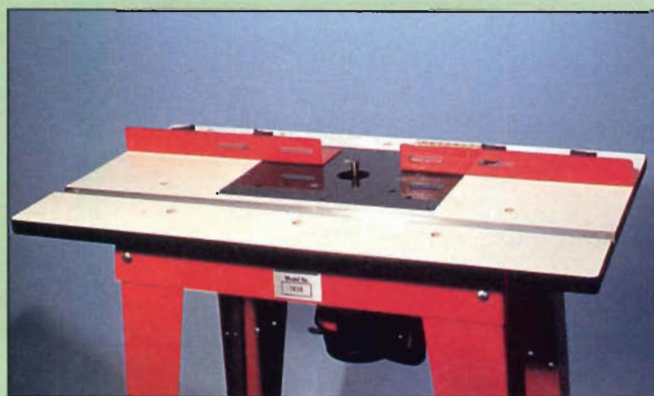
Here's a complete basic setup—top, fence, and leg set—at a decent price. While the tabletop isn't as big or thick as the others, it does have a 3/4" aluminum miter-gauge track and plastic T-edging. The black acrylic mounting plate has a 1 1/4" center hole, but there are no plastic inserts available for it.

The individually adjustable split fence segments have slotted holes in the base for offsetting the outfeed fence for jointing work. Slotted holes in the face accept shop-made wooden subfences that you can adjust laterally to provide maximum support for various bit sizes. There's no bit guard, so I'd suggest picking one up from another company and retrofitting it to a shop-built wooden subfence.

I found it inconvenient to detach the fences from the table in order to remove the mounting plate, although this takes less than a minute to do. While the thinner 3/4" MDF table could possibly sag if used with heavier routers, the heavy-gauge steel base seems to provide ample support for it. At any rate, the table remained flat during my tests.

The leg set for this table includes adjustable rubber feet. RBI also offers as options a miter gauge, a variable-angle attachment (for the gauge), and a dust-collection port.

Table size:	3/4 x 18 x 30"
Table material:	Plastic-laminated MDF, plastic T-edging
Mounting plate:	3/8 x 9 1/2 x 12", acrylic
Fence:	1 1/2 x 12 3/4" (each section)
Dust port:	Optional
Table height (with base):	34"
Price:	\$179 (complete).



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Rousseau RM 3300

The Rousseau stands apart from the rest of the tables in this review for two reasons. First, it has a folding stand that offers two height settings—34 1/2" and 36". When not in use, the table and stand fold flat (somewhat like a TV tray but sturdier) for storage or transport.

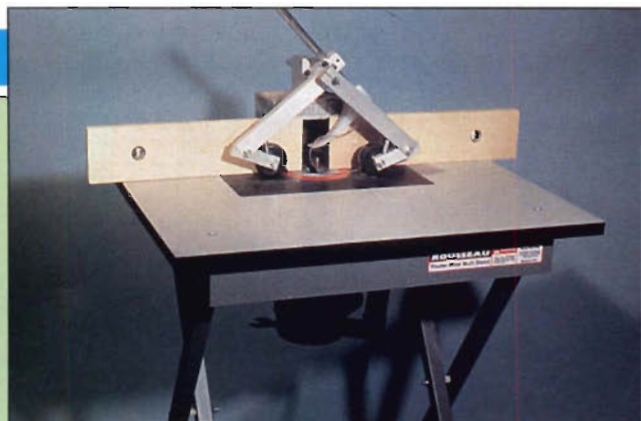
Second, the Rousseau uses a spring-loaded roller hold-down system on the fence. It looks complicated but works exceptionally well. You can set the outboard wheel up to 4" away from the fence for routing wide stock. In my tests, the wheels did a good job of holding the stock on the table and against the fence.

This device has a clear plastic swing-up guard and a separate hold-down foot that applies downward pressure close to the bit for routing thin or narrow stock. Rousseau also sells the setup or fence without the hold-down, substituting a simple swing-up bit guard.

The table uses a solid cast-aluminum fence with split plywood subfences that move independently. The fence includes a bit enclosure with a removable tempered hardboard cover that you can cut for a dust-collection port. However, Rousseau doesn't offer a port, so you'll need to procure one from another manufacturer.

The sturdy phenolic mounting plate comes with two plastic inserts, providing three opening diameters (1 1/4", 2 3/4", and 4"). The smaller insert accepts standard template bushings. Conveniently scribed concentric circles on the plate's underside make it easy to align round bases when drilling holes to mount a router.

The folding stand provided good support for routing smaller pieces, but I found it a bit tipsy when running larger stock through the table. The stand lacks leg levelers.



The company does offer a roller support set that attaches directly to the infeed and outfeed ends of the folding router table. These rollers can be extended up to 4 1/2 feet beyond each end of the table, providing extra table stability as well as stock support. Rousseau offers seven other models.

