Biscuit Joining Alternatives • Shoptest: Delta Contractor's Saw II • Angled Jointer Fence

WOODWORKER'S JOURNAL

Vol. 20, No. 3 May/June 1996

20th Anniversary

NEW FROM THE SOUTHWEST

Pueblo Day Bed

Page 38

Projects...

- Chippendale Foot Stool
- Contemporary Hall Table
- Display Case
- Toy Steam Roller

Tool Review

Fractional Calculators

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Sale prices good thru 6/30/96.

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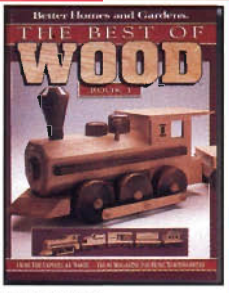

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ALL PURPOSE RIP & CROSSCUT

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12"X40TX1"	$183	$129	$116	$103
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Outperformed 36 other premium blades, both foreign and domestic!
WOOD® Magazine test, Sept. '93, pg. 45

The Proof Is In the Cutting

Both Woodworker II blades performed very well, whether cutting through butter-soft ¾"-thick pine or iron-hard 1¾"-thick ash. The 20° positive hook angle and 15° alternate top bevels give the blades an aggressive attack; we maintained a brisk, uniform feed rate while ripping a variety of woods on the powerful Unisaw and experienced no discernible resistance or slowing. On the smaller saws, switching to the thin-kerf blade allowed very similiar feed rates, again with barely noticeable resistance.

Although we've used blades that cut faster, their cut quality couldn't touch what we got with the Forrest blades. On solid stock, ripped edges came off our saws jointer-finished, smooth and slick with no visible teeth marks—good enough to edge-glue without additional machining. Crosscuts came out crisp and clean with no fuzzing or tiny splintering.

The Bottom Line

Performance of the Woodworker II is impressive enough that you could bolt this versatile, general-purpose blade on your saw and use it for virtually all of your cutting operations.

SHOP TEST, Woodworker's Journal Nov./Dec. '95 pg.78

CHOPMASTER FOR SLIDING COMPOUNDS & MITER SAWS

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	LIST	SALE
Delta Sidekick 6-1/2"x40Tx5/8"	$149	$ 89
Sears 8-1/4" & Delta 8-1/4"x60Tx5/8"	$170	$ 99
Hitachi 8-1/2"x60Tx5/8"	$179	$109
DeWalt 8-1/2" & Ryobi 8-1/2"x60Tx5/8"	$179	$109
Delta 9"x80Tx5/8"	$204	$119
Ryobi–Makita & all 10"x80Tx5/8	$207	$129
DeWalt, Makita, B&D, Hitachi 12"x80Tx1	$229	$139
Ryobi–Makita 14"x100Tx1"	$266	$179
Hitachi 15"x100Tx1"	$277	$189

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

WOODWORKER I – CROSSCUT For TABLE and RADIAL SAW

	LIST	SALE
12"x60Tx1" or 5/8" 1/8"K	$198	$139
10"x60Tx5/8" 3/32"K	$162	$129
8"x60Tx5/8" 3/32"K	$150	$109

OTHER SIZES AVAILABLE

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 hooks.

	LIST	SALE	10%	15%
6" D. 5/8" Bore NEW	$299	$269	$242	$229
8" D. 5/8" Bore	$321	$289	$260	$245
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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5/8" HOLES. Boring up to 1-1/4" $7.50 extra. Larger holes–time basis. Shipping $4.50.

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

SIZES AVAILABLE	LIST	SALE
7-1/4"x60Tx3/32" K	$149	$129
8"x80Tx1/8" & 3/32" K	$202	$169
9"x80Tx1/8" & 3/32" K	$207	$179
10"x80Tx1/8" & 3/32" K	$207	$159
12"x80Tx1-1/8" K	$212	$181

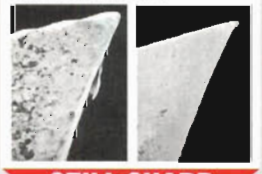
Other sizes available

Above 1" bore standard.

SPECIAL COMBO SALE EXTRA 10%-20% OFF

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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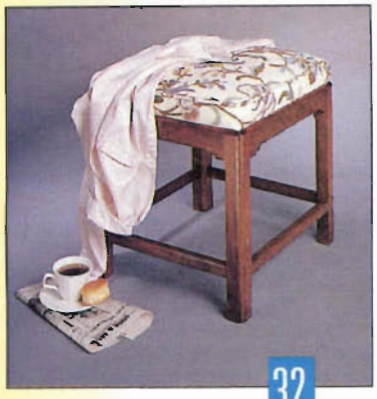
Woodworker's Journal

Vol. 20, No. 3 May/June 1996



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Lynxwiler Photography

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SHOP TALK

National champion English oak (*Quercus robur*) on the capitol grounds, Olympia, Washington (1994). Tree measures 178 inches in circumference, 102 feet tall, and has an 89-foot branch spread. Do you know where there's a larger one?

Yesterday, an interesting new book crossed my desk—which I couldn't put down. No, it wasn't a new projects book or even a new tool catalog. It was the *National Register of Big Trees* for 1996-97, published by American Forests. This directory lists the location and dimensions of the largest known tree of each species currently growing in the United States.

One entry that caught my eye was "General Sherman," the national champion giant sequoia in California's Sequoia National Park. This tree ranks as one of the oldest and largest living things on earth, towering 275 feet above the forest floor and estimated to be 2,600 years old. Another surprise: Florida currently claims 146 biggest trees—more than any other state. Unfortunately, Hurricane Andrew tarnished the Sunshine State's glory when it toppled 17 of its record-holders in 1992.

In all, the new *National Register* identifies 840 champion or co-champion trees, representing 704 different species. Five states now claim or share the 10 biggest of the big trees. Conifers account for nine of them.

California's megatrees include the giant sequoia, the coast redwood, the sugar pine, and the Monterey cypress. Washington takes credit for co-champion western red cedars and one of the co-champion Sitka spruces, in addition to the English oak shown *above*. Oregon has the other co-champion Sitka spruce, the coast Douglas fir, and the Port Orford cedar. Louisiana boasts the largest common bald cypress, and Ohio claims the only deciduous tree in the top ten of biggies–a 129-foot-tall sycamore that measures a whopping 582 inches in circumference.

American Forests, a national conservation organization, conducts the National Registry of Big Trees project with sponsorship help from the Davey Tree Expert Company. To obtain a copy of the *Register*, send $7.95 to American Forests at P.O. Box 2000, Washington, DC 20013, or telephone 202/667-3300.

American Forests relies on interested citizens to find and nominate champion tree candidates. If you'd like to become a big-tree hunter, the organization will provide the information you need to get started. Believe it or not, one individual, Paul W. Thompson, nominated 65 of Michigan's 75 champion trees.

On the home front, we congratulate our technical illustrator, Dana Quiram, for winning the grand prize in a nationwide computer-assisted drafting (CAD) contest sponsored by a software company. To have a look at his winning entry, see the drawings for the Hunt Board project that appeared in our March/April '95 issue. The judges commented that "Dana's drawing and inset views very clearly explained the inner workings of the project and made a complex design look simple."

We're fortunate to have an illustrator of Dana's expertise on our team. We certainly appreciate his efforts in providing the helpful drawings that accompany our project instructions.

Photograph: Albin P. Dearing, Davey Tree Expert Co.

Charles Sommers

WOODWORKER'S JOURNAL

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Woodworker's Journal
PJS Publications, Inc.
2 News Plaza, Box 1790
Peoria, IL 61656

a K►III Communications company

Woodworker's Journal (ISSN 0199-1892) is published bimonthly in Jan./Feb., Mar./Apr., May/Jun., Jul./Aug., Sept./Oct., and Nov./Dec. by PJS Publications, Inc., P.O. Box 1790, Peoria, IL 61656. Telephone (309) 682-6626. Second-class postage paid at Peoria, IL and additional offices.

Subscription Rates: In the United States and its possessions—One year (6 issues): $19.98; two years (12 issues): $33.90. Canada—One year: $29.91 (U.S. funds), includes 7% GST; two years: $53.40 (U.S. funds) includes 7% GST. Foreign countries—One year: $27.95 (U.S. funds); two years: $49.90 (U.S. funds).

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READER LETTERS

Jane Ingram's Mail Truck Bank (Nov./Dec. '95) gave me the idea for this police paddy wagon. The only supply costs were for the spoked wheels and 99-cent child's earrings for the hood ornament. I enjoy your magazine and look forward to each issue.

Larry "Benny" Siefert
New Ulm, Minn.

I finished this end table (featured in your Sept./Oct. '85 issue) in time for the Scottsbluff county fair and was awarded the Reserve Grand Champion ribbon for my efforts. The measurements, drawings, and instructions were excellent and easy to follow. The only change I made was to use walnut instead of mahogany. Thank you for a fine magazine.

Leo L. Phillip
Scottsbluff, Neb.

As a user of liquid polyurethane adhesives since 1987, I can appreciate Mr. Peter Holt's comments (Jan./Feb. '96) about their "growth" or foam-out. First, with a little practice, you'll soon learn the right amount of glue for each application. When foam-out does occur, I cut the dried glue bead from both sides with a snap-off blade knife. Most of the bead can then be removed, leaving very little to be scraped or sanded. When scraping is needed, it's best to use the backside of a chisel held at a 30-45° angle to the work. Pull the tool parallel to the glue line, sand lightly, and the surfaces should be ready for finishing. For best results, water-dampen gluing surfaces even if they test out within the recommended 8-20% moisture content.

Sammy Mayeux
The AmBel Corporation
(distributors of EXCEL polyurethane glue)
800/779-3935

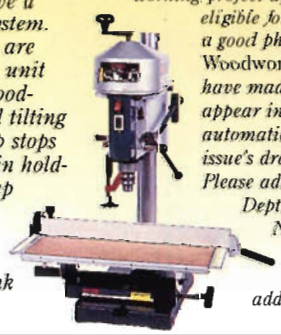
[Editor's note: See also Bob Colpetzer's Shoptest of polyurethane glues in the May/June '95 WJ.]

My wife had me searching out plans to make a gossip bench for some time. To her surprise, we found exactly what she wanted in your July/Aug. '93 issue. I've been a subscriber for many years—keep up the good work!

Seymour Seigel
Rochester, N.Y.

Tool Award

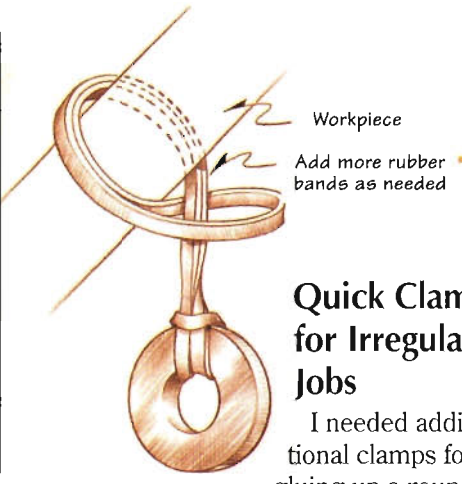
For sending a photograph of his project, Larry "Benny" Siefert will receive a free Ryobi 18½" wood drilling system. Unlike most drill presses, which are designed for metal-working, this unit was developed specifically for woodworkers. It features an oversized tilting table, a scaled rip fence with flip stops for repetitive holes, and a built-in hold-down clamp. The head cranks up and down the column and swivels 180° to allow floor-drilling capability. No more belt switching: instead, you 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 photo and 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.*

SHOP TIPS



Quick Clamp for Irregular Jobs

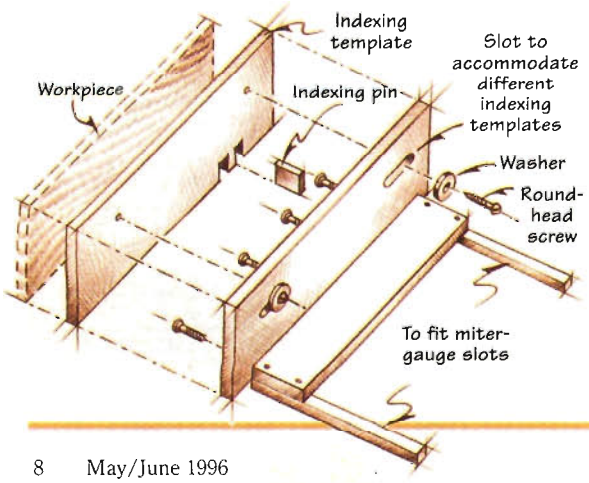
I needed additional clamps for gluing up a round project and came up with this idea. All you need is a rubber band and a washer. Affix the rubber band to the washer as shown. Wrap the rubber band around the object to be clamped and stretch the loop over the washer. That's it! I link rubber bands together as needed to fit my workpiece, and also use these clamps to keep electrical cords tidy.

George Mathis
Grosse Isle, Mich.

Let Your Miter Gauge Be Free

I don't like to tie up my tablesaw miter gauge with box-joint jigs. So, I've made this basic frame with hardwood runners sized to fit my saw's two miter-gauge slots. I simply attach jigs for various joint widths to this carrier frame as needed.

Robert Davis
Snellville, Ga.



Pantyhose Pre-Filter Saves Shop Vac Power

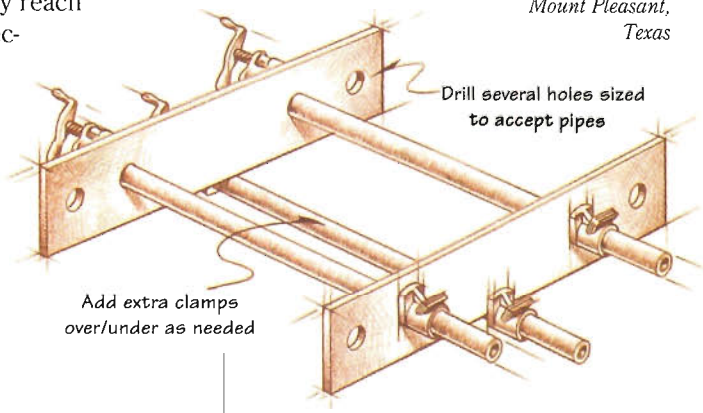
A pair of old pantyhose saves me aggravation and helps me get the most from my shop vac. I cut off enough of one leg to make a pre-filter, tie a knot to close one end, then slip it over the vac's filter cartridge. This stops all but the finest dust and shavings before they reach the filter. It's so effective that I have maximum suction until the canister is packed full. (One pair of hose is enough to make several pre-filters.)

Chuck Kubin
Denver, Colo.

Sure Cure For Clamp Block Fallout

When I edge-glue boards using pipe clamps, clamping blocks have a way of falling out at just the wrong moment. To overcome this problem, I drill matched holes in two boards to accept two or more clamp pipes and position these boards between the clamp ends as shown. If you use this simple press on sawhorses, you can easily add clamps over or under as needed.

Luther A. Hill
Mount Pleasant, Texas



Best Tip Tool Winner

For submitting his shop tip, Luther A. Hill of Mount Pleasant, Texas, will receive the DeWalt 5" random-orbit palm sander (model DW423) shown at right. *This new sander incorporates the firm's unique variable-speed feature and patented Controlled Finishing System, designed to give more control over the sanding process. The unit uses a hook-and-loop pad, and its integrated dust collector will channel up to 80 percent of the sanding dust into the canister.*

To be eligible for a free tool or cash awards, 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.*

PRODUCT NEWS

Variable Speed Adds New Versatility and Control For Fast Stock Removal

When you need to remove a little stock fast, it's hard to beat a belt sander—and the features built into Bosch's newest model make the process easier, faster, and safer.

Powered by a 115-volt, double-insulated motor rated at 5 amps, the 3x21" Bosch 3270DVS incorporates a 3x5" platen that provides from 550 to 1,100 sanding feet per minute. The low-profile sander comes with a narrow dust bag and a detachable front handle for sanding in tight quarters. Its lever-action release permits quick belt changing, and there's a fine-adjustment knob for adjusting the belt track.

Optional gear includes a sanding stand, a sanding frame (which elevates the sander slightly to permit sanding of delicate materials), a sanding fence, and a hose adapter for vacuum dust collection.

Bosch 3270DVS 3x21" Belt Sander, about $179.00. S-B Power Tool Company, 312/286-7330.

Bosch 3270DVS
3x21" Belt Sander

Slide Compound Miter Saw Operates Like a Radial Saw

Initially designed and built for the construction trade, Delta's new 10" slide compound miter saw's (model 36-250) many bells and whistles will earn it a spot in a lot of woodworking shops. And, if you happen to be short on shop space, you'll really appreciate the unit's built-in stand and extra-long table extension, which don't require additional supports.

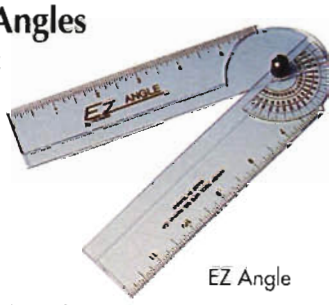
The saw's 13-amp, 5,000-rpm motor and 10" carbide-tipped 40-tooth ATB blade will slice through stock up to 3⅝" thick and 11½" wide at 90°, 3⅜x8" at 45° miter, and 2"-thick stock at 45° bevel. There's an electric brake for quick blade shutdown, a see-through retracting blade guard that covers the blade at all times, a dust-collection bag, and a workpiece clamp.

The one-piece, die-cast aluminum table rotates left and right and displays oversized numerals for easy reading. Quick-action miter locks replace the more traditional screw locks for setting the table at mitering positions. The motor head glides on linear ball-bearing guides that are mated to dual rods.

Sidekick 10" Slide Compound Miter Saw, model 36-250, suggested list: $696.00. Delta International Machinery, 800/438-2486.

Inexpensive Tool For Working Angles

Laying out angles on your next project will be a snap with the EZ Angle from Handy Tool.



EZ Angle

Made of polycarbonate plastic, this unique transparent ruler/protractor can measure and transfer any angle at either inside or outside position. Tightening a lock nut holds the protractor securely at any set angle. Fully opened, it becomes a standard 12"-long ruler and straightedge.

EZ Angle, $7.95. Handy Tool Mfg. Co., 800/257-7553.

New Vac Works In Your Shop and Yard

Sears calls its new 16-gallon Craftsman wet/dry detachable-blower unit a three-in-one shop and yard appliance. Its vacuum capabilities are obvious, but lift the 6-hp motor out of the housing, slip on the blower nozzle, and you have a portable 200-cfm blower ready to herd those grass clippings or fallen leaves just about anywhere you want them.

Craftsman 16-gal. Wet/Dry Vacuum

Numerous features help this vac do all of its jobs better. The 16-gallon drum, for example, has a built-in drain and automatic overflow shutoff for wet/dry operation. Its pleated paper filter can be washed and reused. The drum's molded handles, positive lid

Continued on page 12

FOR WOOD CARVERS, IT'S A POWERFUL TURN-ON

The Ryobi Detail Carver gives you hand-carved results with power tool speed. You get two speeds – high for fast stock removal, low for precision control – plus five different chisel profiles and a carrying case. All for under $70! So turn on the Ryobi Detail Carver. It'll return the favor.

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latch, and 5¼" rear wheels help make it extra mobile in the shop. And, you'll find that the 20-foot power cord and 7-foot non-collapsing hose extend its reach well beyond one's usual expectations.

Accessories include two 2½" extension wands, squeegees, blower nozzle, a diffuser, a caddy for storing accessories, and a 2½" male-to-male blower adapter.

Sears Craftsman 16-gallon Wet/Dry Blower Vacuum (model no. 17706), about $140.

Hitachi Adds 10" Model To Its Slide Compound Saw Line

Well known for its popular 8½" slide compound miter saw, Hitachi has gone the next step and recently introduced a 10" version of the saw, the C10FS.

Hitachi C10FS Slide Compound Saw

The new saw utilizes the firm's highly regarded two-rail slide system, which, according to Hitachi, maintains cutting accuracy on widths up to 12" at 90°, 8" at 45° miter position. It can also cut up to 4x4" at 90° and 45°. The miter turntable utilizes a front-mounted lock knob for one-hand adjusting and has positive right/left miter stops at 15°, 22.5°, 31.6°, 35.3°, and 45°. It also has positive stops for 0°, 30°, and 33.9° bevels. The new saw incorporates a unique adjustable chip guard that helps minimize wood tearout and splintering.

The saw's double-insulated 10-amp motor utilizes an electronic "constant speed" control to maintain constant rpm under load, an electric blade brake, and "soft start" circuitry to reduce startup noise and torque recoil.

Accessories available for the saw include a vise (clamp) assembly, a sliding fence, and a dust-collection bag.

Hitach 10" Slide Compound Saw, model C10FS, suggested list: $1,627.00. Hitachi Power Tools, 404/925-1774.

Oilless Air Nailer, Stapler

Low maintenance heads the features list for three new oilless nailers and staplers that Sears will introduce into its line of Craftsman pneumatic fasteners. The firm claims that the new high-tech components used in these air-powered guns do not require air-line oiling. The new models also incorporate new safety contact mechanisms to eliminate accidental discharge.

Useful for many jobs around the woodshop and home, the 2½-lb. brad nailer drives 18-gauge brad nails ⅜" to 1¼" long. Its side-loading, die-cast aluminum magazine holds up to 100 brads per load.

The crown staplers, available in both ¼" and ½" versions, shoot ¼"x18-gauge or ½"x20-gauge crown staples ½" to ⅞" long. The magazines hold 100 staples per load.

All guns can be run off compressors with air output of 3.2 SCFM at 60 to 100 psi. The slim, single-piece nose used on these units was designed to minimize jamming and to provide more precise nail/staple placement.

Craftsman Brad Nailer no. 18309, $100; ¼" Crown Stapler no. 18306, and ½" Crown Stapler no. 18308, $90 each.

Craftsman Oilless Air Nailer

Bosch Drill/Drivers

New T-Handle Drill/Drivers Offer Cordless Power and Comfort

User preference aside, Bosch reports that the handle design on these two new ⅜" cordless drill/drivers distributes their weight for better control with less fatigue of the hands and wrists. That's because the T-shaped handles center under the tool, and the semi-oval handle conforms to the natural contours of the hand.

The 9.6-volt B2110K provides 175 inch-lbs. of torque in two selectable speed ranges—0 to 350 rpm and 0 to 1,000 rpm. The 12-volt B2310K offers 225 inch-lbs. of torque in two speed ranges—0 to 400 rpm and 0 to 1,200 rpm.

Both drills feature a 16-position clutch and a pair of 1.7 amp-hour high-endurance batteries that recharge in one hour. According to Bosch, these batteries provide 30 percent more run time than previous versions, and they do not have recharge memory problems. In addition, the motors utilize special brushes that never need replacing.

You'll find the drills sold with two batteries, a recharger, and a carrying case. Both models carry a one-year warranty, a 90-day money-back guarantee, and a one-year service protection plan.

Bosch 9.6-volt model B2110K, about $190.00; 12-volt model B2310K, about $205.00. S-B Power Tool Co., 312/286-7330.

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#773-085	3/4" (5K)	~~$8.99~~	$7.29
#773-093	1" (5K)	~~$9.99~~	$8.64
#773-127	1 3/4" (5K)	~~$13.99~~	$11.49
#773-101	1 1/4" (5K)	~~$10.99~~	$9.59
#773-119	1 1/2" (5K)	~~$11.99~~	$10.99
#772-135	2" (5K)	~~$16.99~~	$14.99

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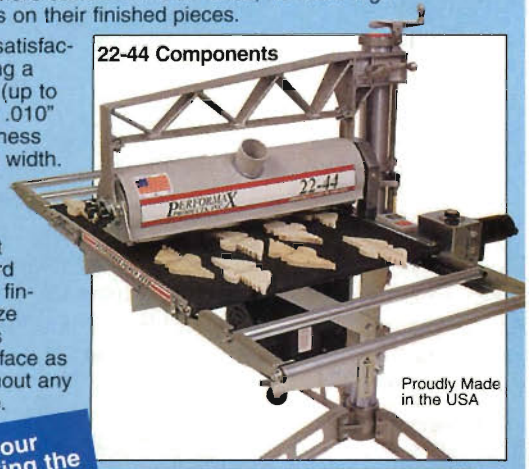

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READERS' INFORMATION EXCHANGE

I've recently acquired a scrollsaw marked "Atlas Woodworker's Shop." No other identifying marks are legible. It is belt-driven, about 16" in the throat. It came with one 4" blade. I would appreciate any information about this tool and a source of 4" blades.

Edward C. McDaniels
22 Chaffee Ave.
Albertson, NY 11507-1808
516/742-8772

I'm looking for a copy of the manual for an 8" Craftsman radial arm saw, model no. 103.29310. (I'll pay for copying and postage.) I also need a Portalign shaper slotting bit, no. 261-SLT, to complete my set. If you have such a bit or the current address for Portalign Tool Co., I'd appreciate hearing from you.

Roger D. Stone
P.O. Box 363
Wolfe City, TX 75496-0363

I have an old Sears three-wheel benchtop bandsaw (made by King Safety Corp.), model no. 103.24300. I will pay copying and shipping costs for the owner's manual and parts list.

Maurice D. Andal
P.O. Box 1088
Carnation, WA 98014

I'd like to purchase old copies of *Woodworker's Journal* (vol. 1, no. 1, through vol. 8, no. 3). I'll pay shipping and handling as well.

William F. Brown
RD 2, Box 244
Lowville, NY 13367
315/376-4277

I have three cartridge filters (no. 91709) for a Sears wet/dry vac. I will give them to the first person who requests them.

Charles Stewart
3309 Camden Dr.
Longmont, CO 80503

I've recently acquired a 24" Craftsman scrollsaw/benchsaw, model no. 103.0404. I'd like to find an owner's manual and any other information for this tool.

William Skotnicki
718 Pennsylvania Ave.
Bridgeport, WV 26330-1254
304/842-7586

After almost 50 years of woodworking, it's become necessary for me to retire. I have an extensive collection of woodworking magazines (including *Woodworker's Journal* back to 1981 and other titles), and over 100 woodworking books, including some from England. Send SASE for my four-page list.

Lionel Kay
75 Hewlett Ave.
Point Lookout, NY 11569

I would like an owner's manual for my old drill press, and especially need information on the motor mounting parts. The machine is from the Patterson Tool and Supply Co. of Dayton, Ohio, model no. 24.

Lonnie F. Bond
1976 Morgan Valley Rd.
Rockmount, GA 30153

Looking for an owner's manual or a scarce part for a tool? If you need to find a source, ask *Woodworker's Journal* readers. Send your request to: Readers' Information Exchange, Woodworker's Journal, PJS Publications, 2 News Plaza, Peoria, IL, 61656, and we'll list it here.

EZ Load Bandsaw Circle/Radius Cutter

A straightforward way to get a round

by Craig Moro

If you are a regular reader of *Woodworker's Journal,* you may have noticed several recent appearances by a new supporting actor in our cast of favorite workshop appliances—the EZ Load circle/radius cutter for the bandsaw. We've used it to make the circular parts for our Rosette Jig (Jan./Feb. '96), to cut the arched top of our Memorabilia Case (Mar./Apr. '96), and to machine other circular components for several recent projects.

Nothing Flimsy Here

This no-nonsense appliance fits most bandsaws that have a ¾"-wide, ⅜"-deep (or deeper) miter-gauge slot. A threaded steel rod runs through the tough ABS miter-slot lock rod to operate two opposed wedges. When the wedges expand, the EZ Load locks in position. To lock or release, you simply flip a solid, well-machined brass cam lever.

The adjustable tool can cut circles from 1" to 48" in diameter. To set the cutting radius, you simply move the extruded aluminum bar that carries the pivot point either toward or away from the saw blade. You tighten the bar in place with strategically located hex set screws.

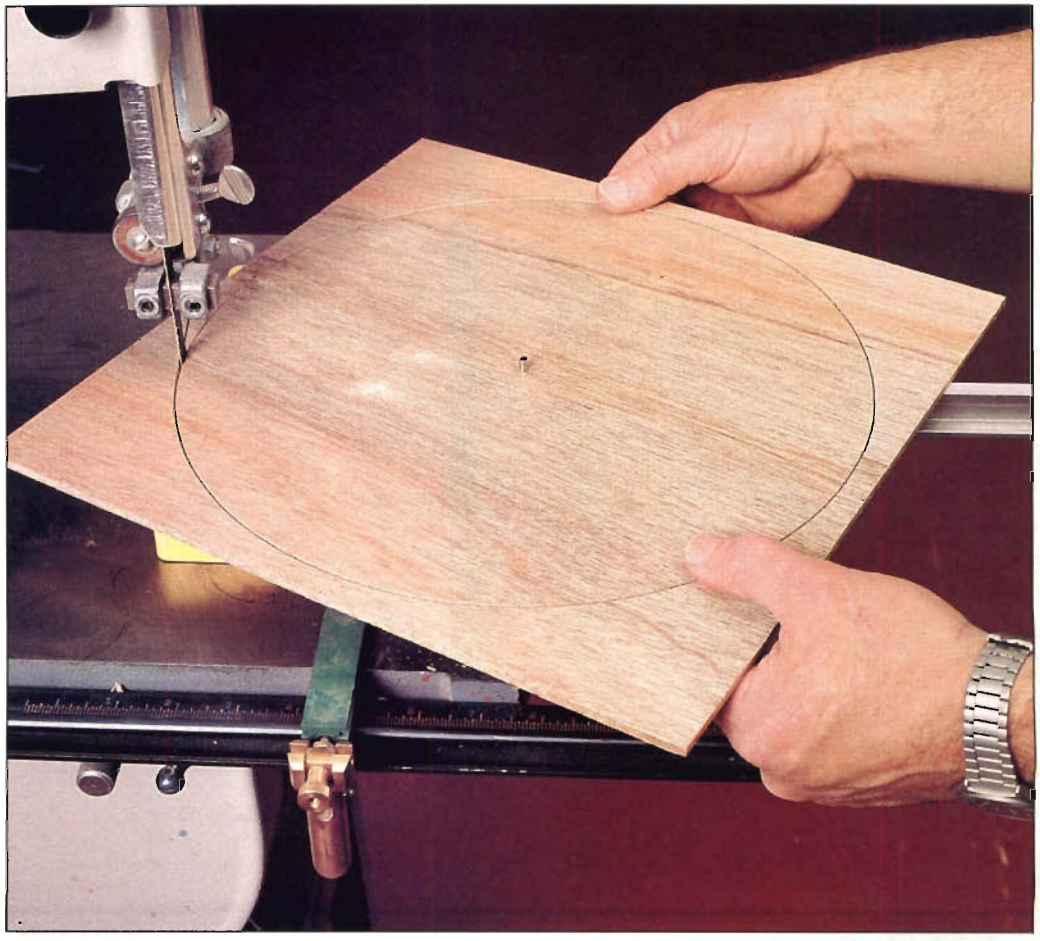
Note: It's easy to overtighten metal against plastic, even the tough, glass-filled ABS material used in the EZ Load. We cracked the underside of the appliance's yellow base by tightening a set screw too zealously.

Operating Basics

First, install the appropriate bandsaw blade for the circle radius you intend to cut. Next, align the circle cutter with your bandsaw blade—a simple procedure. Just loosen two socket flathead screws on the slider base with the hex wrench provided, slide the green miter-slot lock rod until the center of the pivot pin aligns with the leading edge of the saw blade, then retighten the screws. Once set, the alignment needs adjusting only if you change blades.

Next, set the cutting radius. To do this, screw the pivot pin into one of the holes in the radius bar. Then, slide the bar forward or backward to position the pin at a distance from the saw blade equal to the desired radius.

To cut thick materials, drill a pivot hole centered in the back of your workpiece (or carrier board, if your project requires one). The EZ Load includes 3/32"- and ¼"-diameter pivot



Cutting circles became an easy chore in our shop since we purchased the EZ Load bandsaw circle/radius cutter. The tool can cut 1"- to 48"-diameter circles quickly and easily, and it fits most bandsaws with a ¾"-wide and ⅜"-deep or deeper miter-gauge slot.

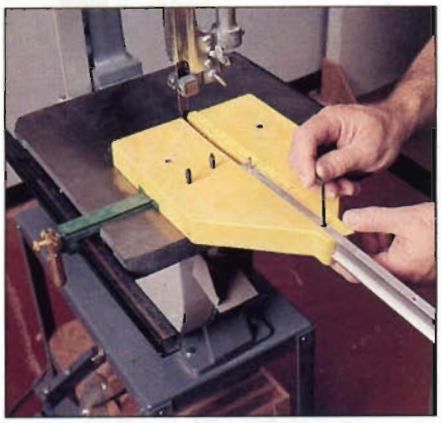


Photo A: After mounting the EZ Load on the bandsaw, you set pivot point to the correct radius (distance to blade), then lock it in place with a set screw. The unit comes with three pivot pins, which store in the radius bar.

pins plus a shallow pivot point for very thin materials. These parts store conveniently in the sliding pivot bar where they're always handy. (See *photo A.*) Now, place the workpiece on the pivot pin and the EZ Load in the miter-gauge slot.

To make the cut, turn on the bandsaw and slide the workpiece (and base) into the blade (making an entry cut) until the stop on the miter-slot bar engages the edge of the bandsaw table. Then, lock the appliance in place and slowly rotate your workpiece into the blade, feeding at an even rate until you've cut the complete circle (or desired portion thereof). Large or heavy pieces may require additional support, such as a roller stand or two.

Photo B: The EZ load also works on stationary disc sanders that have a ¾" miter-gauge slot. Secure it as you do to the bandsaw, position the workpiece against the sanding disc, turn on sander, and then rotate the workpiece.

Simple Adjustments For Dead-On Precision

We like the adjustability the EZ Load offers. It incorporates a self-adhesive measuring tape divided into 1/16" increments. The matte surface of the yellow table and the aluminum radius bar accept pencil marks for smaller fractional adjustments.

To make our Rosette Router Jig, we had to cut two concentric circles that differed in diameter by exactly one saw-kerf width. Precise adjustments like these pose no problem for the EZ Load.

Great For Disc Sanding, Too

The EZ Load works equally well with our stationary disc sander, which has a ¾" miter slot that accepts the tool's lock rod. (See *photo B.*)

To sand the edges of a bandsawn workpiece, move the EZ Load to the sander, place the lock rod in the miter slot, and lock it down. Then, adjust the radius bar until the edge of the workpiece barely touches the sanding disc, and tighten it. To sand the edge, turn on the sander and slowly rotate the workpiece as the sanding disc spins. Readjust the tool if necessary to produce a perfectly sanded disc with smooth, square edges. WJ

Photographs: Kevin May

SOURCE

EZ Load Bandsaw Circle/ Radius Cutter. Fits ¾"-wide, ⅜"-deep or deeper miter slots; cuts 1"- to 48"-diameter circles. Catalog no. 878-582. Price: $49.95 plus s/h. Order from:

Woodworker's Supply
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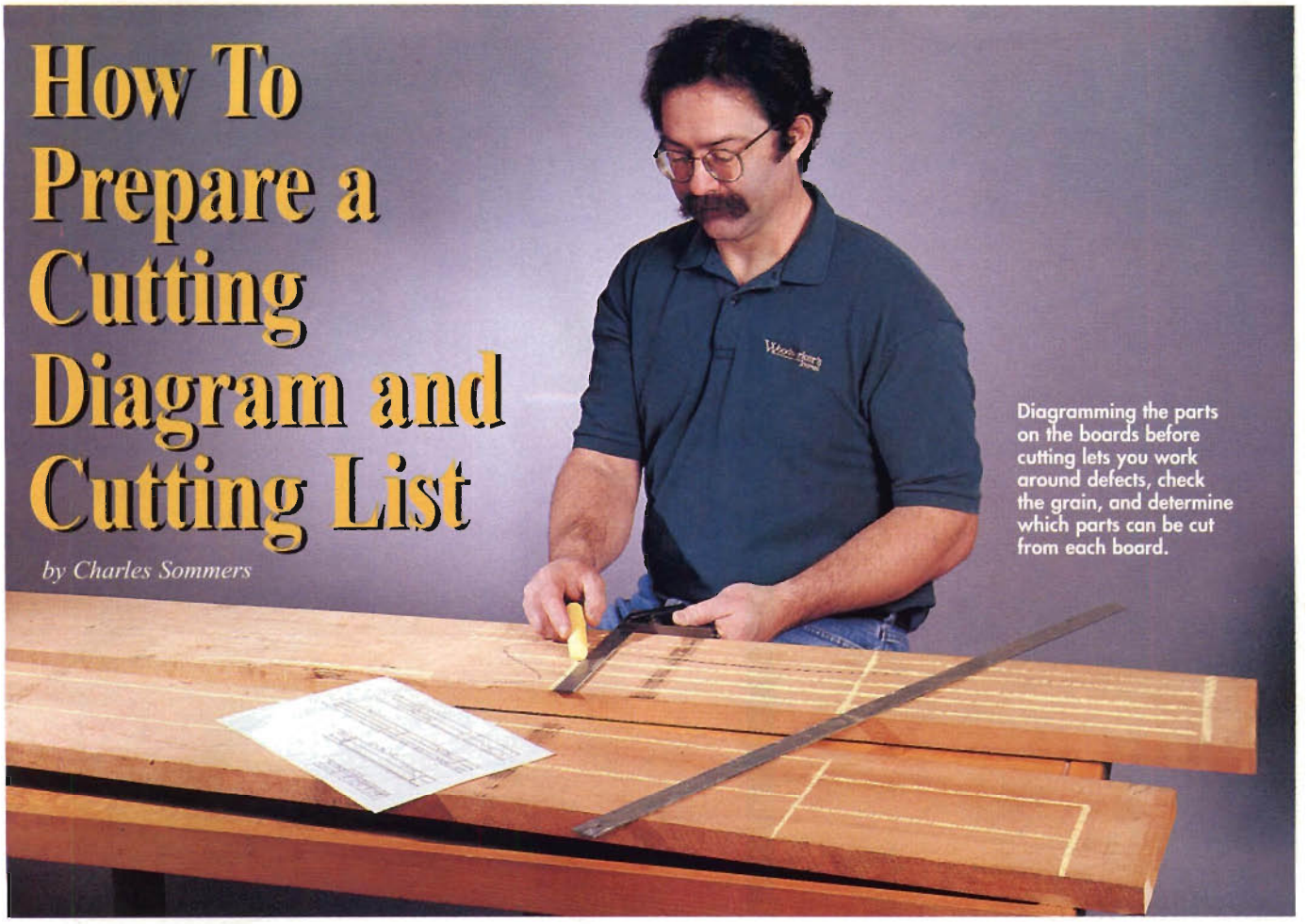
From plan to rough-cut parts in four easy steps

How To Prepare a Cutting Diagram and Cutting List

by Charles Sommers



Diagramming the parts on the boards before cutting lets you work around defects, check the grain, and determine which parts can be cut from each board.

