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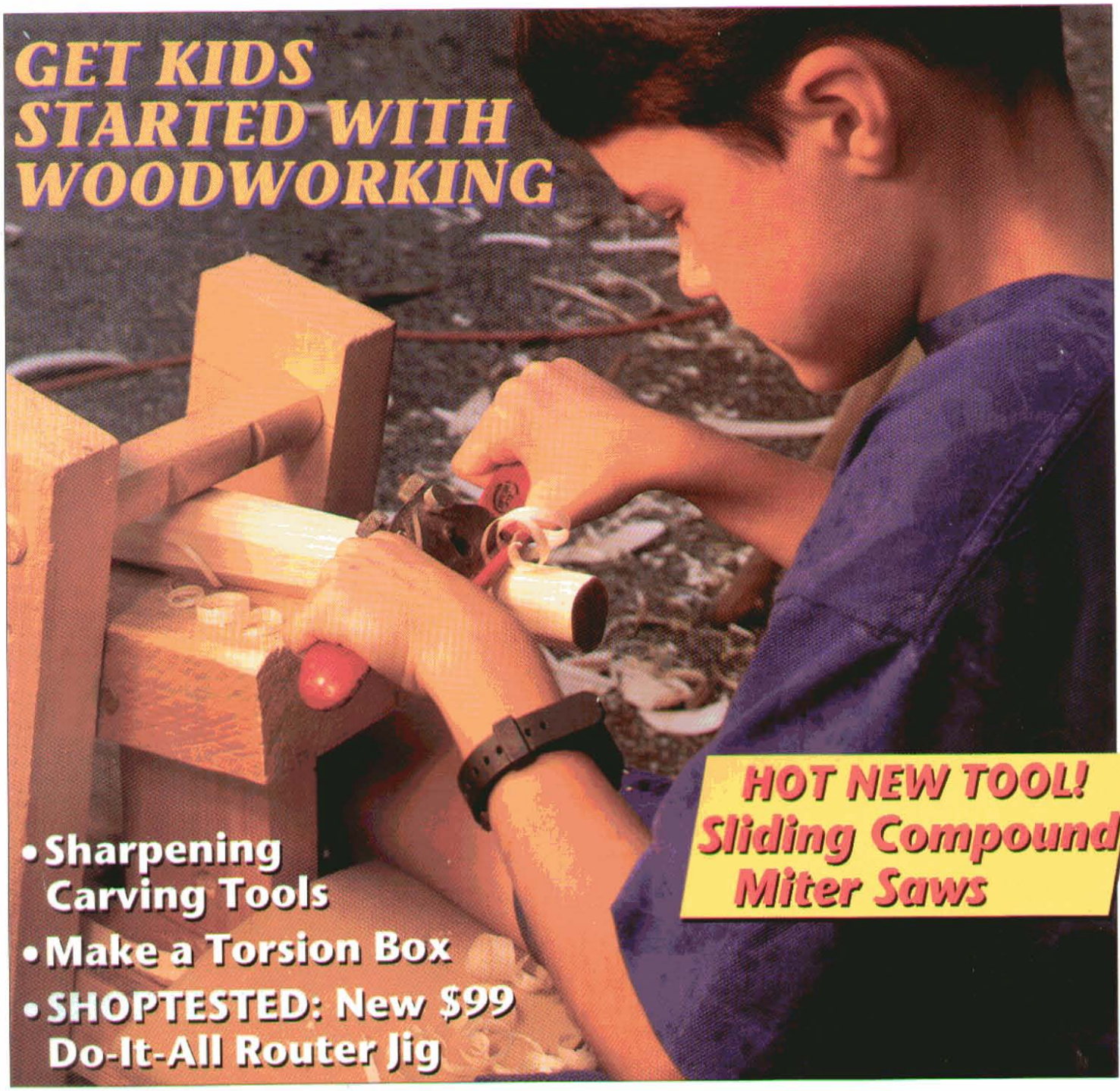
The Woodworker's Journal

BONUS: BACK ISSUE INDEX



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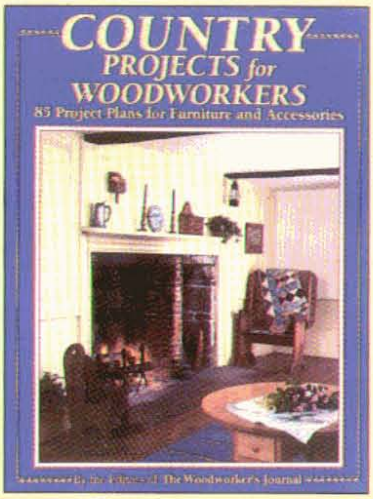
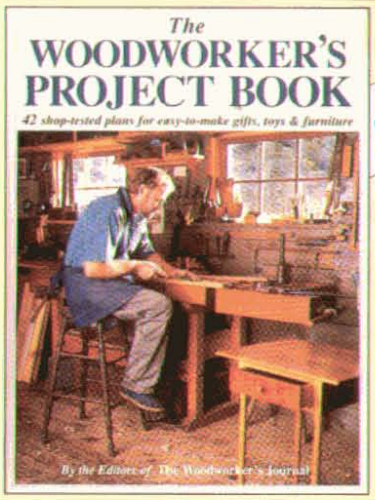


Country Projects For Woodworkers

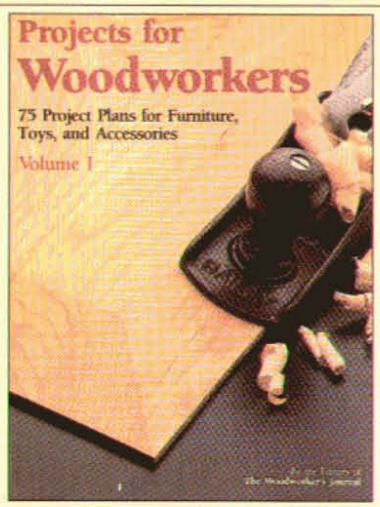
If building the simple, sturdy furniture of the old cabinetmakers appeals to you, then you'll want this collection of country projects from the 1980-84 issues of *The Woodworker's Journal*. 85 complete plans range from projects like Colonial Candlesticks and Fireplace Bellows to more challenging projects such as a Shaker Chest, a Stepped-Back Hutch, and an 18th Century Trestle Table. Some plans are also in *Projects for Woodworkers*, Volumes 1 and 2.



NEW BOOK!

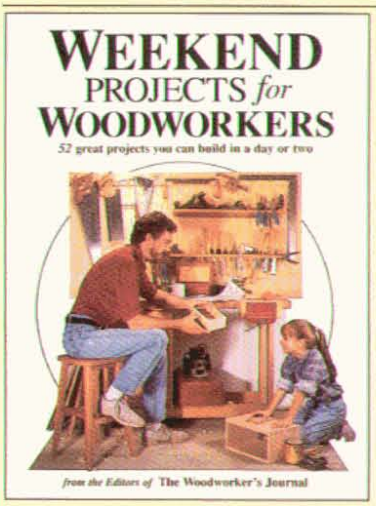
The Woodworker's Project Book

Our first full-color book, these are 42 of our very best, easy-to-make projects. Gleaned from the 1988 issues of *The Woodworker's Journal*, projects include folk-art silhouettes, lamps, pierced-tin cabinets, toys, furniture, decorative woodcrafts, gifts and accessories. Full-size patterns, step-by-step instructions, 74 photos, and over 265 illustrations.



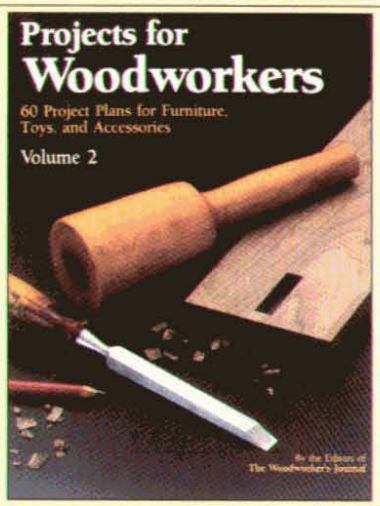
Projects For Woodworkers, Volume 1

Beginning and advanced woodworkers alike will appreciate the full range of styles in furniture, accessories, lamps, clocks, toys and gifts. Of the 75 projects selected from the 1980-81 issues of *The Woodworker's Journal* magazine, plans include a Cabinetmaker's Workbench, Pine Shaker Cupboard, Old-time Icebox, a Cobbler's Bench Coffee Table and a Child's Victorian Sled. Fully detailed instructions, illustrations, and photos.



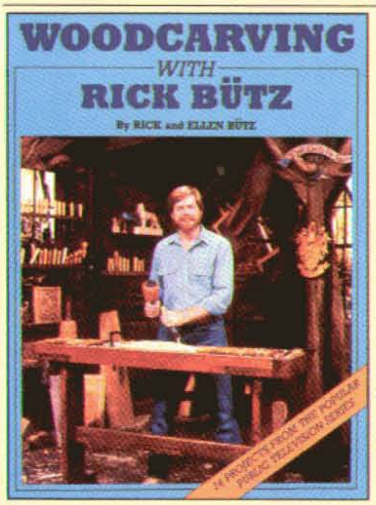
Weekend Projects For Woodworkers

This is the book for the craftsman long on enthusiasm and short on time. Selected from the 1986-87 issues of *The Woodworker's Journal*, all 52 projects are quick, easy and attractive. Each plan is presented clearly with fully detailed instructions and drawings. Whether scrambling for a break or enjoying lots of spare time, woodworkers of all skill levels will appreciate the satisfaction of seeing a project through to completion in just an evening or weekend.



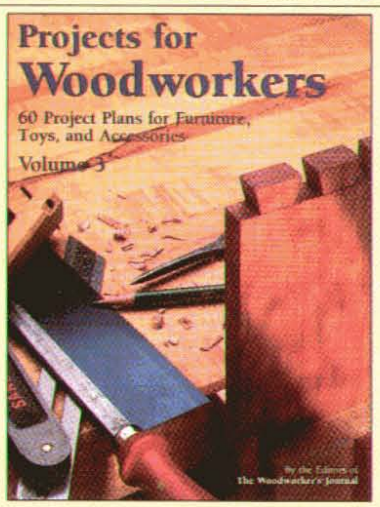
Projects For Woodworkers, Volume 2

Originally published in the 1982 issues of *The Woodworker's Journal* magazine, all 60 projects were chosen with a variety of styles and skill levels in mind. Each project has complete instructions and illustrations. You'll find household accessories like the Desk Caddy, Casserole Dish Holder, and Breakfast Tray easy to build. And you're sure to enjoy completing more involved projects like the Tambour Desk, Old Danish Chest of Drawers and Swinging Cradle.



Woodcarving With Rick Butz

With just a few tools and a few hours to spare, you can share in the pleasures of carving. Wander into the Black Forest of Germany with a carving of St. Nick, or into a Russian village with a Dancing Bears folk toy. Enjoy a chip-carved Quilt Rack, wildlife carvings, and a Tobacconist's Indian. All 14 projects are fully detailed with step-by-step photos. There are chapters on tool selection, sharpening, whittling, chip and relief carving.



Projects For Woodworkers, Volume 3

The best projects from the 1983 issues of *The Woodworkers Journal* magazine—toys, lamps, cupboards, chests, cabinets, tables, planters, mirrors, and much more. Clear illustrations and thorough written instructions make each project easy-to-understand and fun to build. A book you'll want to keep within easy reach of your workbench.

The Woodworker's Journal

JANUARY/FEBRUARY 1993 VOLUME 17, NUMBER 1

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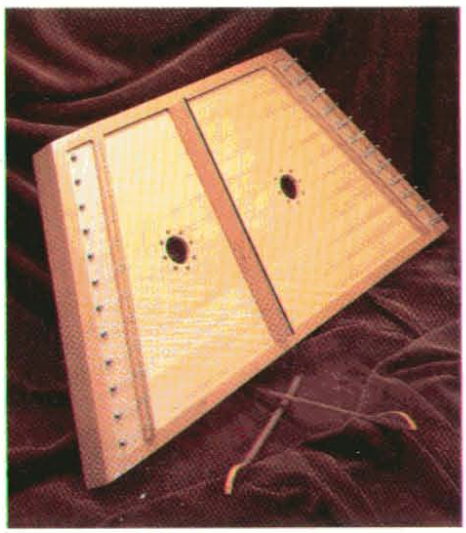

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Shoptalk

A New Generation

There is no "typical" Woodworker's Journal subscriber, but we do know that many of you are parents and grandparents. Think back to how you first got interested in making something out of wood. Perhaps you were just a youngster, with little more than a stick and a pocket knife. Maybe you were lucky and had an adult who took the time to teach you the fundamentals.

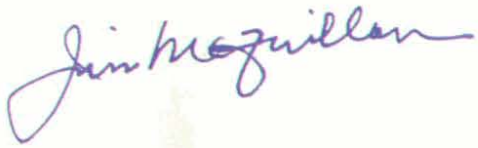
Now, perhaps you'd like to pass some of your enthusiasm for woodworking on to your children or grandchildren. It's a wonderful legacy but, as Roger Homes points out in this issue's article "Green Woodworking With Kids", using some machines and many hand tools requires a degree of eye-hand coordination that young children generally lack. Roger has succeeded in getting his three youngsters interested in woodworking by having them use just a few simple hand tools to build some just-for-fun projects, shown in our step-by-step photos. As a bonus, we've included plans for a simple stool and a shaving horse in the article.

Hot New Tool

Until recently, when a woodworker needed a second saw in the shop (in addition to the table saw), a radial-arm saw was often the first choice. But now there's a new, even more versatile option...the sliding compound miter saw. These saws aren't cheap, but they have much of the same capability of radial-arm saws. Moreover, they also function as a chop saw and, as a big plus, they are portable. Recently, our resident craftsman Mark Ziobro purchased one of these saws, and he's really pleased with it. If you're in the market for a new saw, Jim Barrett's comprehensive review in this issue of sliding compound miter saws is a must-read.

CD Carousel

Several years back we featured a Compact Disk Holder, and that back issue has always been one of our biggest sellers. Unfortunately, the hardware supplier for that project is no longer in business, so, for this issue, we've come up with a new design and a new hardware source. Now you can build our new CD Carousel in either the height shown, or as a half-height version if your collection is more modest.



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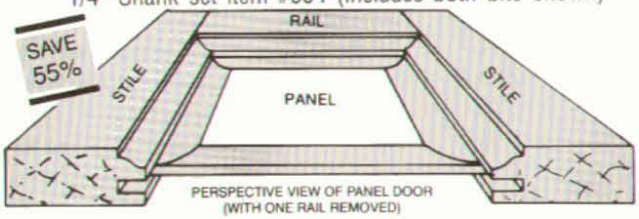
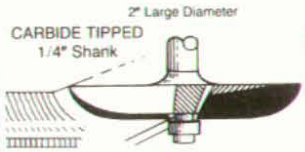


PERSPECTIVE VIEW OF PANEL DOOR (WITH ONE RAIL REMOVED)

RAISED PANEL BIT SUPPLIED WITH BALL BEARING



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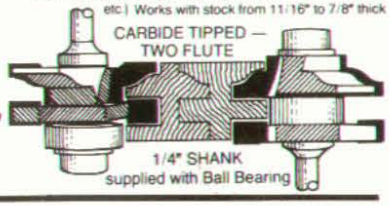

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#601		1/8" **Spiral Cutter**		1/8"	1/2"	1/4" *	$ 9.00
#603	**Solid Carbide**	1/4" Spiral Cutter		1/4"	3/4"	1/4"	$12.00
#903		1/4" Spiral Cutter		1/4"	3/4"	1/2" *	$12.00
#904		3/8" Spiral Cutter		3/8"	1"	1/2" *	$24.00
#905		1/2" Spiral Cutter	*Proper Adaptor Will Be Supplied	1/2"	1 1/2"	1/2"	$29.00
#530		3/16" **Edge Beading**	3/16" Dia. of Circle		1/2"	1/4"	$15.00
#531		5/16" Edge Beading	5/16" Dia. of Circle		1/2"	1/4"	$15.50
#350		1/8" **Round Over**	1/8" R	3/4"	3/8"	1/4"	$11.00
#351		3/16" Round Over	3/16" R	7/8"	1/2"	1/4"	$11.00
#230		1/4" Round Over	1/4" R	1"	1/2"	1/4"	$12.00
#353		5/16" Round Over	5/16" R	1 1/8"	1/2"	1/4"	$14.00
#209		3/8" Round Over	3/8" R	1 1/4"	5/8"	1/4"	$15.00
#355		1/2" Round Over	1/2" R	1 1/2"	3/4"	1/4"	$17.00
#655		1/2" Round Over	1/2" R	1 1/2"	3/4"	1/2"	$17.00
#656		3/4" Round Over	3/4" R	2"	7/8"	1/2"	$21.00
#199		**Multiform Moulding**	Unlimited Patterns	2 1/4"	2"	1/2"	$40.00
#205		1/4" **Cove**	1/4" R	1"	1/2"	1/4"	$12.00
#206		3/8" Cove	3/8" R	1 1/4"	9/16"	1/4"	$13.00
#207		1/2" Cove	1/2" R	1 1/2"	5/8"	1/4"	$14.00
#643		1/2" Cove	1/2" R	1 1/2"	5/8"	1/2"	$15.00
#208		3/4" Cove	3/4" R	1 7/8"	3/4"	1/2"	$26.00
#231		5/32" **Roman Ogee**	5/32" R	1 1/4"	15/32"	1/4"	$16.00
#232		1/4" Roman Ogee	1/4" R	1 1/2"	3/4"	1/4"	$17.00
#506		1/2" **Pattern**	Flush Trim	1/2"	1"	1/4"	$15.00
#508		3/4" Pattern	Flush Trim	3/4"	1"	1/4"	$17.00
#366		1/8" **Slot Cutter**	3/8" Deep	1 1/4"	1/8"	1/4"	$14.00
#368		1/4" Slot Cutter	3/8" Deep	1 1/4"	1/4"	1/4"	$14.00
#204		3/8" Rabbeting	3/8" Deep	1 1/4"	1/2"	1/4"	$13.00
#670		3/8" Rabbeting	3/8" Deep	1 1/4"	1/2"	1/2"	$14.00

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#211		3/8" **Core Box**	round nose	3/8"	3/8"	1/4"	$10.00
#212		1/2" Core Box	round nose	1/2"	11/32"	1/4"	$13.00
#418		3/4" Core Box	round nose	3/4"	5/8"	1/4"	$15.00
#213		1" Core Box	round nose	1"	3/4"	1/2"	$17.00
#548		**Lockmitre**		2"	7/8"	1/4"	$32.00
#214		1/4" **Straight**	plunge cutting	1/4"	3/4"	1/4"	$ 6.50
#216		3/8" Straight	plunge cutting	3/8"	1"	1/4"	$ 6.50
#474		1/2" Straight	plunge cutting	1/2"	1"	1/4"	$ 7.00
#219		3/4" Straight	plunge cutting	3/4"	1"	1/4"	$ 9.50
#779		3/4" Straight	plunge cutting	3/4"	1 1/2"	1/2"	$10.00
#462		1/2" **Bull Nose**	1/2" Dia. of Circle		3/4"	1/4"	$16.00
#464		3/4" Bull Nose	3/4" Dia. of Circle		1"	1/4"	$21.00
#764		3/4" Bull Nose	3/4" Dia. of Circle		1"	1/2"	$21.00
#545		**Tongue & Groove**	Straight	15/8"	1"	1/4"	$29.00
#845		Tongue & Groove	Straight	15/8"	1"	1/2"	$29.00
#546		Tongue & Groove	Wedge	1 3/16"	1"	1/4"	$29.00
#846		Tongue & Groove	Wedge	15/8"	1"	1/2"	$29.00
#450		1/8" **Beading**	1/8" R	3/4"	3/8"	1/4"	$11.00
#233		1/4" Beading	1/4" R	1"	1/2"	1/4"	$13.00
#454		3/8" Beading	3/8" R	1 1/4"	5/8"	1/4"	$15.50
#455		1/2" Beading	1/2" R	1 1/2"	3/4"	1/4"	$17.00
#500		3/8" **Flush**	**Trimming**	3/8"	1/2"	1/4"	$ 7.00
#501		3/8" Flush	**Trimming**	3/8"	1"	1/4"	$ 7.50
#503		1/2" Flush	Trimming	1/2"	1"	1/4"	$ 8.50
#221		1/2" Flush	Trimming	1/2"	1 3/16"	1/2"	$ 8.00
#558		**Thumbnail**		1 3/16"	3/8"	1/4"	$18.50
#658		Thumbnail		2 1/2"	3/4"	1/2"	$35.00
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Letters

*We welcome opinions and comments (both pro and con) from our readers. Address correspondence to: Letters Department, **The Woodworker's Journal**, P.O. Box 1629, New Milford, CT 06776.*

I made the Country Curio Clock project from your May/June 1992 issue. It turned out just fine, but when I called Mason and Sullivan, the company listed as a source for the movement and dial face, I was told that the parts are not available because Mason and Sullivan is in the process of being sold. Where can I get the parts?