Table size:	3/4x20x24"
Table material:	Plastic-laminated MDF, plastic T-edging
Mounting plate:	1/4x9x12", phenolic
Fence:	24"; wood subfences: 13x3 1/4" (each segment)
Dust port:	None
Table height:	34 1/2", 36" (adjustable)
Price:	\$273 (setup as shown with hold-down); \$225 (without hold-down); optional roller supports (RM 2733), \$126.

Trendlines Deluxe Jumbo Precision Table

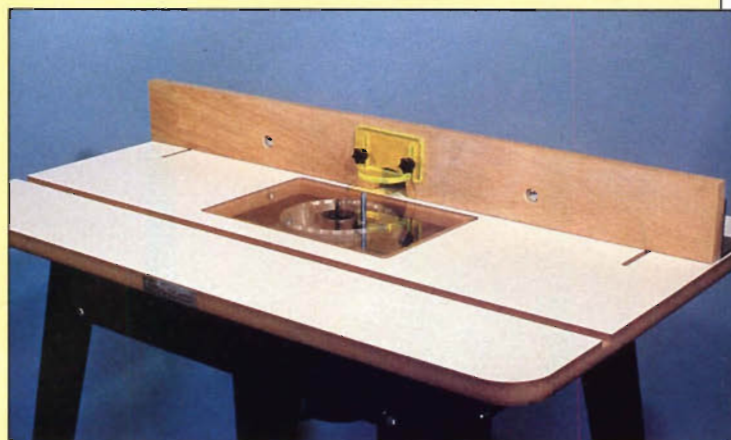
Size-wise, Trendlines offers a lot of table for the bucks, but at the expense of fewer refinements. The 24x36" MDF table has a thin melamine coating rather than plastic laminate, and the miter-gauge slot lacks an aluminum insert. The clear acrylic mounting plate, which has a 1 1/4"-diameter opening, comes with no plastic inserts or leveling screws.

The fence has a one-piece 3x3" aluminum angle faced with a continuous 1x3 3/8x36" hardwood subfence that mounts via 4"-long slots milled into the table. The subfence adjusts easily but has no offset capability.

Table size:	1x24x36"
Table material:	Melamine-coated MDF
Mounting plate:	3/8x7 1/4x11 3/4", acrylic
Fence:	3x3x36" aluminum angle, 1x3 3/8x36" wooden subfence.
Dust port:	Standard 2 1/2"
Table height:	33 1/2"
Price:	\$169.95.

The steel leg set seemed solid enough, but I suspect that the large table, if equipped with a heavy router, might sag over time. The stand has no leg levelers, but the leg bottoms are pre-drilled if you wish to add them.

The simple fence has a clear plastic bit guard and a 2 1/2" dust port. You'll have to rely on your ingenuity to attach other accessories to the wooden subfence. Trendlines does offer a horizontal wooden feather board for the miter-gauge slot and a miter gauge with an integral hold-down clamp (shown in photo C on page 74). Both worked well in my tests.



Vermont American Router Table Model 23469

This otherwise complete, bargain-priced basic table lacks a few features and options. The MDF tabletop, which is coated with melamine rather than plastic laminate, has sharp edges and a thin laminate edge strip. The one-piece fence curiously mounts from front to back rather than from side to side.

The fence doesn't offset for jointing, nor does the large 3½" bit opening in the melamine-coated MDF subfence provide close support for small-diameter bits. However, the fence does come with a clear plastic bit guard and a 2½" dust port. It also clamps easily to each end of the table for a full range of travel across it.

The mounting plate also consists of melamine-coated MDF but appears to be rigid enough to support heavy routers. The plate has no leveling screws, but you do get a set of three plastic inserts that will accommodate various bit sizes.

The steel leg set took considerable time to assemble but provides excellent support for the table. The legs don't have adjustable feet, although rubber end caps do help prevent scuffing and vibration.

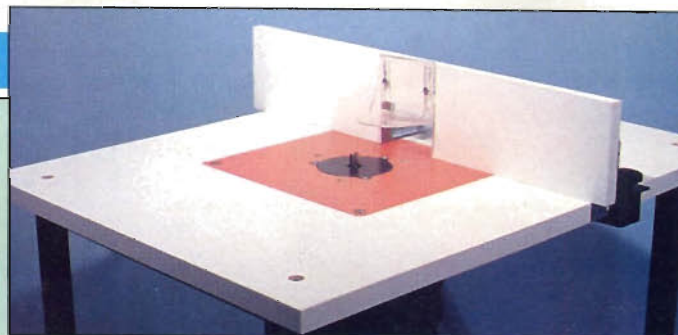


Table size:	1x24x32"
Table material:	Melamine-coated MDF
Mounting plate:	⅞x11x12", melamine/MDF
Fence:	3x3x26" aluminum angle; 5x26" melamine/MDF subfence
Dust port:	Standard 2½"
Table height:	35"
Price:	\$190.

Woodhaven Table No. 172HD and Fence No. 202

Woodhaven offers the widest selection of router tables and accessories on the market. You can buy eight differently dimensioned tabletops with your choice of centered or offset mounting plate cutouts, clear acrylic or black phenolic plates, and a variety of center hole diameters.