For small or simple projects with few parts, we can usually visualize in our heads just how we'll cut the parts from the stock. However, as projects gaining complexity, and with costly lumber at stake, we don't want to make mistakes. To avoid problems, reach for a piece of paper and a pencil before you reach for the tablesaw switch.

Step One: Sort Parts By Thickness

If you're building a project from *Woodworker's Journal*, start with the Bill of Materials. If the project came from another source, check and see if a materials list has been included. If not, you'll need to work directly from the drawings.

First, create a simple chart like the one shown in *table 1*. To do this, set up a separate column for each part thickness you find listed for the project. (In the example, I've listed thickness headings of ¾", ½", ⅜", and ¼".)

Next, read through the Bill of Materials line by line (or scan the drawings), then list the parts and indicate the number of each required under the appropriate thickness column. If a part must be cut from stock that is initially thicker than its finished thickness, list it under the thicker heading.

Step Two: Sort By Width

Using the Bill of Materials and the thickness list you just completed, compile a second list, but this time sort the entries in each thickness category by their width. As shown in *table 2*, I list the widest parts in each thickness category first and work toward the narrowest. As you make up this list, write down the part's complete dimensions including its length.

As we prepare the plans and instructions for *Woodworker's Journal* projects, we organize the construction steps to simplify cutting of the stock and assembly of the project. For example, we usually start by constructing the base or carcass parts first. Since these are usually the larger pieces, we're able to follow another basic rule of layout: Whenever possible, cut the big parts first.

In compiling this second table, you've reorganized the Bill of Materials into a list that you could take to the shop and use as your cutting guide. However, I often use it for the next step—planning exactly how I'll cut the pieces from each board by laying out a part-by-part cutting diagram *(figure 1)*.

Table 1—Thicknesses

¾"	½"	⅜"	¼"
A (8)	F (4)	G (4)	D (20)
B (4)	I (2)	H (4)	E (40)
C (2)			

Step Three: Diagram the Boards

To prepare a cutting diagram, first draw a rectangle to represent stock of each thickness needed. I prefer to draw these imaginary boards to scale on gridded drafting paper. For example, if a project requires 1⅛"-, ¾"-, and ⅜"-thick stock, I draw a separate board blank (rectangle) to represent each thickness. When all parts are laid out, I'll take these diagrams with me to the lumber dealer and use them as a guide for buying the boards I need. For many projects, I prefer to work with the narrowest boards I can get by with. They usually cost less per board foot, allow more flexibility when it comes to laying out, and generally yield fewer scraps and leftovers.

Softwood lumber comes in standarized widths and lengths. If that's what you'll be using, lay out the board blanks using those standard board dimensions. Hardwoods are sold in standard thicknesses but are not milled to standard widths or lengths—you take them as they come. To lay out a diagram for hardwoods, simply arrange the parts to fit the board dimensions that are most commonly available in the particular stock you're using. Then, try to buy boards that come close in dimension to what you actually need, allowing of course for saw kerfs and some wastage.

If you already have the lumber, draw the rectangles to the dimensions of those boards. If you intend to cut all parts, including those of different thicknesses, from the same board, group the parts of each required thickness together. This way you can cut away and plane each group of parts to its respective thickness and then cut the individual parts.

Using this second or cutting list, lay out (to scale) the widest and longest parts first, then the smaller ones. Again, I try to group as many parts of the same width together as I can in order to make use of common cut lines and thus make fewer cuts.

For *Woodworker's Journal* projects, read through the how-to instructions and notes carefully to determine if any parts require special handling procedures or operations. For example, we might, for safety reasons, specify that you start with a 12" length of stock even though the resulting finished part ends up considerably smaller. Or, we might instruct you to do certain machining operations on a large piece, then divide that piece into smaller parts afterwards. As a rule, don't attempt to work with small pieces on a saw, jointer, planer, or router unless absolutely unavoidable. If you can't find a way to avoid it, take extra precautions to safeguard yourself.

Table 2—Widths/Lengths

¾" thick	
A (8)	(¾x4x28¼")
C (2)	(¾x3½x35½")
B (4)	(¾x3x12¼")
½" thick	
F (4)	(½x3⅜x51½")
I (2)	(½x1⅞x30¼")
⅜" thick	
G (4)	(⅜x3¾x60")
H (4)	(⅜x3x10")
¼" thick	
D (20)	(¼x1x11¼")
E (40)	(¼x⅝x1½")

Using chalk or pencil, transfer your paper cutting diagrams onto the boards as we've done in the photo *opposite*. Sketch out each required part. By doing this, you'll find out whether you need to adjust for defects such as knots or checks. You can erase chalk easily and start over without damaging or wasting any stock. Laying out pieces on the actual boards also gives you a preview of color and grain, so you'll get a glimpse of what the project parts will look like before you cut them.

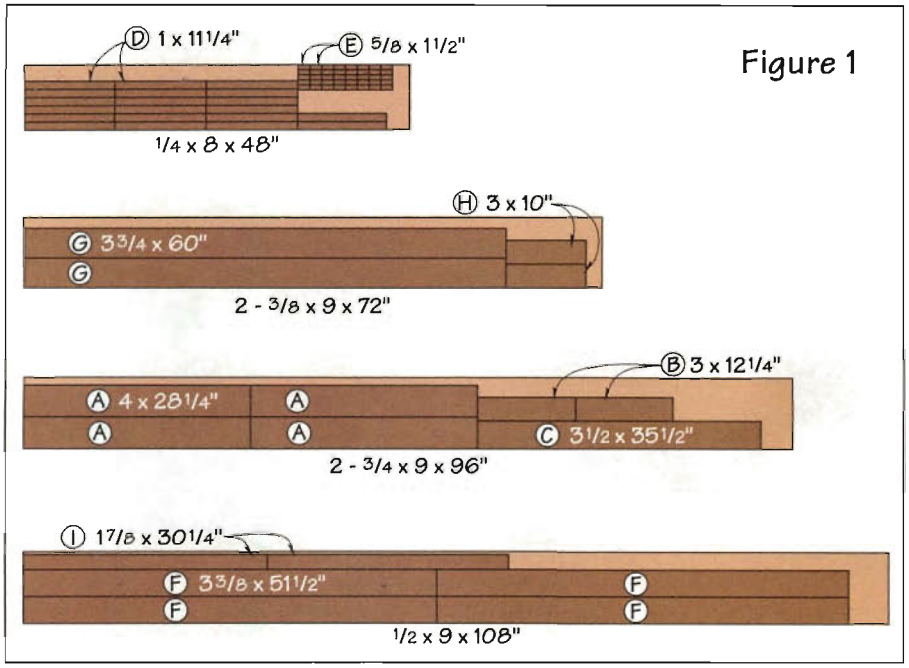


Figure 1

Step Four: Rough-Cut the Stock

Surface and square the stock, then recheck your layout. Next, rough-cut the boards along the key cut lines. I like to label the parts and mark where dadoes, grooves, joints, and other cuts will go. The marks don't have to be precise—just close enough to give you approximate locations so you can check for potential problems.

This is a good time to group pieces for certain subassemblies, especially if you're cutting them from different boards. Also, sort those that need planing or other additional machining. After you've taken care of these tasks, you're ready to make the finish cuts and proceed with the joinery.

Photograph: *StudioAlex*

For the Plate Joiner

Biscuit Alternatives

If you're looking for new applications—or just new solutions to old problems—take a closer look at these lesser-known biscuit offerings.

Have you ever set out to biscuit-join a picture frame or cabinet face frame, only to find that your plate joiner cuts too wide a slot? Or thought about edge-gluing a panel but worried that using multiple small biscuits might not give you good alignment? Have you avoided biscuiting because you wanted to have the option of disassembling the piece?

Well, worry no more. The current generation of specialized biscuits resolves these and other concerns you may have had about plate-joining. You're probably familiar with the now-common compressed beechwood biscuits; the #0, #10, and #20 plates have become standard fare for a lot of woodworkers *(photo A)*. But you probably haven't yet tried—or perhaps even heard of—the H-9, the S-6, the #11, or the Itty Bitty. For more specialized uses, there are also K-20 plastic clamping plates, Simplex KD

Specially designed joining plates increase the versatility of this popular joining technique.

(knock-down) plates, and Hafele/Knapp biscuit-type fasteners.

It Starts With a Slot

If you're not familiar with this technology, modern plate joiners use a 4"-diameter blade that cuts a 5/32"-wide slot. Adjustable stops on most machines limit the depth (and thus the length) of the oval slot cut into the workpiece. You preset the stops to fit the standard biscuit sizes.

The three common plate sizes mentioned above will work for most joinery applications. But eventually, you'll encounter situations that call for something other than conventional biscuits.

Wooden Biscuits Designed For Different Jobs

The largest conventional (football-shaped) wooden biscuit we've come across is the S-6, which measures a healthy 3⅜x1⅞2" (85x30mm). Rated as equivalent to four ⅜" dowels in strength, the S-6 is ideal for large-panel glue-ups, for stile-and-rail construction on larger frame and panel doors, and for similar jobs that require its unusual strength.

To install an S-6, you adjust the plate joiner's cutting depth to "Max" or "M," make the cut, then move the cutter laterally about ⅜" and plunge again. You can also form the slots using a 5/32"-thick, 1⅝"-diameter slot-cutting bit fitted with a ⅜" bearing and mounted in your router.

Another long biscuit, the #4, measures 2⅝x⅞". To cut the slot with a standard plate joiner, set the machine to "M" or maximum and make a single plunge.

The smallest wooden plate we've used, the H-9, measures just 1½x½". Only ⅛" thick, it's suitable for joining thinner stock such as you might use in a picture frame. To properly install an H-9, replace your standard cutter with a special H-9 cutter and set the joiner to cut ¼" deeper than the normal #20 plate setting.

Even smaller, Woodhaven's "Itty Bitty" oval biscuits *(photo B)* measure 13/16x19/32" (.590x .812"). We've used them to join narrow frames and other low-stress joints that are too small for standard-sized plates. They'll work in stock as narrow as 1" for 90° butt joints (¾" for miter joints) and as thin as ¼". These plates are made of hardboard, which doesn't swell like compressed beechwood when wetted with glue. You can increase their structural strength by stack-gluing two of them together. Woodhaven sells a 1" slotting cutter that forms the appropriate slot for these petite plates.

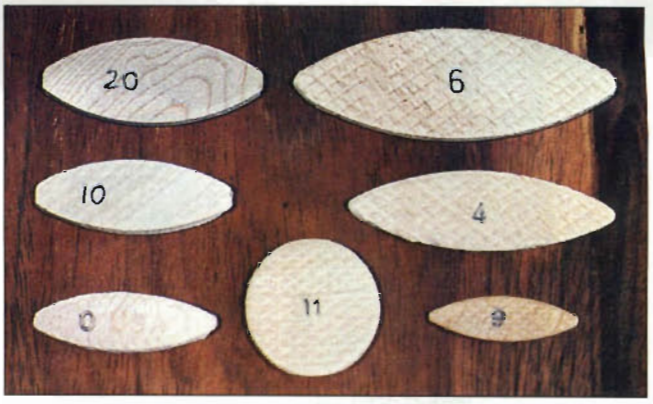


Photo A: Joining plates (biscuits) in common and less common sizes. Made of compressed beechwood, they swell slightly when wetted with glue. Surface is crosshatched; grain runs diagonally.

Photo B: Woodhaven makes its "Itty Bitty" biscuits from ⅛" hardboard. The firm also sells Baltic birch plywood plates sized to fit its slotting cutters.

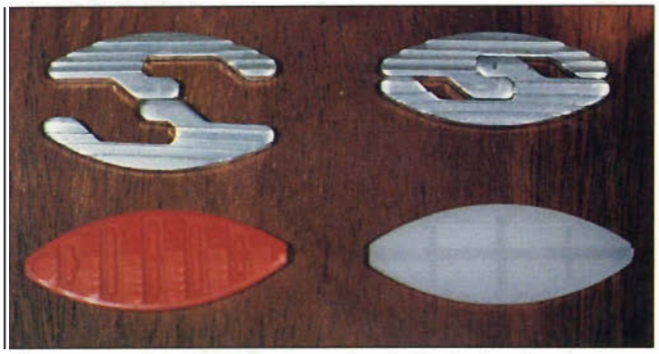


Photo C: Lamello's Simplex two-part detachable joining elements (top); the Lamello K-20 plastic clamping biscuit (lower left); and the Lamello C-20 biscuit (lower right).

If you don't want to buy a plate joiner, Woodhaven and several other firms offer an alternative system. The key item is a 1½"-diameter carbide-tipped slotting cutter that will work in stock as narrow as 1½" for 90° butt joints, 1 3/16" for miter joints. Instead of using the European-designed (standard-sized) biscuits, Woodhaven provides its own Baltic-birch plywood biscuits (also shown in photo B), which are sized (.230x.955x1.25") to fit the slot cut by the bit.

MLCS offers ¼"- and ½"-shank versions of a carbide-tipped slotting cutter that will cut slots (when fitted with the appropriate bearing) for #0, #10, #20, H-9, and S-6 biscuits. The firm's catalog includes a chart to help you match up the parts needed for the different biscuit/bit/bearing configurations.

MLCS also stocks the hard-to-find #11 round biscuits and a bit/bearing kit required to install them. This 1 7/16"-diameter biscuit will join pieces as narrow as 2" wide, and it works well for a wide variety of applications.

Metal and Plastic Biscuits For Special Applications

Here's where this tool departs from the conventional. Lamello's Simplex aluminum plates *(photo C)* provide detachable joining capability, making them ideal for use in projects such as knockdown furniture. You cut the slots with a standard plate joiner using the #10 setting. When these plates are pressed into the slots, the lengthwise grooves you see in the photo improve their adhesion in glue or epoxy. Installation requires a special insertion tool to align the two mating halves.

The red plastic K-20 clamping biscuit (also shown in photo C) doesn't require glue because the biscuit faces have barbed cross-ribs. Once they're installed, you can only remove them by destroying the slot. They're used most frequently in hard-to-clamp setups.

The milky-white C-20 plastic plate was developed to join man-made solid-surface plastics such as Corian, Surrel, and Avonite. This plate typically is not glued. If you wish to fix it permanently, use the bonding agents or cements recommended for the materials being joined.

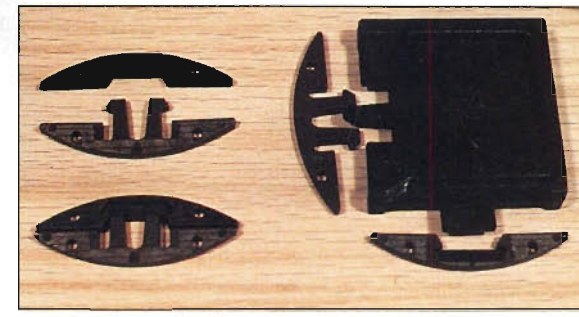


Photo D: The Hafele/Knapp two-piece snap-fitting connector shown separated, joined, and with factory-supplied insertion tool needed to ensure proper setting.

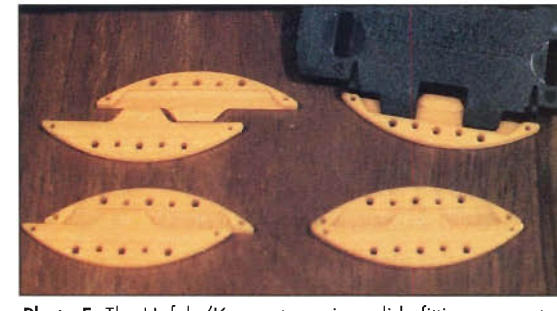


Photo E: The Hafele/Knapp two-piece slide-fitting connector shown separated, joined, and with insertion tool. This connector can be separated after installation.

The Hafele/Knapp snap-fitting and slide-fitting connectors are both two-piece biscuits *(photos D, E)*. Each has its own setting tool to ensure proper alignment and depth. The snap biscuits fit into a #10 slot; the slide-fitting connectors require a #20 slot. You can set both halves in either glue or epoxy, then snap or slide the two together.

To install the Lamello Paumelle hinges shown in the lead photo *(page 20)*, center the joiner's cutter on a joint or seam and use the #20 setting. You'll find the hinges sold in "left" and "right" configurations. Use them separately or mix types, depending on your hinging needs. WJ

Writer: Rob Cook
Lead photo: StudioAlex
Other photos: The author

SOURCES

The biscuits and cutters mentioned in the text are available from the following suppliers:

#0, #10, #20, H-9, C-20, Simplex, H-9 cutter:

Baer Supply Company
800/289-2237

Itty Bitty biscuits, Baltic birch plywood biscuits, slotting cutters:

Woodhaven
800/344-6657

#20, #10, #0, #11, #S-6, #H-9 biscuits, slotting cutters, and bearings:

MLCS
800/533-9298

Hafele/Knapp snap-fitting, slide-fitting connectors, insertion tools:

The Woodworkers' Store
800/279-4441

Lamello Simplex KD, K20, C20, #4, #S-6, #H-9, and Paumelle hinges:

Colonial Saw
909/390-5465, 617/585-9375

Selecting and Installing Cabinet Door Hinges

Planning Ahead Is Half the Battle

by Bob Colpetzer

Open a current issue of any respectable hardware catalog, and you'll find a bewildering array of hinge products. It's tough enough to figure out which type of hinge suits your purpose, let alone how to install it on your planned cabinet. The choices can be overwhelming—which may tempt you to put off choosing and obtaining the hinges until you're well into the project or maybe even have it completed.

Beware of this trap. Select your hinges (and all other hardware) as part of the initial project planning. Choosing the appropriate hardware has as much bearing on your ultimate success as the selection of wood, furniture style, and your construction/assembly techniques.

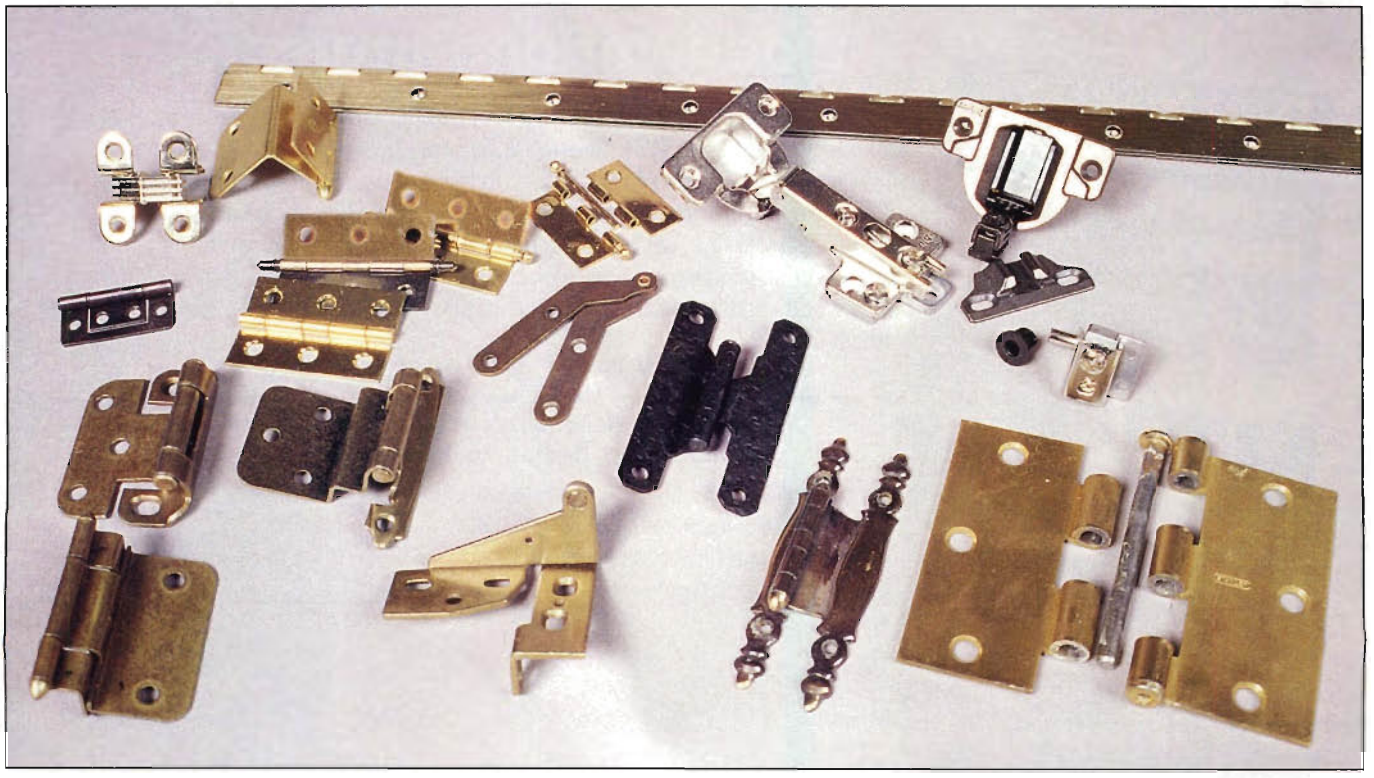
Nor should you leave the problem of installing hardware until later. For most hinge types (as well as drawer slides, catches, etc.), you'll need to pay attention to certain engineering and construction details in order to allow for proper installation. Waiting until assembly time to consider these matters can spell disaster—or, at the least, it can force you into using hinges that don't match the cabinet style or revamping the project to create a location for proper hinge mounting.

My goal here is to introduce you to the many types and styles of hinges, discuss which hinges work best for the various cabinet styles, and explain some installation procedures for the different types. Hopefully this will help demystify the selection of hinge products and make it easier to plan and execute a successful cabinet project.

Five Main Hinge Types

Hinges basically fall into five groups: butt, semi-concealed, surface-mounted, concealed, and European-style. You'll also come across some specialty hinges, but since most of them have been designed for applications other then cabinet doors, I won't go into detail about them.

To select the right hinges for the job, you need to first decide on the style of cabinet you plan to build and the configuration of its doors. Cabinet style comes down mostly to a choice of face-framed or lacking a face frame.



The profusion of hinge products offered in most current catalogs can be bewildering. But if you select the hardware during the preliminary planning stage, you'll have an easier time shopping for hinges and a better chance of executing a successful cabinet.

As for the doors, they can fit flush within the opening or have a lip; they can be back-beveled, full overlay, or half-overlay (also called "reveal").

Once you've figured out the combination of cabinet and door you want to build, consult the charts at *right* to determine the hinge type(s) that will work for your combination of cabinet/door styles. Then, decide which hinge type best suits the cabinet's purpose and its furniture style.

Butt Hinges. You'll find butt hinges *(photo A)* used mostly on flush-mounted doors and sometimes on full overlay doors. They come in a variety of widths and lengths. Unless otherwise specified in the catalog, the measurements given are applied to the hinge as shown in *figure 1.*

Butt hinges come with either loose or fixed pins. With loose pins, the two leaves of the hinges can be separated by simply pulling the pin from the barrel of the hinge *(photo B)*. With loose-pin hinges, a hung door can be removed without unscrewing the leaves. This is not an option with fixed pins. Both loose- and fixed-pin butt hinges can be bought with ball or finial-shaped pin tips. The fixed pins also come with plain ends.

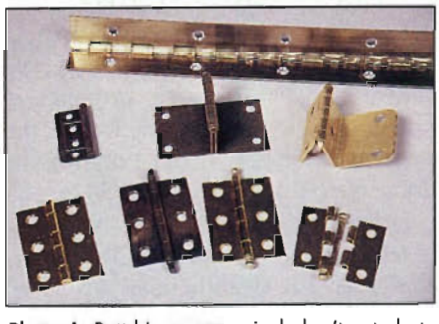


Photo A: Butt hinge group includes (top to bottom, left to right) piano/continuous hinge, non-mortise hinge, wraparound hinges (two styles), and standard butt hinges (four styles).

Hinges for Face Framed Cabinets

Door Style	Hinge Type
Flush	Butt, Surface, Piano/continuous, Concealed, Wrap-around, Knife, Non-mortise, Pivot, Pin
Lipped	Semi-concealed with ⅜" inset Surface with ⅜" offset Surface with ⅜" inset Piano with ⅜" inset
Back Beveled	Surface with reverse bevel Semi-concealed with reverse bevel
Full Overlay	Butt, Piano/continuous, Pivot, Knife, Concealed, Pin European-style surface-mount on face frame (fully concealed)
Reveal Overlay	Semi-concealed with no inset Semi-concealed with variable overlay Surface-mounted with overlay European-style for face-framed cabinets

Hinges for Cabinets Without Face Frames

Door Style	Hinge Type
Flush	Butt, Knife, Piano/continuous, Wrap-around for flush door, Pivot, Pin, Non-mortise, Invisible link European concealed for inset doors
Lipped (Note: Usually not installed on a cabinet without a face frame but can be using these hinges.)	Semi-concealed with ⅜" inset ⅜" offset continuous
Full Overlay	Butt Non-mortise Piano/continuous Knife Invisible link Pin hinges for overlay doors European concealed for full-overlay doors
Half Overlay	European concealed for half-overlay doors

Figure 1 Butt hinge anatomy and measurements

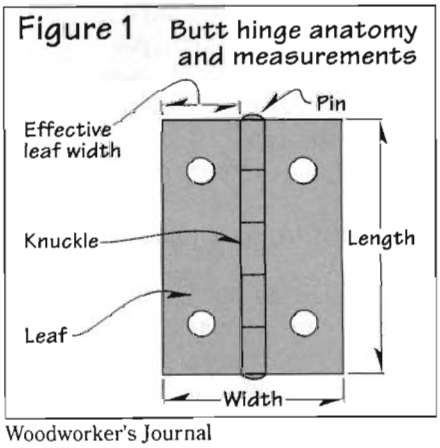
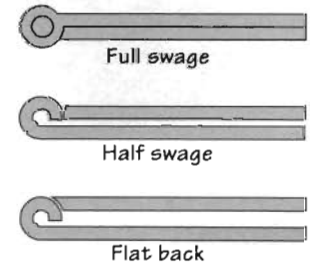
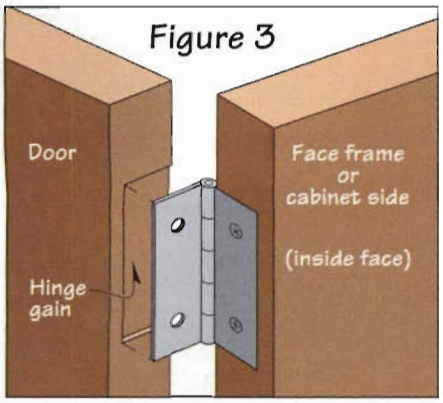
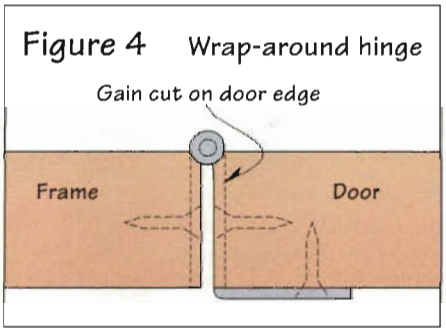


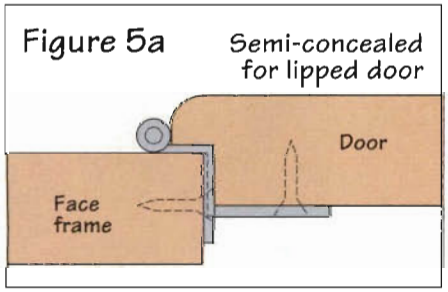
Photo B: Loose-pin butt hinges allow you to remove door without unscrewing hinge leaves.

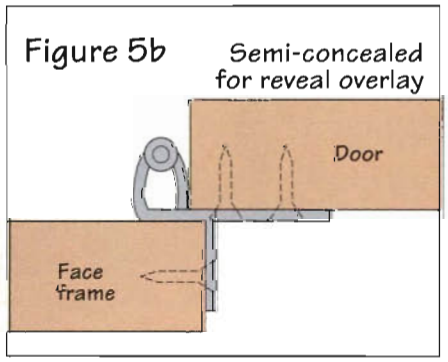
Figure 2 Methods of swaging butt hinges

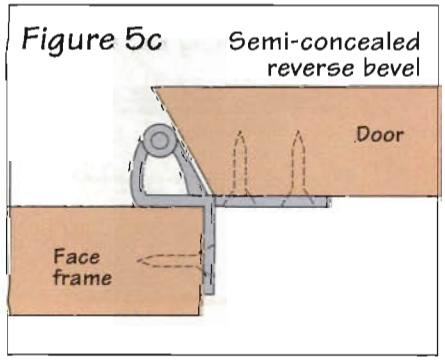












The leaves of butt hinges may be either straight (flat back) or swaged (shaped) as shown in *figure 2*. Regular butt hinges are straight but can be obtained in half-swaged and fully swaged. The amount of swaging affects the clearance on the hinge side, so use a fully swaged hinge if you desire a tight fit *(photo C)*.

To install butt hinges on flush doors, attach one leaf of the hinge to the edge of the door and the opposite leaf to the inside face of the cabinet, or, if the cabinet has a face frame, to its edge *(figure 3)*. On full overlay doors, place one leaf on the inside face of the door and the other on the face edge of the cabinet. In either case, you'll need to cut gains for both leaves to inset them flush with their respective surfaces. (See "How To Cut Hinge Gains" on *page 28*.) Installed properly, only the barrel and pin of the hinge will be exposed when the door is closed.

To determine the size and number of butt hinges you'll need, check the size and weight of the door. Smaller doors that are ¾" thick and measure up to 20x36" usually need only two 2½"- or 3"-long hinges.

Larger doors should have three hinges. If a door is unusually heavy or will be expected to carry additional weight, use a continuous (piano) hinge or wrap-around hinge *(figure 4)*. Both of these hinge types fall within the butt-hinge category and require gains for their installation.

Some manufacturers offer a no-mortise butt hinge. They're designed so that when you bring the leaves together, they lie in the same plane. The leaves must be surface-mounted to provide door clearance. While this type of hinge installs fairly quickly and works satisfactorily, it lacks the aesthetic appeal of a full-mortise standard butt hinge.

Semi-Concealed Hinges. You'll find these hinges used on a wide variety of door configurations and with both cabinet styles. Hinges in this group include the semi-concealed with a ⅜" inset, the semi-concealed with no inset, the semi-concealed with variable overlay, the semi-concealed with reverse bevel, and knife and pin hinges. (See *photo D* and *figures 5a, b, and c*.) When the hinge is closed, the barrel or pivot will be the only part showing.

Photo C: Standard butt hinge with straight swage (flat back).

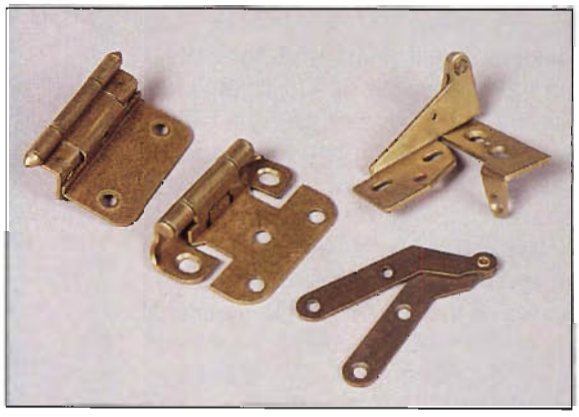


Photo D: Semi-concealed hinge group includes (left to right) lipped, variable-overlay, knife, and pin hinges.

For lipped doors, the semi-concealed type has a couple of bends in one of the leaves to enable it to fit the ⅜ x ⅜" rabbet cut in the edge of the door. We refer to this as a "⅜" inset."

Semi-concealed hinges with no inset and those with a variable overlay (both have a straight leaf) are used for reveal overlay doors on cabinets with face frames. The semi-concealed type with a reverse bevel has the leaf angled (usually at 30°) to match the angle of the back-beveled door.

The semi-concealed types—the ⅜" inset, no-inset, variable-overlay, and reverse-bevel—mount directly on the cabinet face frame edge and the door back and don't require gains. You can select free-swinging or the self-closing feature, which eliminates the need for a catch.

Knife and pin hinges are also considered semi-concealed types but get used less. Knife hinges can be used on flush-door styles in both cabinet

Photo E: Surface-mounted hinge group includes (top to bottom, left to right) two styles for lipped door, reverse-bevel, exterior-mount for flush door, two styles of exterior-mount for lipped door.

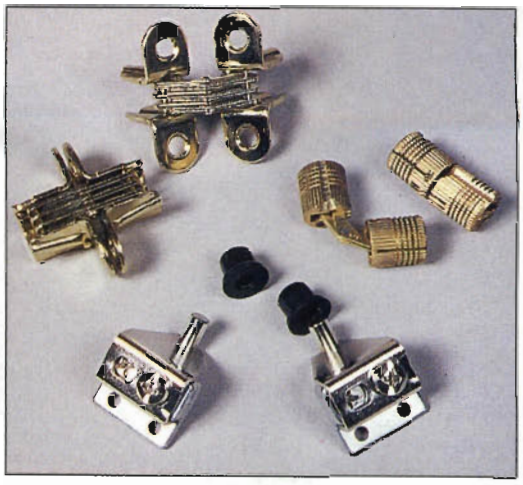


Photo F: Concealed hinge group includes (clockwise from top left) invisible link, barrel, and pivot hinges.

designs and on certain applications for full-overlay doors if the cabinet design allows for the mounting of the cabinet leaf. Knife hinges require that a gain be cut for both leaves, and they can't be adjusted once they're installed.

Because the door leaf of a knife hinge mounts on the top (or bottom) of the door, cutting gains for these in the end grain of the door can prove challenging. Also, screws have poor holding power in end grain, making knife hinges a less than ideal choice for a heavy door.

With knife hinges, you usually cut the gains before assembling the cabinet. This doesn't present a problem in a production environment where jigs and fixtures control the placement of the hinges, but it can pose an obstacle if you're making only a single cabinet.

Generally, you'll find pin hinges used more widely than knife hinges *(figures 6a and 6b)*. Although they require some gain-cutting, they attach to either face or edge grain and offer some adjustability once installed. You'll find pin hinges used mostly on full-overlay doors in both framed and frameless cabinets.

While you can get a pin hinge for flush-mounted doors, it won't have the adjustability you get with the other pin hinges. As shown in figure 6b, these hinges look like knife hinges that have been adapted for mounting on the edge grain of the door. They require gains similar to those for knife hinges.