John Vladd, Aliquippa, Penn.

*Mason and Sullivan has recently been sold to Woodcraft Supply Company. Although it is Woodcraft's intention to eventually carry most of the clock movements and clock hardware offered in the Mason & Sullivan catalog, it will likely be Spring (1993) before they'll actually have the items in stock. Over the years, many projects featured in **The Woodworker's Journal** have featured Mason & Sullivan movements and hardware. After the first of the year, you can call Woodcraft (1-800-225-1153) to check as to exactly when they'll be able to fill your order. Woodcraft tells us they'll continue to use Mason & Sullivan's parts numbering system, so you can continue to use the parts numbers listed in the project, and in the Mason & Sullivan catalog.*

In your September/October 1992 issue, a letter from Marvin Collins described a problem he had with his Sears table saw switch. On one occasion, the saw continued to run after he flipped the switch to the "off" position. On another occasion, the saw started up with no one near the saw.

I had a similar problem with a Ward's radial-arm saw and can tell you that it can be quite a surprise to wake up in the middle of the night and hear your saw running. I purchased the saw in the 1970's and, within a couple of years, the problem began. The switch would stay on when I turned it off. I bought a new switch from Ward's, but that one also only lasted about two years before the same problem started.

Barry Nestle, Alvin, Tex.

Many thanks for your letter. It's another important reminder to always unplug the power cord before putting your hands near the blade or cutter of any machine.

Your November/December 1992 issue had plans for a nice Futon frame, but the price of that top-of-the-line mattress is a bit too much for my wallet. Is there another mattress available that's reasonably comfortable and reasonably priced?

J. R. Allen, Cincinnati, Ohio

Check your nearby department stores, as many of them are starting to carry

Futons. Sears sells a queen-sized cotton-filled Futon mattress for around $140. Keep in mind, though, that our Futon frame is sized for a queen-sized mattress that measures 60 in. wide by 80 in. long. We've come across some queen-sized mattresses that measure only 57 in. wide and 72 in. long. You'll probably want to reduce the length and width of your frame if you purchase one of those smaller mattresses. As mentioned in the written instructions, it's best to have the mattress on hand before starting the project.

When I saw the Ratchet Table Lamp project in your March/April 1992 issue, it immediately became one of my next "things to do." I made it from white oak and applied Jacobean stain for a finish.

However, I wasn't too happy with the black lampshade, so I thought "Why not a wood shade?" I bought a white linen shade for about $7 and glued 1/4 in. thick by 3/4 in. wide by 12 in. long strips of white oak to it. (A coat of Jacobean stain was added before the strips were glued.) It looks great.

John H. Beer, Wynnewood, Penn.

The Convertible Step Stool/Chair project in your September/October 1992 issue is a winner. The designer, Mr. A.B. Beavers, is a thoughtful woodworker, and many thanks for his plan.

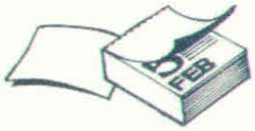
When building the project, I made two slight modifications which enabled the plan to better suit my uses. First, I cut a smaller opening in the bottom half of the lower sides. This, in my opinion, eliminated the need for the spline. Secondly, I installed a simple wood pivot lock on the inside of the legs where they meet. This allows the chair to be picked up by its backrest handgrip and moved, without it coming unhinged.

And my final comment. Part H is shown as 4 1/4 in. wide in the Bill of Materials. However, the correct width, as shown in the cutting diagram on page 49, is 4 1/2 in.

Richard Shimel, Orlando, Fla.

Your safety is important to us . . . We strive to present our plans and techniques as accurately and safely as possible, and we try to point out specific areas and procedures where extra caution is required. But because of the variability of local conditions, construction materials and personal skills, we can't warn you against all potential hazards. Remember to exercise common sense and use safety measures when operating woodworking power equipment. Don't attempt any procedures you're not comfortable with or properly equipped for. Sometimes, for the sake of clarity, it's necessary for a photo or illustration to show power tools without the blade guard in place. In actual operation, though, you should always use blade guards and other safety devices on power tools that are equipped with them. Remember . . . an ounce of prevention really is worth a pound of cure.

— The Editors



Events

We will gladly list as many events of interest to woodworkers as space permits. Listings are free and may include shows, fairs, competitions, workshops and demonstrations. The deadline is eight weeks before publication—March 1 for the May/June 1993 issue. Please address announcements to the Events Department. Readers planning on attending events should call ahead if possible. Scheduled dates and locations sometimes change between publication and the date of the event.

Connecticut: For information on the weekend workshop program and other woodworking programs at the Brookfield Craft Center, call or write to the center at P.O. Box 122, Brookfield, CT 06804; tel. (203) 775-4526.

District of Columbia: Woodworking World—The Washington, DC Show, Feb. 12–14, Hyatt Regency Crystal City, Arlington, Virginia. For information call 1-800-521-7623.

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Minnesota: Woodworking World—The Twin Cities Show, Jan. 29–31, Minneapolis Convention Center, Minneapolis. For information call 1-800-521-7623.

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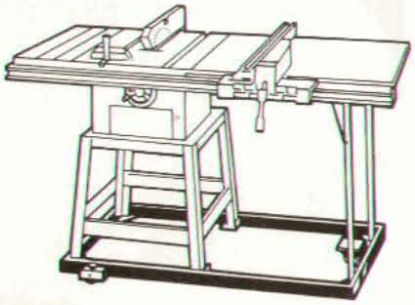

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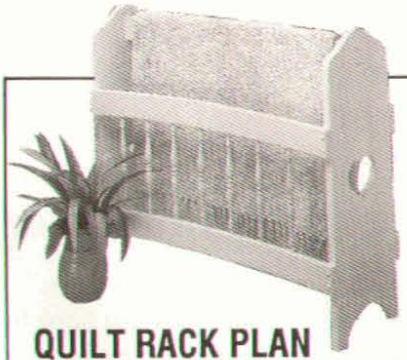

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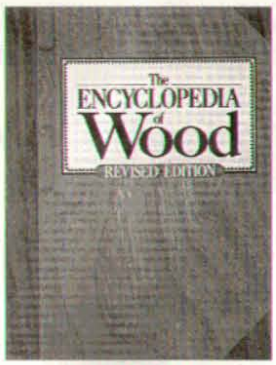

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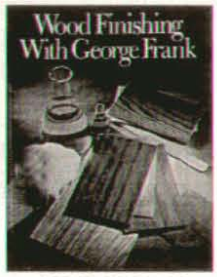

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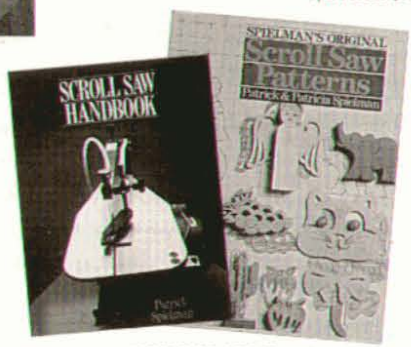

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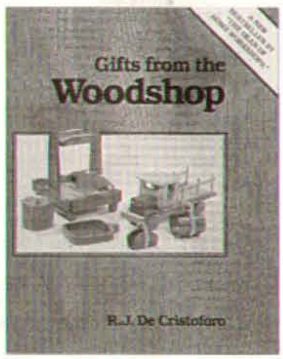

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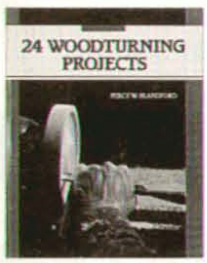

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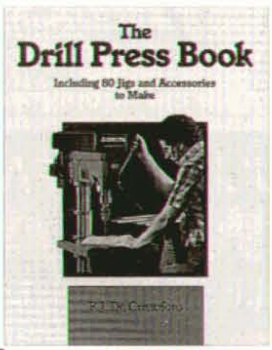

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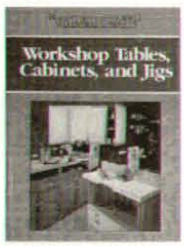

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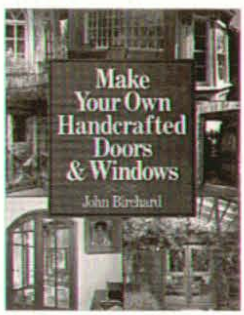

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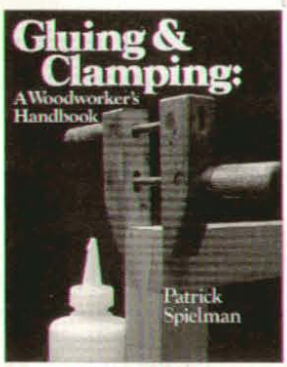

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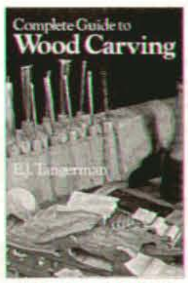

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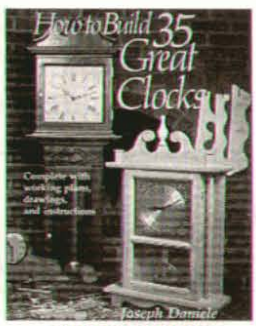

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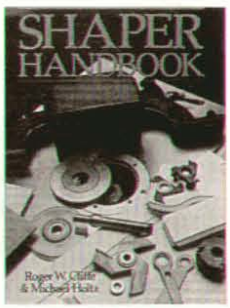

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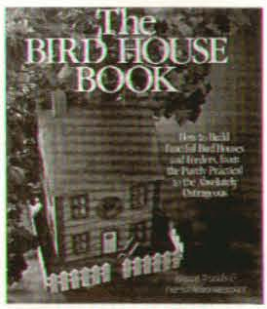

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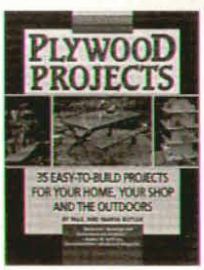

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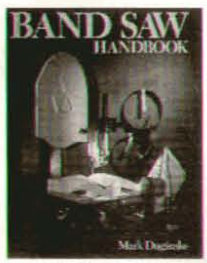

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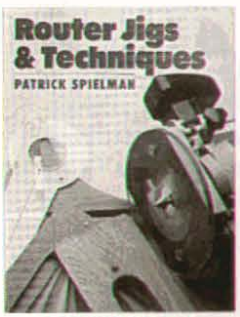

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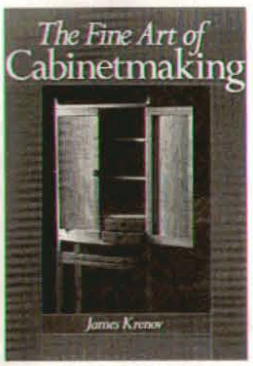

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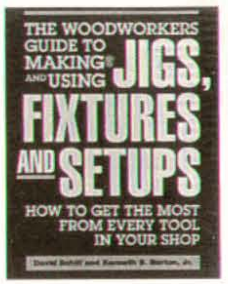

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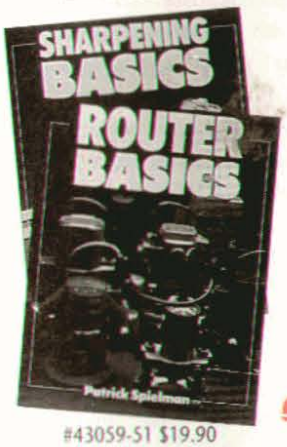

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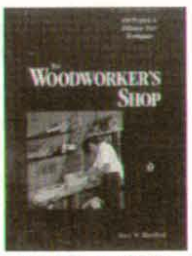

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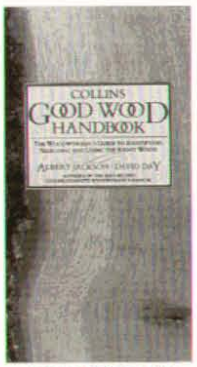

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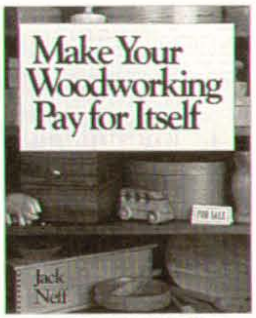

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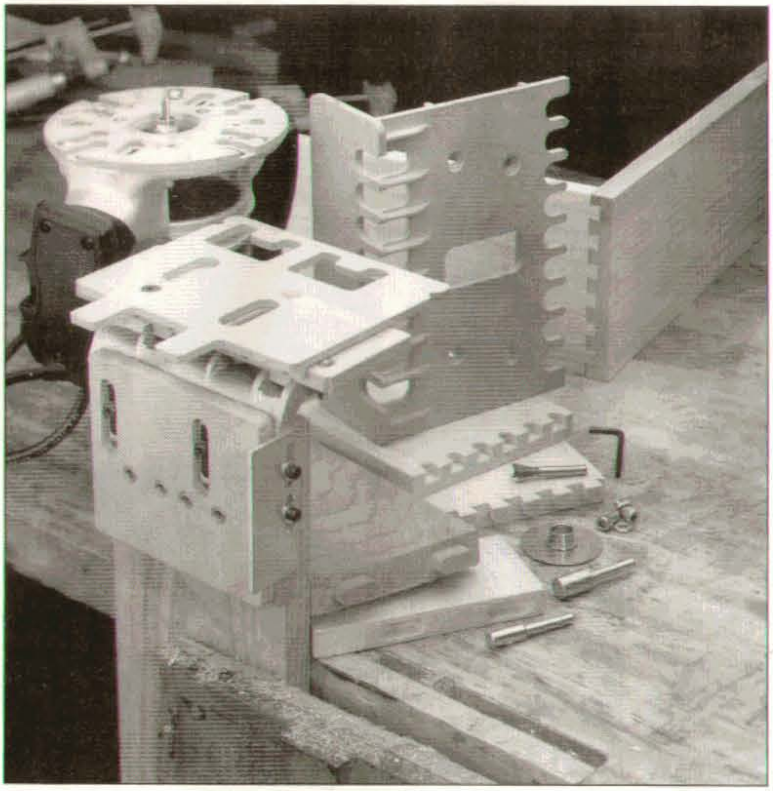

JointMaster

A Multi-joint Jig for Under $100

By Dennis Preston

Learning to hand cut dovetails is not too difficult. However, when faced with much repetitive work, many woodworkers look to jigs to speed the process. There are a number of dovetail jigs on the market, with prices ranging from about $30 to over $300. The jigs vary from small single purpose units to large, elaborate, infinitely adjustable ones. What you buy depends on your need and your budget, but the JointMaster— from Leichtung Workshops—is a good compromise between cost and versatility.

The jig not only lets you cut the familiar half-blind dovetails but it also allows the cutting of through and half-blind finger joints as well as mortise and tenon joints. Boards up to 7 in. wide can be dovetailed with a single setup; wider boards require repositioning the template on the board before continuing. The jig does not cut through dovetails.

Unpacking the Box

The JointMaster system consists of a main frame, templates for dovetails and mortises and tenons, two router bits, a router base plate kit and an instruction manual.

The body of the jig is die cast metal and the templates are made of a tough 30-percent glass-filled nylon. All parts have a clean finish and fit together well.

The router base kit is designed to fit most routers except Bosch. The kit consists of a 6 in. diameter base, four template guide bushings and two alignment pins. The appropriate guide bushing must be used to prevent damage to the templates. For initial set up, the alignment pin is temporarily chucked in your router and the base and guide bushing assembly is centered with respect to this pin, thus assuring perfect centering of the bit with the base. Two 1/4 in. shank carbide router bits are supplied—a 1/4 in. straight bit for cutting mortises and tenons, and a 1/2 in. dovetail bit.

Setting up the Jig

Prior to using the jig you will have to build a bench stand. You will also need several clamps to hold the stock in place on the bench stand.

The stand, which is clamped to your bench top, is simply a sturdy right angle bracket that supports the jig and stock. I used scrap 3/4 in. plywood glued and screwed together. The instruction manual provides the plans. As with most jigs of this type, a good manual is absolutely necessary. This one is clear and well illustrated.

Cutting Joints

Dovetails are easily cut by carefully following the template profile with the router. The real work is done beforehand in making a test joint. You must cut a test joint first using the same thickness stock as your project to assure that the bit depth setting is correct. Minute changes in thickness affect the fit of the pins and tails. Following the manual resulted in a perfect fit on my trials. Half-blind and through finger joints can be made using the same procedure as for dovetails, except that a 7/16 in. straight bit ($19.99 extra from Leichtung) is used in place of the dovetail bit.

The 1/4 in. straight bit (included with the jig) is used to cut mortises and tenons. The supplied templates permit the cutting of both single and multiple joints. One template is used to cut the tenon in the end of the stock. The other template lets you cut the mating mortise in the end, edge or face of the mating stock. As before, cutting a test joint using the same thickness and width stock is necessary for the best fit.

Summary

Overall, the JointMaster system provides good performance and versatility. It takes a little time and practice to get comfortable with the set up procedures, but once done you can grind out identical joints all day long.

The JointMaster Joinery System, catalog no. 30882, costs $99 plus $7.25 shipping from Leichtung Workshops, Dept. P152, 4944 Commerce Parkway, Cleveland, OH 44128-5985; Tel. 1-800-321-6840.

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Readers' Information Exchange

Looking for an owner's manual for an old band saw? Need a bearing for a hand-me-down table saw? Can't find a source of supply for an odd piece of hardware? Maybe our readers can help. Send along your request and we'll try to list it here—and perhaps one of our readers will have an answer for you. We'll include as many requests as space permits.

I have an Electro-Router "500" made by Electro Engineering of Chicago. Would anyone know where I can get parts for it?

Ben Shomper
160 Baird Cove Road
Franklin, NC 28734

I need an owner's manual, parts list and information on a Shopsmith Mark VII, serial no. 40798, and on a Sears Craftsman 12 in. band saw, model no. 103.24250.

Bill Wanks
742 Butte View
Fallon, NV 89406

I was given an old cast iron Sears Craftsman 20 in. tilt arbor jigsaw, model no. 110.24561, and I need an owner's manual and parts list for it.

Frank M. Potts
718 Grove Street
McDonald, PA 15057

I have a 9 in. Craftsman wood lathe. It's all cast iron. The only markings on it are embossed letters on the head (L2) and on the tailstock (L5). The head has a 3/4 in. shaft with bronze bushings. I need an owner's manual and parts list and any information available.

Conrad Duque
60 Searle Road
South Hadley, MA 01075

I need a housing cover, part no. GH6, for a Weller Mini-Shop, model no. 600. The manufacturer no longer carries parts.

Richard Jacobi
14852 Verdun Estates Drive
Florissant, MO 63034

I need the current address for J.M. Wise & Company, small manufacturer of power tool kits, formerly located in Paris, Tennessee, and before that Florissant, Missouri.