The company also makes two tabletop extensions, both of which will also fit most standard tablesaws and one of which fits a drill press. Accessories include five different fences, a fence upgrade kit, hold-downs, stops, feather boards, a fence adjuster, vacuum adapters, guards, push blocks, template guide bushings, a folding leg set, cabinet plans, and a slew of jigs and fixtures—too many to list here. (For more information, see the firm's catalog.)

I called in Woodhaven's 24x32" centered-plate table (no. 172HD); 33" one-piece fence (no. 202) with integral bit guard, dust-collection attachment, and wood subfence, and the hardwood leg set (no. 301). Company reps report this to be their most popular basic setup for home shops.

This fence has no lateral adjustment or offset capability, but you can buy offset wooden fence faces for the 3x3" angle bracket. The plastic-laminated MDF table uses a unique leveling system that consists of four adjustable plastic bars attached to the opening. The firm offers aluminum miter-gauge tracks and a fence-mounted sliding push-block fixture that takes the place of the miter gauge.

I found the table, fence, and leg set as sturdy as any. To this starter set you can add the dozens of Woodhaven accessories available for it.



Table size:	1½x24x32"
Table material:	Plastic-laminated MDF, plastic T-edging
Mounting plate:	9¼x11¼x38", phenolic
Fence:	3x33", 3x3" aluminum angle with ¼"-thick hardwood/plywood subfence
Dust port:	Standard 2½"
Table height:	37½"
Prices:	Table, \$116.99; fence, \$79.99; leg set, \$99.99.

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Bench Oscillating Spindle Sander, model 31-780, about \$210. Delta International Machinery Corp., 800/438-2486.

Fingernail Gouge Jig Makes Grinding Turning Tools Easy

A new jig designed for the Tormek water-cooled grinding system makes sharpening gouges with the "fingernail" profile a no-sweat operation.

To use it, simply slide the jig with its hinged tool clamp onto the Tormek's universal tool bar, lock in

Tormek Fingernail Gouge Jig

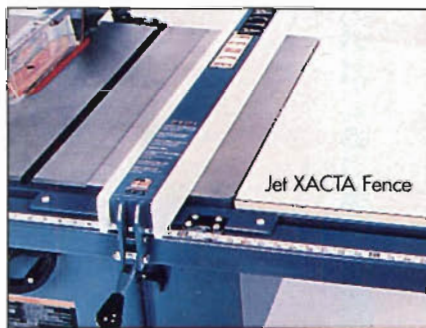


PRODUCT NEWS

the gouge, and adjust the jig for bevel angle and bevel length. With this setup, you can pivot the gouge against the grinding wheel, eliminating a very difficult free-hand grind.

The jig accepts cutting tools up to 1" in diameter. You can select and grind the exact cutting-edge angle and side-edge length you want. Once set, it will regrind to the exact same setting every time or until changed. The jig fits Tormek SuperGrind models 2004 and 1204.

Fingernail Gouge Jig, model SVD-180, about \$55. Tormek, 800/586-7635.



Jet Offers XACTA™ Fence For Tablesaws

T-square-style rip fences continue to gain in popularity, and manufacturers continue to add features and enhancements. As part of that trend, Jet Equipment & Tools recently introduced the new XACTA

fence system for its 10" tablesaws, replacing the fence previously supplied by Biesemeyer.

The new Jet fence system will be available in a 30" version (30" ripping capacity) for home and small

wood shops and a 50" version for commercial users. Both units incorporate a welded-steel fence and rail system that installs easily and quickly on a number of saws without requiring additional mounting holes.

A unique feature of the new XACTA fence is the use of replaceable high-density polyethylene (HDPE) panels for the face of the fence. These help reduce friction and resist abrasion. The steel rail and fence parts have powder-coated paint and the rest of the hardware is made of stainless steel or brass to resist rust and corrosion.

The XACTA 30 will come standard on Jet's contractor's saw, and the XACTA 50 will be offered on the firm's JTAS-10 cabinet saw.

Purchased separately, the smaller version will retail for under \$300, the XACTA 50 for about \$329.

XACTA Fence. Jet Equipment & Tools, 800/274-6848.

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Black & Decker is making random-orbit sander technology available and affordable to almost everyone with its 5" unit (RO100) priced at under \$50.

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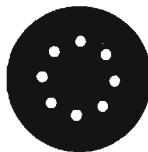
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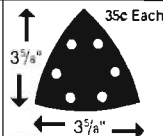


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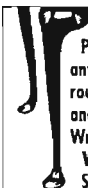
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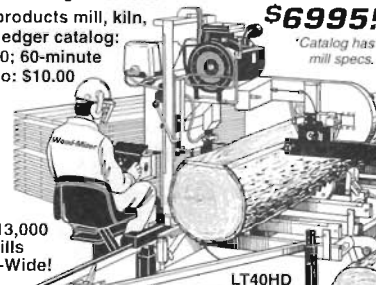


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