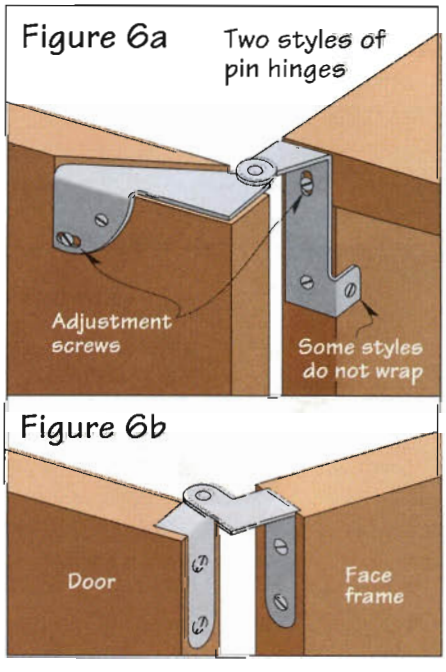
Surface-Mounted Hinges. These fall into two subcategories, both designed for cabinets with face frames *(photo E)*. They include those that mount on the exterior surfaces of the door and face frame *(figure 7)* and those that mount on the exterior of the face frame but on the interior or back of the door *(figure 8)*.

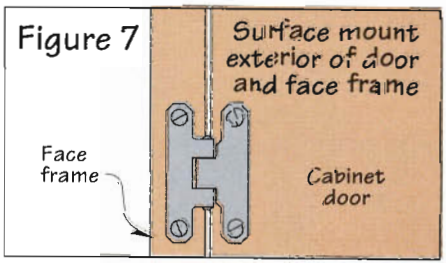
Exterior-mounted hinges can be obtained for flush, lipped, and reveal-overlay doors. On the lipped and reveal-overlay, the door leaf is offset to fit the door. The second group works on lipped, back-beveled, and reveal-overlay doors. For both categories of surface-mounted hinges, the installation requires no cutting of hinge gains. I find these the easiest and quickest to install.

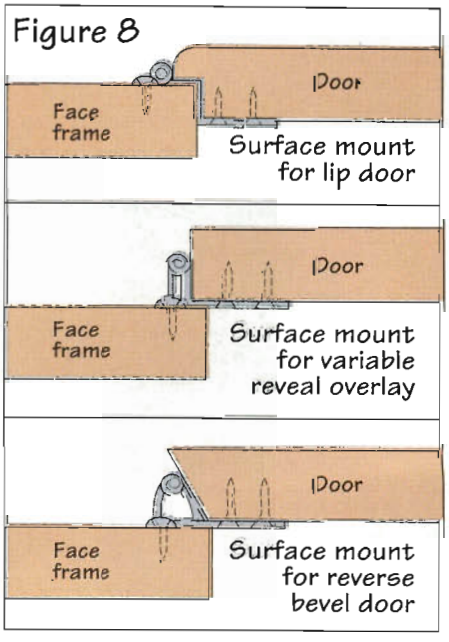
Concealed Hinges. Hinges of this category disappear completely when you close the door. They include invisible link, barrel, and pivot hinges. (See *photo R* and *figures 10, 11, and 12.*) All of these types can be used with both styles of cabinets for either flush doors or full-overlay styles. Installation procedures vary with the particular type and manufacturer, but the invisible link typically requires a mortise that must be drilled and routed. The pivot and barrel types require exact location of properly sized holes.

Most of these hinges do not allow any door adjustment once you've installed the door. However, one style of pivot hinge does provide for both side-to-side and front-to-back door

Continued on page 30







How To Cut Hinge Gains

Step 1. Lay out and mark the location of each hinge *(photo G)*. For most cabinets, and depending on door size, I prefer to position the top of the hinge 1½ to 2½" from the top of the door. I place the bottom hinge an

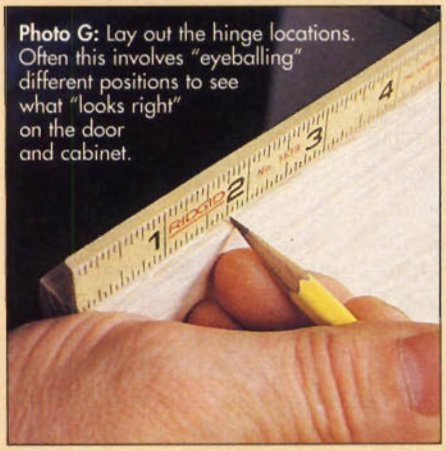


Photo G: Lay out the hinge locations. Often this involves "eyeballing" different positions to see what "looks right" on the door and cabinet.

equal distance up from the bottom. Since their location has a great deal to do with the visual appeal of the door, I study this placement carefully before committing myself. Note: Avoid placing the hinges too close together. Besides leaving the weight of the door unbalanced, it just plain looks bad.

Step 2. Lay the hinge facedown on the door edge, and slide the barrel of the hinge against the face edge of the door. This positions the hinge's pivot point correctly and will prevent the door from binding on the cabinet when the door is fully opened. To move the pivot point farther out, shim the barrel away from the door. I like to

Photo H: Using a utility knife, scribe the outline of the hinge. Note shim behind leaf.

Photo I: Deepen the outline you scribed in the previous step.

do this because it allows the door to swing just a little farther open before contacting the cabinet. Also, this enables you to remove the pin on loose-pin hinges without scraping the finish on the door or cabinet. I use a piece of cardboard from the back of a scratch pad—about 1/32" to 1/16" thick—for the shim *(photo H)*.

Step 3. Holding the hinge in place, score around the leaf with a sharp utility knife. Then, remove the hinge and deepen the scored line *(photo I)*.

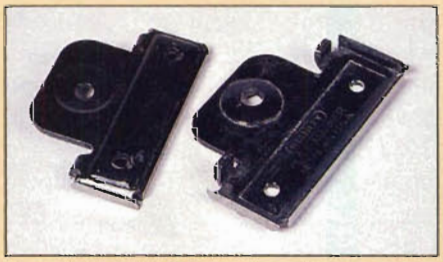


Photo J: Use a butt gauge (two sizes shown here) to lay out butt hinge gains on passage doors and frames.

For passage doors, you can use a butt gauge to mark the lines in one operation *(photo J)*.

Step 4. To establish the depth of the hinge gain, first set a marking gauge equal to the thickness of one hinge leaf. Then, using the gauge, scribe a line on the edge of the door and between the layout lines to mark hinge gain depth *(photo K)*.

Step 5. With a sharp ¾"- to 1"-wide chisel, make relief cuts to the layout line. To do this, place your chisel edge inside the layout and about 1/16" from the scribed line. Incline the chisel to about 30° in relation to the door edge, and lightly tap the head of the chisel with a mallet *(photo L)*. Repeat this procedure at both ends of the hinge layout. For the edge of the gain, use the utility knife to make the relief cut *(photo M)*. This will form a slight shoulder on the gain layout and enable you to deepen the cut with a chisel in the next step. If you don't provide relief, the compression of the

Photo K: Using a marking gauge, lay out the depth of the hinge gain.

wood fibers against the bevel of the chisel skews the cut and you'll end up with a slightly larger gain.

Step 6. With the chisel bevel pointing toward the inside of the gain, place the edge of the chisel on the layout

Photo L: Make relief cuts to the layout line using a chisel (held at 30° angle) and mallet.

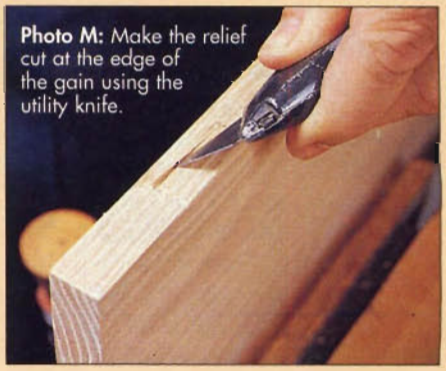


Photo M: Make the relief cut at the edge of the gain using the utility knife.

Photo N: Square the shoulder of the gain using a chisel.

line. Hold the chisel perpendicular to the edge of the door, and give it a sharp rap with your mallet *(photo N)*. Do this to both ends of the hinge layout. Note: Apply the mallet a bit more gently to the edge of the layout; since you'll be chiseling with the grain, it will be easy to cut too deep or split the

Photo O: Make a series of cuts on the face of the gain, holding the chisel bevel side up at an angle of 30°.

wood. Remember, cut the shoulder just deep enough to accept the hinge leaf.

Step 7. Hold the chisel (beveled side up) at an angle of about 30° in relation to the door edge. Then, make a series of cuts (about ⅛" apart and approximately to the depth of the hinge leaf)

Photo P: To remove the chips, hold the chisel bevel side down and adjust the angle as you cut to keep the bottom of the gain flat.

along the face of the gain *(photo O)*. With a thick hinge or extremely hard wood, you may not attain full depth on the first pass. In this case, complete Step 8 and then repeat Step 7 to reach the proper depth.

Step 8. Holding the beveled face of the chisel down, chisel out the chips you started in the previous step *(photo P)*. Adjust the angle of the chisel as you proceed so that its edge cuts a flat bottom in the gain, rather than allowing it to dig in. Increase the angle of the chisel in relation to the door edge if you want to cut deeper; decrease it for a shallower cut. You'll need to cut in both directions to get

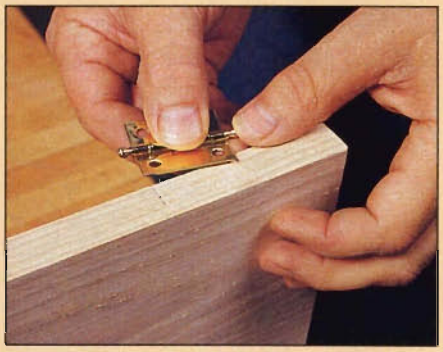


Photo Q: Insert one leaf of the hinge in the gain, checking to see that it sits flush with the surface of the door edge.

in tight to the shoulder ends, but try to do as much of the chiseling as possible working with the grain.

Step 9. Test-fit the hinge leaf in the gain. If necessary, repeat steps 6, 7, and 8 until the hinge leaf fits flush with the edge of the door. With a little practice, you'll be amazed at how quickly and accurately you can cut a flat-bottomed hinge gain.

Step 10. Place the hinge in the gain face side up *(photo Q)*, then lay out the hole centerpoints and drill the screw holes. (I use a Vix bit in my drill, which enables me to center and drill the holes in one step as shown in *photo R)*.

Step 11. Once you've drilled the screw holes, place the door in the cabinet opening and shim it to center it vertically. Then, transfer the locations of the door gains to the cabinet edges.

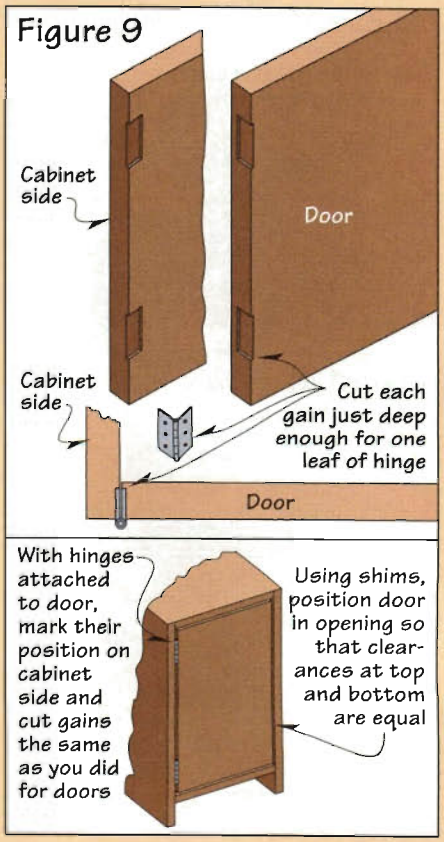
Step 12. Repeat the layout and chiseling procedure to cut the cabinet gains. Note: Support the cabinet side while chiseling the gains.

Step 13. Attach the hinges to the door and then to the cabinet *(figure 9)*.

Photo R: To center and drill screw holes in one step, use a Vix bit.

To simplify this operation, pre-drive the screws into the cabinet holes and then remove them. They will then thread more easily when you're trying to balance the door with one hand and drive the screws home with the other. Note: Remember to install loose-pin hinges with the pin heads on top.

Step 14. If you've cut any of the gains too deep, you can shim the hinges flush with the surface using anything from a single thickness of typing paper to 1/16" manila card stock. Try to stick with hard-finished material (playing cards work well) that won't compress or disintegrate over time.

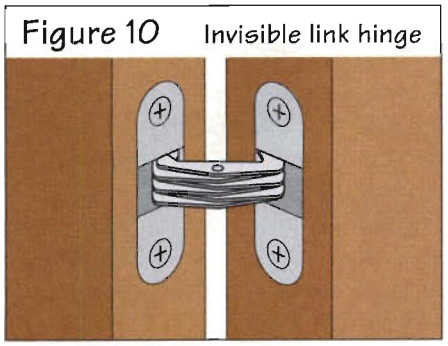


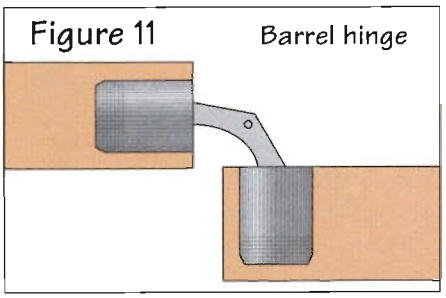
Cabinet Door Hinges

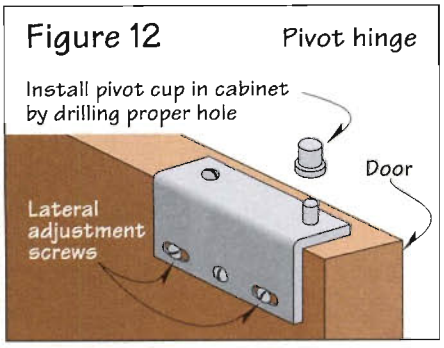
Continued from page 27

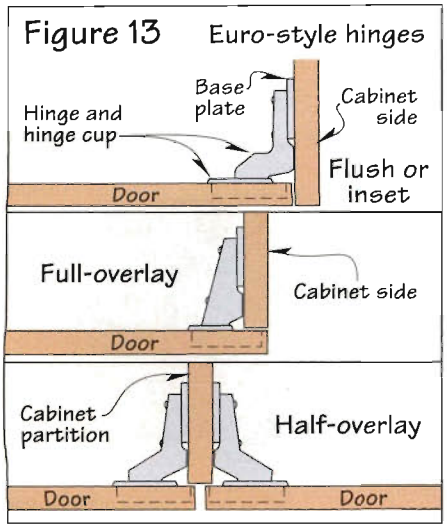
adjustment. When selecting these hinges, you need to consider the size and weight of the door. Make sure to choose a hinge that's rated to meet or exceed your needs.

European-Style Hinges. These might well be grouped with the concealed hinges since they're not visible when the doors are closed. However, because of their unique design and installation procedures, I list them as a separate group.









For the most part, Euro-style hinges were designed for cabinets without face frames and for those built using the 32mm system *(photo S)*. Before you select these hinges, you first need to decide which style of door you'll install; you can get them for flush (inset), full overlay, and half-overlay door styles *(figure 13)*.

Before you buy, figure out what degree of swing (maximum angle of opening) will work best. Depending on the manufacturer, you'll have a choice of 100°, 125°, or 170° *(figure 14)*. In addition, some firms offer a 270° swing for a full-overlay door. This allows the door to open three-fourths of a full circle—far enough that its edge will end up completely flush with the cabinet edge, which is ideal for stereo and TV cabinet designs. You'll also have the choice of either free-swinging or self-closing models.

For doors up to 24" wide and 20 lbs. in weight, a pair of European hinges will suffice. Doors of 20 to 40 lbs. require three of these hinges, and a 40- to 60-lb. door requires four. In all applications, space Euro-style hinges as far apart as possible for best performance.

As the popularity of these hinges has grown, a few Euro-style hinge "clones" have come on the market that are designed for use with face-framed cabinets. Although the selection, swing range, and adjustment options for this application are still rather limited, you do have the option of retro-fitting with a European-like hinge.

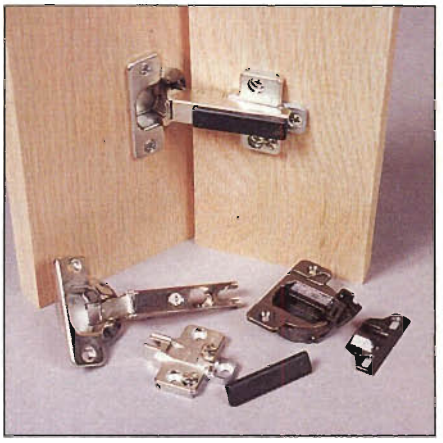


Photo S: European-style hinge group includes (left to right) hinge mechanism, base plate, and screw cover of true Euro-style hinge (also shown installed at top); Euro "clone" hinge parts for face-framed cabinet.

Installation of European hinges may appear complicated because they look different from the hinges we're used to. In practice, however, you'll find them easy to work with. Each hinge has two main parts—the baseplate that mounts on the inside of the cabinet and the hinge mechanism that attaches to the door.

To install, first draw centerlines for the base plate on the inside of the cabinet and for the hinge mechanism on the back of the door. Make sure that they will align when the door is in place. Next, drill the pilot holes for the base plate mounting screws. (To speed up the process, you can make or buy a simple jig that will help position these holes precisely.)

Once you've mounted the base plates, locate and bore (on the centerline) a 35mm hole ½" deep to accept the hinge cup. On cabinets with ¾"-thick sides, the hole should be centered ⅞" from the hinge side of the

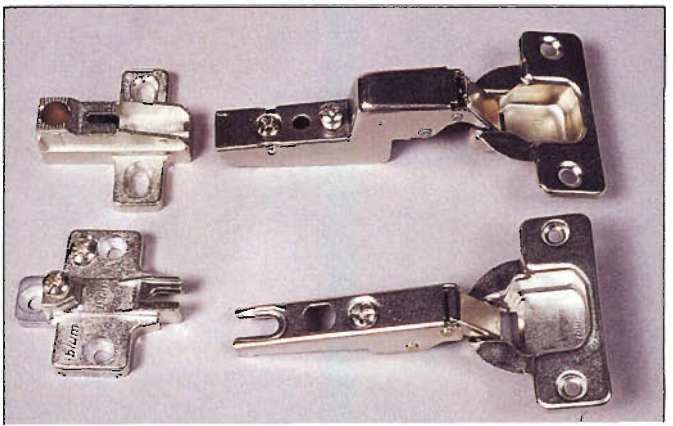


Photo T: Two different brands of Euro-style hinges show snap-together model (top) and screw-together model (bottom).

door for full-overlay and half-overlay hinges. For inset doors, center the hole 13/16" from the edge of the door.

A drill press and a 1⅜" Forstner or multi-spur bit will work fine for boring the cup holes. Again, you can also buy jigs and bits made especially for this operation. They're rather costly, however, so unless you're installing Euro-style hinges on a regular basis, you may not want to make the investment. Once you've bored the holes, press the cup on the hinge mechanism into the hole. Then, square the mechanism to the door edge and install the screws.

Attach the door to the cabinet by securing the hinge mechanism to the base plate. On some brands, the two parts snap together; others require screws *(photo T)*. After mounting the door, you adjust it either two- or three-dimensionally, depending on the manufacturer. (Three-dimensional hinges allow you to adjust the doors vertically, side to side, and front to back for depth. The two-dimensionally adjusting types do not offer the vertical adjustment.)

For the sleek lines of modern kitchen cabinets, office fixtures, and certain styles of modern furniture, European hinges are hard to beat, especially considering their ease of assembly, adjustability, and range of swing. Period furniture pieces and standard face-framed cabinets, however, call for hinges of a more traditional type to preserve their design. Also, because Euro-style hinges extend into the cabinet, pull-out shelves and drawers behind the doors must be designed to clear the hinges.

Hinge Styles

As with knobs and pulls, hinges can be found to match or complement any furniture style. Traditional, provincial, colonial, contemporary, and craftsman (or mission) are just a few of the hinge styles that you can buy to match cabinet styles.

Matching a hinge to the furniture style is every bit as important as doing careful joinery work on the cabinet. A mismatched hinge or hardware style will detract from a cabinet's appearance as surely as careless workmanship.

Identifying the appropriate style may require a little research. I suggest you search out similarly styled furniture pieces to get an idea of appropriate hardware. For a period piece, your local library probably carries illustrated books on furniture periods and styles.

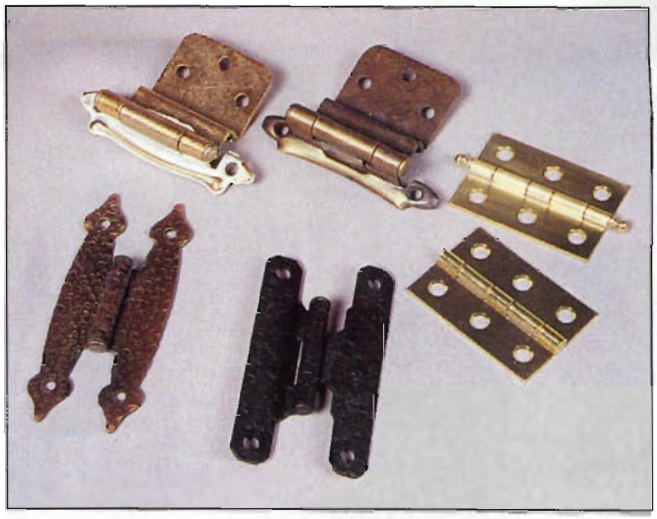


Photo U: Hinges come in a variety of materials and finishes, including (top to bottom, left to right) painted steel, antiqued steel, solid brass, hammered copper, hammered black (steel), and brass-plated steel.

Materials and Finishes

Most hinges are made of steel and come in a variety of finishes or plating, including chrome, brass, copper, bronze, black, hammered black, and white *(photo U)*. Steel hinges, although widely used on all types of cabinet doors, are relatively inexpensive. However, they may corrode over time depending on the climate and humidity. Even brass-plated steel hinges will deteriorate and show wear, which can seriously cheapen the appearance of a finely crafted cabinet.

Finer (and more expensive) hinges are made of solid brass and offered with a polished, brushed, hammered, or antiqued finish. Brass hinges usually come with a lacquer or other coating to prevent tarnishing. They're the best for enhancing the appearance of fine furniture.

Parting Remarks

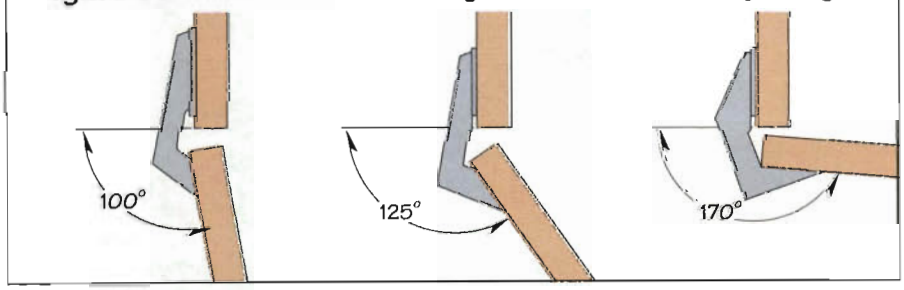
I've attempted here to group the various hinges according to use or application. I've also tried to provide some basic installation instructions for the various types of hinges. Don't assume, however, that you can now bypass the installation instructions provided with the hinges. Installation can vary slightly from one manufacturer to another.

In identifying the various hinge types, I've tried to stay consistent with the standard trade nomenclature. However, don't be surprised if you go to your local hardware store and ask for a particular hinge, and the clerk calls it by a different name—or just pleads ignorance.

This problem comes up when I ask for "abrasive paper" at a couple of local hardware stores. The clerks often respond with glassy-eyed stares of confusion until I mention the word "sandpaper." If you have trouble making it clear what hinge type you want, exercise patience and simply ask to look at the assortment of hinges that the dealer has on hand. If you're catalog shopping, you'll also turn up some occasional contradictory nomenclature, but at least you get to see a photograph of the product before you call in your order. WJ

Photographs: The author

Figure 14 Common swings available on Euro-style hinges



Molded Leg Chippendale

Foot Stool

Whether you want to put your feet up or have a seat, you'll find this piece just the right height and width. Our stool, based on an early 18th-century piece, has been enlarged and simplified. Factory standards for size or style didn't exist when the original was constructed. In that period, craftsmen would size a piece to fit the customer and detail it with their own interpretations of current stylistic trends.

Before You Start

A perfect weekend project, this stool provides an opportunity for you and the fabric artist in your house to pool your talents. Or, if you prefer to make it a surprise, have an upholstery shop prepare the cushion.

We made our stool out of attractive and easy-to-work cherry stock, then stained it dark red. However, feel free to choose your own wood and finish—it will look equally handsome.

Knowing that stools must often bear heavy loads, we chose to construct ours with tried-and-true mortise and tenon joints. They provide superior strength, and a mortising machine makes quick work of them. However, loose tenons or double biscuits would also suffice.

As you read the instructions, note that we initially specify oversized stock. We do this to ensure that we can joint the stock straight and plane it square and to eliminate planer snipe on part ends.

Bill of Materials

Bench

Part	T	W	L	Mtl.	Qty.
A Legs	1½"	1½"	16"	C	4
B Stretchers-top front	1⅛"	2⅝"	16½"	C	2
C Stretchers-top side	1⅛"	2⅝"	14½"	C	2
D Stretchers-bottom front	⅝"	1⅛"	16½"	C	2
E Stretchers-bottom side	⅝"	1⅛"	14½"	C	2
F Seat pad*	½"	15⅛"	17⅛"	PW	1

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

Materials List

C–cherry PW-plywood

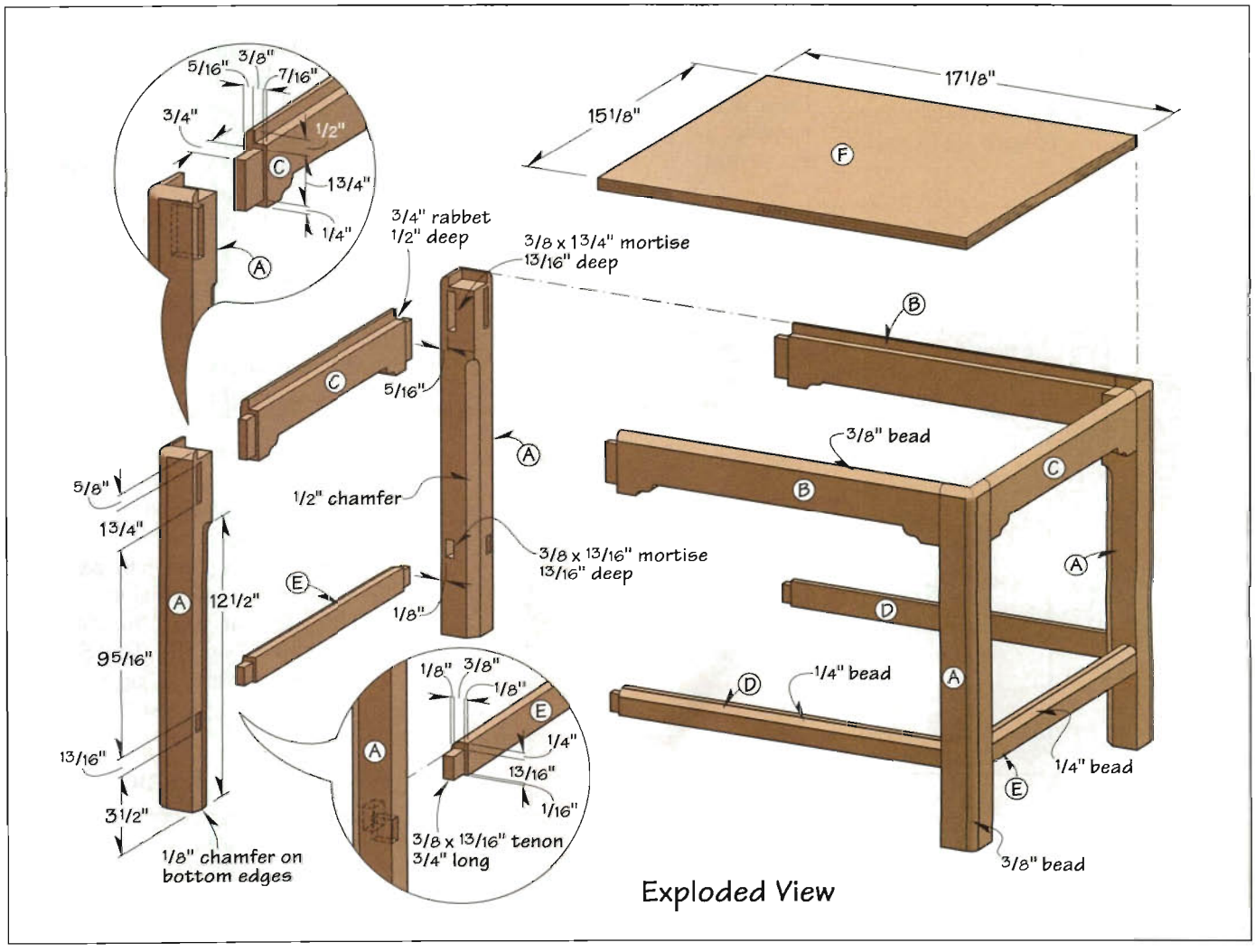
Supplies

Stain, finish

Cut and Mortise the Legs

Step 1. From 8/4 stock, first joint and rip a blank to 1⅝x1⅝x72". (We used cherry.) Next, plane the blank to 1½" square, then crosscut four 16"-long legs (A) from it.

Step 2. Select and mark the top end and the two outside faces of each leg. Using the dimensions shown on the Exploded View details, lay out mortises on the two adjoining inside leg faces to accept the top and bottom stretcher



tenons. Note: To simplify the process, we first laid out the four mortises on one leg, then placed the other three leg blanks alongside it. After aligning the top ends, we clamped the legs together and transferred the mortise lines across their respective faces using a try square. After marking the upper and lower limits of the mortises, we used a marking gauge to scribe their vertical lines.

Step 3. Form the leg mortises. Note: The tenons on the top and bottom stretchers will be ¾" long, but make the mortises 1/16" deeper to allow space for glue. (We used our hollow-chisel mortising machine. If you don't have one, you can use a plunge router, an edge guide, and a straight bit to cut each mortise, then square the ends with a chisel. Or, rough out the mortise on a drill press by drilling overlapping holes, then clean out the waste with a chisel.)

Step 4. Mark the upper limit of the ½" chamfer on the inside edge of each leg. (See the Exploded View.) Using your table-mounted router and a chamfer bit, rout each chamfer by making several shallow passes. Then, using a chisel, cut a ⅛" chamfer along the bottom ends of each leg. Now, finish-sand the legs.

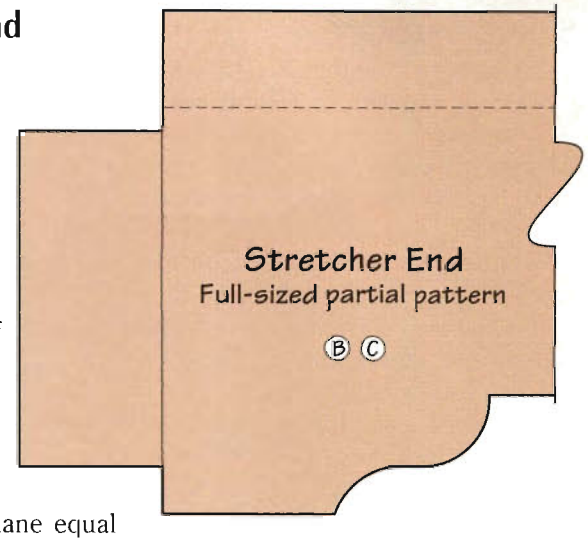
Cut the Stretchers and Form the Tenons

Step 1. For the top stretchers (B, C), joint and rip two pieces of ¾"-thick stock to 2¾x72". Face-glue and clamp the two pieces, aligning the ends and edges. Note: To save material, you may use a piece of less costly stock (such as pine or poplar) for the second or inside face.

Step 2. Plane the laminated strip to 1⅛" thickness. Note: For stability, plane equal amounts of stock from both faces. Rip and plane the strip to 2⅝" wide, then set it aside until Step 4.

Step 3. Joint, rip, and plane a strip of ¾"-thick stock to ⅝x1⅛x72". Using your table-mounted router and a ¼" beading bit, rout one edge of this blank.

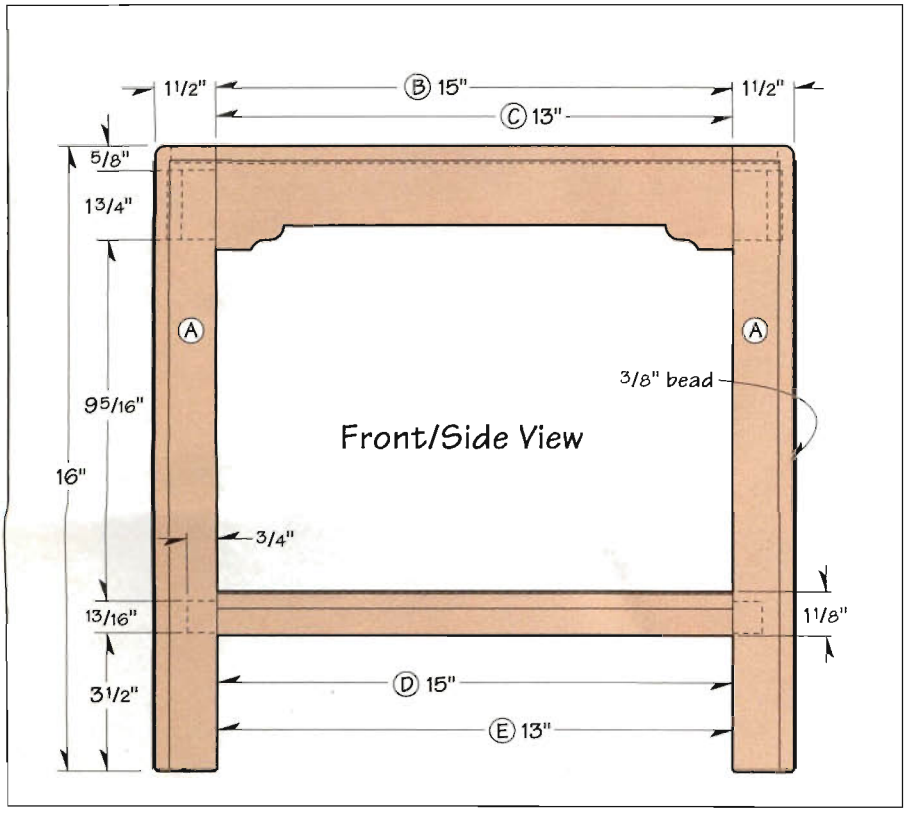
Step 4. From the 2⅝"-wide blank, crosscut two front stretchers (B) and two side stretchers (C) to the lengths listed in the Bill of Materials. (We cut these in front-side-front-side sequence to wrap the grain around the stool.) From the 1⅛"-wide blank, crosscut two bottom front stretchers (D) and two bottom side stretchers (E). (We used our miter saw and a stopblock.)



Step 5. Cut the tenons on the ends of the top and bottom stretchers as dimensioned on the Exploded View detail. (We made the cheek cuts using a tenoning jig on our tablesaw and the shoulder cuts using a spacer block and the tablesaw's miter gauge.) Note: When adjusting the saw's rip fence and jig, use same-sized scrap stock first to test the setup. Also, when cutting the tenon cheeks, always place the same face against the jig to ensure uniform cuts.

Step 6. Transfer the full-sized pattern shown *above* to both ends of the top stretchers. (See also the Front/Side View drawing *below left*.) Using a ¼" blade on your bandsaw, carefully saw the parts to shape, cutting as straight as possible along the outside edge of the line. (We used the bandsaw's rip fence to guide the pieces while cutting the straight portion of the cutouts, then cleaned up the sawn edges with sandpaper and a file.)

Step 7. Using the tablesaw, cut a ¾" rabbet ½" deep along the top inside edge of each top stretcher where shown on the Top Stretcher End View drawing on *page 36*. Then, finish-sand all eight stretchers.