Karl C. Thomas
5226 Harpers Farm Road
Columbia, MD 21044

I need an owner's manual and parts list for a Rockwell Delta wood lathe, series no. 46-111, serial no. FR545.

Robert B. Solda
22 Diane Road
Peabody, MA 01960

I'm looking for an owner's manual and parts list for a Sears Craftsman 10 in. table saw, model no. 113.299110.

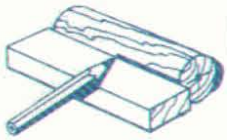
John Wood
P.O. Box 359
Springfield, VT 05156

I have a wood lathe that was built in Springfield, Ohio, with a built-in motor by Robbins & Myers. I need an owner's manual and parts list or any other information.

H. Lipper
518 W. Commercial
Kahoka, MO 63445

I'm looking for a miter gauge, the shaper fence and instructions for the jigsaw and jointer on a Shopsmith 10ER model.

Michael R. Shafer
302 Canal St.
Palmyra, NY 14522

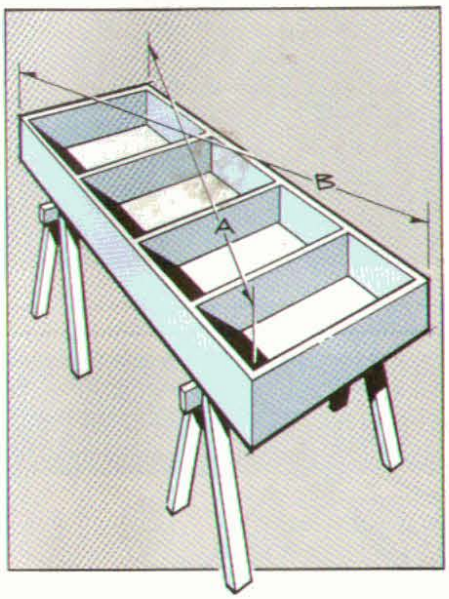


Shop Tips

Rather that just toss out old leather belts and handbags—recycle them in the workshop. They make great clamp pads. Cut the leather to fit the clamps, then use double-stick tape or hot-glue to secure them in place.

Leo Sorel, Raynham, Mass.

Most any shop square, such as a try square or framing square, will work fine checking the squareness of

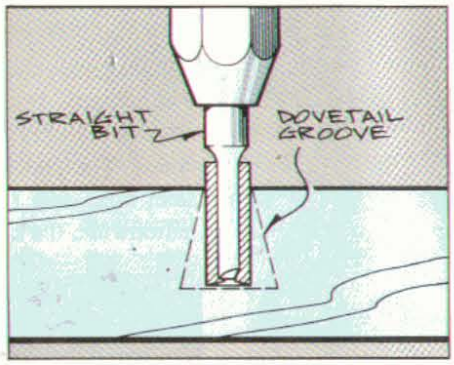


small to medium-sized projects. But for large case pieces, shop squares are just too small to do an accurate job.

Here's an old-time trick that makes the job easier. Simply measure across the diagonals of the case with your tape measure. If the diagonals measure the same (''A'' equals ''B''), the case is perfectly square. If it's off, adjust the case as needed to get the diagonals equal.

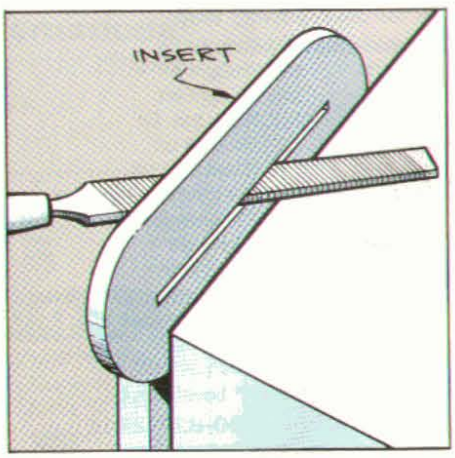
If you are about to varnish a project, and still have on those dust-covered clothes you wore while sanding, it's a good idea to change into some clean clothes. It will help keep dust to a minimum, and that means you'll end up with a smoother finish.

When cutting a dovetail groove with a router and a dovetail bit, it's best to make an initial groove using a straight



bit. The initial groove serves to remove most of the waste stock, allowing the dovetail bit to make a cleaner cut with less burning and minimum strain on the motor. To reduce motor strain when making the straight cut, be sure to do it in several passes, with each pass removing no more than about 1/8 in. of stock.

Many woodworkers like to make ''zero clearance'' inserts for the table saw. However, when using ours, we've found that the saw blade made a rather irritating high pitch ''ringing noise,'' apparently caused by the ever so slight contact between the saw's teeth and the insert slot. Thankfully, all that was needed to quiet things down was a flat file thin enough to fit in the slot. A

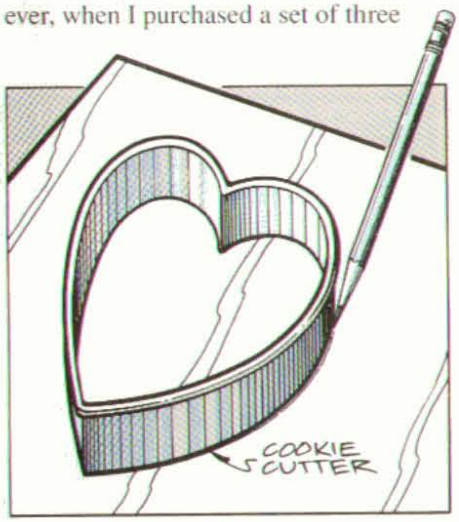


few light passes with the file opened the slot just enough to give our ears some much needed relief.

When gluing a small odd-shaped part, it's often a challenge to figure out how best to clamp it. Sometimes there is no easy way for the clamp to hold the part until the glue is dry. Next time you're faced with such a problem, consider using a bit of non-drying modeling clay. A little creative clay shaping will often secure the part exactly where you want it. When the glue dries, simply peel off the clay. Non-drying modeling clay is sold at most art supply and craft stores.

C.M. Wegner, Minneapolis, Minn.

I like to include a heart-shaped cutout on many of my country pine projects. But, not being much of an artist, my freehand cutlines were often less than satisfactory. My talents improved, however, when I purchased a set of three



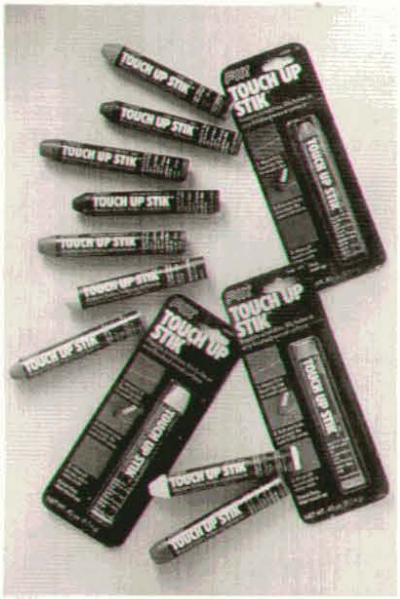
heart-shaped cookie cutters. Now, I need only trace around a cutter for a perfect shape every time.

Kenny Wilson, Konawa, Okla.

The Woodworker's Journal *pays $25—$100 for reader-submitted shop tips that are published. Send your ideas (include a sketch if necessary) to:* ***The Woodworker's Journal,*** *P.O. Box 1629, New Milford, CT 06776, Attn: Shop Tip Editor. We redraw all sketches, so they need only be clear and complete. If you would like the material returned, please include a self-addressed stamped envelope.*

Product News

Touch Up Stik



Frustrated by the occasional nick or scratch in an otherwise flawless finish on your project? New from Darworth are FI:X Brand Touch Up Stiks, an easy-to-use crayon-like color stick. You simply find the stick that most closely matches the color of your finish, rub it into the nick or scratch, and then wipe the excess off with a clean cloth. Available in 12 popular colors, Touch Up Stiks match almost any type of wood, do not fade after application, and yield professional-looking results, even for a beginner. FI:X Touch Up Stiks (about $1.49 each) are available at most hardware stores. Call 1-800-624-7767 for the name of a store near you.

Retrofit Keyless Chuck

Lost your drill chuck key again? If you've been longing for a drill with a keyless chuck, but can't stomach buying a new drill when your old one still works fine, here's a keyless chuck that you can use with your present drill. Black & Decker's new keyless chuck (their model no. 70-015) easily converts all normal-duty 1/4 in. and 3/8 in. corded and cordless drills (with a 3/8-24 spindle and rated at 3.5 amps or less) into a keyless chuck drill. Simple instructions are included that show you how to remove your present chuck and replace it with the new keyless chuck. The chuck features heavy-duty steel jaws, a reinforced steel nose and a durable rubber housing. Available in stores nationwide, the chuck's suggested retail price is $29.99.

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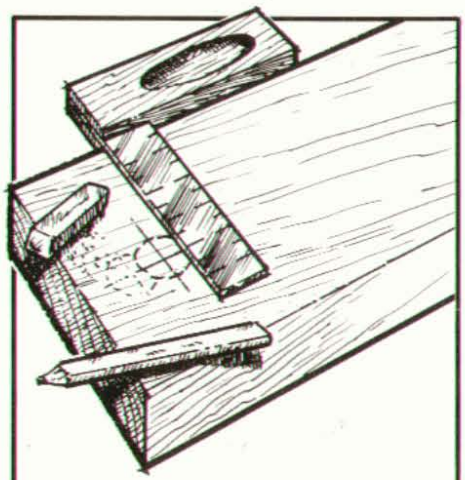

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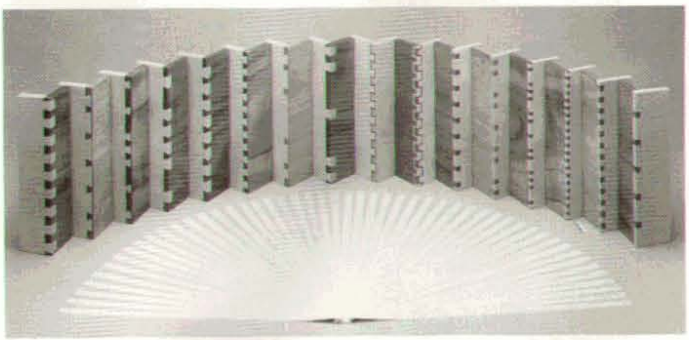


New From INCRA

If you, like thousands of other woodworkers, have discovered the incredible capabilities of the INCRA JIG, and the whole new world of precision joinery that it makes possible, then you won't want to miss this new addition to the INCRA line. INCRA's Master Template Library (made of durable Lexan) is a collection of 50 precision templates, for use with both the Original INCRA JIG and INCRA JIG Pro. The templates enable you to cut just about every equally *and* variably spaced dovetail and box joint imaginable—including the exotic double and double-double joints that INCRA pioneered. A free bonus with the templates is a 16 in. long, 1/32 in. INCRA scale. In woodworking stores and catalogs nationwide, INCRA Master Template Library is $24.95.

New Folding Roller Stand

Record Tools has long had a reputation for high quality, and when they turned their attention to the development of an adjustable roller stand, no stone was left unturned. "We investigated the roller stands available ... and in our opinion developed the optimum design." Record's new stand features wide leg spacing and non-slip feet for sure-footed stability, an ergonomic height adjustment knob that locks the roller at any height from 20 in. to 40 in., and a 2 in. diameter by 11 3/8 in. long steel roller mounted on ball bearings. The stand supports up to 150 lbs. and folds for storage. Suggested retail is $52.28; for more information call (416) 428-1077.

Green Woodworking with Kids

A healthy substitute for MTV

by Roger Holmes

Kids love workshops. "Can I help? What can I make?" pipes a chorus of squeaky little voices whenever I flip on the shop lights. A few years ago, I built each of my kids a little workbench and a small toolbox. Seeing me at work with saws, planes and chisels, they wanted to use them too. But, as we all know, acquiring skills with those tools isn't easy. It takes a certain amount of hand-eye coordination and strength, and it requires that rarest of qualities in a child or adult—patience. As long as I was there to help, my kids, who were three, five and eight years old, did fine and we all had fun. But for quite awhile I found it almost impossible to get any work of my own done.

Then I got interested in green woodworking—making things of wet wood, freshly split from the log. With little more than a drawknife, spokeshave and brace and bit, you can turn out simple chairs and stools from green wood. So one day I built a shaving horse, an ingenious contraption that holds the parts for shaping, and began slicing long, wet strips off a stick of oak with a drawknife. Within seconds three little voices chirped as one, "Can I do that?"

Ever the indulgent father, I dismounted and sat the oldest in the saddle. After about five minutes of instruction on how to ride the horse and work a spokeshave (which I had prudently substituted for the drawknife), he was happily immersed in the task of making the stick round, a pile of nice long shavings growing at his feet. When the five-year-old's turn came, she, too, quickly caught onto the technique and its fascination. The three-year-old couldn't reach the horse's foot rests (pushing against them holds the work), but after I fixed the stick to the horse with a quick-action clamp, he managed almost as well as the others. Each child seemed quite happy to whittle away at the stick for long stretches of time.

Green woodworking has proved to be ideal for the family workshop. We can all work together or, if I need to get on with my own projects, the kids are content to shave sticks of wet wood on their own. Sometimes they need help—I help figure out how something should go together, or lend a hand boring leg and stretcher sockets. Other times, they're quite self-sufficient. One day my youngest labored a long time with the spokeshave, producing a bit of wood that looked to me as though the dog had chewed it. Far from disappointed, he painted it blue and proudly announced that it was a battleship.

In my experience, green woodworking has a number of advantages for children (and adults) who are just beginning to woodwork. Materials are cheap and easy to obtain. Tools are few and relatively simple to use. All sorts of stuff, toys as well as more "useful" items, can be built merely by fitting the end of sticks into holes. Getting results from tools so quickly builds a child's confidence—which comes in handy later on when he or she tackles more complicated tools and techniques. And

children are delighted to be able to make something, no matter how simple (remember the battleship), all by themselves.

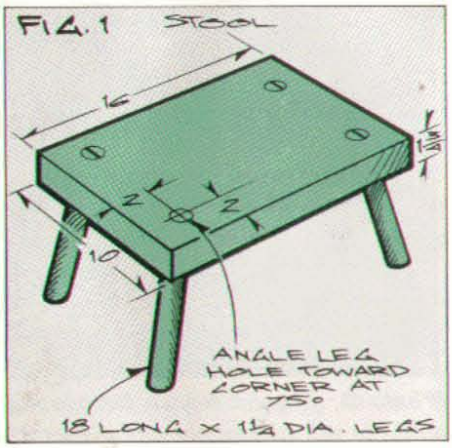
Getting started

If you'd like to try green woodworking with your children (or on your own), it doesn't take much to get started. I'll discuss materials and tools, then walk you through a simple project.

Finding the Wood: You may not have to look farther than your firewood pile for suitable material. Perhaps you have a woodlot. Or even a tree that you've been meaning to remove from the backyard. Lacking these, I buy logs from a firewood dealer. Last year, four 12 in. diameter hickory logs, each 5 feet long, cost me all of $20.

Photo A: With the tools shown here you can tackle a great many green-woodworking projects. They are: iron wedges, sledge hammer, froe, hatchet, wooden maul, drawknife, spokeshaves, brace and bits, crosscut saw.

Given the price—free or dirt cheap—it's worth trying most any kind of hardwood. (Softwoods aren't usually worked green, though that's no reason not to experiment.) Some, of course, are better than others. Traditionally, country chairmakers worked ash, oak and hickory green. Woods like maple and birch that are tough for a child to push a tool through when dried, are much easier to work when green.



Whatever the species, straight-grained wood is easiest to work. Select logs that are free of branches and avoid those whose bark spirals around the log—the grain inside may twist, too. In general, the drier the wood, the harder it is to work. Freshly felled trees will, of course, be wetter. They are also more likely to be free of fungal infections that can affect the wood's strength. (Several chair legs I made from fungus-deteriorated maple, birch and ash failed before I learned that lesson.)

Tools

Green woodworking is not tool intensive. A chain saw comes in handy for cutting logs and big branches. (Without one, I make do by splitting the log into small enough pieces to cut with a crosscut handsaw.) To split logs, I use two large metal wedges and a sledge hammer and, for smaller pieces, a special tool called a froe (see Photo A). An ax or hatchet works well, too.

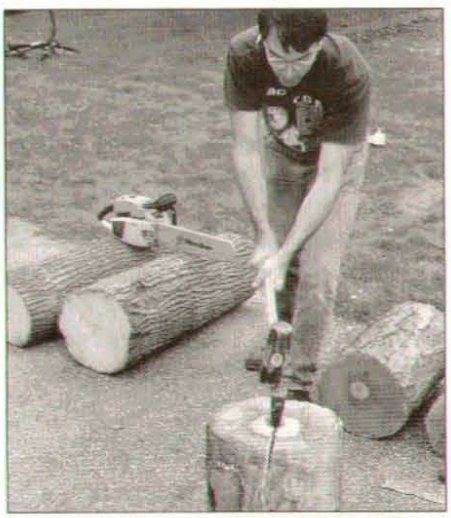
A spokeshave and a drawknife are all you need to shape most parts. I prefer a wooden spokeshave for myself, but have found that the metal ones, whose blades and soles resemble those of a handplane, are better for kids. A smallish drawknife, whose handles are in line with the blade (some are tilted up), is best when you are learning to use this tool.

The companion to these edge tools is the shaving horse, perhaps the most characteristic green-woodworking tool, and the one most folks are least likely to possess. (See the sidebar on page 23 for description and plan). You can press a bench vise or metalworking vise into service, but I encourage you to build a horse. They're much easier for children to use—and kids love them.

A brace and a set of auger bits is the only other essential tool, necessary for boring sockets for the joints. Though young kids may need help with this tool, I think they're better off with a brace and bit than with an electric drill.

Making a Green-wood Footstool

Although kids don't need more than a spokeshave and a stick to pique their interest in green woodworking, this project can be fun to do with your child. The sketch (Fig. 1) shows the dimensions of the stool being made in the



Photos B & C: To split green wood, move from iron wedges and a sledge hammer to a froe or hatchet as the pieces become smaller. Halve the piece at each stage, to help ensure a straight split. Use a large wooden mallet, not a hammer, to strike the froe or hatchet.

photographs, but these can, of course, be altered. Three-legged stools don't wobble if the legs aren't all the same length, but they are less stable in use than their four-legged cousins. For the legs, we used some birch culled from a friend's backyard cleanup. The stool's top, or seat, is kiln-dried pine; off-cuts from a 2 by 12 would work just fine.

Splitting Out Leg Blanks

If you're working with large diameter logs, you'll probably want to quarter them first with iron wedges and a sledge hammer before cutting them roughly to length. If the log has begun to dry, cut off the dry, checked ends first. Move to a froe or hatchet as the pieces you're splitting become smaller. (For accuracy and control, drive a hatchet, like the froe, with a wooden maul, rather than chopping freehand as you would to split firewood.) With practice, you can split parts remarkably close to the size of the finished leg.

The only splitting "tip" of any consequence I can offer is this: for every split, try to place equal amounts of wood on both sides of the wedge, froe or hatchet, as shown in photos B and C. This helps ensure a straight split.

Shaping with the Drawknife

Any older child with reasonably good hand and arm strength and a sense of prudence and responsibility (see safety sidebar) should be able to manage a drawknife. A sharp drawknife peels away green wood with wonderful ease, and children seem to find as much satisfaction in the pile of shavings they produce as in the leg (or battleship) they create. If your child isn't ready for the drawknife, you should rough-out the material with it and the child can finish with a spokeshave.

The best way to learn both spokeshaving and drawknifing is to make a lot of shavings—firewood is cheap. Unlike a plane, a drawknife has no frog or sole to hold the blade at a constant angle to the work; consequently it is more difficult to control the tool. Power comes from the arms, control from the wrists and fingers.