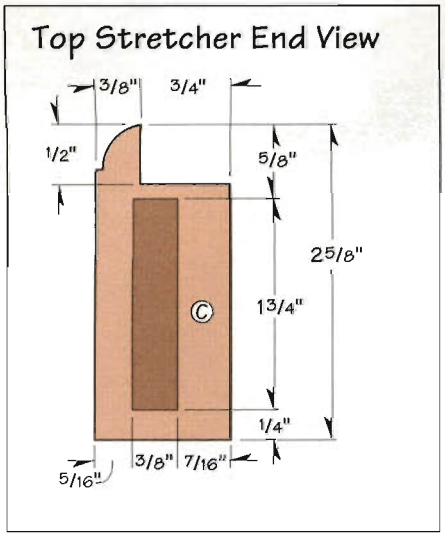
Assemble the Frame

Step 1. Dry-assemble the frame parts to test their fit. Make adjustments if necessary. Note: The outside faces of the stretchers should align flush with

continued on page 36

Foot Stool

continued from page 34

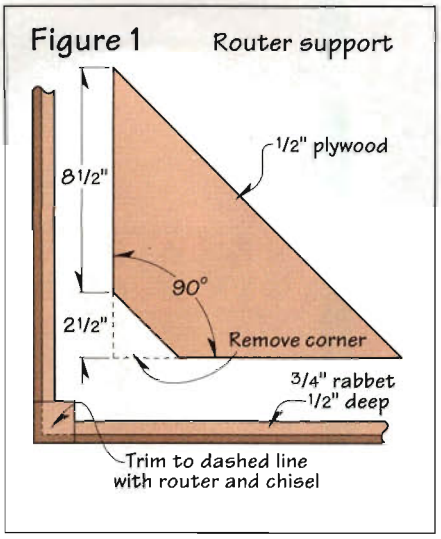


the outside edges of the legs. Then, disassemble the frame and arrange the parts in order for final assembly.

Step 2. Glue, assemble, and clamp one end (one short top and bottom stretcher and two legs). Check the assembly for square and flatness. Assemble the second end using the same procedure.

Step 3. To join the two ends, glue and insert the tenons of both top and bottom side rails into the mating mortises in one of the subassemblies, then into the mortises of the second assembled end. Place the assembly on a flat work surface, clamp it, and then check it for squareness, making sure that all legs sit flat on the work surface.

Step 4. To continue the rabbet into the corners, extend the rabbet lines across the top of the legs as shown in *figure 1*. (We used a sharp pencil to scribe these lines.)



Step 5. Machine away the rabbet waste from the top of each leg. To do this, first make the triangular router support dimensioned in figure 1. (We made our support from ½" plywood scrap, which sits flush with the top of the rabbet.)

Step 6. Clamp the router support across one corner of the frame. If necessary, you can shim the support to make it level with the top edge of the stretchers. Next, using a handheld router and a ¼" straight bit, rout away the waste on the top of the leg to the same depth as the rabbet. (We used a small laminate trimmer for this job because it was easy to control.) Be careful not to rout into or across the guide lines that you scribed earlier. Move the support to the remaining three corners and rout the rabbets the same way. Use a sharp chisel to square the corners.

Step 7. If necessary, sand all stretchers flush with the legs. Then, using your table-mounted router and a ⅜" round-over bit, rout the outside corner of each leg.

Step 8. Switch to a ⅜" beading bit and clamp a guide fence to the router table. Note: Test the setup on scrap as you adjust the bit's elevation so the bottom of the radius will be cut flush with the tabletop. Then, rout along the outside edge of the stool top. Next, raise the bit 1/16", set the fence to cut equal shoulders, and rout the outside corner of each leg.

Step 9. Finish-sand the assembly starting with 120-grit sandpaper and working up to 220-grit. (We used a random-orbit disc sander, then finished with a light hand-sanding.)

Step 10. Apply stain and finish as desired, following the manufacturer's recommendations for the products. (We used Minwax Red Mahogany stain and Deft semi-gloss aerosol lacquer.)

Prepare the Cushion

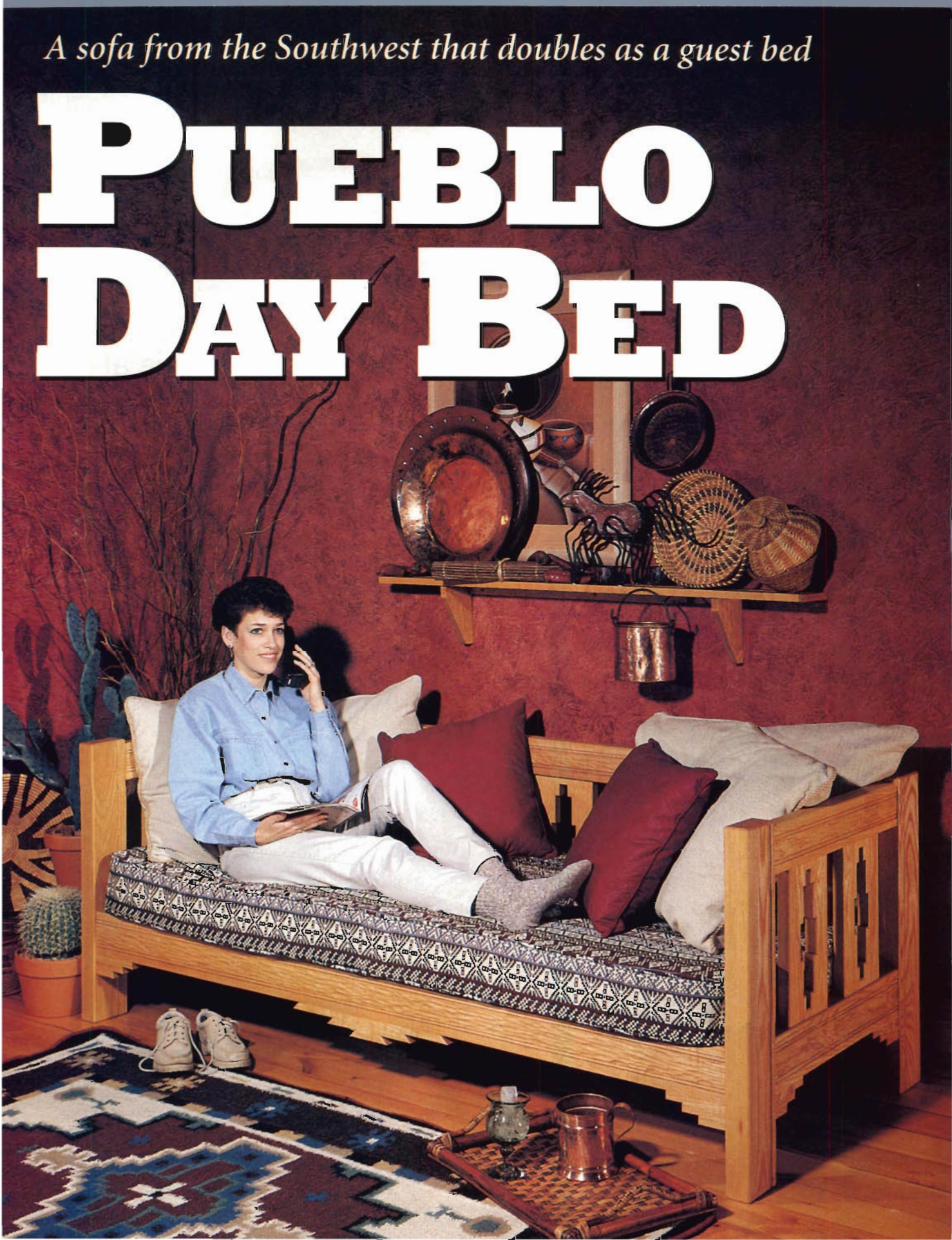
Step 1. For the seat pad (F), measure the inside dimensions of the top rabbet. Cut a piece of ½"-thick plywood to these dimensions, subtracting ⅛" from the width and length to accommodate the upholstery fabric.

Step 2. Select fabric and foam (or padding) for the seat. Then, upholster the seat. Or, take the pad to an upholsterer for covering. (Our seat fits snugly without any attachment to the frame. You may want to use steel angle brackets and wood screws to secure yours.) WJ

Designer/builder: *Mark Ziobro*
Drawings: *Cad Art*
Photographs: *StudioAlex*

A sofa from the Southwest that doubles as a guest bed

Pueblo Day Bed



Designer Chris Sandoval reports that a Navajo rug figure inspired the flat spindles on this sturdy but elegant design. The rest of it derives from traditional New Mexican motifs he'd been working with for several years. (For more about Chris, see the "Craftsman Profile" on *page 72*.) Although you usually see such pieces crafted in Ponderosa pine, we used white ash for our version, both for its appealing grain patterns and its durability.

Before You Start

Chris builds this piece in three different widths—31" deep for a conventional sofa, 35" deep for a deeper sofa, and 40¾" deep (with three spindles on each side) for a full-scale twin-sized mattress. We went the middle road but used a 33"-wide foam mattress that we purchased from a national mail-order catalog. (For information, see Sources at the end of the article.) This way, the piece serves as a comfortable couch by day while still providing your guest with a comfortable sleeping space by night.

We found that the easiest way to create the spindle cutouts was to edge-join them from separate pieces that we had pre-cut to width and length. We then routed the chamfer around the edge of the cutout and squared the chamfer corners with a chisel. Chris, on the other hand, starts with just two halves. He lays out and bandsaws the half-cutout in each and squares the corners with a 1" belt sander. He chamfers the cutout edges and edge-joins the halves. Either approach works; or, you may find another solution you like better.

Mattress cover fabric courtesy of Rachman Collections, Inc., New York, N. Y.

This is not a project you can piece together from the scrap box. We started with 15 board feet of 10/4, 31 board feet of 8/4, and 26 board feet of 6/4 stock. However, we cut parts with an eye to best grain and color match; you can get by with less material than this if you economize.

Although Chris' day bed is unmistakably Southwestern, you could adapt this basic frame to other styles (Craftsman, Prairie, or Ranch, for example) without a great deal of redesign. We suggest you consult books or catalogs that document the particular style you have in mind.

Prepare the Stock, Then Cut And Detail the Frame Parts

Step 1. From 10/4 stock, joint and plane material for the legs to 2¼" thick. Then, rip and crosscut four legs (A) to the dimensions listed in the Bill of Materials.

Step 2. From 8/4 stock, joint and plane material for the rails and the trim parts to 1¾" thick. (Set aside the trim material for now.) Add ¼" to the finished length of all rail parts, then rip and crosscut two top side rails (B), two bottom side rails (C), one top back rail (D), and two bottom front/back rails (E).

Step 3. Cut a bead along both faces of the top rails and legs 1" from both edges. On the bottom rails, bead the front faces only. (To form the bead, we mounted a molding head fitted with three ¼" bead-cutting knives on the tablesaw, Sears' Craftsman nos. 3214 and 3208, respectively. We elevated the head to cut ⅛" deep and then tested the setup using scrap.)

Bill of Materials

Day Bed

Part	T	W	L	Mtl.	Qty.
A Legs	2¼"	4¾"	29¼"	A	4
B Side rails—top*	1¾"	4"	25½"	A	2
C Side rails—bottom*	1¾"	4½"	25½"	A	2
D Back rail—top*	1¾"	4"	73¾"	A	1
E Front/back rails—bottom*	1¾"	4½"	73¾"	A	2
F Trim—center* **	1¾"	2¼"	18½"	A	2
G Trim—corner* **	1¾"	2¼"	5½"	A	8
H Spindles* **	1¼"	7½"	13"	A	11
I Cleats*	1"	1"	73½"	H	2
J Slats*	¾"	5¼"	30¹⁵⁄₁₆"	H	10

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

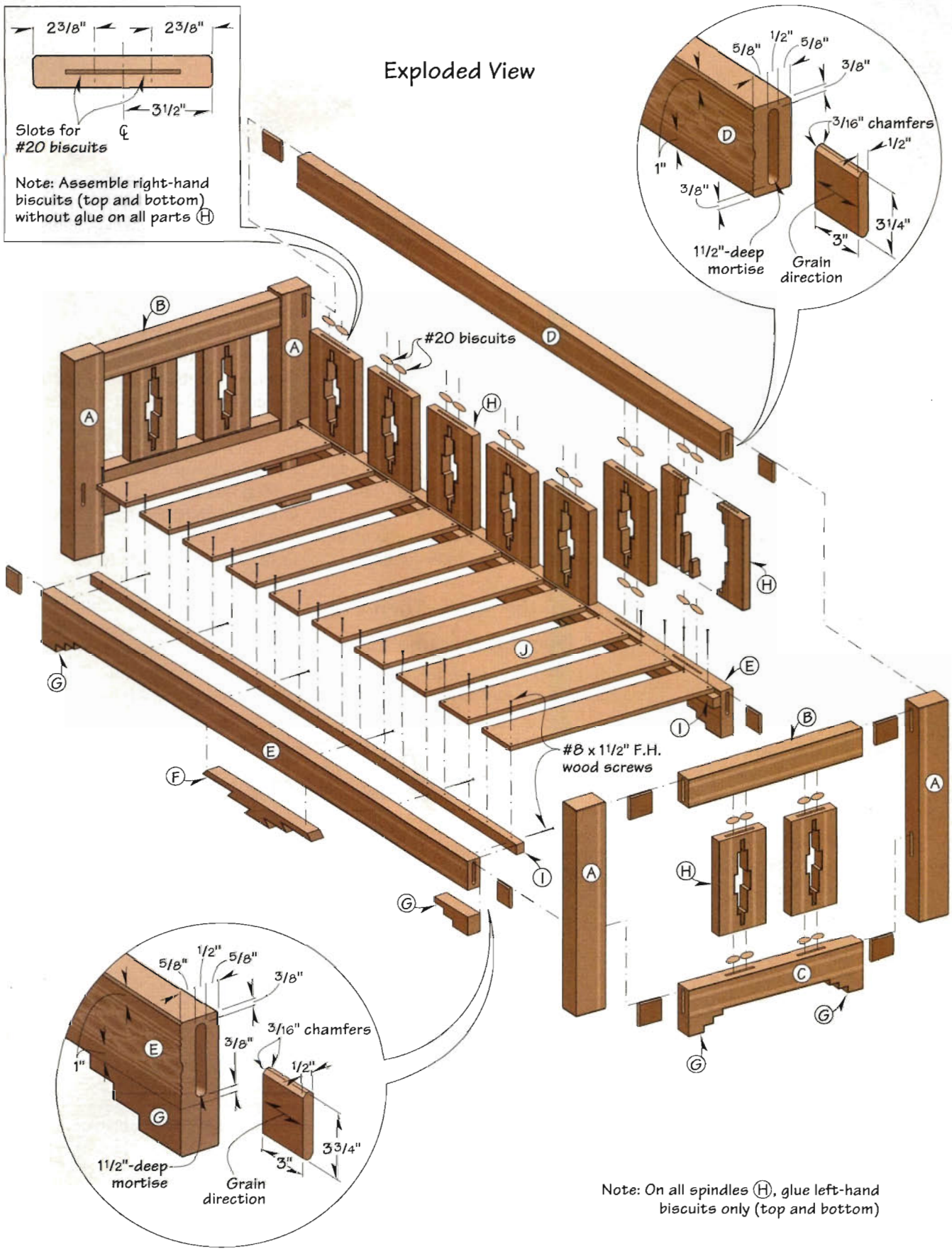
**Part edge-joined from narrower stock.

Materials List

A—white ash
H—hardwood

Supplies

#8x1½" flathead wood screws; #20 biscuits; hardening oil finish. (For other supplies, see Sources at end of article.)


Exploded View
2 3/8"
2 3/8"
3 1/2"
Slots for #20 biscuits
℄
Note: Assemble right-hand biscuits (top and bottom) without glue on all parts (H)
5/8"
1/2"
5/8"
3/8"
3/16" chamfers
1/2"
1"
3/8"
3 1/4"
3"
11/2"-deep mortise
Grain direction
#20 biscuits
D
B
A
H
J
E
I
G
F
#8 x 1 1/2" F.H. wood screws
C
Note: On all spindles (H), glue left-hand biscuits only (top and bottom)

Step 4. On the three top rails (B, D), carve texture (on both faces) in the area between the two beads using a ½"-wide gouge. On the four bottom rails (C, E), texture only the outside faces. (See "Texturing the Rails" *below.*)

Make the Trim Parts, Then Glue Them To the Rails

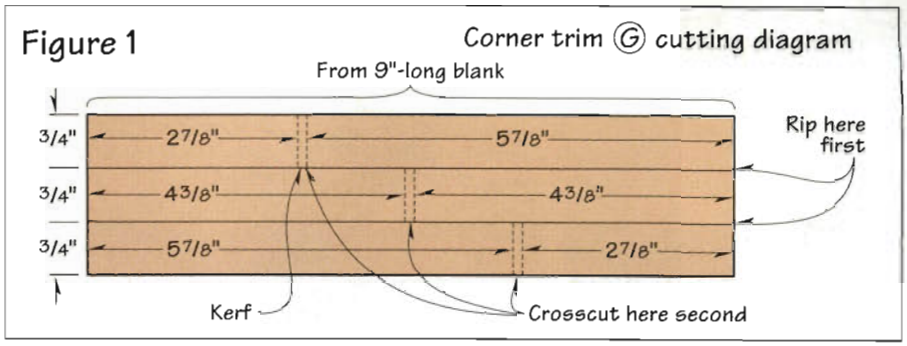
Step 1. From the 1¾"-thick stock you surfaced earlier, cut two blanks to 3x19" for the center trim parts (F). Rip three 1³⁄₁₆"-wide strips from each of these, then joint both edges of each (for tight, invisible glue lines) to ¾" wide. Miter both ends of the three strips at 45°, cutting them to the lengths shown on the Front View drawing on *page 42.* (See the Pro Tip at *right.*)

Step 2. Before gluing up the center trim parts, cut a ⅛" chamfer on the ends of each ¾"-wide piece on the front face. (To avoid tearing out the mitered tips, we used our compound miter saw, setting both the tilt and the miter at 45°. We clamped each part before cutting.)

Step 3. Arrange the pieces of both center trim parts in proper order with the correct faces up. Center the parts with respect to one another and mark their locations. Then, edge-glue and clamp the two trim parts—one pair of pieces at a time—as shown on the Front View.

Step 4. To make the four pairs of corner trim parts (G), cut a 3x37" blank (or two 18½"-long blanks of this width) from your remaining 1¾"-thick stock. From the blank(s), rip three 1³⁄₁₆"-wide strips, again jointing the edges to ¾". Arrange and mark the strips according to their location, then crosscut four 9" lengths from the grouped strips.

Step 5. From each set of 9" strips, crosscut "nesting" pieces for two corner trim parts as shown and dimensioned in *figure 1.* (This approach ensures grain continuity as well as maximizing yield.) Next, lay out the location of each piece on its adjacent piece as shown in the figure. Note: Index from the stepped inside ends when you measure, rather than simply aligning the flush outside ends. Glue and clamp the eight trim parts, two



PRO TIP

To maintain grain continuity in the center trim parts, arrange the three strips from each blank in their original order after you rip them. Then, measure and miter-cut each piece from the center of its respective strip. This way, the grain will flow smoothly across the assembled trim.

Texturing the Rails

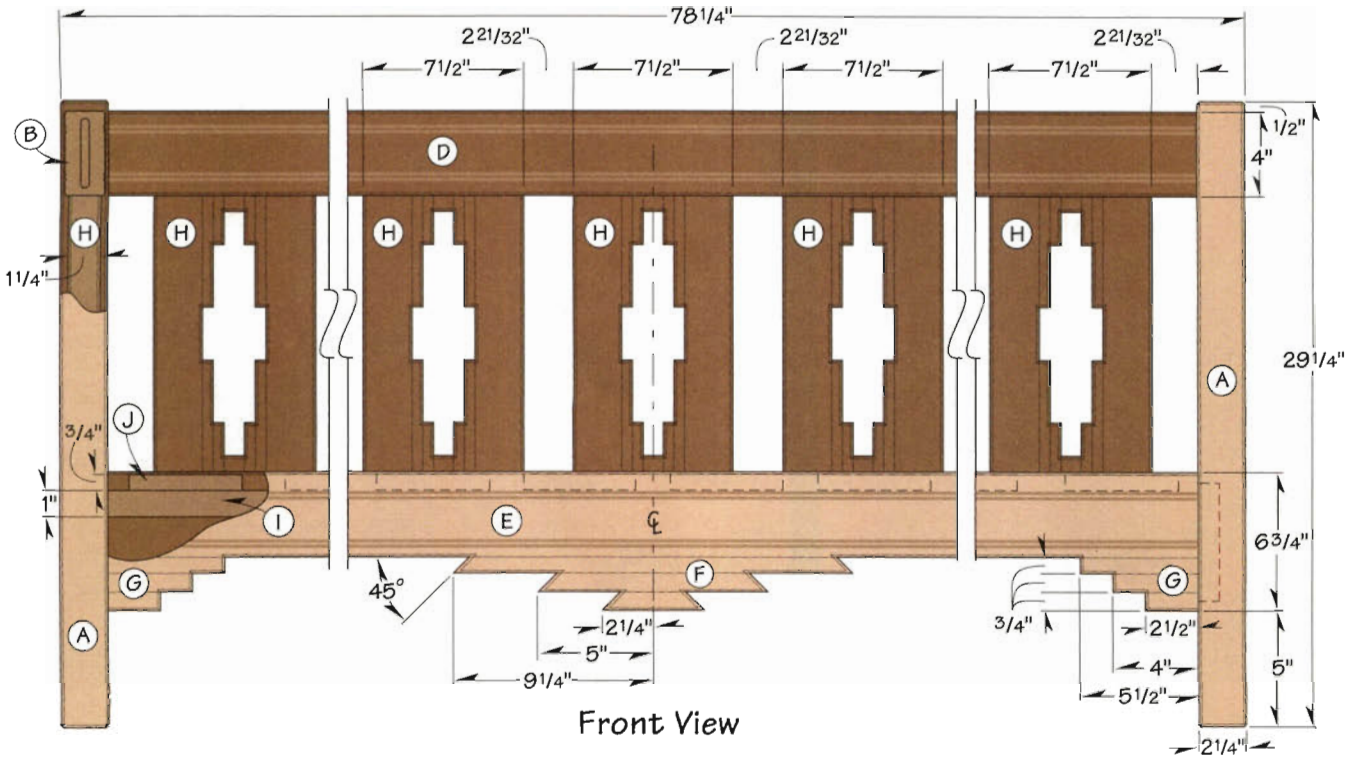
To streamline the rail texturing, we used a reciprocating power carver. (See *photo A.* For ordering information, see Sources at the end of the article.) You can use a shallow gouge (12mm or ½") and mallet, although we found that we got enough of a workout even using the electric tool.

Photo A: To streamline the rail texturing, use a reciprocating power carver. Vary the cuts in depth and length, but keep ⅛x1" as the "nominal" dimensions.

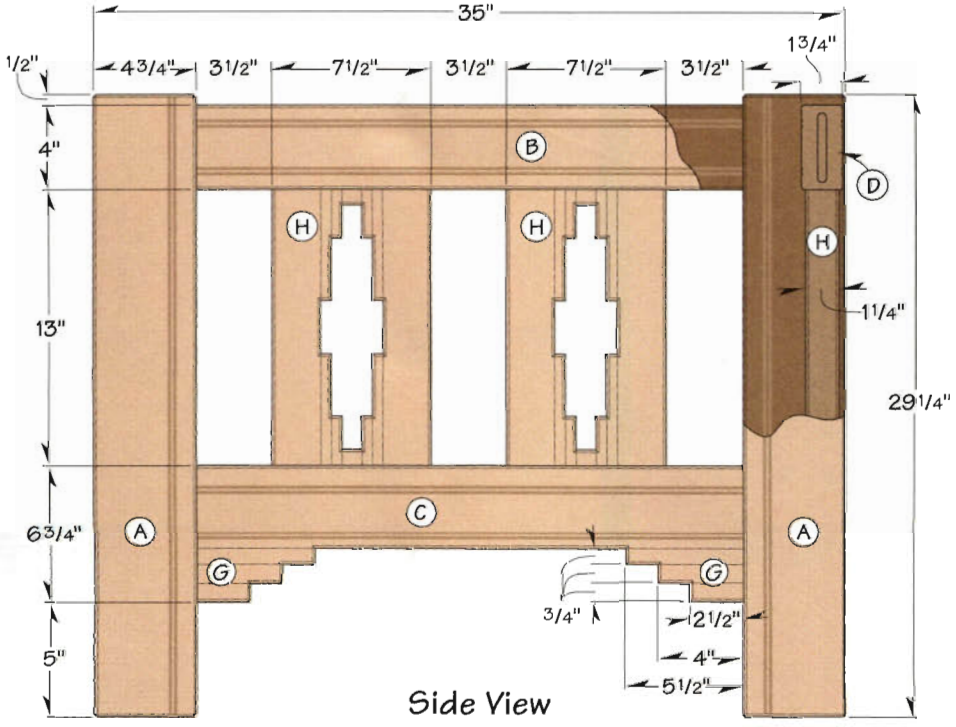
As you carve the rail texture, strive for a random, rough look. To do this, make your cuts nominally ⅛" deep by 1" long—but vary the lengths from ¾" to 1½" as you work. Vary the depth as well, and make occasional "double cuts" by partially overlapping two of the ½"-wide cuts. Carve with the grain, but angle your cuts slightly now and again—anything to produce the "totally random" look.

Photo B: Sand the carved rail texture to give it a smooth, worn feel. Dynabrade air sander with 180-grit flap sander is shown here, although a portable electric drill and flap sander would also do nicely.

Work across the width from bead to bead, proceeding from one end of the rail to the other. Carve into the groove—but not into the bead—to enhance the appearance of depth. Now, sand the carving to smooth it and give it a worn feel. (See *photo B.* We used a Dynabrade air sander with a 180-grit flap sander, although your portable electric drill would also work.)



Front View



Side View

pieces at a time as before, being careful to keep the pieces aligned as much as possible.

Step 6. Center, glue, and clamp the center trim parts to the bottom edge of the front/back bottom rails. Note: Use plenty of clamps to ensure a tight and invisible glue line, and keep the faces aligned flush. If necessary, belt-sand the faces flush after the glue dries.

Step 7. Glue and clamp the corner trim parts to the four bottom rails. Take care to keep the faces flush and the ends aligned. Note: You'll trim the rails (and corner trim) to final length later, which will take care of any minor misalignments. Again, belt-sand the faces flush after the glue dries.

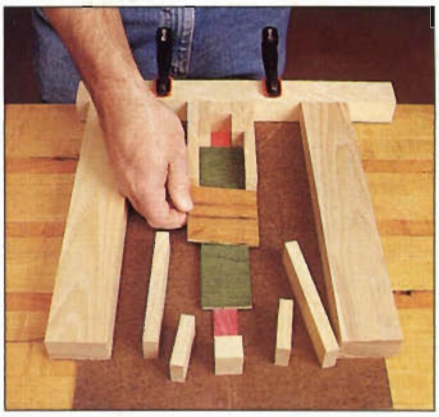


Photo C: Cut plywood spacers (shown here in red, green, and brown) to position spindle pieces during glue-up. Note straight-edged cleat used to align ends.

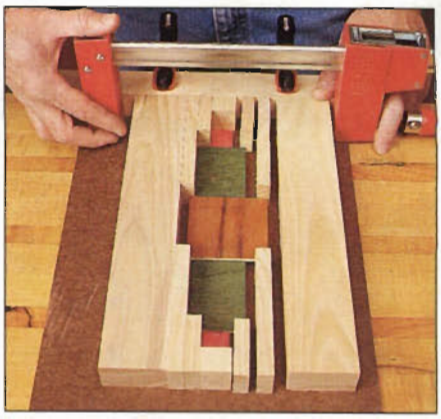
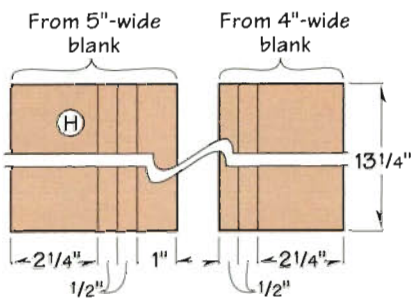


Photo D: Arrange spindle pieces, apply glue to mating surfaces, drop in spacers, and then clamp. Note that spacers establish top-to-bottom dimensions but don't affect width of cutouts.

Figure 2



Machine and Assemble the Spindle Parts

Step 1. To make the 11 spindles (H), joint and plane approximately 26 board feet of 6/4 stock to 1⅝" thick. From this material, cut eleven 9x13¼" blanks. (We didn't have 9"-wide stock, so we cut eleven 5"- and eleven 4"-wide blanks. If you have to do the same, mix and match the 5" and 4" pairs for best grain and color match.)

Step 2. From each 9"-wide blank (or 5"/4" pair), rip seven pieces to the widths shown in *figure 2* and on the Spindle drawing *below left*. Next, crosscut the 1"- and ½"-wide pieces to the lengths shown in *figure 3*. Note: Mark the ends of each piece to retain grain orientation.

Step 3. To assemble the spindles, first fasten a straight-edged cleat across the end of a plywood or hardboard scrap. From ¼" plywood, cut a 3x3", a 2x9", and a 15/16x11½" spacer to keep the spindle pieces in place during the glue-up.

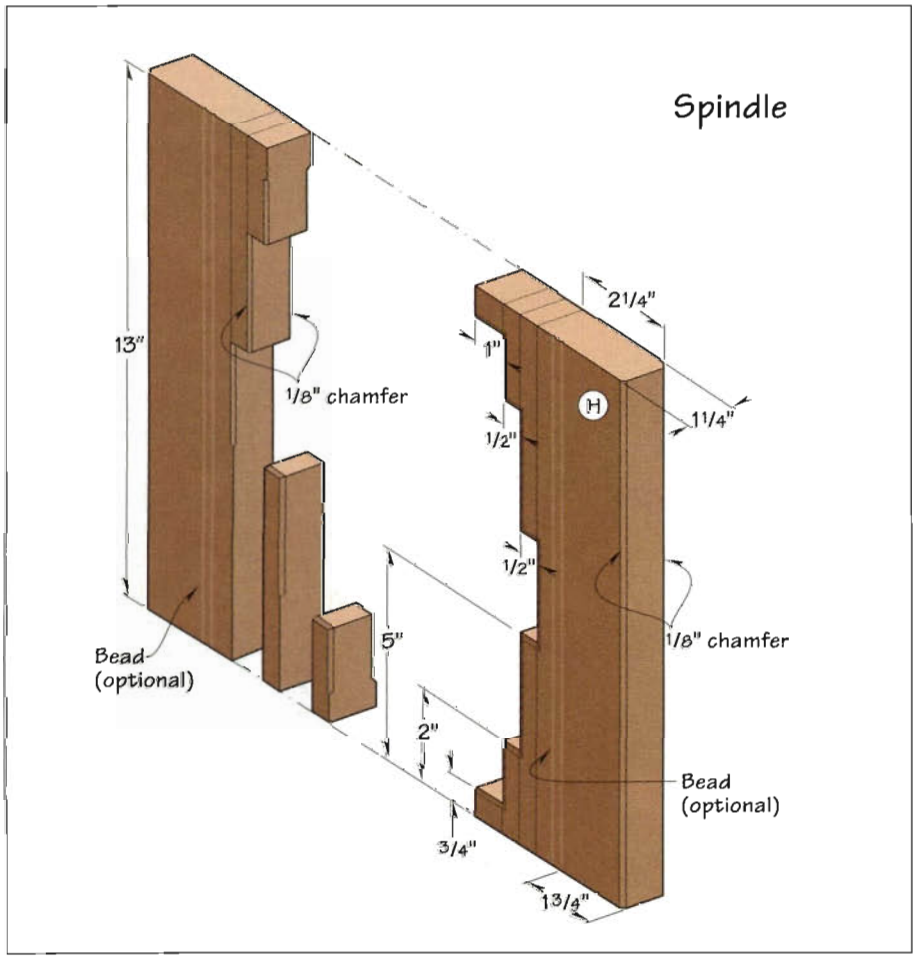


Figure 3

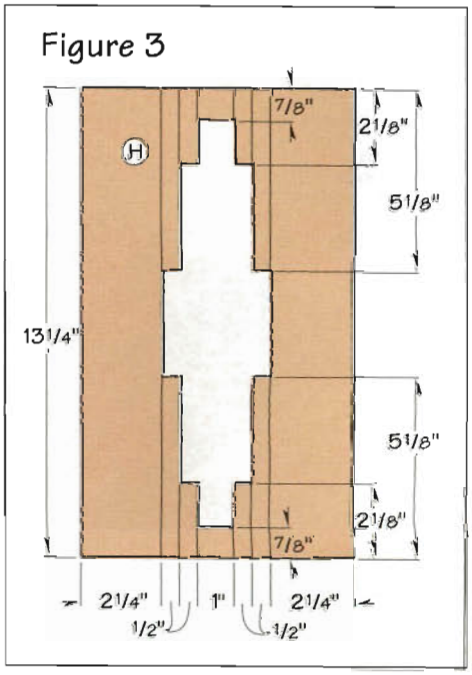


Photo E: Use sharp chisel and shearing motion to square the chamfer corners on spindles and rail trim. At each corner, cut end grain first, then long grain.

Step 4. Arrange the pieces of one spindle as shown in *photo C*, then apply glue to the mating edges and drop in the spacers. Note: The spacers will not fit tightly from side to side and will not affect the edge joints. Apply finger pressure to align the pieces against the cleat and set the locations of all parts. Holding the parts in place with your fingers, apply one clamp (*photo D*). Check the face alignment of all pieces, then apply more clamps as needed. (We used six for each spindle.)

Step 5. Glue and clamp all eleven spindles. When the glue has dried, surface-plane both faces lightly to a final 1¼" thickness. As an option, you can add the same ¼" bead you cut on the rails and legs. (See the Spindle drawing for locations.)

Step 6. Using a chamfer bit and your table-mounted router, rout a ⅛" chamfer on the outside edges of each spindle. Then, rout the inside edges of the cutout on both faces. Square the rounded corners of the chamfer with a sharp chisel (*photo E*).

Step 7. Crosscut one end of each spindle to make the center (1"-wide) section ¾" long. Then, crosscut the other end to yield a 13" final length.

Prepare the Parts For Final Assembly

Step 1. Using the same router-table setup you used before, chamfer all four edges (not the ends) of the legs. Next, add a fence and set it flush with the front edge of the pilot bearing on the chamfer bit. Now, rout all around both ends of the four legs.

Step 2. Install a chamfer bit in your handheld router. Rout the edges (not the ends) of all rails, excluding the inside edges of the front/back bottom rails. Note: Rout the trim parts as well, except for the tips of the center trim, which you chamfered earlier.

Step 3. Square the corners of the chamfers on the center and corner trim parts. (For help with this operation, see the Pro Tip *above*.)

Step 4. Crosscut the rails to finished length by trimming an equal amount of material from both ends. Then, lay out and cut mortises for loose tenons in the legs and rails. (For dimensions and locations, see the details shown with the Exploded View.) Note: Double-check your layouts on the legs before mortising. (To cut our mortises, we made the simple template shown in *figure 4* for use with a plunge router, guide bushing, and ½" straight bit.)

Step 5. From ½"-thick solid stock, cut 14 loose tenons: six to 3¼x3" and eight to 3¾x3". (We used poplar, orienting the grain along the 3" dimension.) Using a chamfer bit in your table-mounted router, rout a 3/16" chamfer on all four edges of each tenon.

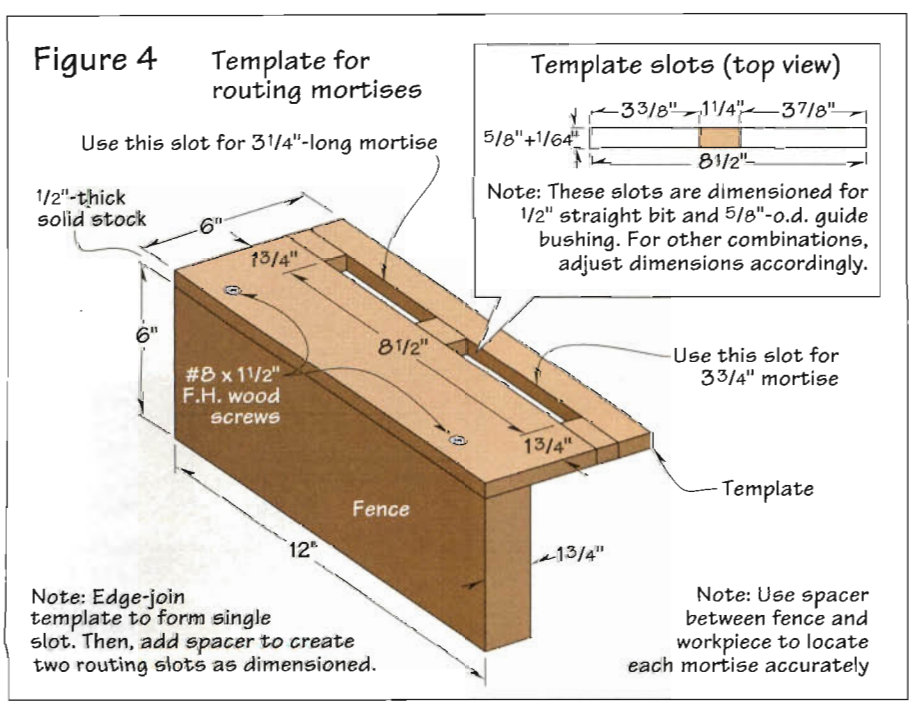
Step 6. Using a plate joiner, cut two #20 biscuit slots in both ends of each spindle. (For dimensions, see the detail that accompanies the Exploded View.)