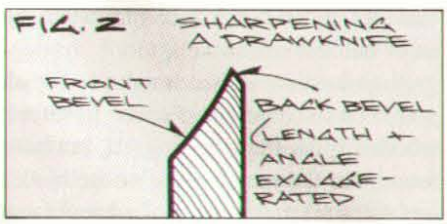
To give a child an initial feel for using

Photo D: A good way to introduce a child to the spokeshave and drawknife is to make a few cuts together, demonstrating how different movements of the hands affect the cut.

a tool like the spokeshave or drawknife, I sit behind him or her on the horse, both of us grasp the tool and take some cuts. I demonstrate how a little downward pressure quickly digs the tool into the wood, and upward pressure lifts it out. It doesn't take long for them to get the hang of it. In Photo D, we're practicing with the spokeshave.

A sharp tool is, of course, much easier (and safer) to use than a dull one. When using the drawknife, I've found that honing a very short second bevel on the back of the cutting edge, as shown in Fig. 2, makes the tool easier to control. Raise the sharpening stones just slightly off the flat back of the tool to establish this back bevel.

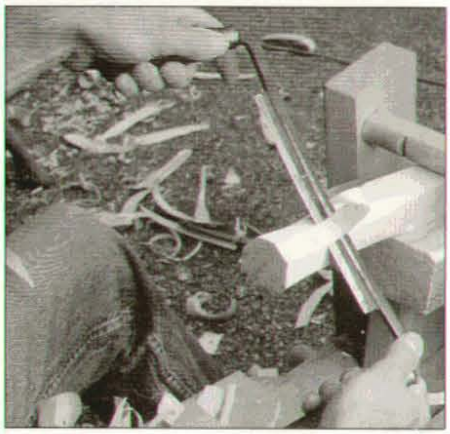
To make a round stool leg, first square



up the blank (Photo E), then shave off the corners to make an octagon (Photo F). Shave the corners again and you're almost there. Novices may want to switch to the spokeshave at the octagon stage (Photo G), but a skilled operator can do everything but the finishing touches with the drawknife. The drawknife is far more difficult to master than the spokeshave (I'm still working on it), so if you are a novice, work slowly and don't try to remove too much stock at once as you get to know this tool.

Spokeshaving

All kids can use this tool and it's really the only shaping tool suitable for the



Photos E, F, G: To make a round stool leg, first shave the leg square (Photo E) along its entire length; the length of one of the square's sides should roughly equal the desired diameter of the leg. Slice off the corners to create an octagon (Photo F), then finish rounding the leg with the spokeshave (Photo G).

littlest practitioners. As shown earlier, the four-hand strategy (two of mine, two of theirs) gets them started. About all I do is make sure the blade is sharp and set for a fairly shallow cut—the most common difficulty seems to be chattering, which is usually the result of taking too big a bite or working with a dull tool. Finishing the work started by the drawknife can take just a few strokes, but the kids usually have so much fun whittling away that I have to watch out that they don't reduce the piece to an insubstantial dowel.

Cutting Tenons

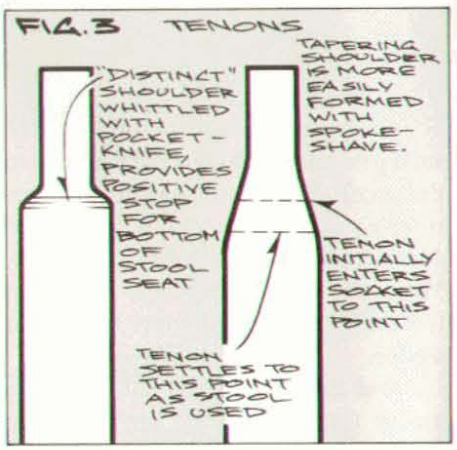
This part of the project requires the most skill, so judge your child and your assistance accordingly. Make a template by boring a hole the size of the seat sockets (3/4 in. for our stool) in a piece of scrap. Starting with the drawknife, shave

Photos H, I: Tenons are shaped using the same square-to-octagon technique as for legs. The adult may want to form the square first using the drawknife. The child can then round it to fit with the spokeshave (Photo H).

Test fit the tenon from time to time in a template that's been drilled with a hole the same size as the diameter of the tenon you're working on (Photo I).

the end of the leg to a square whose sides are just a bit longer than the tenon's diameter. (It can help to draw the circular outline of the tenon on the end of the leg.) The child can now use the spokeshave to pare away the corners and make the tenon round (Photo H), from time to time trying it in the template (Photo I).

Tenons with fairly "distinct" shoulders have several advantages (see Fig. 3). The shoulder provides a positive stop at assembly and the bearing surface it provides keeps the tenon from protruding too far above the seat over the years. You can whittle a sharp shoulder with a pocketknife, but a tenon with a gently



tapering shoulder (which is what a child tends to make with a spokeshave), will work, too. The tenon will settle in a bit with use, but the joint will still be strong.

Making and Socketing the Seat

The seat can be as simple or as elaborate as the child's skills or your assistance permits. The bare necessity is a piece of wood of sufficient length, width and thickness to accommodate four sockets for the legs. Half a log works as well as a 2 by 12 plank, though it's a bit fussier to bore the sockets in the curved surface of the log. Children enjoy chamfering the edges of plank seats with the spokeshave.

We bore the sockets from the bottom of a plank seat, positioning the brace and bit at the angle we desire for the leg. I usually help hold the brace steady, as shown (Photo J). Setting a sliding bevel keeps the angles roughly the same, but don't worry too much about uni-

formity—you usually have to trim the legs after assembly anyway.

I strongly recommend boring the sockets entirely through plank seats and wedging the tenons at assembly (as opposed to boring blind socket holes only part way through the seat). Beginner's tenons are frequently loose fitting, and the wedge expands the tenon to fill the space, making a much stronger joint.

Assembly

Assembly is not difficult. We try the tenons in their sockets to make sure they fit, smear glue in the sockets and on the tenons, and push them together. To start the wedges, we use a chisel to start a split in the center of the protruding tenon end, at right angles to the grain of the seat (Photo K), then drive the wedge home (Photo L). (Alternatively, you can saw slots for the wedges before assembly.) The drawknife is handy for fashioning wedges.

Green wood shrinks as it dries, so it is best to let the tenons dry out before assembly—several days in a dry, warm spot does the trick. Children don't like to wait, so you can speed this process by burying the tenons in a bucket of hot sand for an hour or so. I heat the sand on a portable electric cooking ring with adjustable temperature settings—if the sand gets too hot, it can char the ends of the tenons. If you don't want to go to this trouble, and your child is itching to complete the stool right away, go ahead. You can always tighten a shrunken, loosened tenon by driving in another wedge.

After the glue has dried, trim the tenons flat with the top surface of the seat. If the stool wobbles—which is

Photo J: Children usually need help steadying the brace when boring sockets in the seat. Bore the holes from the bottom of the seat, holding the brace at the desired leg angle.

Photos K, L: After assembling the glued legs and sockets, start a split in the end of each tenon with a chisel (Photo K) then drive in a wedge to tighten the joint (Photo L).

SAFETY: *Kids and the Cutting Edge*

Green woodworking, you may be thinking, sounds great for kids, but what about those sharp tools—spokeshaves and, for heavens sake, drawknives? My youngest child has been using spokeshaves since he was three. The tool is easy for small hands to manipulate, the blade is well protected and both hands are occupied on the tool, out of harms way. I think they are one of the safest woodworking tools for kids.

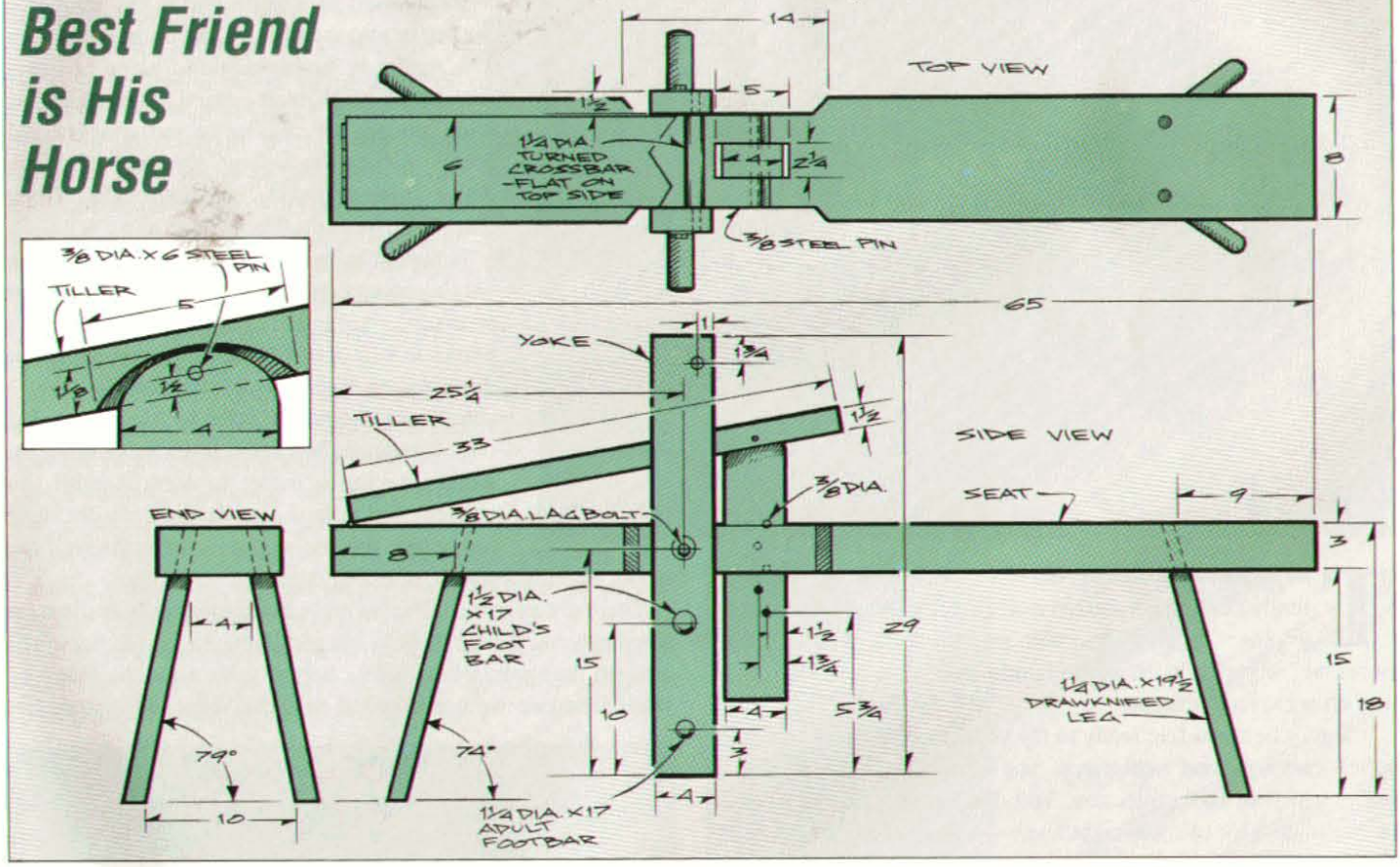
A drawknife is a far safer tool to use than its wicked looks would indicate. Again, both hands are occupied. And although you pull the tool toward you, the natural limitations to the movement of your arms make it very difficult to pull the cutting edge into your body. Drawknives are most dangerous when not being used—when they're being picked up or carried around. The unprotected blade exacts a painful price for careless handling. The most difficult thing about drawknives is learning to control the cut—cutting with a drawknife is much more like whittling than planing. When your child can handle a jackknife, he or she can probably cope with a drawknife. As with all things related to our children's well being, where there's a choice to be made, the wise choice is the safe one. If you have any doubts about your child's ability to safely and responsibly handle the drawknife, let them use the spokeshave instead.

Remember that a dull tool is more dangerous than a sharp one. Control is essential for safety, and the more muscle required to move a dull tool through wood, the less control the child will have over it. When you believe your kids are ready to handle edge tools, make sure they're sharp ones.

Most important for safety is the character and development of the child. My oldest is conscientious and cautious, the middle child is headstrong and impulsive, the youngest lacks the motor skills of the other two. I gauge their tool use and the amount of supervision they need accordingly. I have worked hard to impress upon them that tools are not toys and to teach them the proper way to handle tools. We've had a few superficial cuts, but nothing requiring more than a Band-Aid.

A Green-woodworker's Best Friend is His Horse

● A shaving horse is an ingenious piece of equipment. Employing simple leverage, the woodworker's weight and one of Newton's laws (more or less), it wraps workbench, vise and seat all in a single endearingly ungainly "equinomorphic" appliance. I've made several versions of this venerable tool. The design shown here served as a portable workshop for English chair bodgers, who hauled them around the woods to churn out parts for ladderback and Windsor chairs. The workpiece is grasped between the crossbar and tiller. As the seated worker pulls on the tool, he naturally pushes against the foot bar (a bit of Newtonian action-reaction). Foot pressure pivots the yoke (a lever arm) on its bolt and presses the crossbar against the work. When the worker is required to pull harder on the tool, he naturally exerts more pressure on the footbar, which holds the work tighter, thus resisting the tool's increased efforts to pull it free. The thing may look odd, but it uses energy pretty efficiently. This shaving horse is not difficult to build. With the exception of a maple crossbar and foot bars, mine is made of inexpensive, rough-sawn pine. The only modification I've made for the kids is to bore a pair of foot-bar holes higher on the yoke to accommodate their shorter legs. (You could build a scaled down version of the entire horse, too.) We sit on a piece of foam rubber, which keeps us from sliding back on the seat as we push on the bars.



highly likely—trim the legs to put it on an even keel.

Final Thoughts

Put at the service of a child's fertile imagination, the simple techniques of green woodworking can produce a remarkable variety of things—some easily recognizable by adults, some not. Children need and appreciate adult assistance—part of the fun is making something with dad or mom, grandma or grandpa. But be careful not to provide too much help. Being a rather fussy woodworker, I frequently need to reign myself in. Whenever I get the urge to tidy up the line of a stool leg or "improve the design" of some project, I remind myself of my son's ragged stick battleship and try to see the work through the child's eyes, not my own.

If you'd like to learn more about working with green wood and making rustic furniture, an excellent book on the subject is "Making Rustic Furniture" by Daniel Mack. This is a new book (published 1992) but it provides a comprehensive history of the style, from it's heyday around the turn of the century, up to the present revival that has seen rustic furniture gaining devotees as "fine art." This book covers the gamut of rustic—including twig, peeled, bent willow, southwest, log and even grafted styles—but it fortunately goes well beyond just being a pretty-picture coffee table book. About half the book is devoted to actual how-to techniques, with lots of step-by-step photos. Available for $24.95 from Lark Books, 50 College St., Asheville, NC 28801. WWJ

Sharpening Carving Tools

by Rick & Ellen Bütz

The beauty of woodcarving lies in its simplicity. All you really need to get started is a knife, a piece of wood, and a place to sit. This will provide you with all the necessary ingredients to create hundreds of different whittling and chip carving projects.

Later, when you feel ready to try your hand at making larger relief carvings and sculptures, you can begin adding some gouges to your tool collection. You don't have to rush out and accumulate a lot of tools right away—unless you want to.

Before you begin though, there are several things that you need to know. The first and most important is how to sharpen your tools. There is a big difference between the drudgery of trying to force your way through a piece of wood with dull tools and the wonderful feeling of paring away clean shavings with sharp tools. You also need to develop a sensitivity to the nature of wood itself, a process carvers call "learning to work with the grain." This article will cover both these subjects, so that when you tackle a project you'll be able to experience all the joy woodcarving has to offer.

At first glance, woodcarving gouges look a lot like chisels—except for one important difference—the blades are curved. This allows the tool to "scoop" out wood. Gouges are classified by the width of the blade (usually measured in millimeters) and the amount of blade curvature, which is called the "sweep." The sweep is usually indicated by numerals ranging from 1 to 11 stamped on the blade but some manufacturers have different numbering systems. The larger the number, the greater the curvature, and thus the larger the amount of wood the gouge will scoop out. The illustration shows 12mm gouges. Notice how the curve changes as the number gets higher. There are also many other specialized gouges, including veiners, fishtail, macaroni, and spoon gouges. A quick look through a woodcarving supply catalog will show you the variety of tools that are available.

In addition to a knife and a few gouges, a mallet is also helpful on the larger carvings. The mallet is simply a round piece of heavy wood with a handle. It is used to tap the end of wide gouges to remove wood quickly. We prefer mallets made from lignum vitae. This dense tropical wood has interlocking fibers that resist splitting (Photo 1).

However, even the best quality carving tools won't produce good carvings unless they are properly sharpened. The crisp, clean tool marks left by a well-honed knife or gouge are the sign of a serious craftsman. Besides, a sharp tool is actually safer to use than a dull one. It requires less force to move through the wood, making it easier to control, with less chance of slipping. And carving is a lot more fun when the tools glide easily through the wood, making smooth, polished cuts.

There are as many different ways to sharpen tools as there are woodcarvers. This can be a bit confusing to newcomers. The method that works best for us begins with a medium/fine oil stone. The one we use is called an India Stone. This stone has

Photo 1

a fine side and a medium side, and can be found in just about any hardware store. Always use oil with this type of stone. It lubricates the tool on the stone, and floats away tiny bits of metal that would clog the stone and lessen its cutting power.

To sharpen your knife, first put several drops of light household oil (sewing machine oil) on the fine side of the sharpening stone. Place your knife on the stone at a 25-degree angle and move it back and forth along the length of the stone. Use medium pressure—about as hard as you would press down when writing with a ballpoint pen (Photo 2).

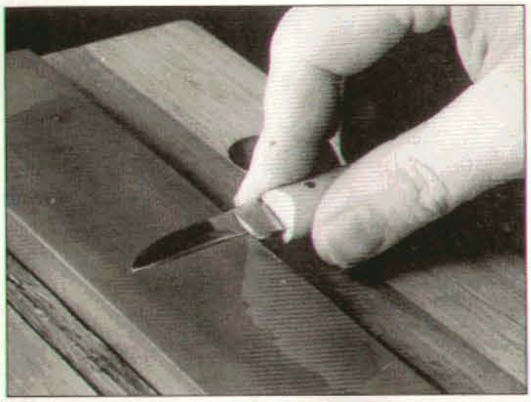


Photo 2

After a minute or so, turn the blade over and sharpen the other side the same way. As the abrasive stone wears away the steel, a thin metal foil will form along the cutting edge of the knife. This is called the burr, or wire edge. It is so small that you can't see it without a magnifying glass. Check for it by lightly dragging your fingertip across the knife blade away from the cutting edge (Photo 3).

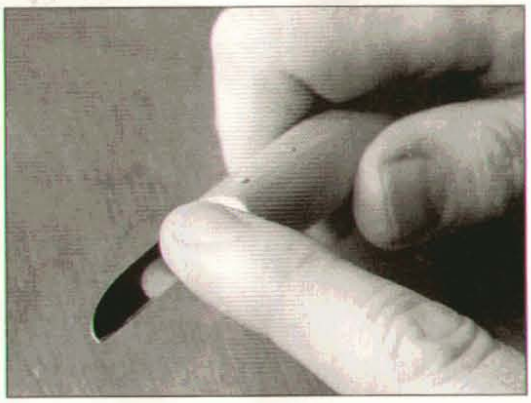
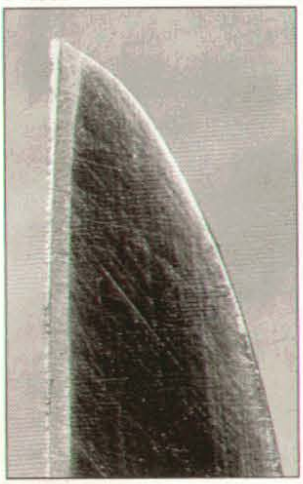


Photo 3

Check both sides of the blade. The burr will feel like a thin, rough edge of metal that catches on the ridges of your fingertips. Continue sharpening until you can feel the burr along the entire edge of the blade (Photo 4A). When you reach this point, the knife is as sharp as it will get on the stone. Don't try carving with it yet, because the burr will either bend over or break off, leaving you with a dull knife.

Photo 4A

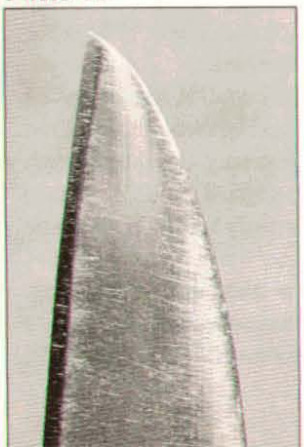


To remove the burr, use a strop. This is simply a strip of leather tacked down to a piece of wood. The leather serves as a very fine sharpening stone.

To strop the knife, hold it at a 25-degree angle to the strop and stroke the blade along the leather in a direction away from the cutting edge (Photo 5). To make the strop work more quickly, you can rub a little fine abrasive like jeweler's rouge into the leather.

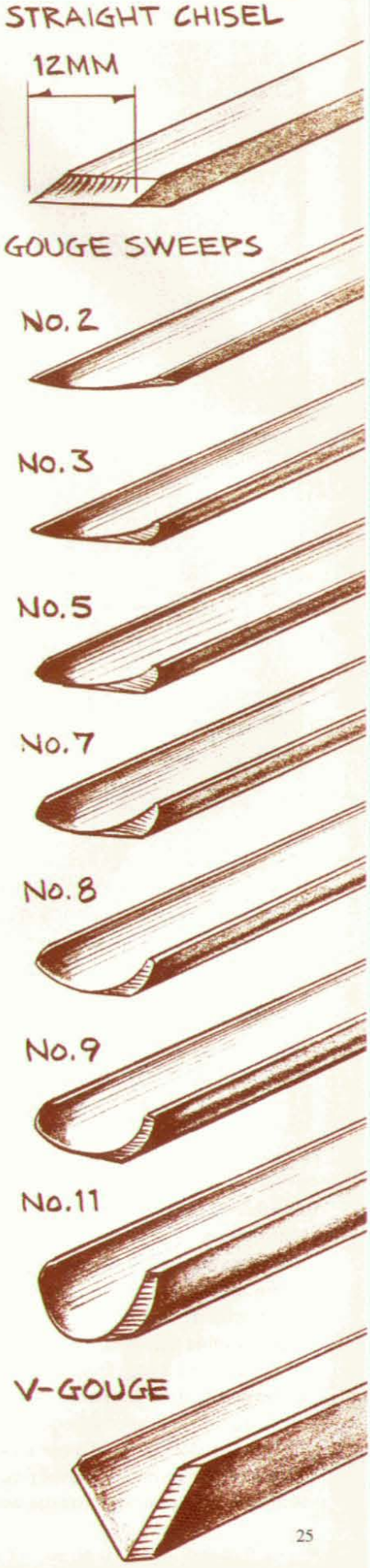
Stroke the knife along the leather 10 times on one side, lift the blade completely off the leather, turn it over, and strop the other side 10 times. Repeat this procedure until you can no longer feel a burr. You may find this will take 15–30 minutes (Photo 4B).

Photo 4B



When you are through stropping, test the edge of your blade for sharpness. Take a piece of soft wood like white pine or basswood and make a test cut across the end grain, which is the edge of the wood where you can see the annual growth rings (Photo 6). If the knife is razor sharp, it will remove a clean chip with a slight whistling sound. However, if the wood crunches and tears, the blade needs more stropping.

Use the same basic procedure to sharpen a gouge. The main difference is in the motion you use for sharpening the cutting



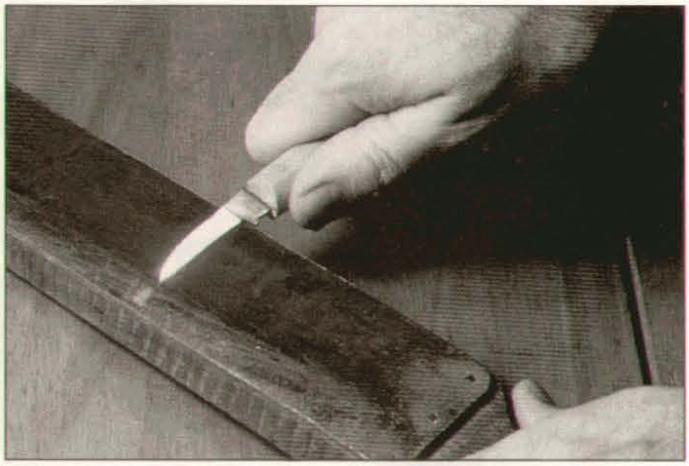


Photo 5

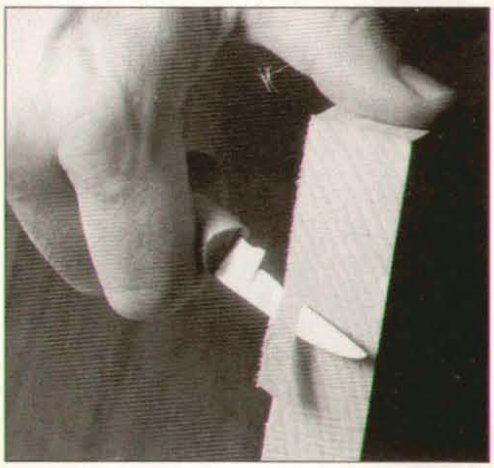


Photo 6

edge on the stone. For the gouge, the tool is placed at about a 30-degree angle to the stone. Rub it along the length of the stone, rotating the tool as you go, so the entire cutting edge gets sharpened (Photo 7). When you can feel the burr on the gouge, put the sharpening stone away.

You can use the leather strop to remove the burr. However, the curved shape of the cutting edge does take longer to polish than the flat blade of a knife. A quicker way to do this is to use a slip stone. This is a small abrasive stone with one rounded edge and one sharply angled edge. Our favorite slip stone, called a fine white Arkansas, is made from a natural rock mined for its excellent abrasive qualities.

Holding the slip stone in your right hand, place a few drops of oil on the stone's rounded edge. Then take the gouge in your left hand and rub the slip stone briskly along the inside diameter, which is the cutting edge of the blade (Photo 8). Continue until you can no longer feel the burr.

For a final touch, you can polish the bevel of the gouge on the strop. The tool will guide more smoothly through the wood if the bevel is polished. Stroke the blade gently along the length of the leather, away from the cutting edge. This will remove any microscopic remnants of the burr edge, and polish any scratches left by the sharpening stone.

Test the sharpness of your gouge by making a practice cut across the grain on a piece of pine or basswood. If your gouge is dull it will crush and tear the wood fibers (Photo 9). But, if it

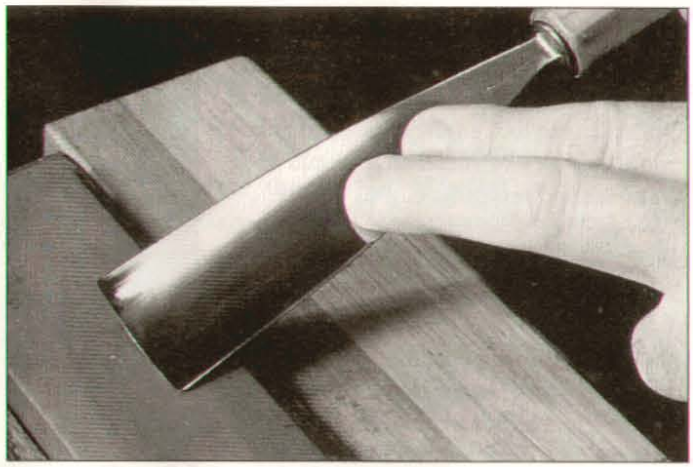


Photo 7

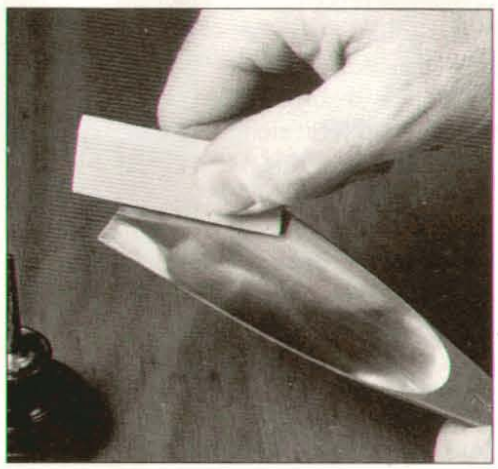


Photo 8

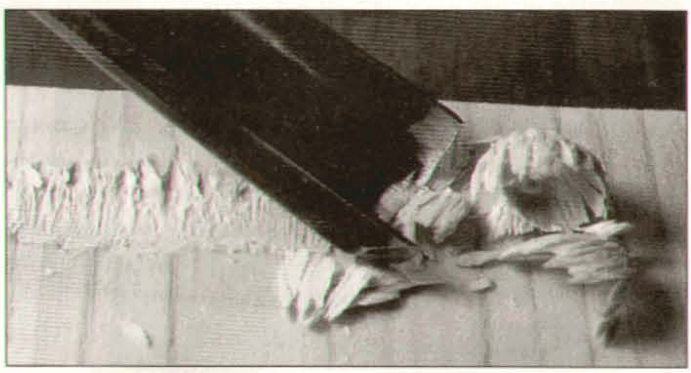


Photo 9

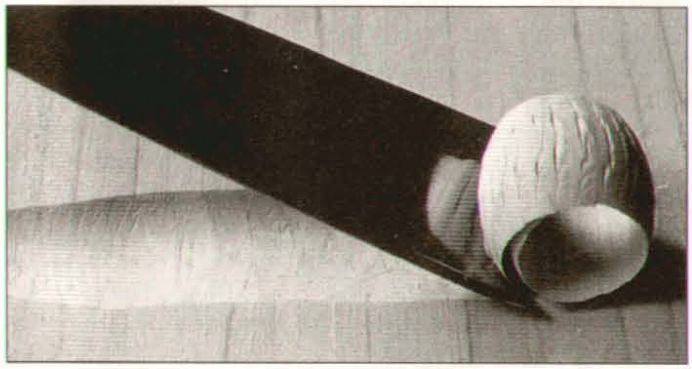


Photo 10

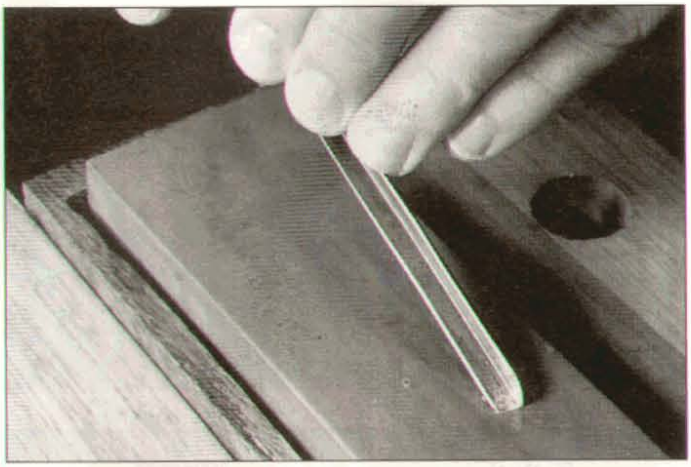


Photo 11

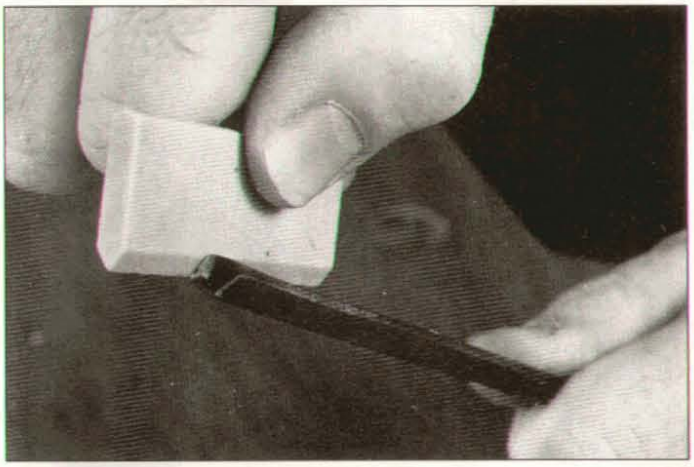


Photo 14

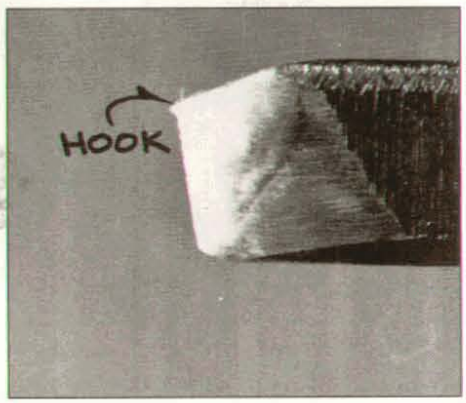


Photo 12

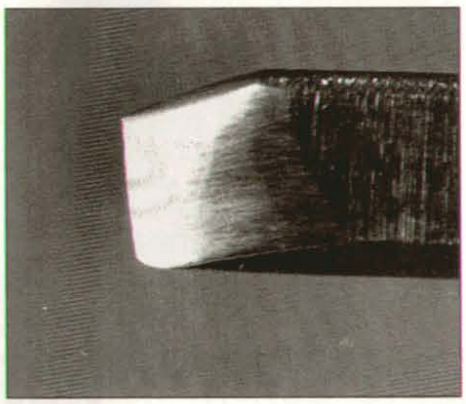


Photo 15

Photo 13

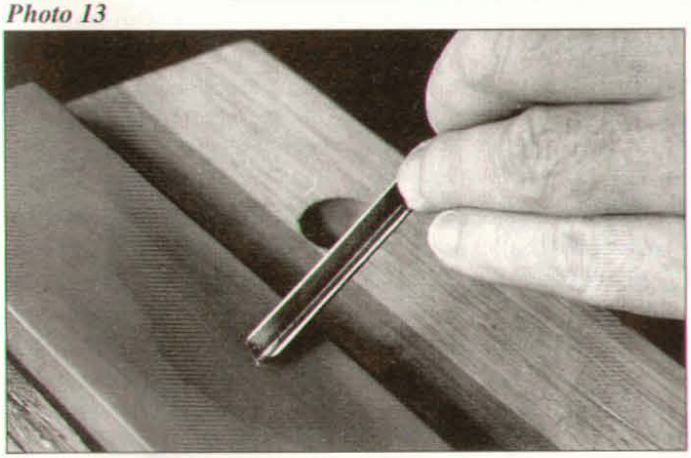
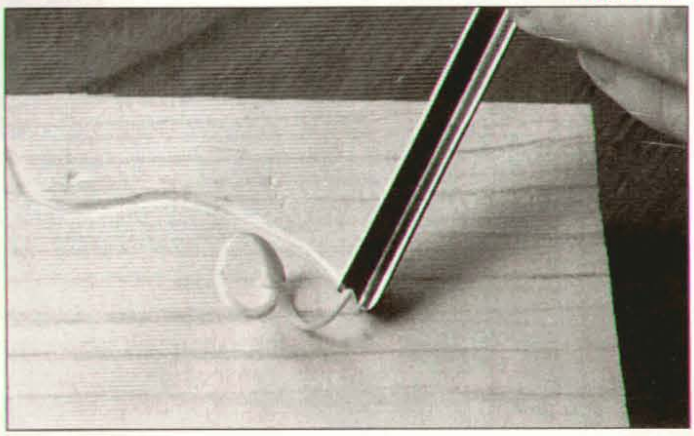


Photo 16



is sharp it will make a clean cut (Photo 10).

All gouges are sharpened basically the same way, regardless of the sweep. The only exception is the V-gouge (also sometimes called parting tool). This extremely useful tool is one of the trickiest to sharpen properly.

Begin by treating each side of the V-gouge as a tiny knife, and sharpen it by sliding it back and forth on the stone (Photo 11). Each side of the V-gouge is held at a 25-degree angle to the sharpening stone, just as the knife was. This sharpening motion will hone the flat sides of the gouge, but the V-profile of the cutting edge will cause a small "hook" to form at the point of the V (Photo 12). You must remove the hook before the tool will cut properly. Otherwise, it will plow into the wood causing splinters. Remove the hook by treating the bottom of the V like a miniature gouge. Gently rock it back and forth on the stone with the same motion used on the other gouges (Photo 13).

Use the angled edge of the slip stone to remove the burr on the inside bevel (Photo 14). Polish the outer bevel with the leather strop. When your V-gouge is properly sharpened it will look like this (Photo 15).

Check the sharpness of your V-gouge by cutting cross-grain on a piece of soft wood (Photo 16). It should cut smoothly and cleanly without tearing the wood.

After your tools are sharp, you are ready to begin carving. However, even with perfectly honed tools, you still need to give some consideration to your wood.

We use basswood or white pine for many of our carving projects. These soft woods can be purchased at lumber stores or

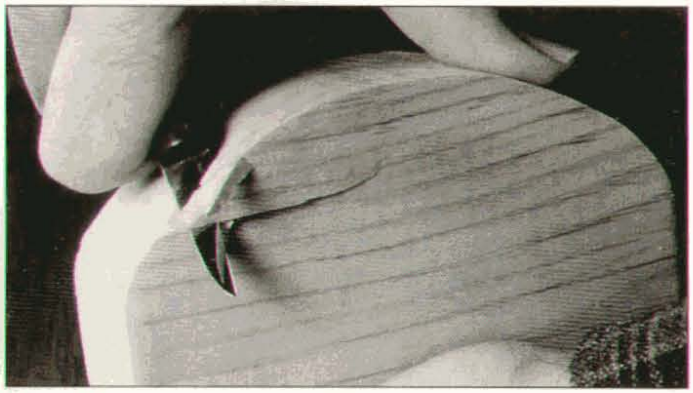


Photo 17

Photo 18

woodworking supply companies. You can also use other woods for carving, but if you are a beginner, it's best to start with woods that are soft and have an even grain.

Grain simply means the texture of the wood. Each type of wood is made up of microscopic hollow wood fibers. They give each species its individual characteristics such as density, color and hardness.

The arrangement of fibers also determines how you shape the wood. The carving tool must be worked in the same direction that the wood fibers overlay each other. This is called "carving with the grain." For example, even with a sharp tool it is possible to create rough splinters when carving if the tool is cutting against the alignment of the fibers (Photo 17). Instead, if you cut from the opposite direction into the wood, the same cutting edge will produce clean shavings (Photo 18).

Carving with the grain is mostly a matter of developing a feel for it, even an ear for it. Carving against the grain makes a distinctive crunching sound. Carving with the grain makes a soft whistling sound.

Don't worry about trying to figure this out with logic. In time you will develop an instinct for the correct direction. It's a lot like petting a dog or a cat. One way feels right, and the other direction feels rough (to you and your pet).

So get your carving tools sharpened up and get ready to start your favorite project.