Step 7. Lay out locations for the spindles along the mating rail edges where shown on the Front and Side Views. Using the layout marks on the spindles, transfer the biscuit locations to the top and bottom rails. Reset the plate joiner fence to center the cutter on the rail thickness, then slot the rails.

PRO TIP

To square the chamfered corners on the corner trim, first extend the lines of the routed chamfer into the corners with a pencil. To establish the intersection, hold the back of a sharp chisel flat on the routed chamfer, then use a shearing motion to cut out the waste (end grain first, then the long grain). Use the same technique on the mitered center trim parts, but follow through on the shearing motion to cut a steeper angle at the point of intersection.

As an alternative, you can use a triangular file to establish the intersection. Then, finish the cleanup with a flat file.



Assemble the Frame, Then Add Cleats and Slats

Note: To avoid wood movement problems, we recommend that you glue only two of the four biscuits to each spindle (same side, top and bottom). This allows the spindles to expand and contract as ambient humidity changes without splitting or causing joint failure.

Clamping the spindle/rail assemblies can be a challenge. We found it easiest to work in stages, using the legs to keep the assembly square.

Step 1. Place the lower back rail on a large work table. Using the layout marks from the biscuit-slotting, position and dry-assemble (with biscuits) one of the end spindles to the rail, aligning the biscuit slot layout marks. Disassemble, then apply glue to the bottom biscuit on one side of the spindle only. Note: To avoid confusion, glue either the right-hand or left-hand biscuit on all spindles. Insert a dry biscuit on the other side. Now, glue and clamp the spindle to the rail, again applying glue only to the biscuits on the one side. Repeat this procedure to assemble all seven spindles to the lower back rail.

Step 2. Glue one biscuit into the slot on each spindle top that corresponds with the side you glued on the bottom end. Then, dry-clamp the lower rail (using the tenons) to the back legs.

Step 3. Apply glue to each of the biscuits you glued to the spindles in the previous step. Then, working quickly, insert a dry biscuit into the other slot on each spindle top. Slide the top rail into position between the legs and clamp it to the spindles. (If necessary, loosen the clamp on the legs to do this, then retighten.) Now, dry-clamp the legs to the top rail. Check the dry joints between the legs and rails for square, then allow the glue to dry.

Step 4. Unclamp the legs from the back rail assembly. Use them to follow the above procedure for assembling the side rails and spindles. Again, make sure that you apply glue only to the same-side biscuits on the spindles. After assembly, check the dry joints between legs and rails for square, then glue the loose tenons into the legs. Now, glue and clamp the legs to the side rails to make two complete side frames.

Step 5. To complete the frame assembly, lay one side frame on the floor (with cardboard underneath) with the mortises up. Using glue and tenons, join the back rail assembly and front rail to the side frame. Apply glue to the other side frame and tenons, then fit the frame onto the top rail ends. Now, carefully lower the assembly to horizontal, floor-standing position, and clamp. (We used three 8' pipe clamps, although 48" bar clamps would also work, provided you gang them properly so as not to pull the assembly out of square.)

Step 6. From 1"-thick hardwood stock, rip and crosscut two cleats (I) to dimension. (We used poplar.) Temporarily clamp the cleats where shown on the Exploded View to allow the slats to sit slightly (1/32") below the top edge of the rails. Then, glue and screw the cleats to the bottom rails using #8x1½" flathead wood screws.

Step 7. Finish-sand all parts. Use a sanding block on the chamfers to keep the edges crisp. Next, apply your choice of finish. (We brushed on a coat of hardening oil finish, wiped off the excess, and allowed it to dry overnight. We then applied a second coat and sanded with 320-grit wet/dry sandpaper while it was still wet, then wiped off the excess.)

Step 8. Measure the interior frame depth from bottom rail to bottom rail, then cut 10 hardwood slats to fit. (We used poplar.) Space the slats evenly along the rails, then attach them to the cleats using #8x1½" screws. Note: Because of cross-grain construction, do not glue the slats. WJ

Lead photo: Lynxwiler Photography
Other photos: Kevin May

SOURCES

Foam Mattress. Extra firm closed-cell foam, 5x33x74". Polyester cover. Catalog no. 799-6754, $85.00 plus s/h. Order from:

J.C. Penney
800/222-6161

Reciprocating Carver. Automach HCT-30A by Sugino; includes five blades, wrench. Catalog no. 09G41, $299.95 plus s/h. Order from:

Woodcraft
800/225-1153

Flap Sander. 180-grit aluminum oxide abrasive discs, ¼" shank (catalog no. 860-428). Price: $13.35 plus s/h. Other grits also available. Order from:

Woodworker's Supply, Inc.
800/645-9292

Woven Southwestern-Motif Fabrics. Durable 100% cotton. Several styles available. For more information, contact:

Rachman Collections, Inc.
212/268-3655

High visibility for dolls or other treasures

GLASS DISPLAY CASE

We like to view special objects from all sides in order to appreciate them properly. However, many treasures are too fragile to handle except on rare occasions. This case makes an ideal enclosure for showing off that antique doll or prized quartz geode while providing protection from dust, moths, and sneezing admirers. And with its simple construction, you can easily upsize or downsize it to fit your needs.

Start With the Posts

Note: To avoid complications, we suggest you have the glass and mirror panels on hand while building the case. Make certain the glass fits easily in the frame and post grooves before you glue any parts.

Step 1. To make the posts (A), rip 6/4 cherry stock to 1⅜" wide, then joint two adjacent faces square. Note: Straight-grained material works best for these parts. Plane the remaining faces to 1¼" square, then crosscut four post blanks to 19" long. After studying the grain to determine the best arrangement, mark the front and rear faces and the relative position of each blank.

Step 2. Rip a 13/32" strip from the front face of each front post blank and the rear face of each rear blank. Set your jointer to cut 1/32" deep, then joint the sawn faces of the strips and the post blanks. Note: Always use push blocks when jointing thin stock.

Step 3. Using a ¼" straight bit in your table-mounted router, rout a ¼"-deep groove centered in the newly jointed face of each blank. (See *figure 1.*) Then, glue and clamp each face strip back onto its original blank, aligning the grain carefully.

Step 4. After the glue has dried, joint and plane the posts to 1" square, removing the same amount of stock from each face to keep the ¼"-square channel centered. Trim one end of each post square, then crosscut all four to 18" long.

Step 5. Mount a ⅛" rip blade on your tablesaw, then cut a 3/16"-deep groove on both inside faces of each post where dimensioned on the Front View detail on *page 50.* Note: Check the grooves with your glass and mirror to make sure the panes

will slide freely in them. You may need to widen the grooves slightly. (We widened ours to 9/64".)

Step 6. Bore holes in the post ends for the ½"-diameter brass post fittings. To do this accurately, first make the guide block and drill press support described in "Dead-On Drilling Aids" on *page 49*. Chuck a ½" Forstner bit in your drill press and clamp the T-shaped support to the drill-press table. Fit the guide block's indexing strips into the post grooves and seat the block flush with the top of the post *(photo A)*. Clamp the post and guide block to the support as shown in the photo. Align the guide block's indexing hole with the bit, adjusting the table height and drilling depth as needed to drill ½" deep into the post. Bore identical holes in both ends of each post.

Step 7. Using a chamfer bit in your table-mounted router, cut a ½"-wide chamfer on the outside corners of the posts as detailed on the Exploded View. Use stopblocks, and a fence to stop the chamfer ¾" from each end, making repeated light cuts to avoid chipping. (We tested our router-table setup on scrap to establish proper cutting depth and range.) Note: Don't hesitate at the stopblocks, or the stock will burn. Clean up minor burn marks with a scraper.

Step 8. Remove the stopblocks, then chamfer the inside corner of each post as detailed on the Front View. Make repeated light cuts as before.

Make the Frames

Step 1. To make the top and bottom frame parts (B, C), joint and plane a 5½x72" piece of cherry stock to ¾" final thickness. Rip two 2¼"-wide pieces from this stock, then select and mark the inside edges and faces on both pieces. Crosscut four 17"-long frame blanks from each piece, marking their order for grain "wrap." At the same time, cut a length of scrap to the same thickness and width as your frame stock for testing router setups.

Step 2. Elevate your tablesaw blade to cut 3/16" deep and set the rip fence 15/16" from the blade. Keeping the outside edge of each frame piece against the rip fence and the inside face down, cut a 9/64"-wide groove for the glass and mirror panes. (We did this in two passes.)

Step 3. Cut a ¼" rabbet ¼" deep along the top inside face of the top frame pieces (opposite the face with the 9/64" grooves). This rabbet will accept the ¼"-thick glass lid.

Step 4. Install a ⅛" round-over bit in your table-mounted router. Set a fence flush with the outside edge of the bearing, adjust the bit height, and rout along the top outside edge of each frame side. (See *figure 2.*)

Step 5. Rout a second round-over along each frame side, cutting in from the opposite face in several passes to form a half-round or bullnose.

Bill of Materials

Doll Case

Part	T	W	L	Mtl.	Qty.
A Posts*	1"	1"	18"	C	4
B Frame sides-top	¾"	2¼"	16⅜"	C	4
C Frame sides-bottom	¾"	2¼"	16⅜"	C	4
D Bottom panel*	¾"	17⅞"	11⅞"	CP	1
E Feet	¾"	1½" dia.		C	4

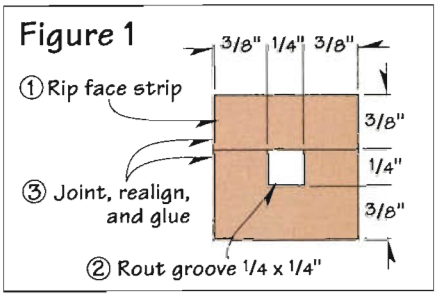
*Parts cut to final size during construction. Please read all instructions before cutting.

Materials List

C-Cherry
CP-Cherry plywood

Supplies

#0 biscuits; #10-24 threaded rod; #10-24 nuts; #10 washers; ½"-o.d. brass tubing; ⅛"- and ¼"-thick plate glass; ⅛"-thick plate mirror; finishing supplies; adhesive-backed contact paper; ⅞"-dia. adhesive-backed felt pads.



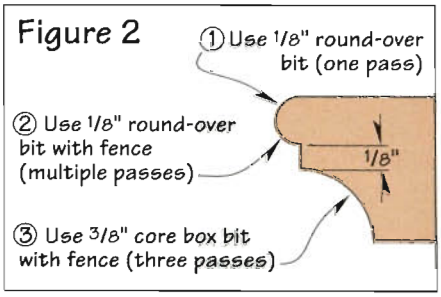
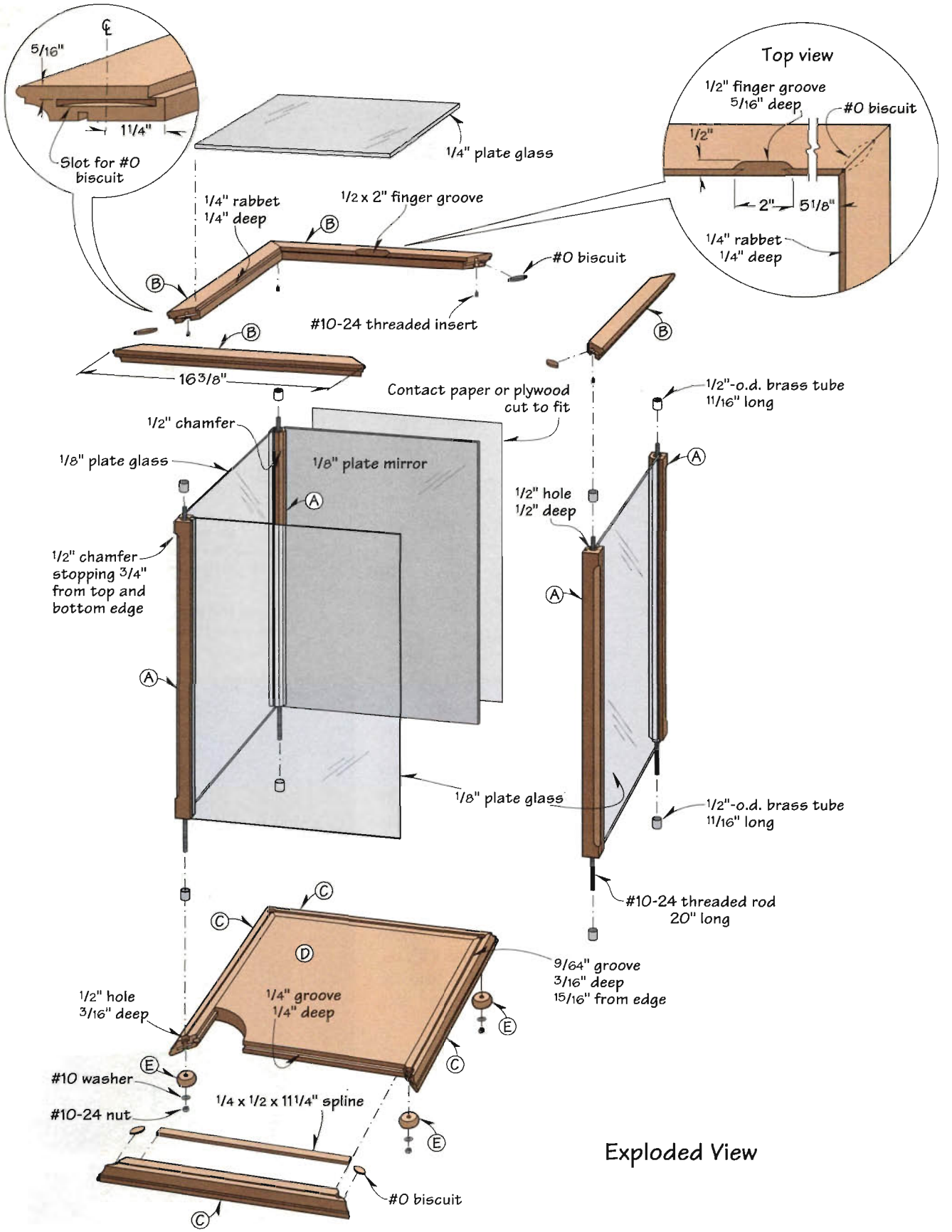


Photo A: Use a T-shaped support clamped to the drill press table to hold the posts vertical while drilling holes in the ends.


℄
5/16"
11/4"
Slot for #0 biscuit
1/4" plate glass
Top view
1/2" finger groove
5/16" deep
#0 biscuit
1/2"
2"
51/8"
1/4" rabbet
1/4" deep
1/4" rabbet
1/4" deep
1/2 x 2" finger groove
#0 biscuit
#10-24 threaded insert
B
163/8"
Contact paper or plywood cut to fit
1/2"-o.d. brass tube
11/16" long
1/2" chamfer
1/8" plate glass
1/8" plate mirror
A
1/2" hole
1/2" deep
1/2" chamfer stopping 3/4" from top and bottom edge
1/8" plate glass
1/2"-o.d. brass tube
11/16" long
#10-24 threaded rod
20" long
C
D
9/64" groove
3/16" deep
15/16" from edge
1/2" hole
3/16" deep
1/4" groove
1/4" deep
E
#10 washer
#10-24 nut
1/4 x 1/2 x 111/4" spline
#0 biscuit
Exploded View

(See figure 2.) Next, change to a ⅜"-radius core box bit. Adjust the fence as needed to cut the cove shown in the figure, and rout to final depth in three passes.

Step 6. Miter-cut both ends of all frame sides to 16⅜" long. (We used our miter saw fitted with a stopblock.) Next, lay out and cut slots for #0 biscuits on the mitered ends of the frame sides where shown on the Exploded View detail.

Step 7. Dry-assemble the bottom frame using biscuits. Clamp and square the frame, then measure the inside dimensions. From ¾"-thick cherry plywood, cut a square piece for the bottom panel (D) slightly larger than these dimensions. Now, "sneak up" to the final size by making very thin cuts on the tablesaw and test-fitting the panel until it fits snugly in the frame but doesn't open the miters. Unclamp and disassemble the frame parts.

Step 8. Mount a ¼" dado head on the tablesaw and cut a centered, ¼"-deep groove around the edge of the bottom panel, keeping the good (top) face of the plywood against the fence. Without changing your setup, cut an identical groove along the inside edge of each bottom frame side, again keeping the top face against the fence.

Step 9. From ¼"-thick hardwood stock, cut four ½x11¼" splines. Glue and clamp the bottom frame around the panel using biscuits and splines. Then, glue, biscuit, and clamp the top frame, and check it for square and flatness. (We used ½" dowels nested in the coves as clamping pads.)

Install the Metal Fittings

Step 1. When the glue has dried, bore ½" holes 3/16" deep in the frame corners to match those in the posts. (See *figure 3* on *page 50*.) Use the guide block you made earlier to position the holes on the frame, and set the drill-press stop to proper depth. Note: Seat the block's indexing strips in the frame grooves.

Step 2. Using your drill press, drill ⅜"-deep holes into the underside of the top frame corners for the #10-24 threaded inserts. To do this, use the twist bit recommended by the insert

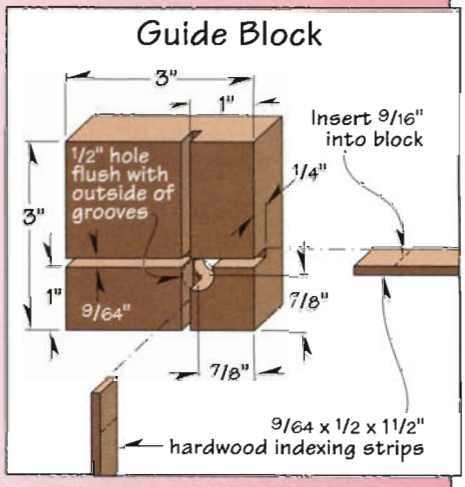
Dead-On Drilling Aids

We designed the simple guide block shown at *right* to help align and bore holes accurately in the post ends and the top and bottom frames. We started with a ⅞x3x3" block of hardwood and cut two ⅛" kerfs ¼" deep into the block where dimensioned. Note: If necessary to fit your glass, change the fence setting slightly and enlarge the grooves (as we did) to 9/64" wide to match the grooves in the posts.

Next, using a Forstner bit in our drill press, we bored a ½" indexing hole centered ⅞" from the corner, aligning the outer edge of the hole with the outside edges of the grooves as shown. From ½"-thick hardwood, we ripped and crosscut two 9/64x1½" indexing strips and snug-fit them in the block's grooves, positioning them as shown in figure 3 on *page 50*. Note: Leave these strips dry so they can be adjusted as needed.

It's critical that the posts be held firmly upright while boring the end holes, so we made the support block shown at *right* for this. We cut two 1½x4x9" pieces of scrap hardwood and cut a centered V-groove lengthwise in the face of one piece. (To cut this groove, we elevated the tablesaw blade ¾" above the table, tilted it to 45°, and then bevel-ripped two kerfs from opposite edges of the stock.)

We aligned the bottoms of these two blocks on the saw table and joined them in a T-shape using glue and countersunk #8x1¾" flathead wood screws. We stood this support block on end and attached it to a ¾x8x8" plywood base using #8x1½" flathead wood screws. (The base clamps to your drill-press table.) Note: This fixture works well for end-drilling both square and round stock.



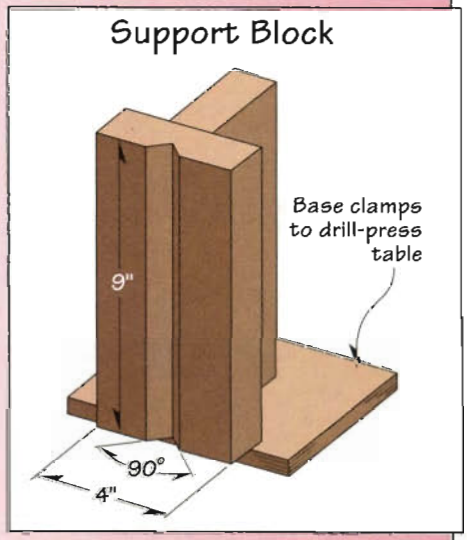
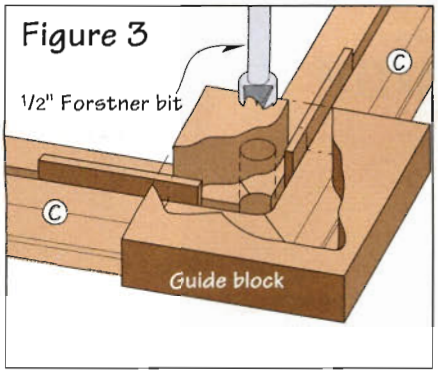
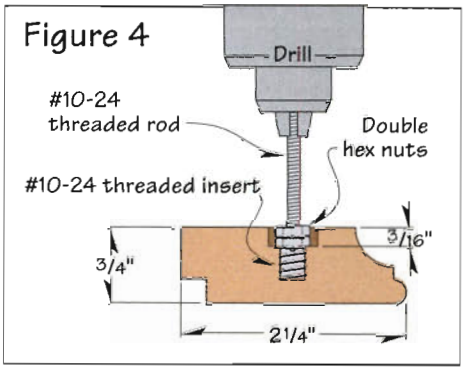


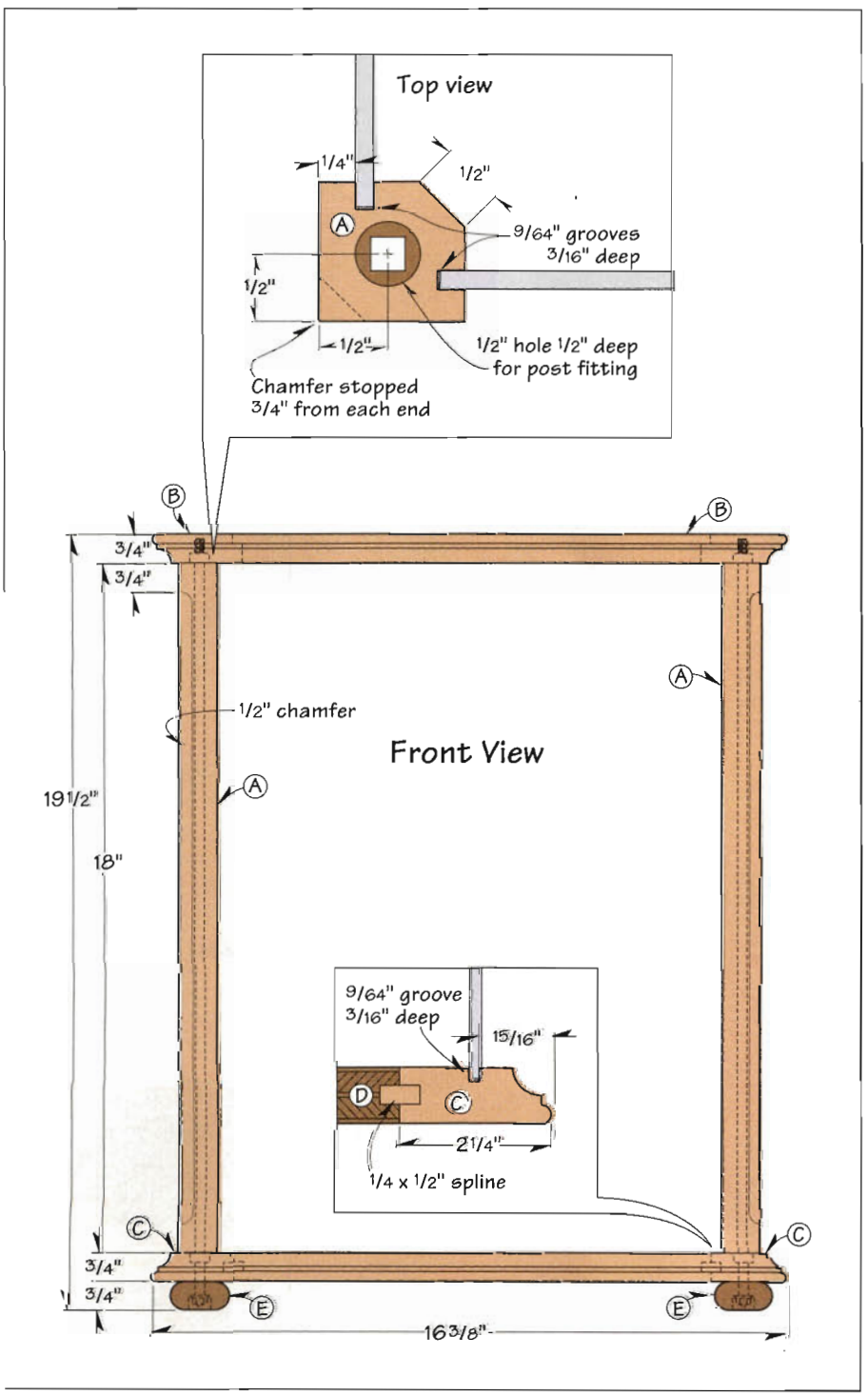
Photo B: Insert the indexing strips in their grooves, then seat the guide block flush with the top of the post. Clamp the post to the T-shaped support block.

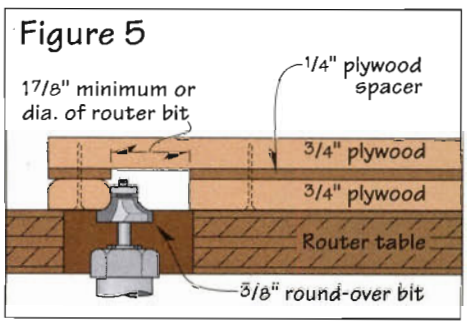


manufacturer and center it in the holes made earlier by the Forstner bit. Change to a 3/16" bit, release the depth stop, and drill through the bottom frame at each corner, centering these holes in the ½" holes.

Step 3. Install inserts in the top frame holes. (To install ours, we used the technique shown in *figure 4*, holding our portable drill square to the frame and slowly driving the inserts







into the holes. After driving an insert, we loosened the outside nut and reversed the drill to back the rod out.)

Step 4. Insert a length of ½"-o.d. brass or copper tubing into each post end until it bottoms in the hole. Then, cut the tubing 5/32" from the post ends using a hacksaw. Note: Use a fine-tooth blade and light cutting pressure.

Step 5. With the tube segments in place, check the alignment of the post and frame grooves. To make minor adjustments, enlarge the frame holes slightly (not the post holes) as needed to align the grooves, using a small gouge.

Now, Make the Feet

Step 1. To make the feet (E), start with a piece of 3/4x1 5/8x8" cherry stock. From it, cut four 1 5/8"-square pieces. Scribe diagonal lines from corner to corner on one face of each, then drill a 5/32" hole through the center.

Step 2. Fit your bandsaw with a 1/8" blade and a circle/radius cutter set to cut a 3/4" radius. Then, cut a 1½"-diameter disc from each square. At the same time, cut a ¼"-thick plywood scrap to this diameter to use as a spacer for the routing jig shown in *figure 5*. (We used the bandsaw circle/radius cutter reviewed on *page 16* to cut the discs, then moved the tool

Continued on page 52

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Continued from page 50

to our disc sander to sand the foot edges smooth. As an alternative, you could turn the feet on a lathe or use a circle cutter on the drill press. If you choose this latter method, cut the discs from the full length of stock.)

Step 3. To round the edges of the feet, first make the jig shown in figure 5 and *photo C*. Glue the spacer to the jig where shown, then attach a foot using a #6x1½" flathead wood screw.

Step 4. Install a ⅜" round-over bit in your table-mounted router and elevate the bit to cut slightly less than its full radius. (This leaves a small flat for the bearing to ride on when you turn the piece and make the second cut.) Rout one edge, invert the foot, and then repeat. (See photo C.) Shape the remaining feet the same way.

Step 5. Using a ⅝" Forstner bit, counterbore a centered, ⅜"-deep hole in one face of each foot. To do this, clamp the foot in a handscrew clamp laid flat on the drill-press table. (This counterbore will accept a hex nut and allow clearance for tightening the nut with a socket during assembly.)

Step 6. Remove one of the hex nuts from the threaded rod you used to seat the inserts. Chuck the rod into a portable drill, then thread a foot onto the rod and tighten the nut against it. Holding the drill in one hand and a random-orbit palm sander in the other, sand the feet smooth *(photo D)*. Note: Run the drill at approximately 1000 rpm and keep the sander moving to avoid forming a flat. (If you prefer, chuck the rod and foot assembly into your drill press and hold the sander with both hands.)

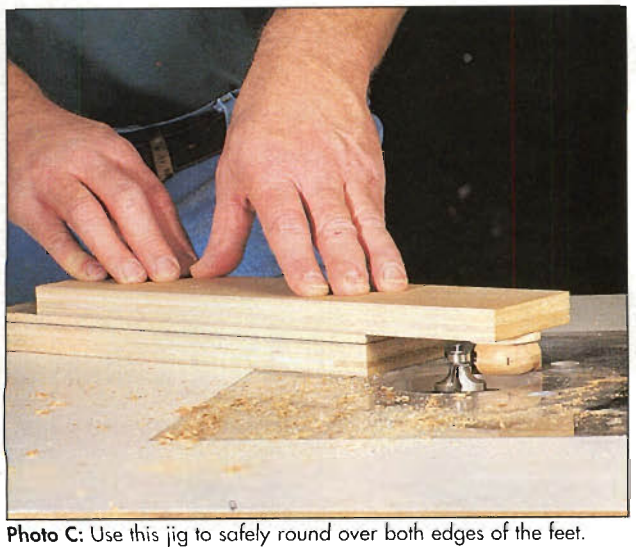

Photo C: Use this jig to safely round over both edges of the feet.

Step 7. After sanding the feet, remove the threaded rod. Then, using a twist bit, re-drill 3/16" holes through the existing foot holes.

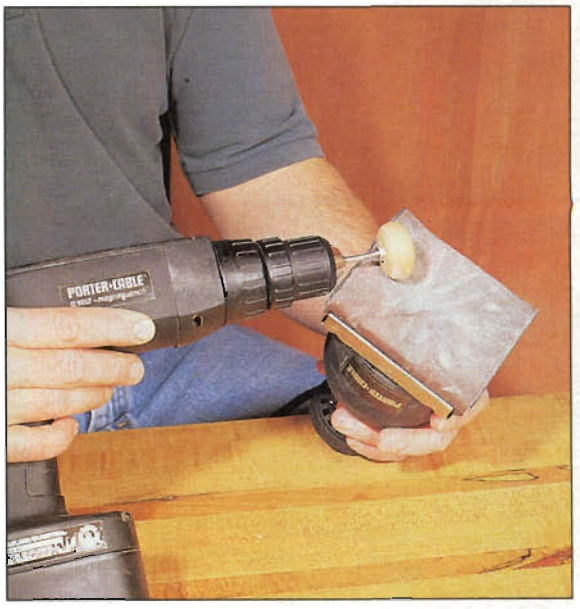

Photo D: Finish-sand each foot using a portable drill and palm sander.

Add the Finishing Touches

We chose to use a mirror in one of the four sides. If you prefer to leave the case open for viewing from all angles, substitute a glass pane for the mirror.

Step 1. Have the glass and mirror panes cut at a glass shop. Size the ¼"-thick glass for the top frame opening to fit closely but not tightly. Note: Have the sharp corners of the ⅛" glass eased for safe handling and the edges of the ¼" glass lid polished.

Step 2. Apply a coat of polyurethane varnish to the back of the mirror and set it aside to dry. (This coating will provide extra protection for the silver back.)

Step 3. Using a ½" cove bit in your table-mounted router, rout a centered, ½x2" finger groove 5/16" deep on the inside edge of the top frame where shown on the Exploded View detail. Use stopblocks and a fence to limit the groove's depth. Note: When you want to open the case top, start by lifting the glass with the corner of a credit card.

Step 4. Sand all parts to 220-grit. Use dowels wrapped with sandpaper to sand the coves. Block-sand the post chamfers and "feather" the transition from the stopped chamfers to the square corners to smooth any minor chipping left by the router bit.

Step 5. Remove dust using a tack cloth or compressed air, then apply your choice of stain and finish. (We used Minwax Cherry #235, then sprayed on three coats of clear semi-gloss lacquer, sanding with 320-grit paper after the second coat.)

Step 6. Cut four 20" lengths of #10-24 threaded rod. Place the top frame upside down on a protected surface and thread the rods into the corner inserts. Insert the brass fittings in their holes on the posts, then place the posts over the rods.

Step 7. Slide the glass and mirror panes into their grooves, then lower the bottom onto the rods and posts. Place the feet over the rod ends, then add the washers and nuts. Tighten the nuts to snug the assembly. If there is any play between the posts and glass, align the post corners with the frame miters before tightening completely.

Step 8. Add ⅞" felt pads to the bottoms of the feet. Arrange the objects to be displayed, then add the top glass panel. If desired, cut and adhere a piece of contact paper or plywood to the back of the mirror to provide additional protection for the silvering. WJ

Project design: *Bob Colpetzer*
Photographs: *StudioAlex*
Illustrations: *Cad Art*

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Another earthshaking construction implement

Steam Roller

Once again, Ed and Carole Schmidt of Reynoldsburg, Ohio offer up a gem from their line of original designs. Says Ed: "It's an ideal project to make from scraps around the shop. The only tricky piece is the pivot; your readers may have to practice a couple of times with this part. Other than that, it can easily be made in a few hours."

Before You Start

If you own a lathe, you can simply turn the 2"-diameter dowel stock required for the rollers. If not, we've listed suppliers for the dowels and other parts in Sources at the end of the article. A note of caution: As with all projects involving small parts, use push sticks, carrier boards, zero-clearance inserts, and sliding tables. Do whatever it takes to keep your fingers clear of the bit or blade and to minimize the chances of kickback.

Machine the Chassis Parts First

Step 1. Plane a 3x14" piece of 8/4 walnut stock to 1¾" thick, then rip and crosscut a 2¼x12" blank for the chassis parts. From this blank, cut a 3½" length for the front chassis (A), and set it aside for now.

Step 2. Fit your tablesaw with a ⅛" square-ground rip blade, then set the fence 2⅛" from the blade. Cut a ⅛" rabbet ¾" deep along one edge of the remaining blank. This rabbet will form the narrow lip or "fender" on the back of the rear chassis. (See the Rear Chassis drawing on *page 57.*)

Step 3. From the rabbeted blank, crosscut the rear chassis (B) to 3¾" rough length.

Step 4. From ⅜"-thick walnut stock, cut a 2x3¾" piece. Face-glue and clamp it to the bottom face of the rear chassis blank. After the glue has dried, bandsaw the rear chassis (the edge opposite the rabbet) to 1⅞" final width using the rip fence. Then, crosscut it to 3½" length, squaring both ends.

Step 5. Lay out and bore a centered 1" hole ⅜" deep in one edge of the front and rear chassis parts where dimensioned on the Front Chassis and Rear Chassis drawings on *page 57.* Note: On the rear chassis, bore the edge opposite the rabbeted edge.

Step 6. On the top face of the front chassis, drill a 3/16" hole ¼" deep for the steering wheel post where shown on the Front Chassis drawing.

Step 7. Lay out the wheel well radius on the chassis parts where shown on the drawings. (We cut a 1⅜"-radius plywood disc using a circle cutter. We then used the disc as a template and traced the radius onto one end of both chassis parts.)

Step 8. Stand the chassis parts on end and bandsaw the radii to rough shape, keeping the blade outside the line. Now, sand to the line using an oscillating spindle or drum sander. Note: Do not reduce the thickness of the fender lip on the rear chassis to less than 1/16".

Step 9. Lay out and sand the beveled faces and edges on the two chassis parts as dimensioned on the Front Chassis and Rear Chassis drawings. (We used our stationary disc sander, sanding carefully to the line.)

Step 10. Using a 1/16" round-over bit and table-mounted router, rout all 90° edges on the two chassis parts. (See the Exploded View on *page 56* for reference.) Break the edges you can't rout using 220-grit sandpaper.

Add the Cab Parts

Step 1. To make the cab parts, first cut a 1x10" blank from ½"-thick walnut stock. From it, crosscut two 1"-long instrument panels (C).