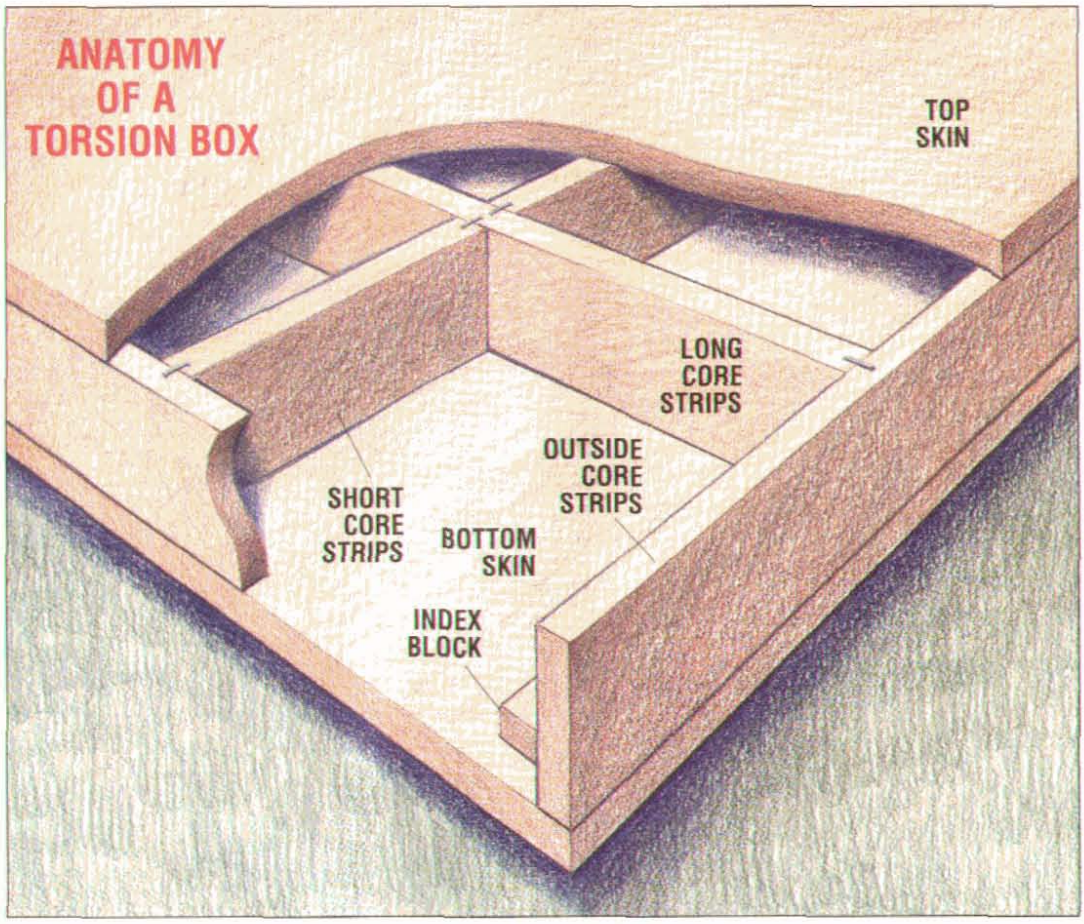
Rick and Ellen Butz are professional woodcarvers living in Blue Mountain Lake, New York. This article is excerpted from their book ***Woodcarving With Rick Butz.*** *Ordering information can be found on the form bound in the center of this issue.*

Make a Torsion Box

The High Strength/Lightweight Alternative to Solid Wood

by Ed Speas

When most woodworkers think of woodworking materials and construction methods, they think of solid wood or plywood, using terms like mortise-and-tenon, frame-and-panel, apron, rail, or carcass. But solid wood isn't always the best choice, and even with adequate supporting framework, table or workbench tops made from solid wood can twist and bow. For some applications, there is another choice: The torsion box; "T-box" for short. The T-box is ideal for surfaces where stability is important, and contrary to what you may at first think, they aren't really complicated or difficult to build. The T-box that we show being constructed here is the bench top for the T-box workbench project on page 44. The entire workbench is constructed from just two 4 by 8 sheets of medium density fiberboard (MDF).



A T-Box is a mostly hollow-core structure that has a skin material attached to each side. A hollow core door, and an airplane wing are two good examples. The T-Box gives you a strong and stable panel, as thick as you like, without adding excess weight or expense to the project.

A T-Box can be used for any vertical or horizontal panel where extra strength and stability are required. A few of its many uses include doors, shelving, desk and table tops, cabinets, benches, and work surfaces.

For furniture, the core is usually made of a man-made sheet material (MSM). Plywood, or medium density fiberboard (MDF), are the best choice. The skins are also made of MSM. Plywood, MDF, or particleboard all work well. The choice is determined by what type of finish covering you will be applying to the skins; veneer, leather, plastic laminate, paint, etc. In most cases, your best choice for the skins is also MDF. It is the best substrate for veneer, and also accepts paint very well.

It is very important to understand that a T-Box is simply a building block. Like a frame and panel, or a chair leg, it isn't much without the addition of other T-Boxes, or other parts.

How a T-Box Works

Individually, the parts of a T-Box can be easily bent or broken. Yet when assembled into a single, unified structure, they create a box or panel with great strength and stability. The strength comes from the glue.

We tend to think of glue as that yellow or white liquid in the bottle. But when glue has cured in our project, it is a very thin, very hard layer of material, with incredibly strong sheer strength properties. No matter how you try to bend, twist, or destroy a T-Box, you are trying to sheer a glue line somewhere.

Glues that bond by mechanical adhesion, such as contact adhesive, do not have this property. You must use a specific adhesion glue such as polyvinyl acetate (white glue), or alaphatic resin, (yellow glue).

The Core

The core consists of several core strips attached to form a grid that the skins will be attached to. There we're using 1/2 in.

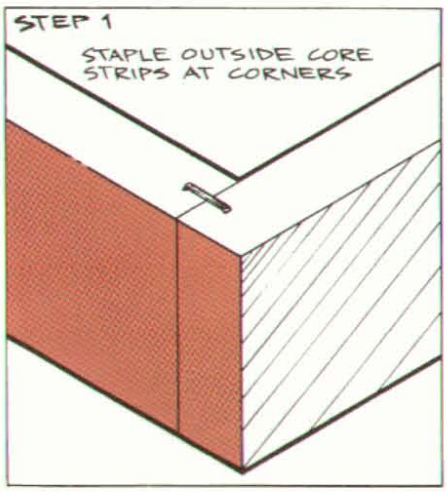
material for the core strips, although 3/4 in. material is also fine.

A basic core layout would consist of the core strips spaced approximately 4 in. to 6 in. apart. This is not a hard and fast rule, just a place to start. The closer the core strips are, the stronger and heavier the T-Box will be, and the less chance that the skin will depress in the voids.

The width of the core strips is determined by the final intended thickness of the T-Box. That is, the thickness of the T-Box, minus the thickness of the two skins. All core strip parts can come straight from the table saw.

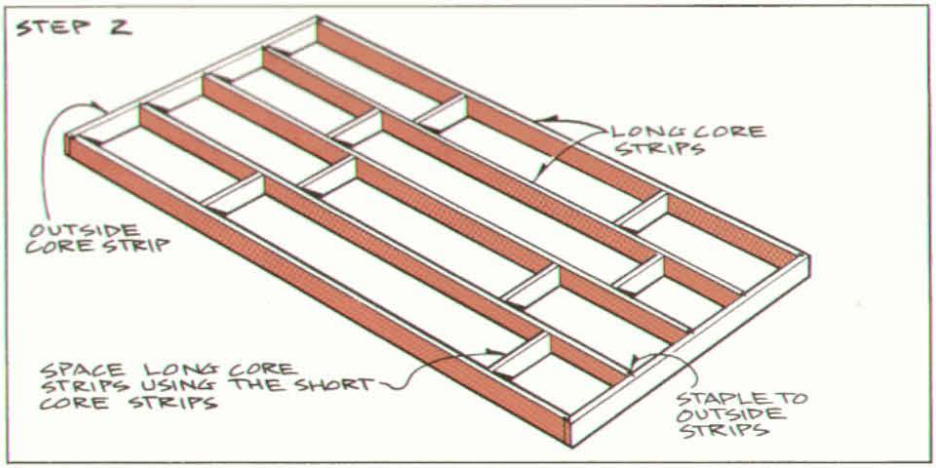
Designing the Core

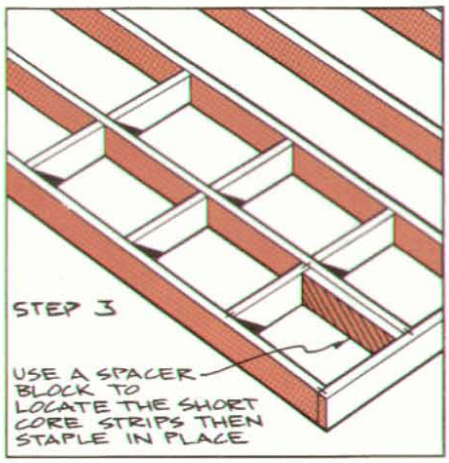
The core layout must be designed specifically for each individual T-Box. After you determine the basic spacing of the core, you must then consider everything that is subsequently attached to the T-Box. A good example of this is the mounting of the vise to the workbench project. At every point where there will

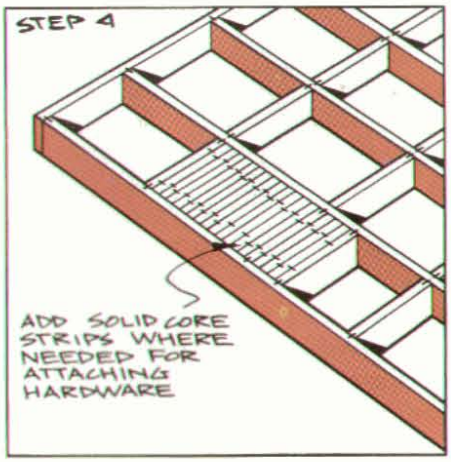


be a screw, dowel, bolt, etc., you must have solid core strips to support the attachment. You don't want a screw to be holding only to a 1/2 in. skin. So, at every location where something will be mounted, add extra core strips to the basic layout. Remember, keep it as simple as you can.

You can see the importance of good planning before you start construction. Once a T-Box has been glued up, you can't go back and add more core strips.







Constructing the Core

The core construction should also be kept as simple as possible. There is no gluing or joinery involved. At each attachment point of the core strips, just staple across the butt joint on both sides of the core.

To start, hold the outside corners together, and staple the joint on the top (Step 1). Do this to all outside corners to finish the perimeter of the core.

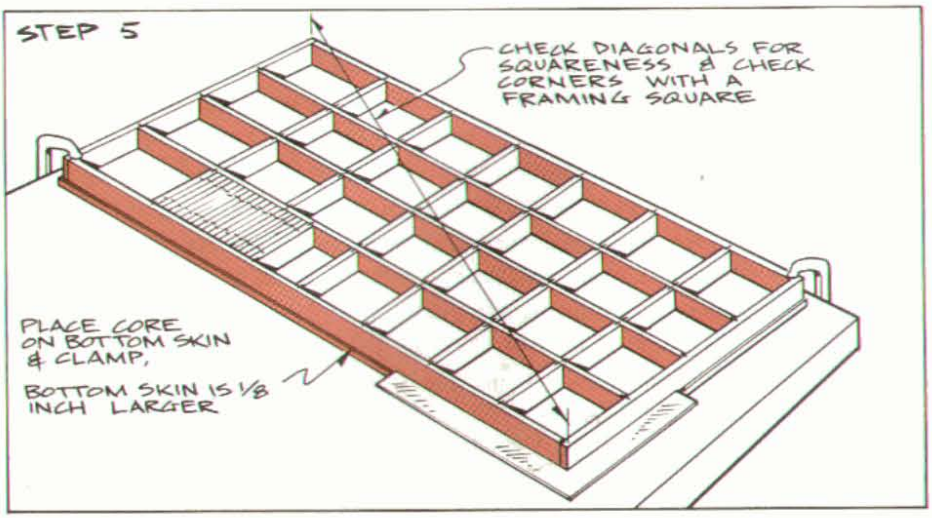
Next, take the remaining long core strips and position them by using the appropriate short core strips as spacers (Step 2). Then staple the long strips into position. Now you will need to cut a couple of spacers to position the short core strips (Step 3). Add the remaining core strips as needed to fill out these areas that must be solid to accept hardware mountings (Step 4). Then turn the core over and staple the other side of the core in the same way.

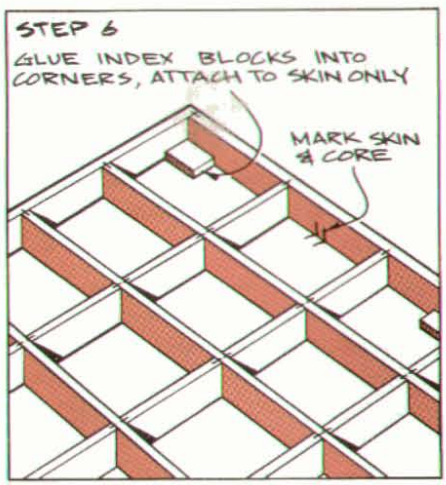
The Skins

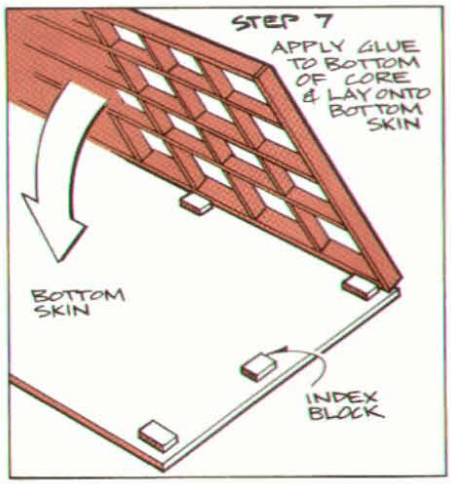
The thickness of the skins can be anything from 1/8 in. to 3/4 in. It depends on what the T-Box will be used for. In most furniture application, you will use a thin skin to keep the weight down. For work surfaces, you will probably want a thicker skin to reduce deflection over the voids of the core.

Make the core the size that you want the T-Box to be, but cut the skins a little oversize, about 1/8 in. all around. It's important to cut the skins slightly oversize, since it's all but impossible to get the assembled core to exactly match a predetermined dimension. Then, after assembly, the skins can be trimmed flush with a router.

If you are going to apply veneer to the skins, they must be veneered before they are assembled to the core. Otherwise, the glue will cause the skins to depress over the voids, forcing an excess of glue into







these areas. Such a situation would cause the veneer to bubble and lift. Try applying veneer to an already constructed sample T-Box, and you'll discover this for yourself.

Assembly

Now that the core is assembled and the skins are complete, we are ready to attach the skins to the core. But before this is done we need some way to keep the core square and straight as the skins are being applied.

A good way to do this is to first take one of the skins and lay it on a bench or table with the side to be glued facing up. Lay the assembled core structure on the skin as it will be in the final glue up. Then, square the core by measuring the diagonals and clamp it to the skin at the corners (Step 5).

Next, you'll need a way to index the core to the skin, so that after the core is removed (so glue can be applied to the edges), it will be automatically indexed to the skin when repositioned for the final glue-up.

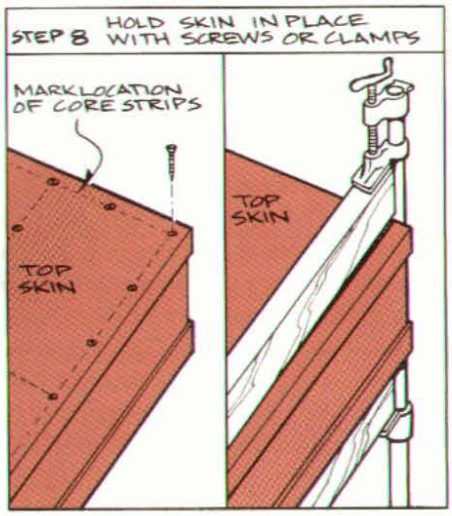
You will need several small blocks, about 1/4 in. thick by 1 in. square. With hot melt glue, fasten one block to the skin at each of the four corners, tight against the core (Step 6). Now glue as many additional blocks as needed around the perimeter of the core to keep it straight. After the clamps are removed, the blocks will hold the core square and in proper registration to the skin.

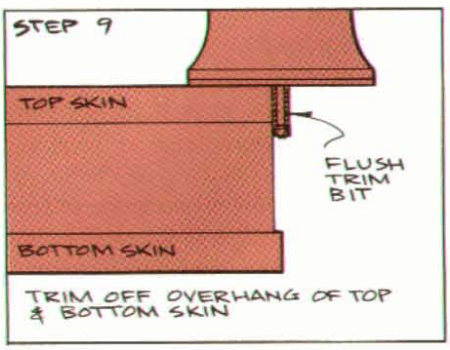
The core can now be removed for gluing. When the core is repositioned down on the skin, the blocks will hold the core in perfect registration (Step 7). Be sure to mark both the core and skin (as shown in Step 6) so that you get the core back on the same way it was when you attached the blocks.

Glue Up

There are two choices when it comes to clamping the skins to the core (Step 8). If you plan on doing a lot of T-Box work, a clamping press, such as a veneer press, is the best choice. But for occasional T-Box construction, fasteners, such as nails, staples, or screws are fine to hold the skins in place while the glue cures. If you use a mechanical fastener, first mark on the skins where every core strip is. Be sure to use plenty of fasteners.

Apply glue to the edges of the core, making sure to use enough. There is no need to apply glue to the skin. The core can now be repositioned to the skin with the positioning blocks (as shown in Step 7). Next, apply glue to the edges of the other side of the core. Position the opposite side skin and attach it to the core using the same fastening method—either glue or glue plus mechanical fasteners—as you used on the first side. If you are using a clamping press, you'll





need to add a few brads through the opposite side skin and into the core, so the skin doesn't slip out of registration as clamp pressure is applied.

Trim Edges

Once the T-Box has been clamped, trim the overhanging skins with a router and flush-trim bit (Step 9), and clean up any excess glue. If your project requires an edging, add it now. Treat a T-Box edge the same way you would an edge on a sheet of pre-veneered plywood.

Attachment

Now that you have built a T-Box, you need to know how to attach one to another. There are several ways of doing this. You can attach them the same way that you would join two pieces of plywood, such as with screws, glue, splines, dowels, or a plate jointer. These all work quite well. Or you can use the pocket and ledger (see Another Option side bar).

T-Box Construction Summary

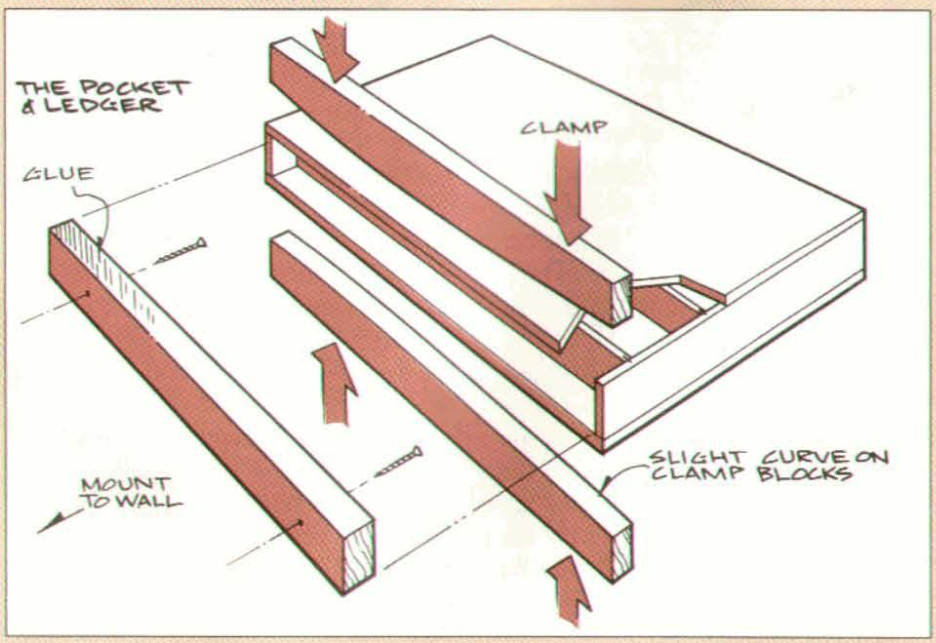
1. **Design:** Make as many sketches and drawings as you need to visualize the finished project.
2. **Working Drawings & Mock-ups:** Now is the time to make decisions regarding size, proportion, type of material, mountings, etc.
3. **Cutting List:** From your final working drawings, make a parts cutting list that includes the thickness, width, length and number required of each different part.
4. **Cut Parts:** Using your cutting list as a guide, cut all the parts. Be sure to cut your skins slightly oversize.
5. **Add Veneer** (if needed)**:** Now is the time to apply veneer to the skins, if your project requires it.
6. **Assemble The Cores:** Assemble the core structures according to your working drawings.
7. **Assemble The T-Boxes:** Square up the core of each T-box to the skin with the positioning blocks, add glue, and assemble the skins to the core. If mechanical fasteners are being used, both glue and nail (or screw) the skins to the core.
8. **Clean Up Edges:** Flush-trim the overhanging skins with your router and a flush-trim bit, and scrape off any excess glue. If your project requires veneer or solid wood edgings, now's the time to apply them.
9. **Final Assembly & Finish:** Where possible, apply finish to each separate T-box before final assembly. If your project is comprised of several T-boxes, join them together using your chosen method of attachment.