Step 2. On the remaining blank, lay out and sand a bevel along one edge—not the end—as dimensioned on the Seat Back drawing on *page 57.* Note: The grain must run across the finished seat back. (We adhered the piece to a carrier board and sanded to the line using our stationary belt sander.) Then, crosscut a 1"-long section from the beveled blank for the seat back (D).

Step 3. Lay out and sand a ⅛" radius at both corners of one end of the instrument panels and at the beveled end of the seat back blank. (We used the stationary disc sander.)

Step 4. Using a 1/16" round-over bit in your table-mounted router, rout the top edges of the instrument panels. Note: For safety, adhere the instru-

Bill of Materials

Steam Roller

Part	T	W	L	Mtl.	Qty.
A Front chassis*	1¾"	2"	3½"	W	1
B Rear chassis* **	2⅛"	1⅞"	3½"	W	1
C Control panels*	½"	1"	1"	W	2
D Seat back*	½"	1"	1"	W	1
E Axle supports—side	⅜"	½"	2 1/16"	C	4
F Axle supports—front	⅜"	½"	4⅛"	C	2
G Pivot—rear*	1"-dia.		1¼"	W	1
H Pivot—front*	1"-dia.		1¼"	W	1
I Rollers	2"-dia.		3⅜"	B	2

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

**Part laminated to achieve final thickness.

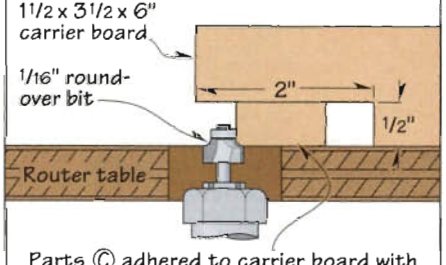
Materials List

W–walnut
C–cherry
B–birch, maple, or beech

Supplies

⅛", 3/16" hardwood dowel; aerosol polyurethane finish. (For other supplies, see Sources at end of article.)

Figure 1 Carrier board for routing parts ©



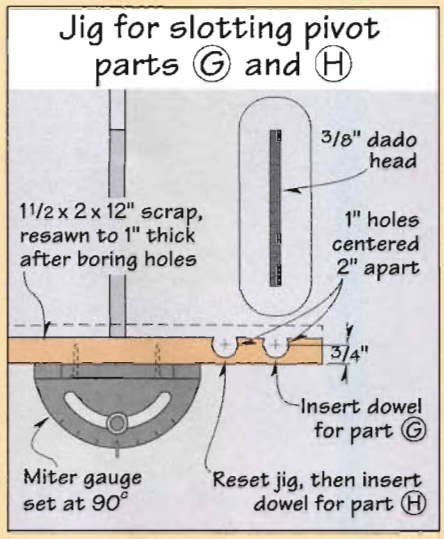
Parts © adhered to carrier board with double-faced tape or hotmelt glue

Slotting the End Of a Dowel

To make a jig for slotting the end of a dowel, first cut a 1½x2x12" piece of scrap stock. Stand it on edge and bore two 1" holes through it (centered on the thickness) near one end. Space the hole centerpoints 2" apart. Next, resaw the piece to 1" thick, which will cut away part of the holes you bored.

Attach the jig to your miter gauge, aligning the center of one hole with the dado head. To use the jig, insert the dowel into the hole by gently twisting it until it's flush with the table. Use one hole to cut each section of the pivot.

Insert the first dowel into the jig, and cut a centered ⅜" slot ⅞" deep in one end. This will be part G. Remove the dowel, then reposition the jig to align the dado head with the second hole. This time, position the jig to cut away a generous 5/16"-wide (21/64") notch at the edge of the dowel. Reattach the jig, insert the second dowel, and cut the notch. Turn the dowel 180°, then cut a second notch to form a centered 11/32"-thick tongue. (To ensure parallel cuts, we turned the jig upside down and oriented the dowel for the second cut using a combination square.)

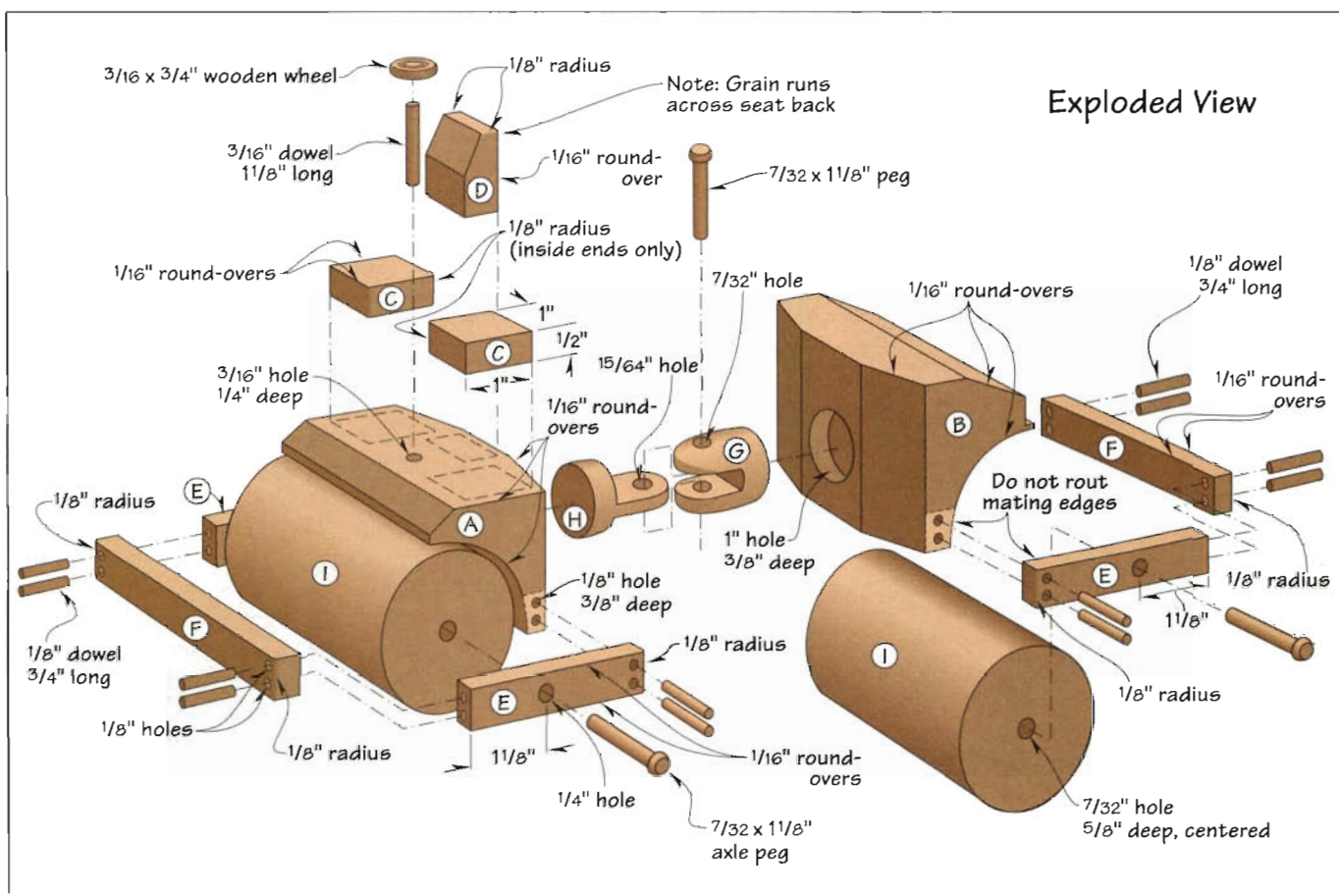


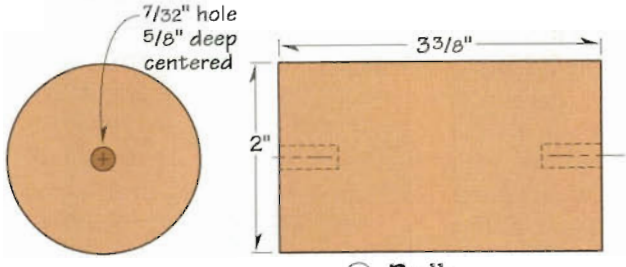
ment panels to a rabbeted carrier block as shown in *figure 1* to keep your hands away from the bit. (We adhered the parts to the carrier with hotmelt glue.)

Step 5. Cut a ½x1x6" piece of scrap, and adhere one end of it to the flat edge of the seat back. (We used hotmelt glue.) Lay the assembly flat on the router table, and rout the back ends and top back edge. Next, stand the assembly on one edge, and rout the ends and edges, including the beveled surface. Flip the assembly edge for edge, and repeat the procedure.

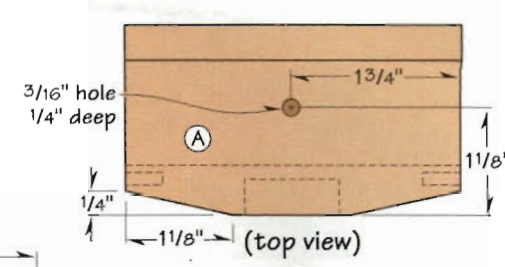
Step 6. Finish-sand the three cab parts, then glue them to the front chassis where shown on the Exploded View. Note: Center the parts with respect to the steering post hole. (We used slow-cure cyanoacrylate, holding the pieces in place until the glue cured.)

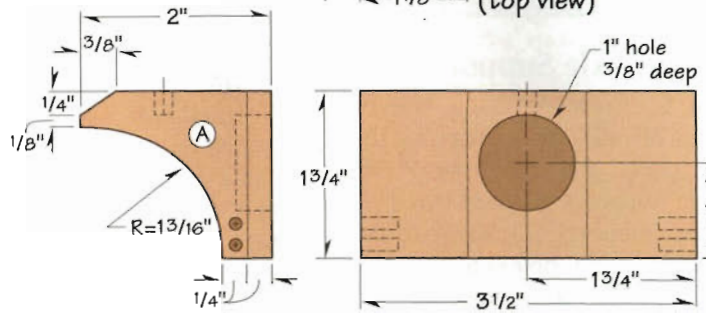
Step 7. Cut a 1⅛" length of 3/16" dowel for the steering post. Glue it into a 3/16x¾"-diameter wooden wheel. Now, glue the post into the hole in the front chassis.



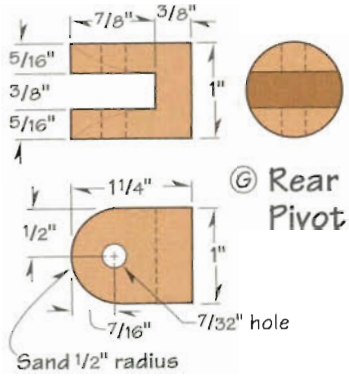


Ⓘ Rollers

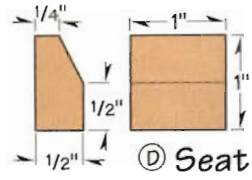




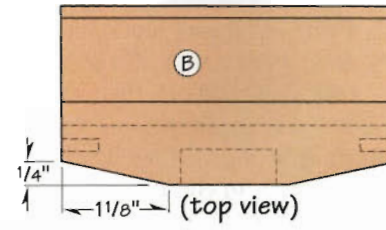
Ⓐ Front Chassis

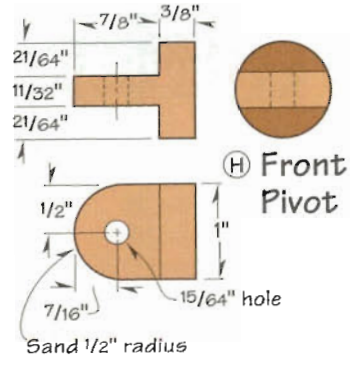


Ⓖ Rear Pivot

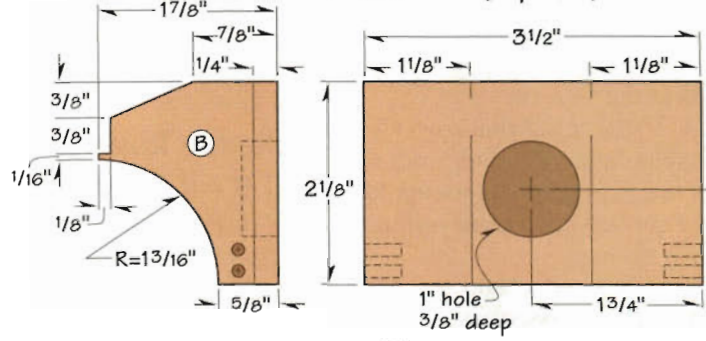


Ⓓ Seat Back

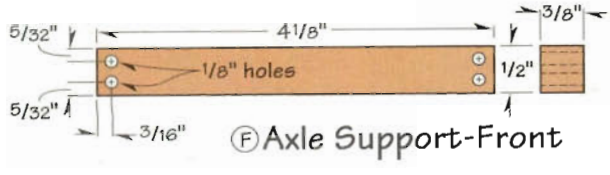




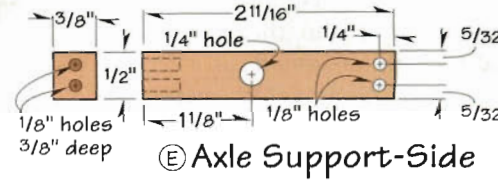
Ⓗ Front Pivot



Ⓑ Rear Chassis



Ⓕ Axle Support-Front



Ⓔ Axle Support-Side

PRO TIP

To ensure a perpendicular radius on the slot and tongue, we drilled a 3/16" hole 3/8" from one edge of a flat piece of scrap. We glued in a 1¼" length of 3/16" dowel, then fitted the pivot parts *onto* the dowel to keep them upright as we sanded the radius.

Make the Axle Supports

Step 1. From 3/8"-thick cherry stock, rip 24" of ½"-wide strips for the axle supports. Crosscut four 2 11/16"-long side supports (E) and two 4⅛"-long front supports (F). Then, drill a centered ¼" axle hole through the shorter parts 1⅛" from one end.

Step 2. Arrange the side and front supports to form two complete axle supports. Note: Make sure you have the side support axle holes positioned as shown on the Exploded View. Now, glue and clamp the supports using right-angle forms to keep the parts perpendicular.

Step 3. From ⅛" dowel stock, cut sixteen 7/16"-long pegs. After the glue has dried, drill, glue, and peg the axle support joints where shown on the Axle Support drawings. Note: Don't attach the supports to the chassis at this time. Sand the dowels flush, then sand a ⅛" radius on the outside corners of both supports and on the outside ends of the side supports.

Step 4. Using a 1/16" round-over bit in your table-mounted router, rout all edges of the axle supports except for the inside surfaces that mate with the chassis parts.

Step 5. Glue and clamp the axle supports to the chassis parts where shown on the Exploded View. Check to make sure that the supports are perpendicular to the chassis parts, then allow the glue to dry.

Step 6. Drill ⅛" holes through the side supports and into the chassis parts where dimensioned on the Exploded View. Apply yellow woodworker's glue to the remaining dowel pegs you cut earlier, and peg the supports. Sand the pegs flush after the glue has dried.

Machine and Mount the Pivot Parts

Step 1. To make the front and rear pivot parts (G, H), cut two 6" lengths of 1" walnut dowel. (To mail-order the dowel stock, see Sources.) Mount a 3/8" dado head on your tablesaw and elevate it to 7/8". Next, make a jig to hold the parts during cutting. (See "Slotting the End of a Dowel" on *page 56.*)

Step 2. Crosscut each pivot part to 1¼" finished length. Fit the mating parts together, leaving a 1/32" gap between them. Lay a handscrew clamp flat on your drill-press table on top of a backing board. Clamp the parts with the tongue and slot parallel to the table and resting on the backing board. Measure the actual shank diameter of your axle pegs, then drill a hole of this diameter through both parts, centered along the slot/tongue. (Ours measured a true 7/32".)

Step 3. Lay out and sand a ½" radius on the end of each pivot part as shown on the Front and Rear Pivot drawings on *page 57.* (We used the stationary disc sander. See the Pro Tip *above left.*) Then, using a twist bit, enlarge the hole in the tongue to 15/64".

Step 4. Apply glue to the sides of the two pivot parts. Insert the blunt ends into their respective holes, gently twisting them into position. Make sure that the slot and tongue end up parallel with the horizontal surfaces of the chassis parts.

Make the Rollers, Then Pull It All Together

Step 1. From 2" dowel stock, cut two 3⅜"-long rollers. (For mail-order information, see Sources.) Using a V-notched router table fence and 1/16" round-over bit, rout both ends of each.

Step 2. Drill a centered 7/32" hole ⅝" deep in both ends of each roller. (For help with this operation, see the Pro Tip *above right.*)

Step 3. Finish-sand the two rollers and any other parts that still need it. Apply finish to all parts before assembling. (We sprayed on two coats of a quick-drying aerosol satin polyurethane, scuffing between coats where possible with 0000 synthetic wool.)

PRO TIP

To drill a centered hole in the ends of the rollers, first clamp a piece of scrap at least 1" thick to your drill-press table. Using a 2" Forstner or spur bit, bore a ¾"-deep hole in the scrap. Without moving the scrap piece, insert one end of a roller into the 2" hole, change to a 7/32" bit, and drill the hole ⅝" deep. Then, turn the roller end for end, and repeat.

Step 4. Trim four 7/32x1⅛" axle pegs to 1" long. (See Sources for mail-order information. We stained birch pegs with a brown permanent marker to resemble walnut.) Insert a drop of glue into each roller hole, then position the rollers between the supports and peg them, taking care not to get any glue in the axle support holes. Make sure that the rollers rotate freely.

Step 5. Pin the two pivot parts together using a 7/32x1⅛" axle peg. To secure the parts, apply a drop of glue in the hole on the bottom face of the slotted rear pivot (G). As you drive the peg home, the glue will lock it in place without impairing the pivoting action. WJ

Photograph: StudioAlex

Sources

Hardwood Dowels. Select New England birch, beech, or maple, 2" dia. by 36" long (catalog no. BD-2000). Price: $8.75 plus s/h. Select walnut dowel, 1" dia. by 36" long (no. WD-1000). Price: $4.80 plus s/h. Order from:

Woodworks
800/722-0311

Axle Pegs, Steering Wheels. Birch axle pegs, 7/32x1⅛" shank (catalog no. AP1). Price: $1.50/ package of 20 plus s/h. Small birch wheels, 3/16x¾"-dia. (no. W07520). Price: $1.20/ package of 20 plus s/h. Order from:

Meisel Hardware Specialties
800/441-9870

Contemporary Hall Table

Note the strong but subtle details in this graceful table designed and built by resident craftsman Dick Coers. The top "floats" on pointed legs and tapered aprons, creating an interesting play of light and shadows. (See photo A.) The apron tapers, which are in fact straight, seem to curve softly. The round leg bottoms appear to be turned but are easily shaped with a router.

Begin With the Legs

Step 1. For the four legs (A), start with a 4½x76" piece of 8/4 cherry stock. Crosscut it in two for ease of handling, then rip a pair of 1⅝"-wide blanks from each piece. On each of the four leg blanks, joint two adjacent faces square, then plane the remaining faces to 1⅜16" square. Study the color and grain of these blanks to determine the best orientation for each leg. Mark the two inside faces to indicate its position.

Step 2. Add an extension to your tablesaw's miter gauge and set the gauge to cut a 60° inside miter *(photo B)*. Mark one leg 34⅜16" from the bottom end, then clamp a stop-block to your miter-gauge extension so the blade will contact the leg at this mark. Now, miter the top end of one leg. Rotate the leg, repeating this cut until you've made a four-faceted point as detailed on the

Front View drawing on *page 65*. Repeat this procedure to produce four 35"-long pointed legs.

Step 3. Set up a taper jig to cut tapers on the inside leg surfaces as dimensioned on the Side View drawing. (See "Make a No-Fuss Taper Jig" on *page 64*.) We suggest that you cut a test piece to confirm the jig setting.

Step 4. Rout a round-over on all four edges of each leg. To do this, install a ⅜" round-over bit in your table-mounted router and set a fence flush with the front edge of the bit's pilot bearing. Note: Start with the straight section of the leg and finish with the tapered end. This will produce a round profile at the bottom end of each leg.

Step 5. Finish-sand the legs to 220-grit to remove machine marks and soften the transition from straight to taper. Block-sand the faceted top to keep the bevels crisp.

Make the Aprons

Step 1. Joint and plane a 7x60" piece of cherry stock to ⅞" thick. Then, cut front and back aprons (B) and two side aprons (C) as dimensioned in the Bill of Materials.

Step 2. Lay out tapers along the top edges of the aprons as shown on the Front and Side Views. Leave a 3" flat contact surface centered on the front and back aprons and a 1½" surface on the side aprons. To modify the jig for cutting the apron tapers, remove the toggle clamp mounting pad. (This lowers the clamp to

Bill of Materials

Hall Table

Part	T	W	L	Mtl.	Qty.
A Legs*	1 9/16"	1 9/16"	35"	C	4
B Aprons-front/back	⅞"	3⅜"	44⅛"	C	2
C Aprons-side	⅞"	3⅜"	9⅝"	C	2
D Corner brace	⅞"	2"	5¼"	C	4
E Top	⅞"	13½"	48"	B	1

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

Materials List

C–Cherry
B–Birch

Supplies

#20 biscuits; #8x1¾" flathead wood screws; #6x1¼" self-piloting face-frame screws; semi-gloss lacquer

Builder's Notes

Two factors guided me in the design of this piece. First, our household needed a place near the entry where family members could drop off car keys and mail. Second, I discovered an extraordinary pair of highly figured birch planks at nearby Pekin Hardwoods. One of these planks forms the tabletop (and, no, the other one isn't for sale). The table's almost three-foot height provides an opportunity to show off that one-of-a-kind board you've been reluctant to cut into smaller pieces.

A word of caution: Don't stand on a table like this to change a lightbulb. While the leg assembly is strong, heavy weights could stress the joints. Add a fitted glass top for extra protection if wet hats, cats, or newspapers regularly land on your table.

–Dick Coers

Photo A: The curly birch top seems to float on the faceted legs and tapered aprons.

Photo B: Repeat 60° miter cuts to form point on top end of each leg.

engage the thinner apron stock as shown in *photo C.*) Now, replace the clamp using shorter wood screws. Reposition the jig fence and stop-block following the same procedures you used to set up the jig for the legs.

Step 3. Using a ⅛" round-over bit in your table-mounted router, rout all edges and ends of the aprons. Note: The router bit will not reach the corner where the tapered edge intersects the end, so you'll need to block-sand or file this corner round. Sand off all machine marks and soften the transition from the tapered to the straight edge. Now, finish-sand the aprons to 220-grit.

Step 4. Lay out centerlines and cut slots for paired #20 biscuits on the apron ends as dimensioned in *figure 1.* (See the Pro Tip for hints on cutting paired slots with a plate joiner.)

Step 5. Clamp a 48"-long straight-edged board (we used a jointed 2x4) to your workbench. Next, align the top edge of one side apron and the tops of its corresponding legs against the straightedge as shown in *figure 2.* Now, transfer the centerlines from the apron biscuit slots to the inside faces of the legs.

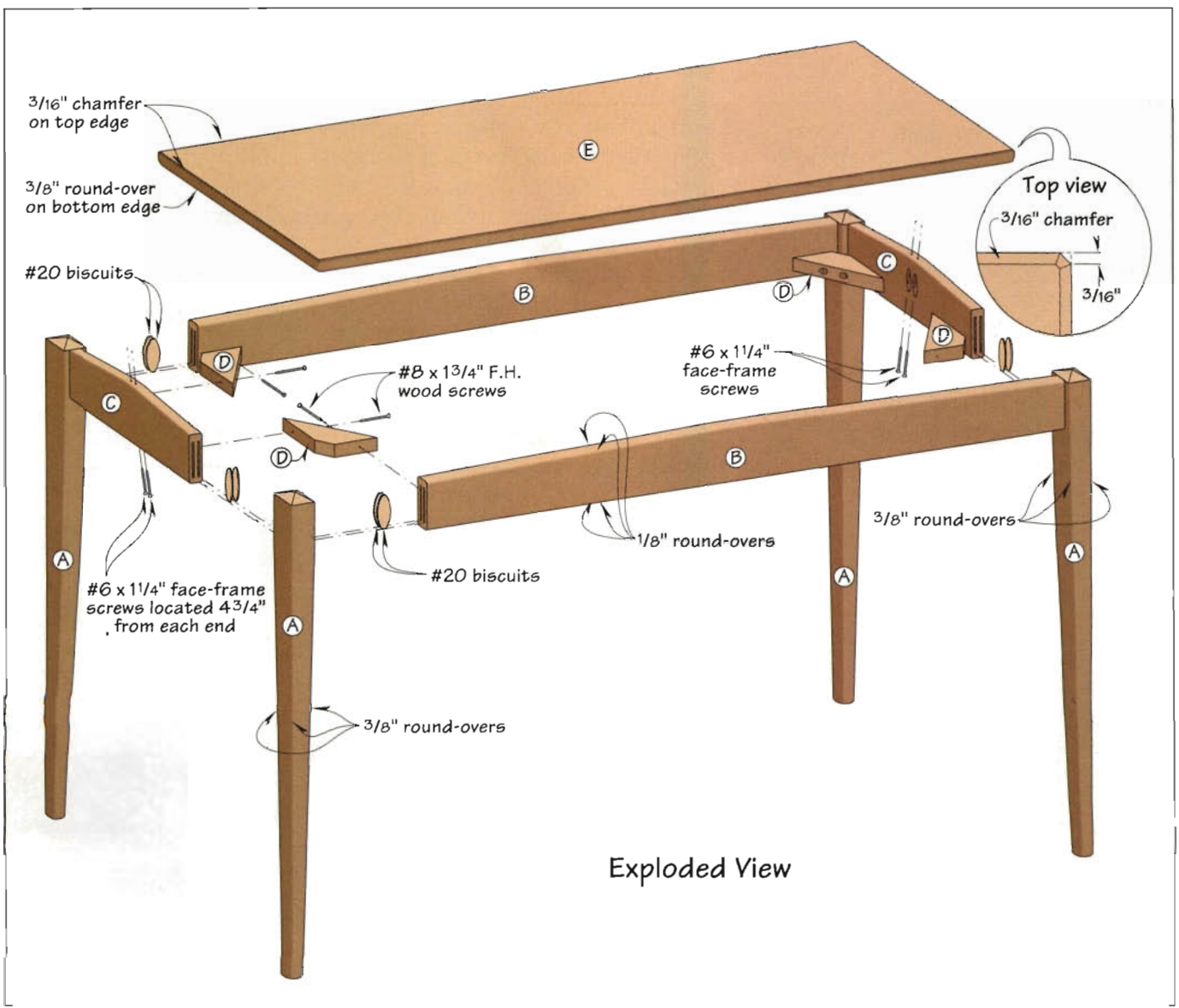
Step 6. Adjust the plate joiner fence, locating the first biscuit slot where shown in figure 1. Cut the first slots on all legs, then use the spacer to cut the parallel second slots as you did on the aprons.

Step 7. Chuck a step drill bit into your portable drill and, using a pocket-drilling fixture, bore two pocket screw holes in each side apron (C) where shown and dimensioned on the Exploded View drawing.

Make Corner Braces, Then Assemble the Frame

Step 1. From ⅞"-thick cherry stock, rip a 2x24" piece. Miter-cut four corner braces (D) from this piece to the dimensions listed in the Bill of Materials. (We used a miter saw.)

Step 2. Chuck a ⅜" Forstner bit in your drill press and drill ⅜"-deep counterbores in the long edge of each corner brace as shown on the Front View detail. Replace the Forstner bit with a 3/16" bradpoint bit, and bore shank holes (centered in the counterbores) through each brace. Test-fit #6x1¼" wood screws in the pocket holes on the side aprons and #8x1¾" screws in the braces to verify that the screws will not break out through the aprons or the top. (Use shorter or longer screws as needed.)



Exploded View

PRO TIP

When cutting side-by-side biscuit slots, set up the tool to correctly position one slot in the stock. Then, place a ⅛" spacer under the joiner's fence to create the ⅛" spacing between the slots. Note: For all pieces, always keep the outside face up when cutting slots.

Figure 1

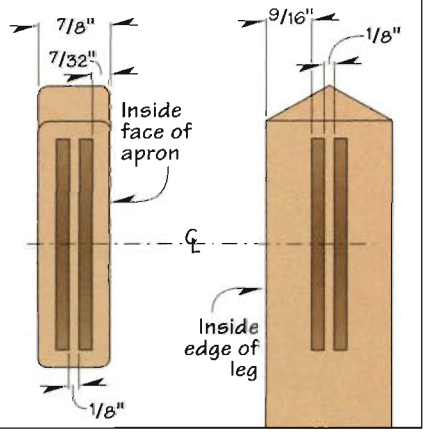
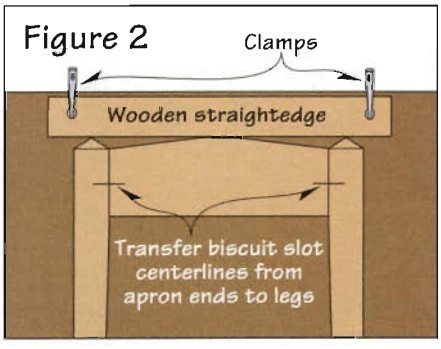


Figure 2

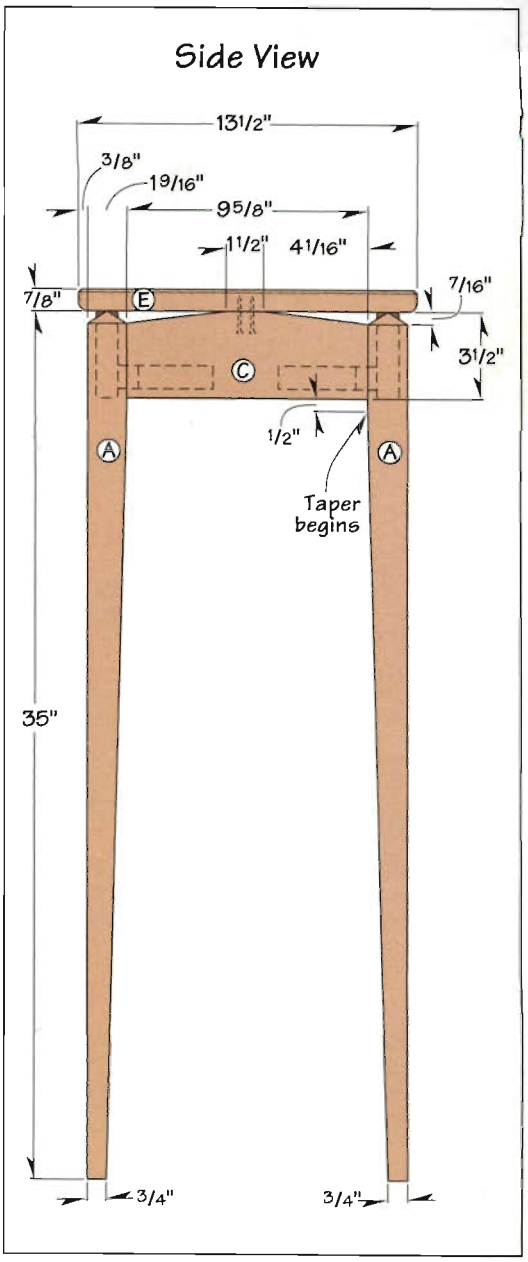


Step 3. Dry-assemble the side aprons and legs with biscuits, aligning their tops with the straightedge as before. Apply clamps, check to make sure that all parts fit properly, and then unclamp.

Step 4. Glue and clamp one side apron/leg assembly, keeping the top flush against the straightedge. Check the assembly for square and flatness, then adjust as needed. Use glue sparingly to minimize difficult cleanup in the rounded corners. Note: Cut any glue squeeze-out with a sharp knife while it is semi-solid, then lift out the glue bead with an awl. Now, glue, clamp, and align the remaining side apron/leg assembly. Set both assemblies aside to dry.

Step 5. Glue and clamp the front and back aprons between the two side assemblies, and again check for square. Place the assembly on a flat, level surface and make sure that the frame stands evenly on all four legs. After the glue has dried, correct any minor leg problems by standing the longer legs on sandpaper and the shorter legs on waxed paper on a flat surface. Rub the legs back and forth until they're even.

Step 6. Clamp the corner braces in position, then drill pilot holes for the screws. Note:



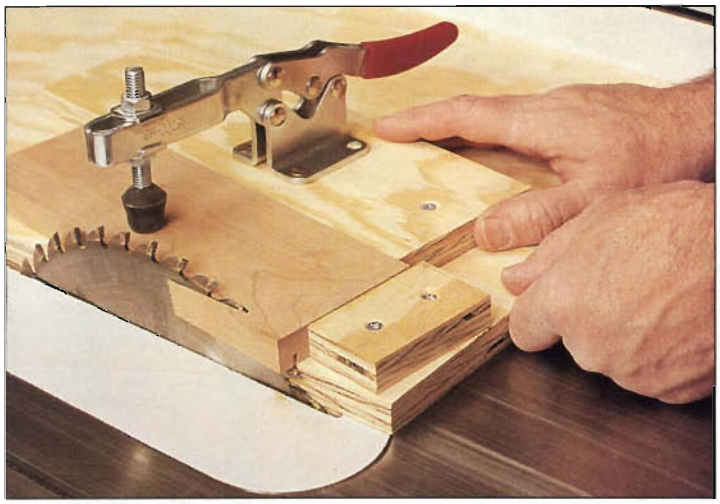


Photo C: Modify jig for apron tapers by repositioning fence and removing clamp mounting pad from fence.

Photo D: Locate corner braces low on aprons so they won't be visible through the gap.

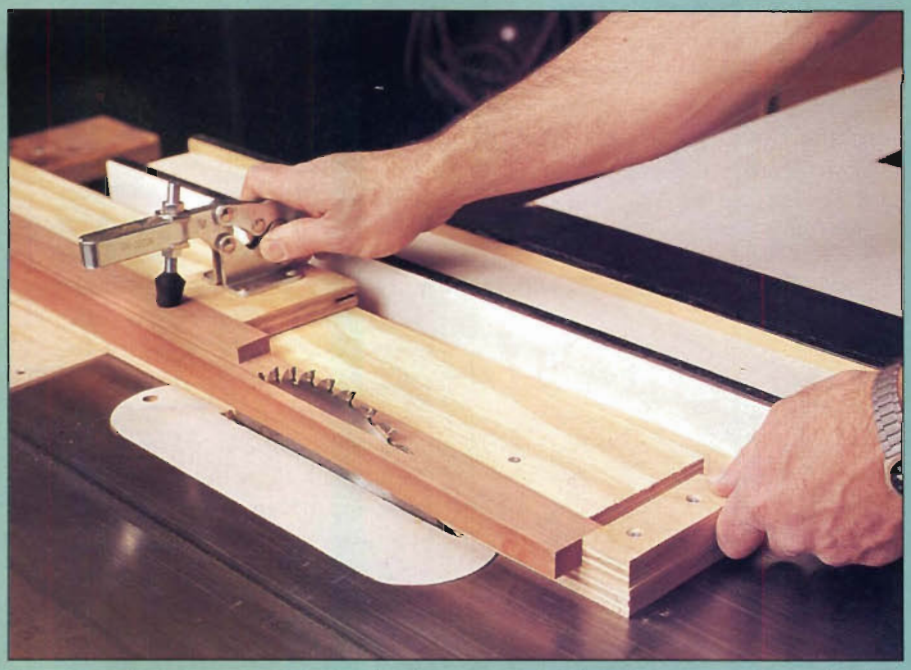
Make a No-Fuss Taper Jig

We like this taper jig for its simplicity and safety. Most taper jigs rely on nothing but a small heel at the base to keep the workpiece in place as the jig tracks against the fence. Jigs that track over the fence are an improvement but still do not hold the work as securely as this one.

To build the jig, start with a base piece of ¾"-thick plywood 6 to 10" longer than your workpiece. (See the drawing *below*.) Rip this piece wide enough to accommodate a toggle clamp between the workpiece and the tablesaw fence. (Our jig measures 8¼x45".) Note the fence setting for future reference.

Mark the desired final width of the leg at its bottom end on one inside face of the blank, then mark the upper limit of the taper on the same face. Position the blank on the plywood base, aligning these marks with the left edge of the base, and then clamp the blank temporarily.

From ¾" plywood, rip a piece 4" wide and as long as the jig base. Crosscut a 4"-long piece from this stock to use as a mounting pad for the toggle clamp. The remaining length of stock serves as the jig fence. Position this fence flush against the leg and attach it to the jig base using #8x1¼" flathead wood screws.