Another Option

Depending on what you are planning to make, the pocket and ledger is a version of T-box construction you may want to consider. It's nearly identical to standard T-box construction, with one minor exception: By extending the core strips out on one side, when the skins are applied, a pocket—or mortise—is formed in the T-box. The ledger—or tenon—is a piece that's then cut to fit within this pocket. The pocket and ledger can be employed as a method of joinery when you are mounting one T-box to another (be sure to add extra core strips in that area of the T-box onto which the ledger will be screwed), but its most common application is probably as a way to make a shelf seem to hang invisibly on a wall.

If you are making a T-box that employs the pocket and ledger, keep in mind that the ledger is the same width as the core strips, and for consistency should be cut on the table saw at the same time as the core strips. The ledger is usually about square in cross-section, but when making the T-box it's a good idea to make the pocket just a hair deeper than the ledger thickness. As with any mortise and tenon, this little extra space allows a place for the excess glue to go as the ledger and pocket are assembled.

The standard assembly proceedure is to first screw (or glue and screw if you are assembling one T-box to another) the ledger to the surface on which it is to be mounted. Apply glue, then slide the T-box with the pocket into place over the ledger. Use cambered clamp blocks to apply pressure so the skins of the pocket are firmly fixed to the ledger, as illustrated.



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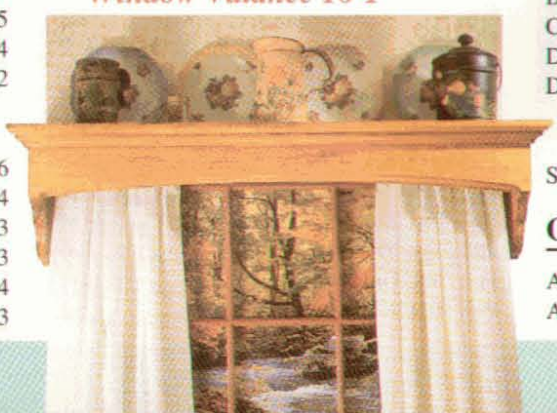

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Vol. 9 No. 6 Nov-Dec '85 Dulcimer, Dining Table, Shaker Washstand, Marking Gauge, Veneered Wall Clock, 4 x 4 Off-Roader, Teddy Bear Puzzle, Duck Pull-Toy, Landscape Cutting Boards, Early American Tall Clock, Desk Organizer, Moravian Chair; *Articles:* Weaving a Rush Seat, Part I; Table Saw Ripping Problems and Solutions; 4-Piece Book Match Veneering; Running a Profitable Business.

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Vol. 10 No. 3 May-June '86 Contemporary Lamp, Early American Bench, Steam-Bent Clock, Pine Hutch, Goose Basket, Toy Crane, Condiment Holder, Shop Workstation, Parsons Table, Shaker Lap Desk, Victorian Whatnot Shelf; *Articles:* Toymaker Clare Maginley; Flattening Warped Boards; Choosing a Router; Supported Steam Bending.

Vol. 10 No. 4 July-Aug '86 Wall-Hung Display Cabinet, Latticework Planter, Country Bucket Bench, Adirondack Chair, Coffee Mill, Clamdigger's Basket, Box of Shapes Toy, Disk Clock, Tenon Jig, Dictionary Stand, Shaker Slat-Back Side Chair; *Articles:* Selecting the Right Project for Production; More About Warped Boards; All About Router Bits; Sliding Dovetail Joints.

Vol. 10 No. 5 Sept-Oct '86 Vanity Case, Stool, Coffee Table, Blanket Chest, Mortar and Pestle, Whale Folk Art Silhouette, Toy Wagon, Cranberry Rake, Router Bit Box, Shaker Drop-Leaf Table, Desk with Tambour Top; *Articles:* Are Your Prices Competitive?; Restoring a Rosewood Chair; Basic Router Operations; Making Tambour Doors.

Vol. 11 No. 2 Mar-Apr '87 Garden Bench and Table, Mirrored Wall Shelf, Rhombohedron Puzzle, Wood Sawyer Whirligig, Folk Art Door Stop, Kangaroo Pull Toy, Colonial Wall Shelf, Contemporary Hall Table, Shaker Sewing Desk; *Articles:* How to Create a Direct Mail Promotion; Types of Finish; The Mortise and Tenon, Part II; Bevel-Edged Drawer Bottoms.

Vol. 11 No. 3 May-June '87 Kitchen Canister Set, Riding Biplane, Contemporary Serving Cart, Napkin Holder, Decorative Planter, Country Vegetable Bin, Medicine Cabinet, Shop Drum Sander, Vienna Regulator Clock, Display Pedestal; *Articles:* Penetrating Oils; The Jointer; Veneer, Part I; Dovetail Key Butt-Miter.

Vol. 11 No. 4 July-Aug '87 Early American Bookcase, Trash Container, Low-Cost Workbench, Country Basket, Desk Calendar with Pen & Pencil, Butterfly Pull Toy, Vanity Mirror with Drawer, Apothecary Chest, TV/VCR Cabinet; *Articles:* Shellac; The Hand Plane; Veneer, Part II; Incised Carving.

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Vol. 11 No. 6 Nov-Dec '87 Rocking Horse, Three-Drawer Jewelry Chest, Tapering Jig, Rolling Toy, Folk Art Silhouette, Two Towel Racks, Early American Style Wall Shelf, Corner Cupboard, Stacking Wine Racks, Curio Cabinet; *Articles:* Glues and Gluing; Band Saw Setup; Making the Continuous Bracket Foot; Step-By-Step To a Flawless Finish.

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Vol. 12 No. 2 Mar-Apr '88 Oak & Glass Tier Table, Crystal Regulator Clock, Early American Candlesticks, Arrow Wall Decoration, Three-Drawer Country Wall Box, Key Cabinet, Contemporary Box, Shaker Carrier, Folk Harp; *Articles:* Use and Sharpening of the Hand Scraper; The Lathe: Basic Setup; Quartered Turnings; Lacquer.

Vol. 12 No. 3 May-June '88 Loon Carving, Early American Dry Sink, Contemporary Dresser, Old-Time Pipe Box, Antique Knife & Fork Tray, Dutch Tulip Folk-Art Silhouette, Colonial Salt Box, Bud Vase, Miter Gauge Stop, Hunt Table; *Articles:* Spindle Turning; Selecting and Sharpening Lathe Tools; Recessed Finger Pull Step-by-Step; Coloring Wood: An Overview.

Vol. 12 No. 4 July-Aug '88 Magazine Rack, Occasional Table, Mitered-Corner Box, Heart Stool, Decorative Cutting Boards, Piggy Bank, Turned Bowl, Country Cupboard, Four-Drawer Lamp; *Articles:* Faceplate Turning; Workshop Layout; Dovetails on the Table Saw; Staining Basics.

Vol. 12 No. 5 Sept-Oct '88 Miter Cutting Jig, Captain's Clock, Country Coffee Table, Rooster Folk-Art Silhouette, Harvest Basket, Bird Push Toy, 18th-Century Pencil Post Bed and Nightstand, Bookcase Desk; *Articles:* Wood Movement; Joining Ring Segments; Drill Bits; Filling Open-Grained Woods.

Vol. 12 No. 6 Nov-Dec '88 Shaker High Chest, Table Saw Crosscut Box, Country Vegetable Bin, Whale Pull Toy, Colonial Wall Sconce, Treetop Christmas Ornament, Classic Pickup Truck, Contemporary Cradle, Child's Carousel Lamp; *Articles:* Flattening Wide Surfaces with the Hand Plane; Making a Cove-Edged Raised Panel: Core-Box Bit Method; Polyurethane; A Sander For Large Surfaces.

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Vol. 13 No. 2 Mar-Apr '89 Adirondack Settee, Country Village, 18th-Century Tilt-Top Table, Toy Fishing Trawler, Two Trivets, Folk-Art Cow, Greek Revival Birdhouse, Pine Armoire, Oriental Mirror; *Articles:* Transferring and Enlarging Patterns; Making Tripod Legs; Three Easy Finishes for Pine; The Portable Circular Saw.

Vol. 13 No. 3 May-June '89 Storage Seats, Table Saw Gauge, Oval Extension Table, Nessie Pull Toy, Back Massager, Decorative Wall Key, Country Wall Shelf, Contemporary Mirror, Jewelry Chest; *Articles:* Panel Retainer Disk System; Understanding Circular Saw Blades; Cutting Box Joints; Non-Toxic Finishes; Massachusetts Woodworker Paula Garbarino.

Vol. 13 No. 4 July-Aug '89 Shaker Long Bench, Folk-Art Sign, Toy Farm Tractor and Wagon, Miniature Flower Cart, Kitchen Tongs, Wall Cabinet with Tinsel Art, Stacking Bookshelves, Country Pie Safe; *Articles:* Dealing with Uneven Wood; Tinsel Art; Coping with Your Radial-Arm Saw; Brushing Lacquer; A Visit to a Woodworking Show.

Vol. 13 No. 5 Sept-Oct '89 Country Bake-Room Table, Chippendale Small Chest, Stacking Desk Trays, Pencil Box, Apple Doorstop, Space Shuttle Toy, Marquetry Coasters, Ice Chest with Marbleized Top, Globe Stand; *Articles:* Table Saw Basics; Cutting Full-Blind Dovetails; Marquetry: The Pad Method; Marbleizing; Mount Lebanon Shaker Village: A Museum in the Making; Tool Review: Four Portable Planers.

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Vol. 14 No. 2 Mar-Apr '90 Small Early American Mirror, Shop-Built Sanding Blocks, Cookie Jar Holder, Hourglass, Candle Holder, Toddler Cart, Folk Fiddle, Plant Stand, Santa Fe Bench; *Articles:* Making Drawers; Using Router Bits in the Drill Press; Finishing Outdoor Projects; Making Curved Instrument Sides; A Conversation with the Westovers.

Vol. 14 No. 3 May-June '90 Garden Table & Chair, Planter Box, Stackable Shoe Rack, Victorian Wall Shelf, Child's Stepped-Back Cupboard, Cat Push Toy, Tabletop Armoire, Shaker Tall Clock; *Articles:* Japanese Saws; Gluing Oily Woods; Tung Oil; Make a Tombstone Frame-and-Panel Door; Are Woodworkers Killing Our Rain Forests?

Vol. 14 No. 4 July-Aug '90 Slant-Back Cupboard, Folding Deck Table, Two Toy Dragsters, Colonial Sign, Barbecue Tray, Workbench Helper, Harvest Table, Plate Rack, Sunburst Mirror; *Articles:* Rasps; Safety: Workshop Finishes Pose Risks; Making the Dovetailed Wedge; Knock-Down Hardware.

Vol. 14 No. 5 Sept-Oct '90 TV/VCR Cabinet w/Pocket Doors, Shaker Woodbox, Cabinet with Punched Tin Doors, Sushi Set, Carved Pineapple, English Cutlery Tray, Toy Train Set, Workbench, Portable Tool Chest; *Articles:* Files and How to Use Them; Compound Angle Dovetails; Water-Based Finishes; Making the Slip Joint; Shop Test: 6 Dovetail Jigs.

Vol. 15 No. 1 Jan-Feb '90 Santa Fe Chair, Santa Fe Table, Clamp Rack, Provincial Bench, Step Stool, Box with Marquetry Top, Ash Wall Desk, Fork Lift Toy, Connecticut River Valley Highboy, Part 1; *Articles:* Tempering Steel Tools; 3 Easy Finishes for Oak; Making a Cabriole Leg; Hand-Cut Dovetails; *Special Section:* Back Issue Index.

Vol. 15 No. 4 July-Aug '91 Mountain Dulcimer, Shaker Drop-Leaf Table, 4 Easy Picture Frames, Shop-Made Lathe Chuck, Napkin Holder, Fisherman Whirligig, Horse & Cart Toy, Gumball Machine; *Articles:* Shaping on a Table Saw; Turning Small Boxes; Low-Tech Picture Frames: Use Simple Hand Tools for a Professional Job; Gel Stains; Tool Review: Thin Kerf Blades.

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Vol.15 No. 6 Nov-Dec '91 Country Pine Writing Desk, Hurricane Lamp, Little Folks' Desk & Bench, Colonial Dollhouse, Jewelry Box, Father Christmas Carving, Heirloom Toy Chest, Plastic Bag Recycler, Faux-turned Vessels: 4 Full-size Patterns; *Articles:* Noise in the Shop; Faux-turned Vessels (technique); The Frame and Panel; Tool Review: Biscuit Joiners.

Vol. 16 No. 1 Jan-Feb '92 Country Pine Mirror, Drop-leaf Dining Table, Chess Set, Shop Workcenter, Bandsawn Heart Box, Scroll-sawn Door Harp, Classic Firetruck, Toucan-on-a-Branch, Window Valance; *Articles:* Safer Router Bit Designs and New Accessories; Dutch Turning; Veneering; Tool Review: Plunge Routers; Special Section: Back Issue Index.

Vol. 16 No. 3 May-June '92 Cherry Lingerie Chest, Picnic Table, Butternut Breadbox, Tabletop Napkin Holder, Shoot-the-Moon Rollerball Game, Intarsia Project, Drill Press Organizer, Country Curio Clock; *Articles:* Thinking Like a Craftsman; Collet Chuck Turning; Sharpening Guides & Gizmos; Finishing Kits.

Vol. 16 No. 4 Jul-Aug '92 Lawn Glider, Aeolian Harp, Candle Holders, Tractor/Trailer Toy, Audio/Video Remote Rack, Western-style Belt Buckle and Bolo Set, Side-by-side Chest/Cupboard, 3 Space-saving Projects for the Shop; *Articles:* The Cordless Tool Revolution; Finishes for Maple; Joining Tops to Tables and Case Pieces.

Vol. 16 No. 5 Sept-Oct '92 Early American Pine Hutch, Child's Windsor Chair, Universal Table Saw Jig, Convertible Step Stool/Chair, Finger-saving Plastic Bag Handle, Acrobatic Bear Folk Toy, Kids' Kitchen Playcenter, Easy-build Bookshelves; *Articles:* Amps vs. Horsepower; An Introduction to Chairbuilding; Vacuum Turning; Tool Review: Benchtop Table Saws.

Vol. 16 No. 6 Nov-Dec '92 Gov. Winthrop Slant-front Desk, Futon Bed/Couch, Low-cost Router Table, Toy Livestock Truck, Heirloom Jewelry Box, Scroll-sawn Nativity Scene, Early American Doll Bed, Router-built Wall Cabinet; *Articles:* Stick and Cope Doorbuilding; Linenfold Carving; Tool Review: High-end Scroll Saws

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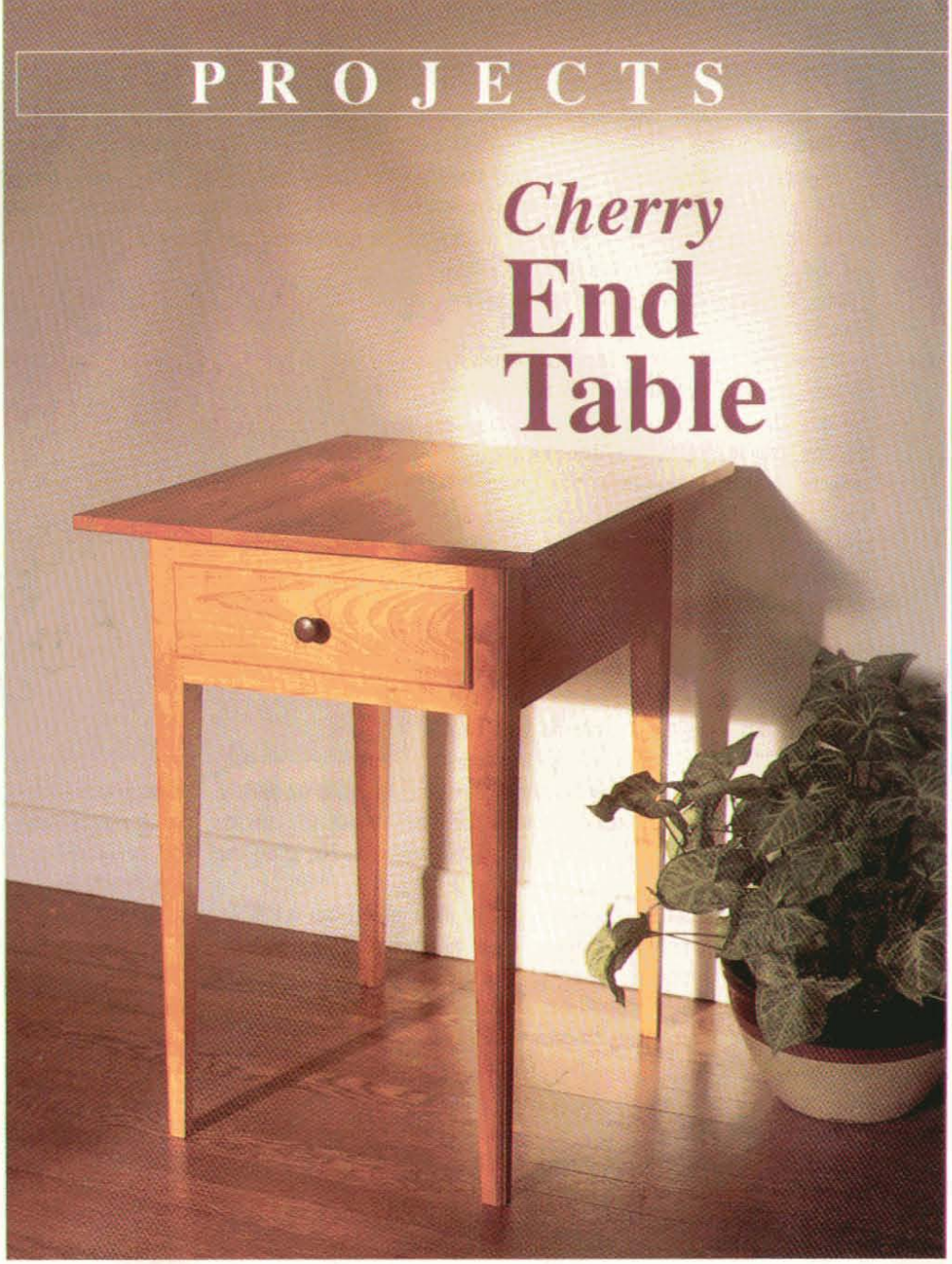
Cherry End Table



Early American country cabinetmakers were often influenced by the well-known designers and furnituremakers of their day. As highly-skilled craftsmen in Boston, New York and Philadelphia were turning out ornate, high-priced masterpieces, visiting country cabinetmakers couldn't help but notice.

Country craftsmen soon built their own versions of the big-city pieces, with the design simplified to reflect both the builder's skill and the ability of his rural customers to pay. This lovely end table, with its nicely tapered legs, is in the general style of tables by George Hepplewhite, the now-famous 18th century furniture designer. Shaker furnituremakers also felt the influence of Hepplewhite, as his style is common to many of their tables and case pieces.

The table shown is from the Wayland, Massachusetts workshop of Gene Cosloy. The drawer sides and back are poplar, while the bottom is birch plywood. The rest of the table is made of solid cherry, a favorite wood of early country cabinetmakers.