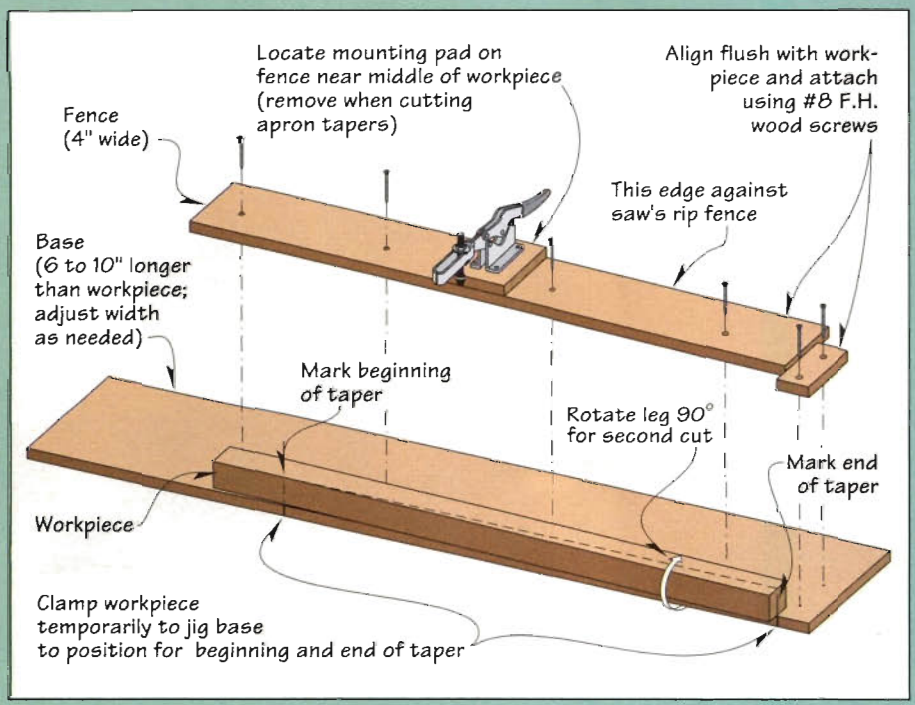
To cut second taper, rotate piece 90° and reclamp using waste from first cut as a clamping block.

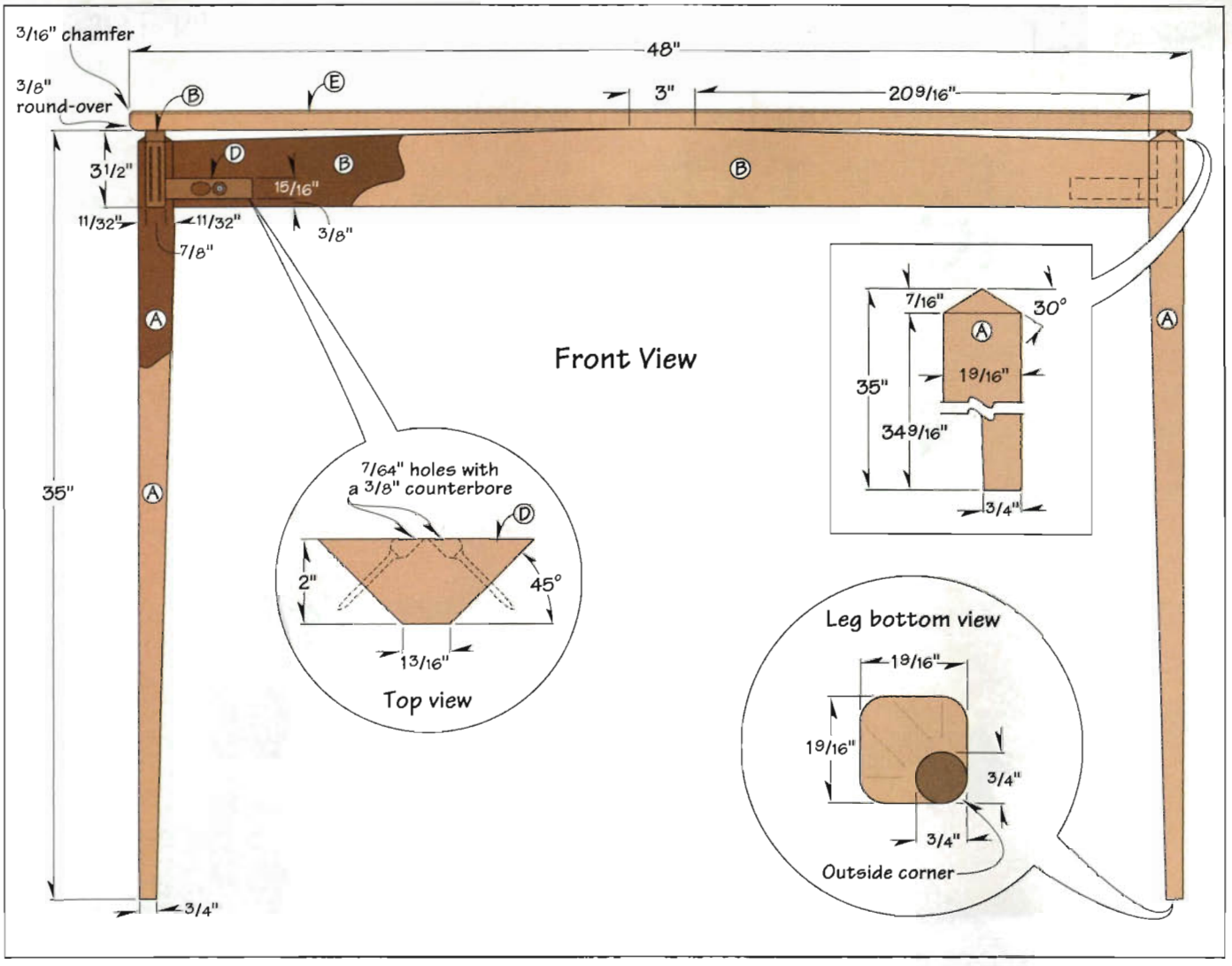
Align the mounting pad with the center of the workpiece and screw it in place. Next, mount the toggle clamp on the pad, and adjust the clamp to hold the workpiece securely without contacting the area to be sawn. Mount a 1¼x4" stopblock square against the bottom of the leg and screw it to the base. Now, remove the temporary clamps.

To use the jig, set your tablesaw fence 8¼" from the blade (the width of the jig base), and elevate it to cut through the leg. Plan your cutting sequence (as shown at *left*) so that you always have square and straight surfaces against the jig.

Adjust the toggle clamp, then make the first cut. Loosen the clamp, rotate the leg 90°, then reclamp it using the waste from the first cut as a clamping block on the tapered surface. (See photo *above*). Now, make the second cut.

To modify the jig for cutting the apron tapers, remove the mounting pad. Then, reposition the jig fence and stopblock as needed.





Locate the braces near the apron bottoms so they won't be visible between the apron tapers and the tabletop. (See *photo D*). Apply glue to the mitered ends, then screw the braces in place.

Add the Top and Finish

Note: If you're using a single wide plank for the top, make sure that it is square and free of twist. If your piece has more than slight defects, rip it into two pieces (or more, if your jointer and planer have narrow cutting widths). Face-joint and plane the pieces to remove any twist. Then, edge-joint, glue, and clamp them, carefully realigning the grain pattern.

Step 1. Plane the material for the table top (E) to ⅞" final thickness. Joint one edge, then rip and crosscut the top to the dimensions listed in the Bill of Materials.

Step 2. Install a chamfer bit in your handheld router, and set it to cut 3/16" deep. Clamp the tabletop vertically in your bench vise. Next, clamp a square-cornered piece of 8/4 scrap to one corner of the top, aligning the edges. (This will provide router support and also serve as a backing board.) Rout a dog-ear on the corner, starting in the scrap and holding one handle of the router stationary as you carefully swing the other to complete the cut. Repeat this procedure to dog-ear the other three corners. (See the corner detail on the Exploded View.)

Step 3. Lay the tabletop faceup on your workbench, then rout a 3/16" chamfer all around the top edge. Note: Rout end-side-end-side in a smooth counterclockwise motion.

Step 4. Change to a ⅜" round-over bit and set it to cut a full radius. Rout all around the bottom edge of the top.

Step 5. Block-sand all chamfers and dog-ears to keep the edges crisp. Then, finish-sand all other surfaces of the top to 220-grit.

Step 6. Apply finish to the top before assembling it to the frame. Note: Coat all surfaces—top, edges, and bottom—evenly. Otherwise, the top may cup if one face absorbs or loses moisture faster than the other. (We sprayed on two coats of semi-gloss lacquer, then sanded lightly with 320-grit sandpaper before applying a third coat. Finally, we dry-buffed all surfaces with 0000 synthetic wool.)

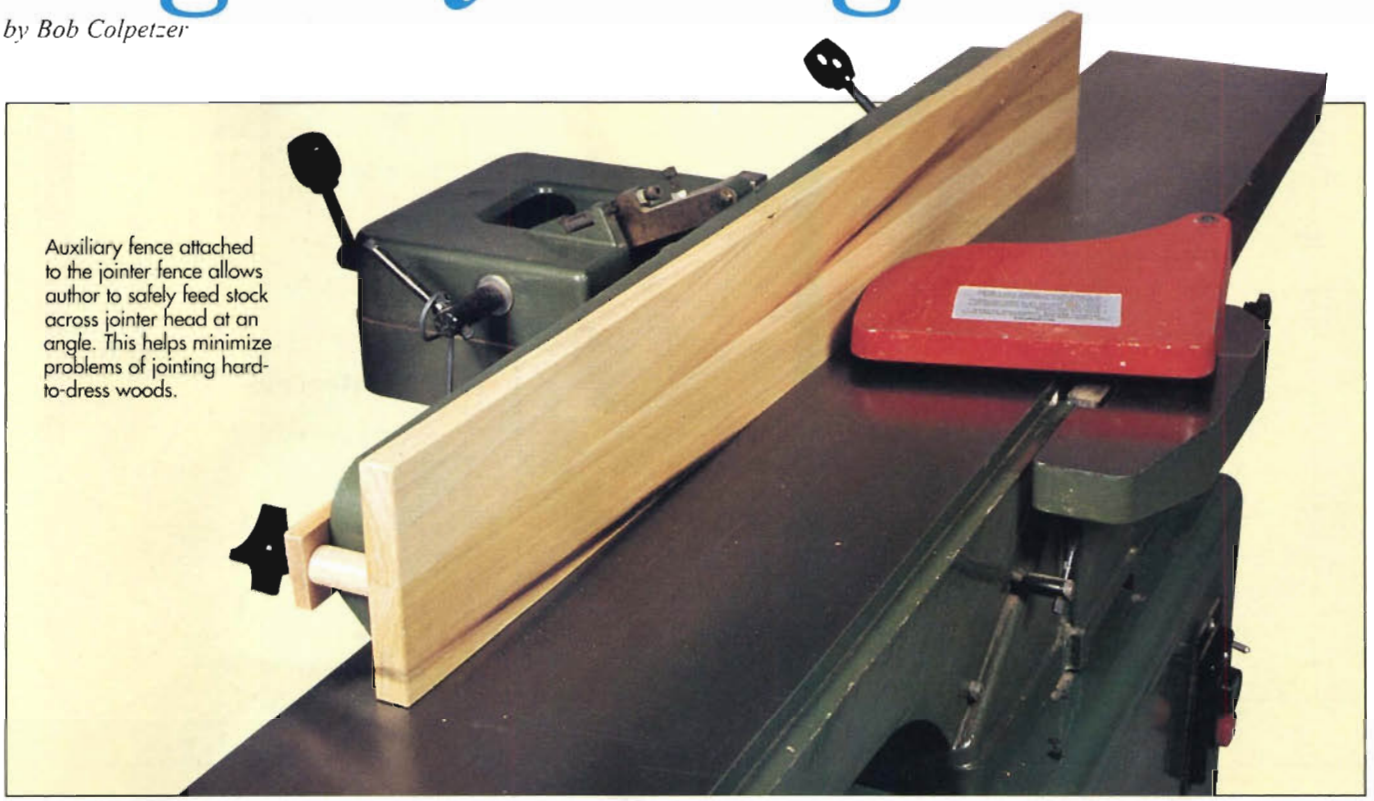
Step 7. Place the top upside down on a padded work surface. Invert the leg assembly and center it on the top. Now, attach the frame to the top using #6x1¼" self-piloting face-frame screws. WJ

Lead photograph: Lynxwiler Photography
Other photographs: Kevin May

Try a new angle on tough-grained woods

Angled Jointing Fixture

by Bob Colpetzer



Auxiliary fence attached to the jointer fence allows author to safely feed stock across jointer head at an angle. This helps minimize problems of jointing hard-to-dress woods.

Most jointers on the market have a fence that can be 1) tilted for bevel cuts and 2) repositioned laterally along the length of the knives. Unfortunately, there's no way to change the line of stock feed—it is always fixed at 90° to the knife head.

Recently I needed to joint the edges of some hard maple, notorious for its reverse grain and difficulty of dressing without tearout. This particular batch of stock was no exception, and its highly figured grain also added to the challenge.

I knew that jointing these boards at a slight angle to the cutter head would help minimize the problem. The question was, *how could I do this?* My eventual solution was to build the auxiliary fixture shown above.

While considering the jig's features, I knew I wanted it to be easy to install and remove, but I didn't want it to compromise the accuracy of my jointer's stock fence. Naturally, I designed the fixture to fit my own jointer and fence, but it can easily be modified to fit any jointer.

How I Made the Fixture

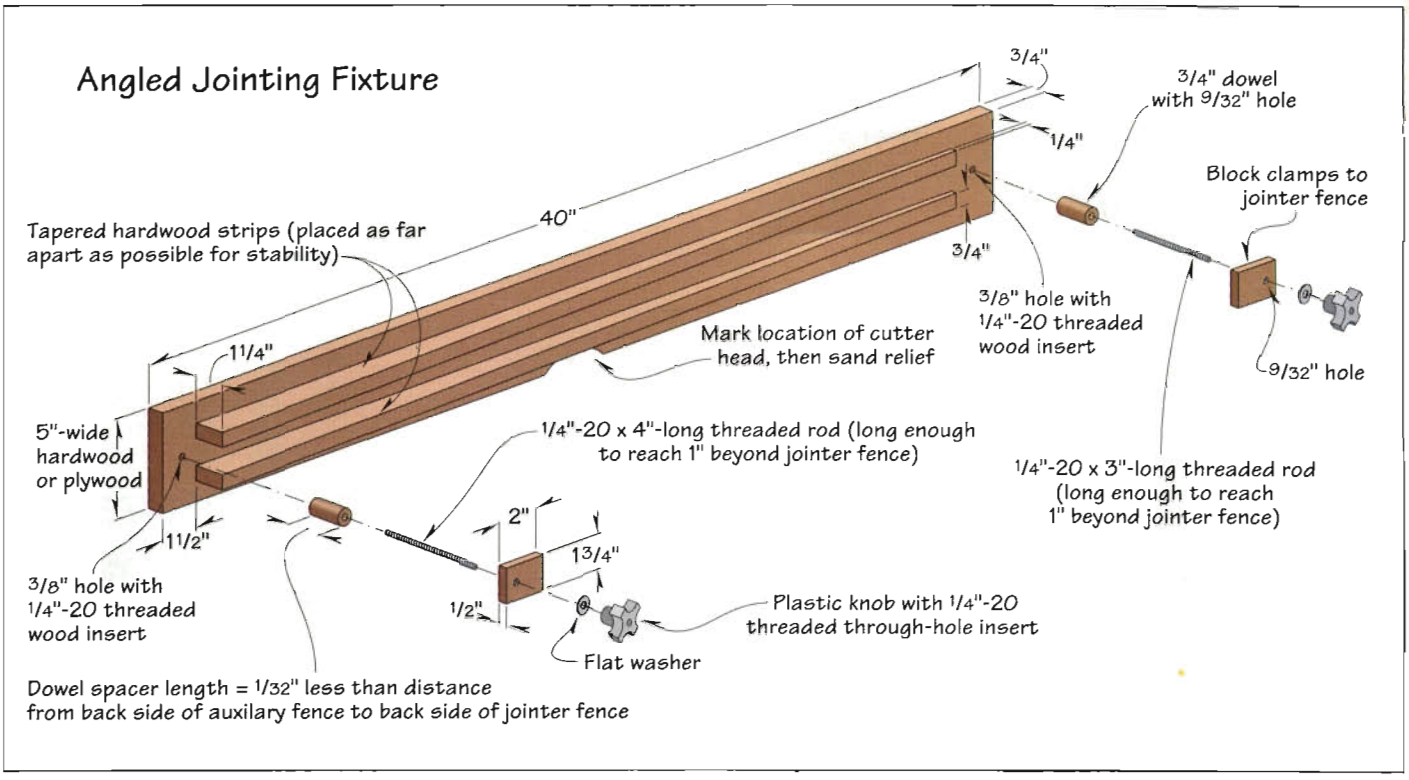
To make the auxiliary fence for my jig, I first edge-glued two 3"-wide pieces of the straightest 13/16"-thick hardwood stock I had, flip-flopping the two pieces so the annual growth rings would oppose each other (to enhance stability). You may prefer to use a length of high-quality ¾"-thick plywood, such as Baltic birch or Apple Ply.

I face-jointed and planed this glued-up blank, then jointed one edge and ripped the blank to 5" final width. Next, I crosscut the fence to 40" final length, which was 3" longer than my jointer fence.

To provide clearance for the jointer knives and cutter head, I laid the prepared board on the jointer table, aligned the ends with the fence, and then marked the cutter head's location on the board. Using an oscillating spindle sander, I formed a relief notch for the head where marked.

Using a tapering jig on my tablesaw, I cut a tapered strip from a 1½x1⅝x37" piece of hardwood stock, then ripped this strip in two. The strips taper from 1¼" to ¼" over their length, about a 1.5° angle. If you work with woods even more cantankerous than hard maple, you may want to increase the angle.

Next, I glued these tapered pieces to the face of the board as shown on the drawing *opposite* and in *photo A*. I wanted to keep the strips as far apart as possible while maintaining solid contact with the jointer fence. I used a



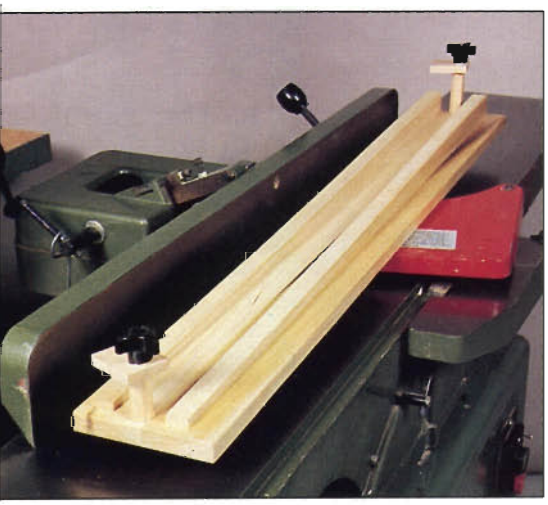


Photo A: Tapered strips glued to the inside face of the auxiliary fence automatically place it at an angle to the jointer fence, altering the line of feed to less than 90°.

square to align their ends while positioning the strips.

Wanting a simple but positive way to attach and secure the fixture to the jointer, I devised the bolt clamps you see at each end of my auxiliary fence. I simply drilled a ⅜" hole at each end of the fixture and installed ¼"-20 threaded inserts in the holes. (See the Source listed at the end of the article.) Next, I cut a length of ¼"-20 threaded rod for each insert, making sure they were long enough to reach 1" beyond the back side of the jointer's stock fence.

To make the spacers, I drilled a 9/32" hole through two lengths of ¾" dowel. For the clamping blocks, I cut two ¼x1¾x2" pieces of hardwood and drilled a 9/32" hole near one end of each. I cut the dowel spacers 1/32" shorter than the distance measured from the back side of the auxiliary fence to the back side of the jointer fence. Then, I assembled each bolt clamp using flat washers and ¼"-20 through-hole plastic knobs. (See Source.) Installed, these clamps work like a charm. (See *photo B.*)

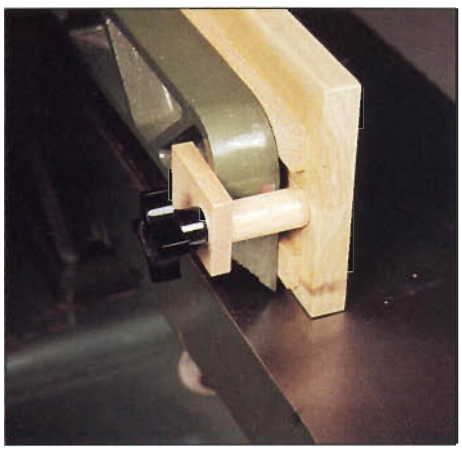


Photo B: Shop-made clamp bolts secure jig to the jointer fence. Knobs and threaded inserts provide secure mounting and allow quick, easy attachment and removal.

To finish the fixture, I sanded a radius on all sharp corners, then applied a sanding sealer. After the sealer was dry, I scuff-sanded it with 400-grit sandpaper and then applied a coat of paste wax.

How It Works

The fixture works better than I expected, and I find myself using it to joint more than just the maple for which it was originally intended. It does an especially nice job of face-jointing unruly or reverse-grain stock.

Nowadays, I keep the fence on my jointer almost full-time, removing it only when I need the full width of the cutters for jointing the face of a wide board. Then, I simply loosen the knobs and remove it from the fence. WJ

Photographs: *By the author*

Source

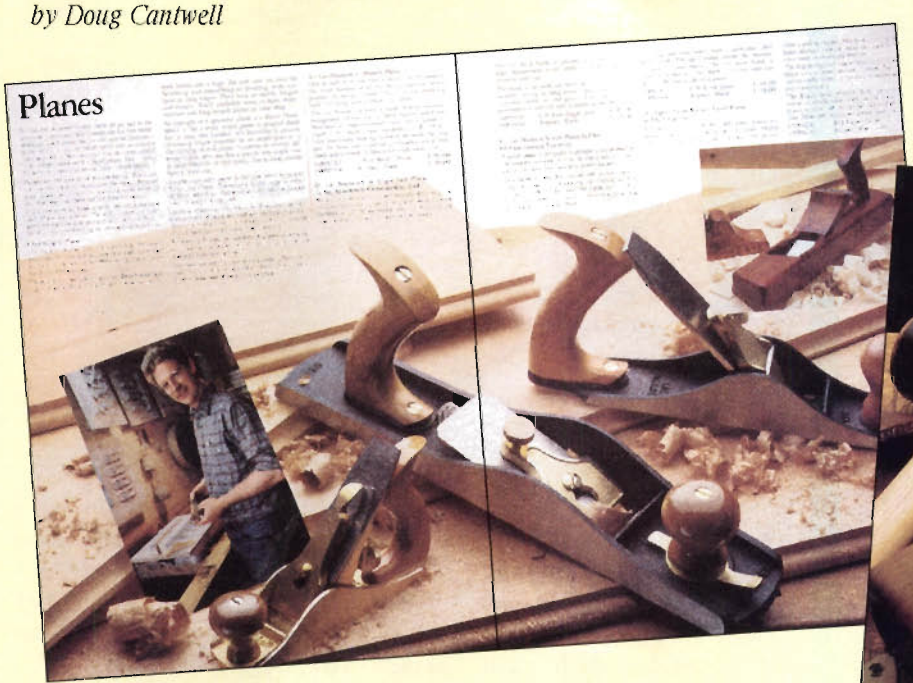
¼"-20 threaded inserts. Pkg. of 10 (catalog no. 28803). Price: $2.95 plus s/h. Plastic five-star through-hole knobs, ¼"-20 (catalog no. 23804). Price: $.95 ea. plus s/h. Order from:

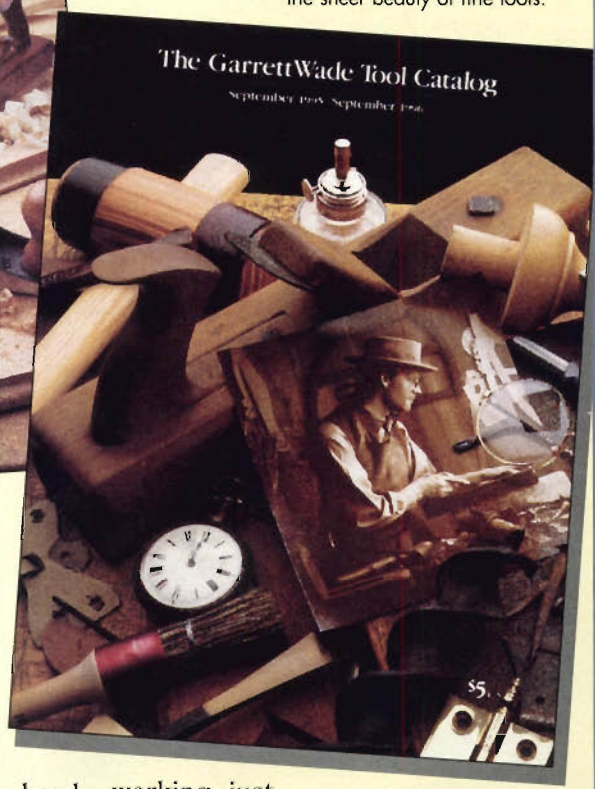
The Woodworkers' Store
800/279-4441

Riding the Crest

Three mail-order houses and how they've managed 20 years of explosive growth

by Doug Cantwell





Garrett Wade, started in New York in 1975, has held with a philosophy of "technical selling." Garry Chinn, founder and president, has perennially emphasized tradition—as well as the sheer beauty of fine tools.

Traveling the high road: Typical Garrett Wade spread offers a wealth of detailed information to help the advanced woodworker make the right choice. The beauty of the tools speaks for itself.

As part of our continuing 20th anniversary retrospective, we offer this chronicle of three suppliers that have grown up with—and certainly contributed to—the remarkable phenomenon of amateur woodworking in America. I limit the discussion to three representative firms—Garrett Wade, Woodworker's Supply, and Woodcraft—each of which has charted its own course and positioned itself differently in a thriving marketplace.

Garrett Wade

In early 1975, Garry Chinn had just opened shop as Garrett Wade, Inc., a New York mail-order firm specializing in fine hand tools for the woodworker. At the time, there was not a single magazine that targeted the amateur woodworker, so he bought his first ad space in *Workbench*, a publication aimed at the do-it-yourself carpenter. The response blew him away. Within a week, 4,000 readers had sent in requests for the Garrett Wade catalog.

That first, 32-page issue offered a modest selection of fine, mostly European-made hand tools and accessories. Today's 176-page edition features a much broader array of the same, but also a limited selection of high-end power tools, a line of top-quality, British-made router bits, a number of premium finishing products, a couple dozen good books, and a few pages of top-of-the-line brass hardware.

In describing Garrett Wade's trajectory, Chinn chronicles the meteoric rise of woodworking in America. "I began thinking about my own company in the early '70s because it was so hard at that time to find quality and specialized tools. I finally got Garrett Wade started in early 1975. Later that year, *Fine Woodworking* appeared, and the interest in amateur woodworking just seemed to explode."

Chinn has kept pretty much to the high road, presenting a comparatively small line of carefully chosen products. "For the most part, we've done this by design, although recently the competition has pressured us to sharpen our focus on professional-grade hand tools." As more and more suppliers have moved in to stake out a share of the market, Garrett Wade has found it most cost-effective to target the advanced-intermediate and expert woodworker.

This past year, Garrett Wade mailed 125,000 copies of its catalog—a mere handful compared to the millions circulated by some of the more growth-minded houses. The lavishly pro-

duced catalog carries a $5.00 cover price and is in fact sold at book dealers and woodworking stores. "We don't prospect," says Chinn, which means that the firm doesn't rent mailing lists (as its competitors do) from other companies whose customers might be interested in Garrett Wade products.

"It comes down to what you vibrate to. I still get a terrific thrill from talking to customers about selecting a good set of chisels, helping them isolate the components of a tool so they can think through how the tool will serve them—both now and maybe a year or two from now."

The current Garrett Wade catalog epitomizes Chinn's strategy of technical selling: elegant, full-color close-ups of fine tools in action; paragraphs of useful advice (not sales pitches) on every page; an uncrowded format that encourages you to pause and reflect on the merits of each tool and whether it might meet your needs.

In the opening spread of the sharpening section, for instance, you'll find two-thirds of a page devoted to the basics of preparing and using a stone. The remainder of the spread focuses on a couple of sharpening systems, showing each up close in action and describing it in detail.

"You've got to control the beast," Chinn observes. "The pressure is always there to squeeze one more product onto a page, which leaves less room for technical information." For that matter, paper and mailing costs have persuaded the firm to trim its 208-page catalog to 176 pages. "Economics tends to dictate," says Chinn, "but we try."

Woodworker's Supply, Inc.

John Wirth started Woodworker's Supply of New Mexico in 1973 as a small retail store in Albuquerque that soon developed into a big mail-order business. What got him into this venture? "A sheer love of woodworking, and also a sincere interest in what the woodworker needs," according to operations manager Paul Reardon.

Today, the firm's densely packed, 156-page catalog would have you believe that the woodworker needs at least one of everything. Each page presents 10 or 12 products, each with a small ID shot and a paragraph of promotional information. You can order a lathe or a latch, a drill press or a drawknife, a compressor or a can of shellac.

However, a profusion of products does not imply lax standards of integrity. In fact, rule number one of Wirth's *Code of Conduct for Woodworker's Supply* is "to offer only products that perform their intended function well and represent good value."

The soup-to-nuts spread of items and the catalog's no-frills format seem to target every woodworker out there, from newcomer to professional. Rather than fill precious pages with technical information, Woodworker's Supply urges you to call (toll-free) its large and experienced tech support staff.

"How would I sum up our philosophy?" asks Reardon. "Service, service, service." Service to the third power, you might say, has been the John Wirth strategy from the beginning. The recent catalog opens with some ambitious claims: "If there's a problem, we want to hear about it and solve it! Tell us what you want us to do, and if it's within reason, we'll do it."

To help deliver that degree of ultimate service, Wirth has kept his company on the edge of computer database technology. This has alleviated many of the usual bottlenecks associated with the mail-order business, both at the purchasing and at the order-fulfilling end.

The catalog states in so many words, "We wish to be your only source for the products we sell." To back this up, the firm guarantees lowest price for 90 days beyond the date of purchase. (With its ever-proliferating product line, Woodworker's Supply could make a case for being your only source—*period.*)

Then: The 32-page Woodworker's Supply 1981 catalog leaned heavily toward hand tools. Here, a whole page goes to a handful of German and Japanese wooden planes, offering detailed information. Most photos in this issue were still black and white.

Now: Recent February '96 catalog features packed pages, power tools, and hot deals blocked in bright red. These days, the 136-page book is printed on inexpensive, recyclable paper.

Woodworker's Supply moved to its present Albuquerque location in late 1979. After phenomenal growth during the '80s, the firm opened three more regional outlets in Wyoming (1990), North Carolina (1991), and New Hampshire (1995).

To make sure you don't overlook a deal like this, the firm circulates its catalog aggressively. Woodworker's Supply doesn't disclose the quantities or frequency of its mailings, but we would estimate, based on what turns up in our mailbox, at least a half-dozen catalog issues per year.

This kind of vigorous salesmanship has yielded dramatic growth: exponential leaps in annual sales for the last 10 years, three new regional outlets since 1990, and a #1 ranking for last-12-month mail order purchases among professional woodworkers (according to the 1995 Woodworking in America survey).

To further promote the cause of service, Woodworker's Supply has expanded its outreach with a current chain of four retail/distribution centers (Casper, Wyoming, Graham, North Carolina, and Seabrook, New Hampshire, in addition to Albuquerque). In the showrooms, the firm offers hands-on demonstrations, seminars, and classes. Customers can also attend frequent tool fairs, where they have a chance to talk directly with factory reps.

Woodcraft

Having started as a one-room store in Boston in 1928, Woodcraft doesn't exactly fit the mid-'70s paradigm. However, the 20-year boom has nevertheless altered the firm's course dramatically.

Founded by George Eaton, Woodcraft originally had supplied cabinetmakers and woodworking schools with new and rebuilt machinery. During the '50s, Eaton took over the Delta franchise in Boston and also launched a limited mail-order business, offering fine hand tools made by Marples of England and a couple of German suppliers.

In the early 1960s, Rogers Welles purchased Woodcraft and expanded the mail-order business considerably. Welles began importing several new lines of quality European-made tools, including Pfeil carving tools from Switzerland. Under Welles, the Woodcraft catalog grew from a slim 30-page sheaf of engraved black-and-white illustrations to a glossy, 115-page magazine with four-color photos.

Acquired by SBR, Inc., in late 1987, Woodcraft mobilized for major growth to handle the booming market. Under its new owner, the firm took off in a novel direction, opening retail stores in several urban centers. To cut overhead and expand operations, the company moved its warehouse, distrbution, and customer service departments to Parkersburg, West Virgina, in 1989. The administrative offices followed in 1992.

Woodcraft continued to expand its mail-order department, adding 50 percent more capacity to the Parkersburg warehouse. Woodcraft acquired 11 additional stores from Shopsmith in 1994 and added a couple of new locations the following year, bringing the total of retail outlets to 21.

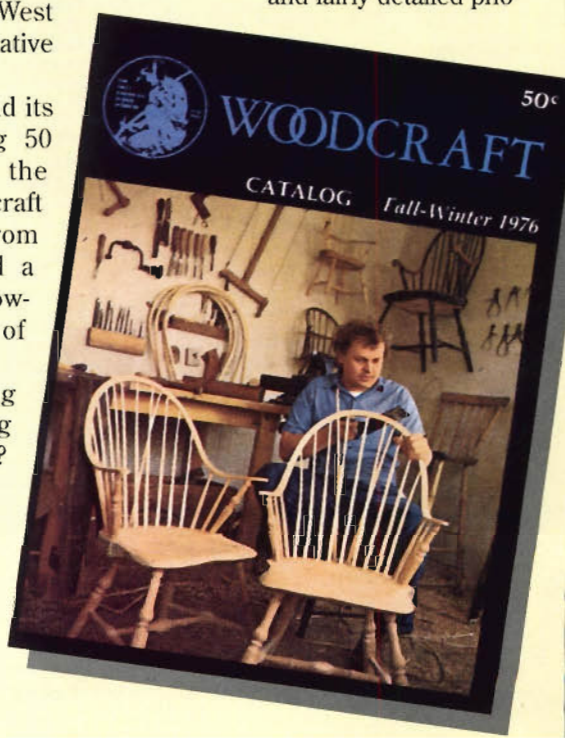
What's the logic of opening stores when you've got a thriving catalog operation going already?

"In the mail-order business," says Gary Lombard, director of retail operations, "you skim the surface in a fairly random fashion, then try to analyze your success statistically to see how much of the market you're reaching."

A retail store, on the other hand, Lombard likens to *a sponge*. "You plop a store down in any given locale, and it 'soaks up' customers that already purchase through your catalog. But it also draws customers who won't go near a catalog, as well as customers who order through your competitors' catalogs. You find out there's a much greater concentration of woodworkers in any given area than you ever imagined."

By developing both the catalog and the retail centers, Woodcraft hopes to provide a total package of service and information. The stores give customers a chance to pick up a tool and get acquainted with it before they buy. They also present free tool and technique demonstrations as well as pay-as-you-go classes, lectures, and seminars. "We want to give the customer every opportunity to grow *as* a woodworker," adds Lombard, "while we in turn grow *with* the woodworker."

Woodcraft has by no means neglected its mail-order business in favor of the retail outlets. The firm's current 136-page catalog, with its glossy paper and fairly detailed pho-



Woodcraft had been around for nearly 50 years when this 70-page catalog mailed in late 1976. The firm experienced the mid-'70s boom along with its upstart competitors and saw its 40-page book grow to 100 pages in a decade.

Since its acquisition by SBR, Inc., in 1987, Woodcraft has moved in a new direction by opening 21 retail stores in major cities, thus attracting customers who don't catalog-shop. The Detroit store (shown here) opened in February, 1994.

tos, falls somewhere between those of Garrett Wade and Woodworker's Supply in its presentation. An average page offers six to eight items and a bit more info than Woodworker's Supply, but stops well short of the lengthy passages and lush photos of Garrett Wade. During fiscal '95-96, Woodcraft will mail 3.2 million copies.

By the same token, Woodcraft has positioned its product line somewhere in the middle ground. Keeping with company tradition, the catalog features 30 pages of fine hand tools, most of them devoted to carving. Except for a strong selection of power carvers, Woodcraft does not offer many power tools. Several pages go to quality hardware, several to project supplies and clock movements, and several to the firm's traditionally generous selection of books. Otherwise, the current Woodcraft line, like that of Woodworker's Supply, includes a broad range of product categories.

Future Directions?

Although representatives of the three firms became tight-lipped on the subject of strategic plans, they did agree on one thing. Recent surges in paper costs and mailing charges are changing the nature of their business.

The move toward regional and local retail outlets will help ease these pressures, as will the swiftly evolving technology for networking information. "The Internet is beginning to impact the way we do business," says John Wirth. "Those with a computer may not want catalogs in a few years." Imagine, if you can, a world without catalogs. Wirth hints that "Woodworker's Supply will have a significant on-line presence shortly."

Garrett Wade originally beat everybody out of the gate by opening a site on CompuServe in the early '90s. In those days, however, Chinn found that it generated little interest or revenues and so dropped the site after three years. For the present, he's decided to wait a year or two to see where the technology will go from here.

According to Ken Kupsche, director of catalogs, Woodcraft is working on an Internet site (ww.woodcraft.com) that should be up and running by April 1996. The site will provide a forum for information exchange, a bulletin board for seminar schedules, and new product announcements. As yet, however, none of the three firms has unveiled a plan that's likely to render the mail-order catalog or the toll-free line obsolete. WJ

Photographs and catalogs: *Courtesy of Garrett Wade, Woodworker's Supply, and Woodcraft*

Chris Sandoval

Albuquerque carver and furniture maker contributes more than just his craft

by Doug Cantwell

The first thing you notice on arriving in New Mexico is the brilliant, high-country sunlight. The play of this light on intricate forms probably explains why ornamental carving has become such a prominent part of the crafted landscape.

You won't have to look hard to find Chris Sandoval's contributions. Stop in at Albuquerque's old La Posada Hotel and inspect his architectural carving in the lobby, or visit the Zoological Gardens, where he carved the corbels for the colonnade. If you have more time, drive north on I-25 to Pecos National Monument and tour the visitor's center. On your way, stop off at the capitol building in Santa Fe to admire his furniture on the second floor.

One of the few residents who *did not* relocate from elsewhere, Chris apprenticed himself to his dad George, who had run a respected Albuquerque shop for years. He went on his own in 1980, then teamed up with Mark Carrico in 1992 to form *Artisans of the Desert*, a production shop that today keeps the two partners and four or five staff members busy.

Photo B: Bed frame and cedar-lined chest. Ponderosa pine with stain, wash, and tin panel inserts.

Although most of the furniture built by *Artisans* goes to New Mexico and Arizona customers, the firm has exported pieces to a dozen other states as well. Chris takes care of the relief carving, doing nearly all of it with hand tools. "The rosettes in cherry [shown in *photo F* opposite] each took five and a half hours," he reports. "In pine, they'd probably have taken me a couple of hours less."

Chris is not one to carve his rosettes and then go home to the television. Through Albuquerque Interfaith, a council of local churches, he's been working to get more funding at the state level for education. He recently helped organize a forum to this end that spotlighted a bipartisan panel of New Mexico legislators. "Some of them were half-hearted about coming because they figured meetings like this never draw more than 20 or 25 citizens," says Chris. "When over 700 of us showed up, I think it got their attention."

In 1985, Chris put himself on the map when he bid on and won a commission to build the furnishings for the new visitor's center at Pecos National Monument. "I knew that 20 other people were bidding on it, so I went all out on the drawings. I'd made up my mind that I really wanted this job."

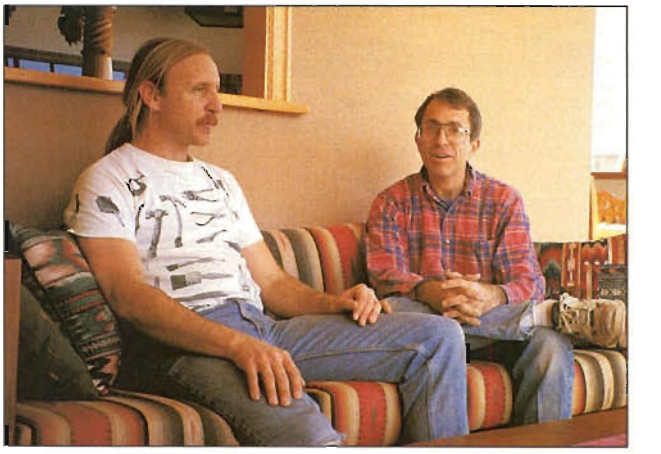


Photo A: Chris Sandoval (left) and partner Mark Carrico formed *Artisans of the Desert* in 1992. Here they field-test a sofa version of our cover project in their Albuquerque showroom.

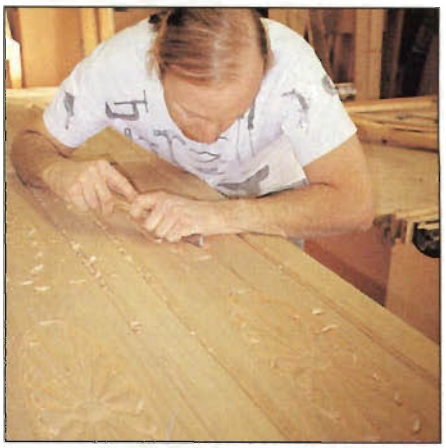
With just one assistant on the payroll, Chris realized he'd taken on a formidable piece of work. The reception counter, built-in book display, desk, chair, table, and *trastero* (the cabinet shown behind the counter in *photo D*)

Photo C: Architectural panels and rope molding. Sugar pine with stain. La Posada Hotel restoration, Albuquerque.

Photo D: Reception counter, *trastero*, and book display. Ponderosa pine. Pecos National Monument Visitor's Center.

Photo E: Chair. Cherry with stone-painted poplar. Built on commission for the state capitol building, Santa Fe.

Photo F: Chris does all of the carving for *Artisans*. The rosettes on this cherry refrigerator enclosure took him 5½ hours each. ▶



took three months to build and carve but won enthusiastic praise from the New Mexico press and local officials. According to one of the rangers at Pecos, visitors often comment that Chris' furnishings surpass anything they've seen at a national park facility.

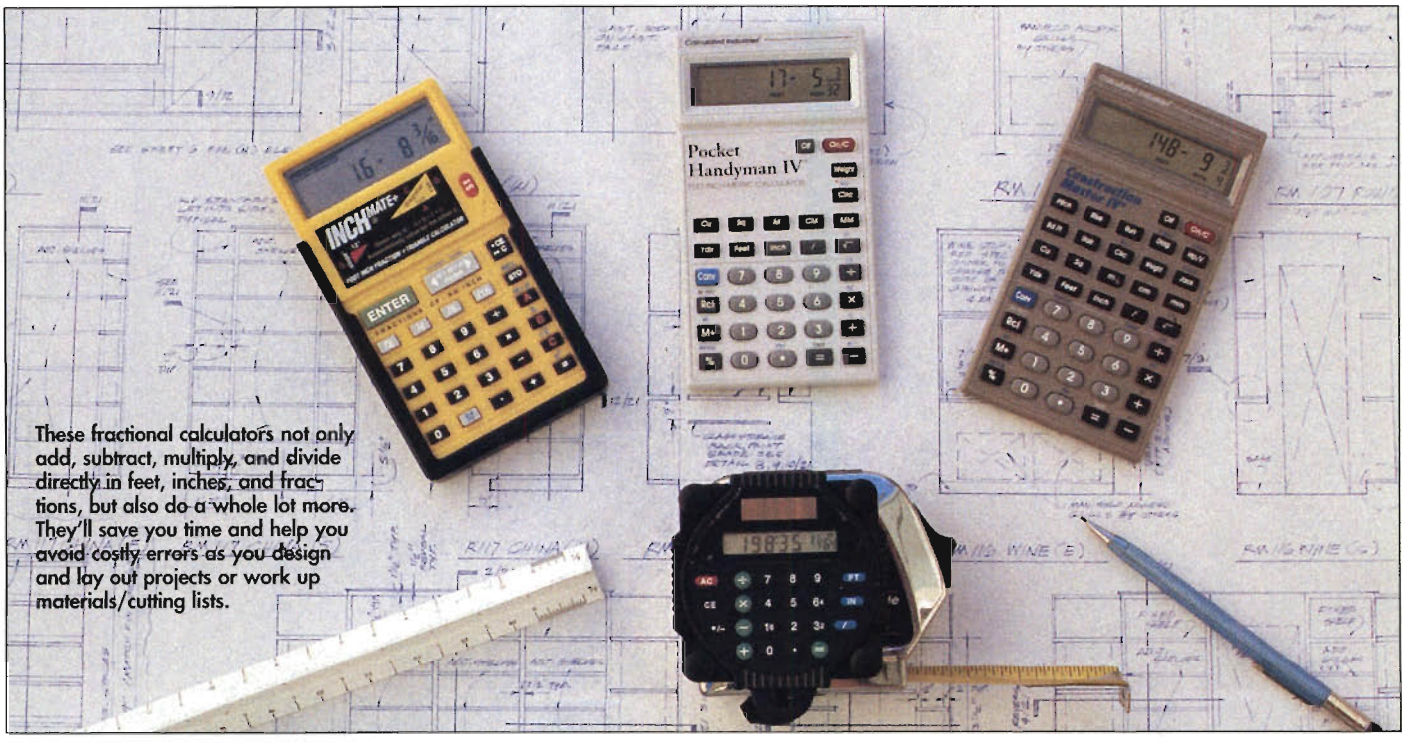
In 1991, Chris won another commission to build two sets of furniture for public areas in the capitol building at Santa Fe, known locally as the Round House. This time, he reinterpreted a Native American carved motif in a contemporary vein, combining the warmth of cherry with stone paint. The sofas, chairs, and end tables are striking in their originality, even among some of the more eccentric sculptures and wall hangings done by other local artists. Yet, the pieces still look comfortably at home in the Round House's traditional New Mexican decor. WJ

Photographs: *Doug Cantwell (A, B, F); Kirk Gittings (D, E); Chris Sandoval (C).*

We Test Four Versatile Models

Fractional Calculators For Woodworkers

by Jim Barrett



These fractional calculators not only add, subtract, multiply, and divide directly in feet, inches, and fractions, but also do a whole lot more. They'll save you time and help you avoid costly errors as you design and lay out projects or work up materials/cutting lists.

When planning, designing, and building most projects, we think in terms of feet, inches, and fractions of an inch. After all, that's what we read on our rules and plans. But adding or subtracting a bunch of fractions can be a pain in the brain for many of us. For example, try quickly adding 1' 6½", 2' 1⅜₁₆", 3' 3⅝₃₂" and 5⅞". If you're a non-whiz at math like me, you'll probably reach for pencil and paper. Not many of us will reach for our pocket calculator to find the answer either. Most calculators are decimal-based, and unless we first convert fractions to decimals, they won't give us a quick solution.

Enter the fractional calculator. I found four readily available units that would give me that answer quickly. They add, subtract, multiply, and divide in feet, inches, and fractions—and do a lot more. The photo *above* shows this foursome: the InchMate+, the TapeMate, the Pocket Handyman IV, and the Construction Master IV.

You may have seen these calculators (or earlier versions of them) advertised in woodworking catalogs. Except for the recently introduced TapeMate, the original models appeared on the market well over a decade ago. Editor Chuck Sommers tells me he still uses Calculated Industries' Measure Master-Plus, which he purchased nine years ago.

As with most electronic equipment, the manufacturers continue to refine and expand the capabilities of these handy devices. The Construction Master IV and Pocket Handyman IV have reached their fourth generations; likewise, the "+" after the InchMate logo indicates that new features have been added to the original model.

In this review, I'll take a close look at these new-generation calculators. Although all four units share numerous features, I did find significant differences between them.

To evaluate the calculators, I first determined which functions they could perform. Next, I tested each function to see how quickly and easily each unit performed it. I then looked at each calculator from an ergonomic standpoint to evaluate key size and spacing, keyboard layout, ease of operation, and readability of the display. All of the units except for the solar-powered TapeMate run on conventional button-type lithium batteries. The Radio Shack model, which I'll discuss separately, gets its power from both a battery and a solar cell.

All of the calculators reviewed here use logical arithmetic input. This simply means that you enter the data and formulas from left to right—([9] [+] [3] [x] [4] [=]), for example—the same way you would read or write them out.

InchMate+

The bright yellow InchMate+ *(photo A)* replaces the original InchMate. It performs the four basic mathematical functions (add, subtract, multiply, and divide) in foot-inch-fractions (FIF), decimal feet (DF), and metric. Pushing the [mode] key located next to the [enter] key sets or toggles the desired mode. This key also converts the displayed information from mode to mode.

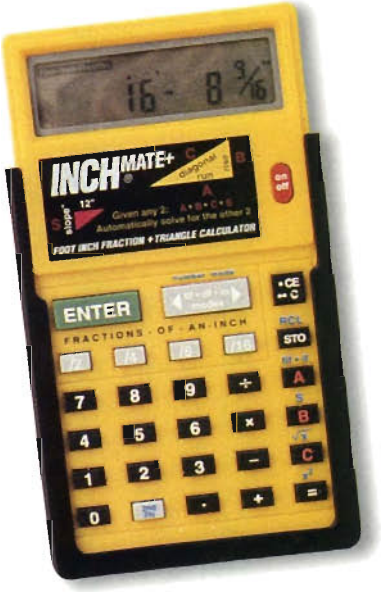


Photo A: The InchMate+ will instantly solve right-triangle problems. The simple but straightforward key pad and prompting display take only a few minutes to figure out.

Turn on the InchMate+, and the display prompts you to enter a number for feet, then inches, then the fraction. For example, press [4], [enter], [6], [enter] and it displays 4'-6" and prompts you for the fraction's numerator. Key in that value, press [enter], and it prompts for the denominator, which you select from one of the four fraction keys on the key pad, i.e., ([/2], [/4], [/8], or [/16]). While this may sound tedious, the prompting display makes it very easy to use.

Unfortunately, the "fixed" fraction denominator system limits the calculator's range to fractions of 1/16" or larger. The other three calculators handle fractions down to 1/64". If you work in increments of 1/32" or 1/64", you'll probably want to pass the Inchmate+ by and purchase one of the others.

On the other hand, this unit does provide fast conversions. Assume that you've entered 4' 6". Press the [mode] key, and it shows 4.5' (decimal); press that key again, and it displays 1.3716 (metric).

If you want to use the InchMate+ for ordinary math calculations, press the [2nd Fn] key at the bottom of the key pad, then the [mode] key, to set the display to "number mode." The [2nd Fn] key, used in combination with certain other keys, changes the display format. For example, pressing [2nd Fn], then [A] toggles the display from FIF (the default setting) to IF. This same key also enables you to do square and square root calculations, determine the slope of a right triangle (inches rise per 12 inches run), and recall entries from the calculator's memory.

Individual entries can be stored temporarily in memory using the [STO] key, then retrieved for doing more complex calculations. For example, suppose you want to find the total area of two different cabinet doors. You calculate the area of one door, store the value in memory, then calculate the value of the second door and add it to memory. Pressing recall [RCL] automatically displays the total stored in memory.

The InchMate+ lacks a percent [%] key. I find this function useful for adding on a waste factor (say, 10%) when estimating lumber and materials and for doing conventional, everyday math computations.

The "plus" on the new version refers to several new keys ([A], [B], and [C]), which automatically solve right-triangle problems (without using the Pythagorean theorem ($A^2 + B^2 = C^2$). For example, given any two dimensions—run (A), rise (B), diagonal (C) and/or slope (S), the [2nd Fn] key combined with the [B] key instantly solves for the other two. The Pocket Handyman IV and Construction Master IV also solve right-triangle problems, but the InchMate+ handles them with fewer keystokes and a bit less head-scratching.

Although handy for figuring out roof pitches, rafter lengths, stair dimensions, and the like, and for squaring foundations, the right-triangle functions don't come into play that often for in-shop woodworking projects. However, it doesn't hurt to have them available, should the need arise.

Overall, I found the InchMate+ easy to use and fast for solving common length and area problems expressed in feet, inches, and metric units. It has the largest LCD display of the group, and the key pad looks uncluttered and easy to figure out. The dust-proof rubber-membrane keys feel well-spaced and positive to the touch (even for those with fat fingers).

The calculator has a hard plastic protective case and a complete instruction manual that offers numerous helpful sample problems.

InchMate+, about $50. Sonin, Inc. Call 800/223-7511 for the name of your nearest dealer or source.

TapeMate

This ingenious little fractional calculator *(photo B)* attaches to the face of many 20' and 25' tape measures, including the Sears Craftsman tape shown in the photo. At first glance, I thought this add-on tool might be a bit gimmicky (and bulky), but it performs quite a number of functions, given the unit's size and simple key pad. Surprisingly, it didn't get in the way when I used the tape. At about $30, it's also the least expensive FIF calculator I tested.

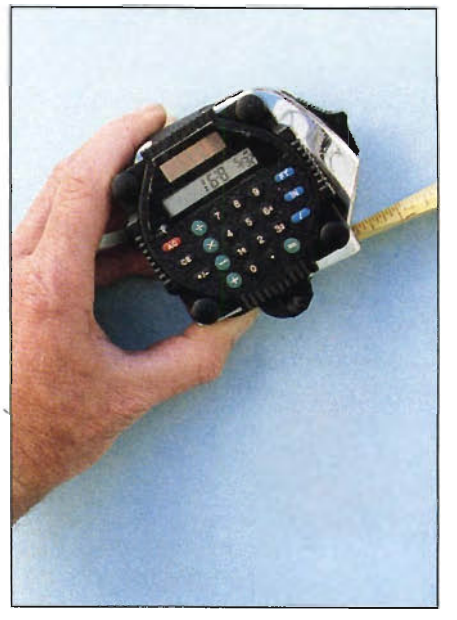


Photo B: The TapeMate attaches to the side of a tape measure case for on-the-spot fractional calculations. The unit easily detaches from the tape for benchtop use and handles fractions down to 1/64".

The solar-powered, four-function TapeMate does linear calculations in FIF, IF, decimal feet, and decimal inches. It works common fractions down to 1/64" and will calculate square and cubic feet using the multiplication [X] key. For example, press [7] [FT] [X] [7] [FT] and the display will show 49' on the right side and "sq" in the upper left-hand corner.

While the TapeMate lacks many advanced functions found on the other fractional calculators (it won't do instant conversions, has no memory or keys for square, square root, or percentage), I found it perfect for quick, on-the-spot calculations when using the tape measure—like measuring and adding together the dimensions of several boards in my lumber pile, or computing the linear footage required for a tabletop.

The 5/16x2 7/8x3 1/2" calculator snaps into a holder that fastens to the tape measure case with a wide rubber band. It detaches easily from the holder so you can use it independently of the tape. The calculator can be attached facedown to protect the key pad when it's not being used.

Despite its size, the TapeMate appears fairly sturdy and impact-resistant. If you have beefy fingers, you may find the small, low-profile keys hard to operate. I had to press the keys harder than on the other machines to make the entries appear in the display. Pressing the keys with a pencil actually worked better than using my fingers.

The solar cell eliminates the need for batteries and will operate the calculator outdoors or in a well-lighted room. However, it worked slowly and sometimes erratically for me in low-light conditions.

Despite these minor annoyances, I like the TapeMate for its simplicity. With it, I can do most of the calculations I need for designing projects, reading plans, or making up materials and cutting lists. With its straightforward approach, one doesn't have to be a math wizard to figure out how to operate it.

TapeMate, about $30. Sonin, Inc. Call 800/223-7511 for the name of your nearest dealer.

Pocket Handyman IV

If you find yourself needing instant answers to complex or difficult calculations, I recommend this calculator *(photo C)*. It's essentially the same unit as the older Pocket Handyman III (still available) but with several new bells and whistles. (I tested a prototype of the new unit, which should be available by the time you read this).

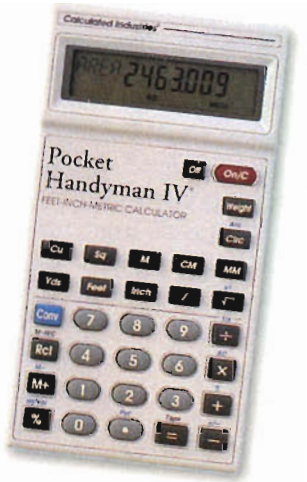


Photo C: Loaded with features, the brand new Pocket Handyman IV will perform just about any calculation you'll need for a woodworking project without being too complex or hard to use.

I found this calculator to be powerful and surprisingly simple to operate. It allows you to add, subtract, multiply, and divide directly in FIF, IF, yards, decimal feet, decimal inches, and in meters, centimeters, and millimeters. You can also do square and cubic calculations in each of the above and easily convert to and from each dimensional format.

To operate, you enter the values in the order of feet, inches, numerator, and denominator by simply keying in each number, then pressing the appropriate [Feet], [Inch], or [/] key.

The calculator works in fraction denominators of 1/2" to 1/64". You can set the displayed fraction denominator to any of these, depending on the degree of accuracy desired. You can also set up the calculator to work in two fraction modes—normal and fixed. In normal mode, the unit automatically rounds a fractional result to the lowest common denominator. (For example, 6/16 rounds to 3/8.) In fixed mode, the fraction remains the same as the fractional setting. You'll also find [pi] and percent [%] keys. (See my comments about these under InchMate+.)

Other features useful for us woodworkers include:

- A circle [Circ] key for finding circumference, circular area, and arc lengths.
- A materials cost-estimating function activated by the [Conv] [•] keys. You can also use this function on the Construction Master IV to calculate cost-per-board foot.
- A memory [M+] key that temporarily stores or adds displayed entries. Combined with the recall [Rcl] key, it enables you to do more complex calculations. (See my InchMate+ comments.)
- A Paperless Tape feature that stores up to 20 entries in the calculator's memory and lets you scroll through them. I found this handy for reviewing the keyed entries when checking my work.

The Pocket Handyman also incorporates a [Weight] key for converting a dimensioned cubic volume to a weight value. This function would be useful in concrete and masonry work but not in the woodshop, because it thinks only in terms of very large weights and volumes. It won't directly calculate pounds per cubic foot.

This calculator has a sturdy vinyl case and a magnet to hold it in place. I found the 1/4"-tall display numerals clearly legible against the gray background and the large, rubberized keys easy to find and activate. For the type of woodworking I do, this one would be my first choice of the lot.

Pocket Handyman IV, about $39. Calculated Industries, Inc. Call 800/854-8075 for the name of your nearest dealer.

Construction Master IV

Designed primarily for the building trade, this powerful calculator *(photo D)* has all of the features of the Pocket Handyman IV I just described plus two additional rows of shortcut keys for instantly solving a wide variety of framing and carpentry problems, e.g., run, rise, pitch, diagonals, stair dimensions, hip and valley members (regular and irregular), and jack rafters.

Photo D: The Construction Master IV picks up where the Pocket Handyman IV leaves off, with two additional rows of shortcut keys designed primarily for carpenters. I consider it a powerful, top-of-the-line calculator.

I won't explain how all of these special keys work because the instruction manual does an excellent job of that. If you frame houses or are otherwise involved in construction, they'll save you hours of tedious calculation and prevent costly mistakes. The run, rise, and diagonal keys also provide instant solutions for right-triangle problems.

While I feel that the Construction Master IV would be overkill in most woodshops, the one feature that would tempt me to fork over the extra dollars for it is its board feet [BdFt] key and materials cost-estimating function. This shortcut key instantly converts entered lumber dimensions to board feet. For example, enter the dimensions and multiplication [x] key [2] [x] [4] [x] [12] without feet and inch marks, press [BdFt], and it displays the answer (8 board feet).

If you're calculating several boards, you save each answer in memory [M+], then recall [Rcl] them for the total. Multiply that total by the cost-per-thousand (Mbf), then use the material cost-estimate feature [Conv] [•] to display the dollar value for the order. This feature would be a time-saver for anyone who routinely buys or sells lumber by the board foot.

As with the Pocket Handyman, the Construction Master has a magnetized vinyl case and a comprehensive instruction manual that fits into the case's pocket. I found the display quite legible and the keys large and easy to manipulate.

Construction Master IV, about $79. Calculated Industries, Inc. Call 800/854-8075 for the name of your nearest dealer.

Photographs: *By the author*

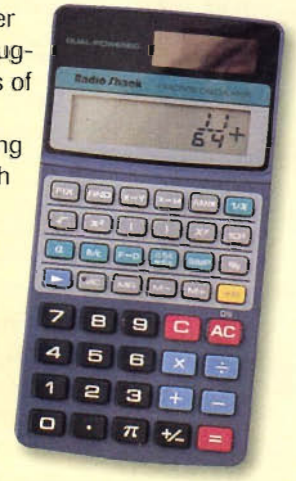
Radio Shack Fraction Calculator
(Model EC-2035)

This calculator does not quite fit in with the others I'm reviewing. It will do fractional calculations but unfortunately does not work in dimensions as the others do.

Basically, the unit has been designed to perform higher math problems, as the esoteric top half of the key pad suggests. Most of these functions don't fit the special needs of us woodworkers.

I did manage to solve various dimensional woodworking problems with it, although not as quickly or easily as with the others. It works in inches/fractions only, so I had to first convert feet to inches in order to enter such values. For example, to enter the dimension 3' 5¼", I mentally converted the 3' to 36", added the 5 and keyed in [41] [a] [1] [b/c] [4]. Besides performing the four basic math functions, it will convert mixed fractions into improper fractions, improper fractions into mixed fractions, decimals into fractions, and fractions into decimals.

If you have a budding math student in the family, this unit would be well worth the $21 price tag. You can find it at most Radio Shack stores (catalog no. 65-529).



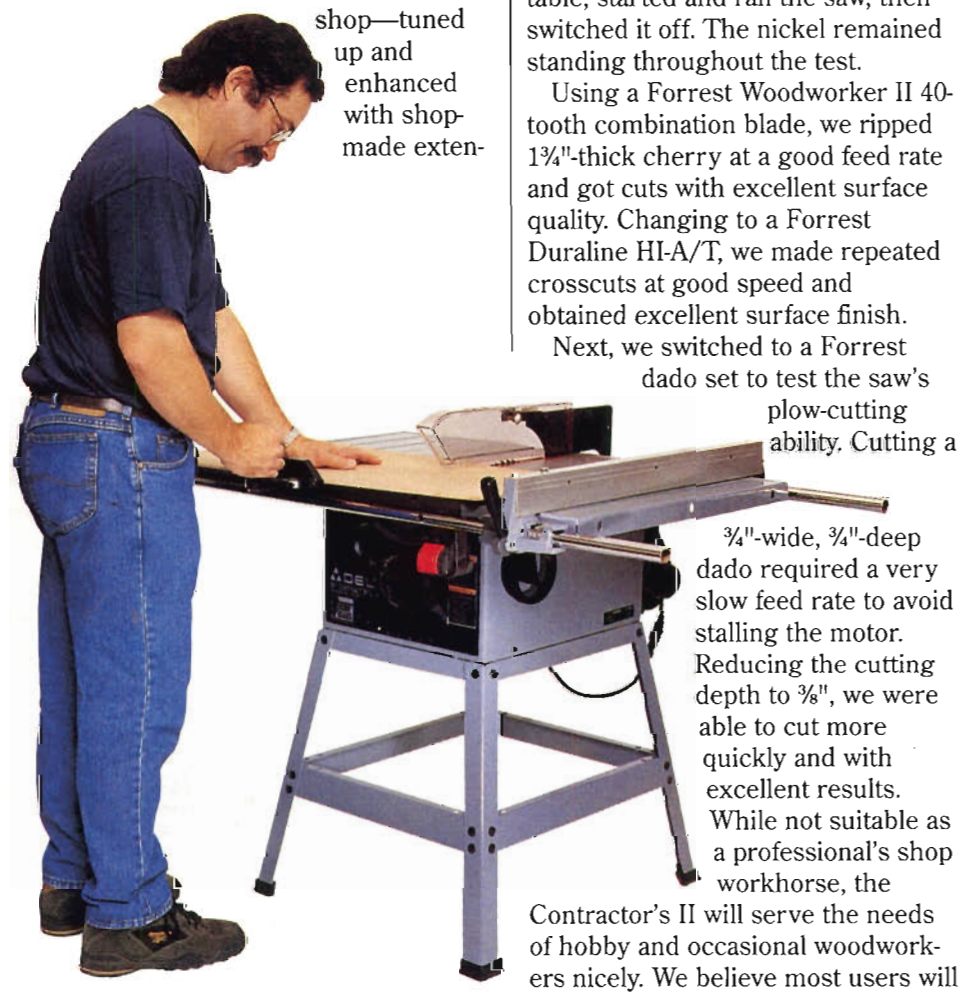
Radio Shack Fractional Calculator

SHOP TEST

Delta 10" Contractor's Saw II, Model 36-630

by Craig Moro

The Delta 10" Contractor's Saw (model 34-444) has remained, through several evolutionary model changes, a popular first tablesaw for many woodworkers. Plenty of professionals also continue to use it in the shop—tuned up and enhanced with shop-made extensions, an after-market fence, and often a more powerful motor—as a secondary or even primary saw.



Knowing the saw's history, we were naturally curious to know how Delta's newest release—the Contractor's Saw II—would stack up.

The Proof Lies In the Cutting

Delta advertises this saw as a "smooth operator," and we agree. We stood a nickel on its edge on the table, started and ran the saw, then switched it off. The nickel remained standing throughout the test.

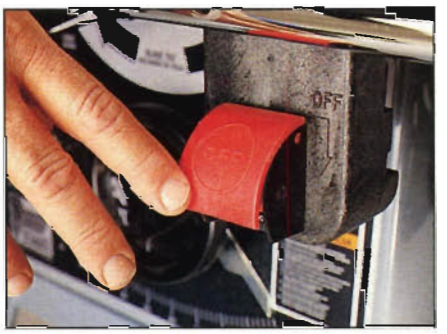
Using a Forrest Woodworker II 40-tooth combination blade, we ripped 1¾"-thick cherry at a good feed rate and got cuts with excellent surface quality. Changing to a Forrest Duraline HI-A/T, we made repeated crosscuts at good speed and obtained excellent surface finish.

Next, we switched to a Forrest dado set to test the saw's plow-cutting ability. Cutting a ¾"-wide, ¾"-deep dado required a very slow feed rate to avoid stalling the motor. Reducing the cutting depth to ⅜", we were able to cut more quickly and with excellent results.

While not suitable as a professional's shop workhorse, the Contractor's II will serve the needs of hobby and occasional woodworkers nicely. We believe most users will want to upgrade this saw with an after-market fence and add shop-made extension tables to make the saw more flexible and efficient. The "II" ably fills the niche between stationary professional machines and lightweight benchtop models.

A more portable saw than the Delta Contractor (which weighs in at 251 pounds), the 210-pound Contractor's II will surely find its way onto many construction sites. WJ

We like the front-mounted switch on the Contractor's Saw II and believe it to be the safest, most convenient switch we've yet tested. To turn on the saw, lift the red switch cover and flip up the toggle *(above)*. To shut it off, simply push against the red cover *(below)*.



Photographs: *Kevin May*

SPECIFICATIONS
DELTA 10" CONTRACTOR'S SAW II

Model number	36-630
Blade diameter	10"
Arbor	⅝"
Arbor speed	3000 rpm
Maximum depth of cut @ 90°	3⅛"
Maximum depth of cut @ 45°	2⅛"
Maximum width of dado head	13/16"
Table size w/extensions (LxW)	27x40"
Motor	1½ hp, 1ph, 115/230v
Weight	210 lbs.
Warranty	2 years

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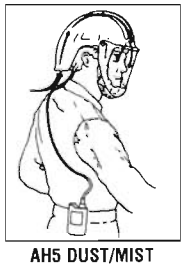

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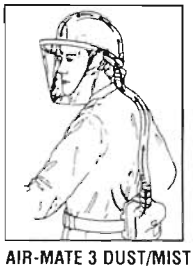

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RACAL HEALTH & SAFETY

Using the VertiLathe

by Bob Colpetzer

G.H. Devine, Inc., markets a vertical lathe drill-press attachment called the VertiLathe. With this unique tool, you can turn spindles, small funiture parts, toy parts, and—with the addition of a pen-making mandrel—pen and pencil sets on your drill press.

VertiLathe includes base plate with ball-bearing live center, tool rest, two drive centers, allen wrench, and mounting hardware.

What You Get

The kit includes a base plate with a ball-bearing live center, a chrome-plated tool rest, two drive centers that lock into your drill-press chuck, and the necessary mounting hardware. The screw center will handle workpieces up to 1" in diameter; for pieces 1" or larger, use the spur center.

The sturdy, 6"-long tool rest bolts to the base plate with a ¾"-long socket-head cap screw. You'll find the cap screw, and an allen wrench to tighten it, included in the kit.

Setting Up the VertiLathe

To attach the VertiLathe to a drill press, first position the drill-press table to accommodate the length of material you want to turn. Next, bolt the base plate to the table using the carriage bolts, washers, and nuts provided.

Before tightening down the base, align and center the live center under the drill chuck. To do this, the instructions suggest locking a pointed length of ⅜" dowel or a long tool bit in the chuck. I prefer to use my plumb bob. I simply clamp the bob's string in the chuck so that its point reaches to within 1/16" of the live center's point, then move the base until the two points align. This approach made the task easy, especially when I was setting up to turn a foot on a 30"-long leg blank.

To mount the stock, first locate centerpoints on each end of the blank. Drill a ⅛" hole at each of these points, then drive the screw center (or press the spur center) into one end of the workpiece. Mount the drive center in the drill-press chuck and tighten it. Then, lower the drill's spindle to center the workpiece firmly on the live center. Now, lock the spindle.

Bolt the tool rest to the base plate and position it within ⅛" of the workpiece. Turn the workpiece over by hand to make sure everything clears, then you're ready to turn.

How It Worked For Me

The VertiLathe is a well engineered and constructed tool. The short tool rest limits the effective length of turning you can make on it, although I turned spindles up to 12" long by first turning one end of the spindle and then reversing the piece to turn the opposite end.

The unit performed well at both high and low speeds with no vibration or chatter. The instructions recommend spindle speeds of 750, 2000, and 4000 rpm for roughing, shaping, and finishing, respectively.

VertiLathe mounted on author's drill press for testing.

While these speeds may be appropriate for turning small-diameter stock like pen blanks, I would use slower speeds for turning larger-diameter spindles. I also recommend that, when using the screw center, you drill the ⅛" hole ¾" rather than ½" deep. This allows you to insert the full length of the screw center without danger of splitting the workpiece.

The one drawback I found in using the tool was having to turn the piece in a vertical position—opposite the customary horizontal orientation we're used to. My neck and back started cramping after a few minutes of working in that position. For an occasional turning, this probably won't present a problem. However, if you have to turn a number of spindles at one time, you may find it to be a nuisance.

To overcome this, I tilted my entire drill press over and clamped a section of the column in my bench vise. While not completely horizontal, this setup felt more like working on a standard lathe. Most of all, it relieved the cramping.

When I first saw the tool, I was skeptical. After a test run, however, I was pleasantly surprised at how easily it set up and how well it performed. Although it has its limitations, I recommend it enthusiastically to those who have need of an occasional turning, or whose shop is already overcrowded, or whose budget won't permit a full-scale lathe. At $49.50, the VertiLathe is a bargain. You can order one direct from G. H. Devine, Inc. (telephone 914/338-7621), or from Woodworkers Supply, Inc., TrendLines, or Penn State Industries. WJ

Photographs: *The author*

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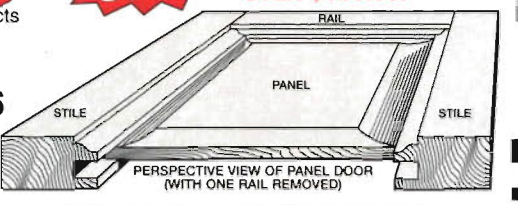

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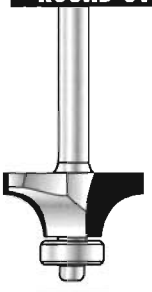
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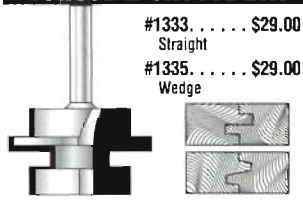
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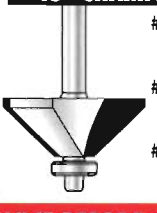
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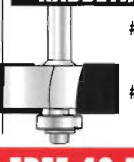
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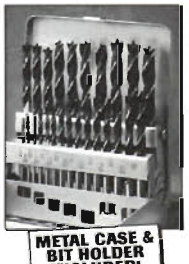

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