Make the Legs

The legs (A) can be made first. You'll need four pieces of stock, each one measuring 1 1/2 in. square and 25 1/4 long. Lay out and mark the locations of the leg mortises. Size them to fit the tenon dimensions shown in the Tenon Detail. Note that the two side aprons (B) and the back apron (C) have identical tenons.

Cut the mortises using the drill press and a 3/8 in. diameter drill bit. Bore a series of holes, one alongside the other, to remove most of the stock, then use a chisel to clean up the remaining waste material.

The bead can now be added to the outside corner of each leg (see Bead Detail). A router table with a 3/16 in. beading bit will cut each bead in short order. As shown in the front and side views, the legs are tapered on the two inside surfaces. Note that the taper starts at a point 6 5/8 in. from the top of the leg. A table saw tapering jig, if you have one, will come in handy here. If not, lay out and mark the tapers on each leg, then hand plane the stock to the marked line. After the tapers are cut, use a hand plane to cut a 10 in. long chamfer on the inside of each leg as shown in the Chamfer Detail.

Make the Aprons and Stretchers

Next, make the two side aprons (B), the back apron (C), the upper stretcher (D) and the lower stretcher (E). Begin by cutting these parts to the lengths and widths shown in the Bill of Materials.

The tenons can be cut using the table saw and a tenon jig. As always, it's a good idea to check your jig set-up by first making some test cuts on scrap stock. Keep in mind, though, that for the test to be accurate, the scrap stock must be the same thickness as your project stock.

Assemble the Legs, Aprons and Stretchers

After a thorough sanding, the legs, aprons and stretchers can be assembled. Before starting, though, dry-assemble all the parts to make sure everything fits to your satisfaction.

The assembly is best done in two steps. In the first step, the legs are joined to the side aprons. Start by adding a thin coat of glue to the leg mortises and the apron tenons, then fit the parts together and apply pressure with bar or pipe clamps. Check the parts for squareness and make any needed adjustments. Once all looks okay, let the pair of leg/side apron sub-assemblies dry.

In the second step, the back apron and the upper and lower stretchers are joined to the two leg/side apron sub-assemblies. The procedure for gluing and clamping is the same.

Lay out and mark the centerline location of the 1/4 in. diameter tenon dowel pegs. Once marked, bore 1 in. deep holes to accept them. Cut the pegs slightly on the long side, then add a coat of glue and tap them in place. Trim the protruding ends flush to the surface with a sharp chisel and sand smooth.

Add The Cleats and Spacers

The four cleats (F) are made from stock measuring 3/4 in. thick

by 1 1/2 in. wide. Cut them to length so they fit snugly between the stretchers and back apron, then notch the corners to fit around the legs.

The cleats are attached to the side aprons using glue and 1 1/4 in. by number 10 roundhead wood screws, but you first need to counterbore a 1/2 in. diameter by 3/4 in. deep hole for each screw. At the bottom of the counterbore, drill a 1/8 in. diameter hole to accept the screw shank.

Since the two upper cleats are used to attach the top, you'll need to bore three 1/8 in. diameter holes in each one to accept 1 1/4 in. long by number 10 wood screws. Note, as shown in the exploded view, that the holes are elongated to allow the top to expand and contract across its width as the moisture content in the wood changes.

The two spacers (G) are added next. Start with 3/4 in. thick stock that's a bit wider than necessary and cut it to a length that allows for a snug fit between the legs. Now, rip the stock to final width, keeping in mind that for the drawers to operate smoothly, the inside edge of the spacers must be flush with the inside edges of the legs. Once you are satisfied with the fit, glue the spacers in place.

Now, cut the two glueblocks (H) to size and bore a 1/8 in. diameter screw shank hole in each one as shown. These blocks, along with the upper cleats, serve as a means to attach the top to the base. Glue the blocks flush with the top edges of the back apron and upper stretcher as shown in the exploded view.

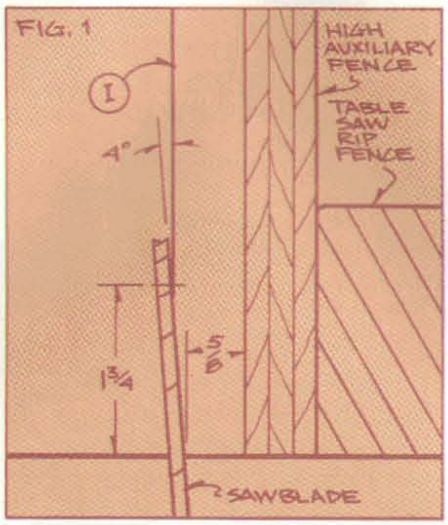
Make The Top

You'll probably need to edge-glue a few boards in order to get the 19 in. width needed for the top (I). When cutting the boards for the top, it's best to cut them so that the glued-up stock will be a bit wider and longer than necessary. After gluing, the top will be trimmed to final size.

To edge glue, apply a thin coat of glue to the mating surfaces, then clamp firmly with bar or pipe clamps and set aside to dry. There's no need to add dowels or splines here, as this joint matches long-grain to long-grain, a joint that is as strong as the wood itself. If the edges start to slide out of alignment, clamp two or three waxed cleats (made from hardwood that measures about 1 in. square by 20 in. long) across the boards. The cleats keep the boards flush while the wax prevents the cleats from sticking to the glue.

When dry, remove the top from the clamps and scrape away any glue that may have squeezed out of the joint. Use the table saw to trim the top to the final length and width dimensions.

To give the top a lighter look, all four edges are beveled as shown in the front and side views. Since the top overhangs the front, back and sides by 2 in., we made the bevel 1 3/4 in. wide. The bevel can be cut in short order with a sharp hand plane. Keep in mind, though, that the bevels on the front and back edges run "across the grain," while the bevels on the side edges run "with the grain." Across-the-grain planing will tend to splinter the wood at the ends. To minimize this, cut the front and back bevels first—starting the cut from the ends and work toward the center. Once the front and back bevels are complete, cut the bevels on the side edges. By cutting the side bevels last, you will clean up any splintering from the across-the-grain cuts.



You can also cut the bevels using the table saw. To support the top, you'll need to add an auxiliary fence to your rip fence. The auxiliary fence should be at least 10 in. high. Raise the table saw blade to a height of about 2 in., tilt it to 4 degrees, and locate the auxiliary fence so that the bevel starts 5/8 in. from the edge (Fig. 1). Now, with the saw running, hold the top firmly against the fence and pass one edge over the blade. The splintering problems associated with hand planing also apply to table saw cuts, so you'll want to do the front and back edges first, then the side edges. After the bevels are cut, a bit of sanding or some work with a scraper will smooth any rough edges.

Make The Drawer

The front (J) is made from 3/4 in. thick stock, while the two sides (K) and the back (L) use 1/2 in. thick material. The bottom (M) is 1/4 in. plywood.

Cut the front to overall length and width, then use the table saw and dado head to cut the 1/4 in. by 1/2 in. rabbet on the top and side edges. The router table and a 3/16 in. beading bit is then used to add the stepped roundover.

The dovetail layout is shown in the side view of the drawer. Once cut, assemble the drawer as shown. The bottom is secured to the lower end of the back with a few 1/2 in. long by number 6 flathead wood screws.

Turn the cherry knob (N) to the dimensions shown or, if you prefer, purchase one from your local hardware store. If the store doesn't stock cherry knobs (and many don't), you can add a coat or two of cherry stain to one of their standard birch knobs.

Bill of Materials
(all dimensions actual)

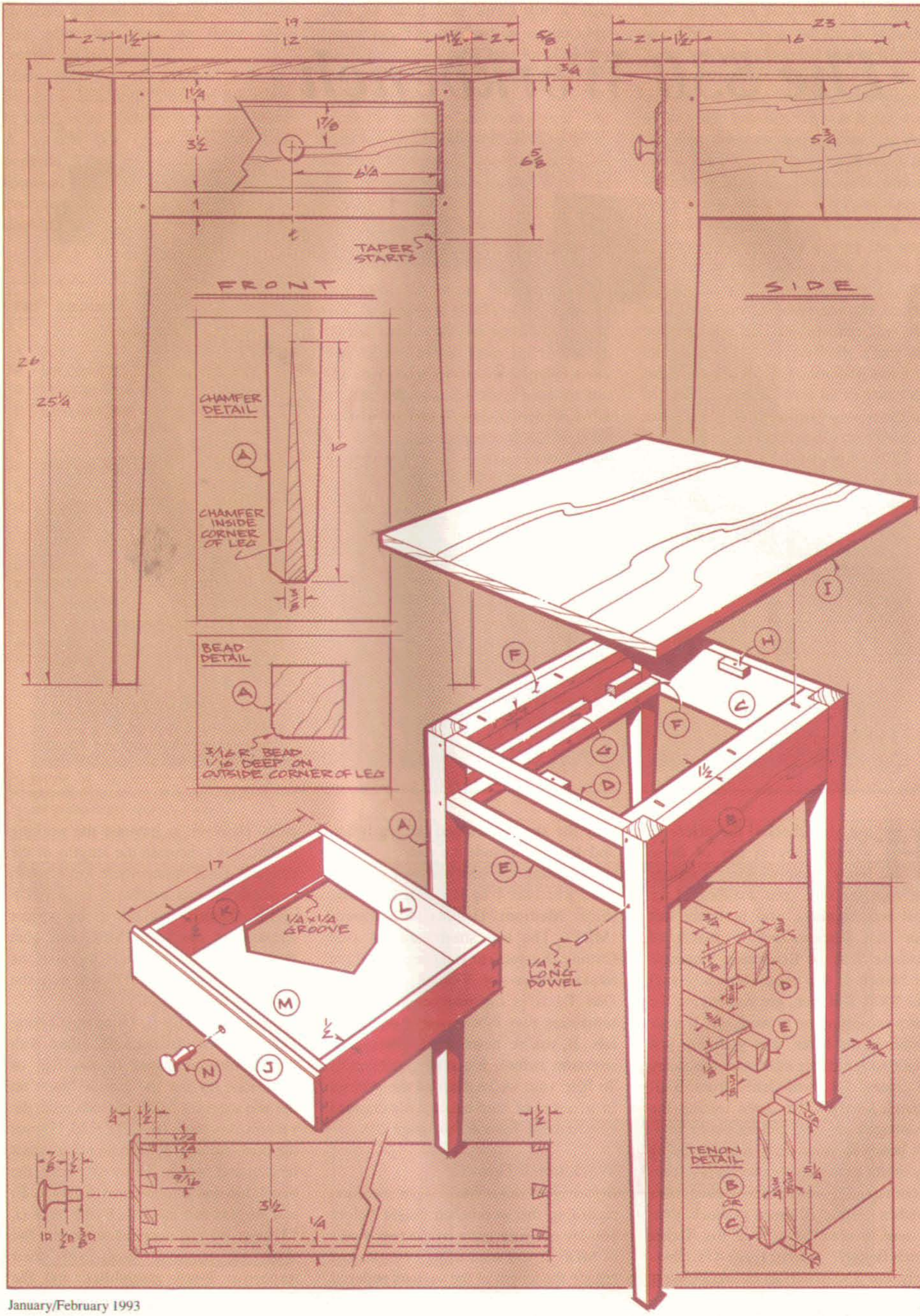
Part	Description	Size	No. Req'd.
A	Leg	1 1/2 x 1 1/2 x 25 1/4	4
B	Side Apron	3/4 x 5 3/4 x 17 1/2*	2
C	Back Apron	3/4 x 5 3/4 x 13 1/2*	1
D	Upper Stretcher	3/4 x 1 1/4 x 13 1/2*	1
E	Lower Stretcher	3/4 x 1 x 13 1/2*	1
F	Cleat	3/4 x 1 1/2 x 17 1/2	4
G	Spacer	3/4 x 3/4 x 16	2
H	Glueblock	3/4 x 3/4 x 2	2
I	Top	3/4 x 19 x 23	1
J	Drawer Front	3/4 x 3 3/4 x 12 1/2	1
K	Drawer Side	1/2 x 3 1/2 x 17	2
L	Drawer Back	1/2 x 3 x 12	1
M	Drawer Bottom	1/4 x 11 1/2 x 16 3/4	1
N	Drawer Knob	see detail	1

* Length includes tenons

Finish Up

All the parts can now be given a thorough final sanding, finishing with 220-grit. Use a vacuum cleaner to remove most of the dust, then a tack rag to pick up what remains. Once the dust is removed, apply a couple of coats of penetrating oil.

Finally, mount the top to the base by driving 1 1/4 in. long by number 10 roundhead wood screws up through the holes in the upper cleats and glueblocks.


FRONT
SIDE
TAPER STARTS
CHAMFER DETAIL
CHAMFER INSIDE CORNER OF LEG
BEAD DETAIL
3/16 R. BEAD
1/16 DEEP ON OUTSIDE CORNER OF LEG
1/4 x 1/4 GROOVE
1/4 x 1 LONG DOWEL
TENON DETAIL
B
OR
C
A
D
E
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19
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12
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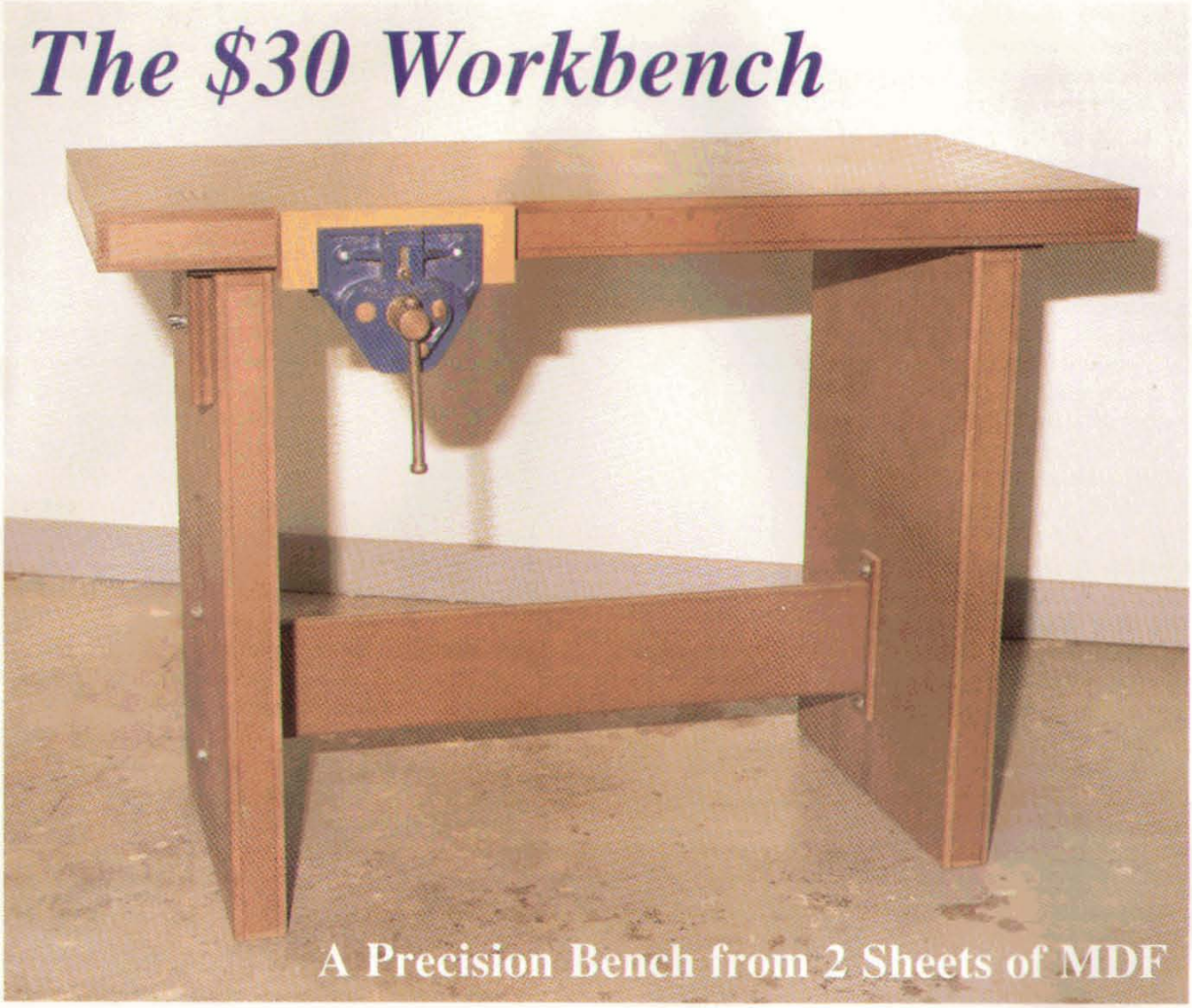
25 1/4
17

The $30 Workbench



A Precision Bench from 2 Sheets of MDF

Have you checked the prices of workbenches in any of those fancy woodworking catalogs that regularly fill your mailbox? Like most woodworkers, you probably lust after that luscious-looking bench of Burmese Teak or Rhodesian Muninga, but blanch at the price—typically well over $500. But then, are you buying the bench to admire or to work on? If your answer is the latter, then you may just decide to build this utilitarian bench, by Ed Speas. Ed, who hails from Ballground, Georgia, has been touting the advantages of—and selling plans for—this bench for some time now. If you've any doubt as to why this bench is—from a craftsman's standpoint—better than benches costing 10 times as much, then be sure to read Ed's "Is a Big Ticket Bench Better?" sidebar (page 47). Obviously, our $30 materials estimate covers only the sheet stock and the hardware, and does not include the vise.

Incredibly, the bench shown is made from just two 4 by 8 sheets of 1/2 in. thick Medium Density Fiberboard (MDF). The two sheets are cut (see Cutting Diagram) to yield parts for three torsion boxes—or T-boxes, for short. One T-box is the workbench top, the remaining two T-boxes serve as pedestals. If you've never tried T-box construction before, it's really quite easy. To help you, we've detailed the process in a series of step-by-step illustrations (see Make A Torsion Box, page 29).

Workbench How-To

Before you start: Make your decision regarding the workbench height before you lay out your parts on the two sheets of MDF. If you want a lower height, just reduce the length of the various pedestal parts. However, to increase the working height, don't increase the lengths of the pedestal parts, since there isn't much room to do this on the 4 by 8 MDF panels. Instead, just cut a few spacer strips from the scrap MDF and glue these under the pedestals to raise the height. Each layer of MDF will raise the benchtop height 1/2 in.

Lay out and cut parts: Using the Cutting Diagram as a visual guide, along with the dimensions listed in the Bill of Materials, lay out the various parts on the two sheets of MDF. As indicated, the various core parts (B, C, D, F, G, H) plus the plate parts (I, K) can be cut to exact length and width. However, both the bench top and the pedestal skins (A, E) and the stretcher and bench stop parts (J, L) must be cut oversize to start. The skins are trimmed flush with their respective T-box assemblies, and the

stretcher and bench stop are cut to final size after the glue on these sub-assemblies has dried.

Make benchtop and pedestal T-boxes: Make the benchtop T-box as described in the Special Techniques article: Make A Torsion Box (page 29). The two pedestal T-box assemblies are nearly identical to the top assembly, with the exception being the long core strips are doubled up in the center, and there's no area of solid core strips for a vise mounting. The doubled-up center core strips provides a solid area for the bolts (M) that are used to join the stretcher to the pedestals.

Make the stretcher and bench stop: The stretcher and bench stop are both laminations of two sections of 1/2 in. MDF. The sections should have been cut slightly oversize, as noted earlier, so the parts can be cut to final length and width after the glue has dried. Bore a 1/2 in. diameter hole in the bench stop as indicated, 2 3/4 in. up from the bottom end, then use your band saw or jig saw to cut the 1/2 in. wide slot up to the hole.

Add the end plates: Glue and screw the stretcher end plates on the stretcher ends, and the pedestal end plates onto the top ends of the two pedestals. Note that the left edge of the left side pedestal plate must be notched to allow clearance for the bench stop.

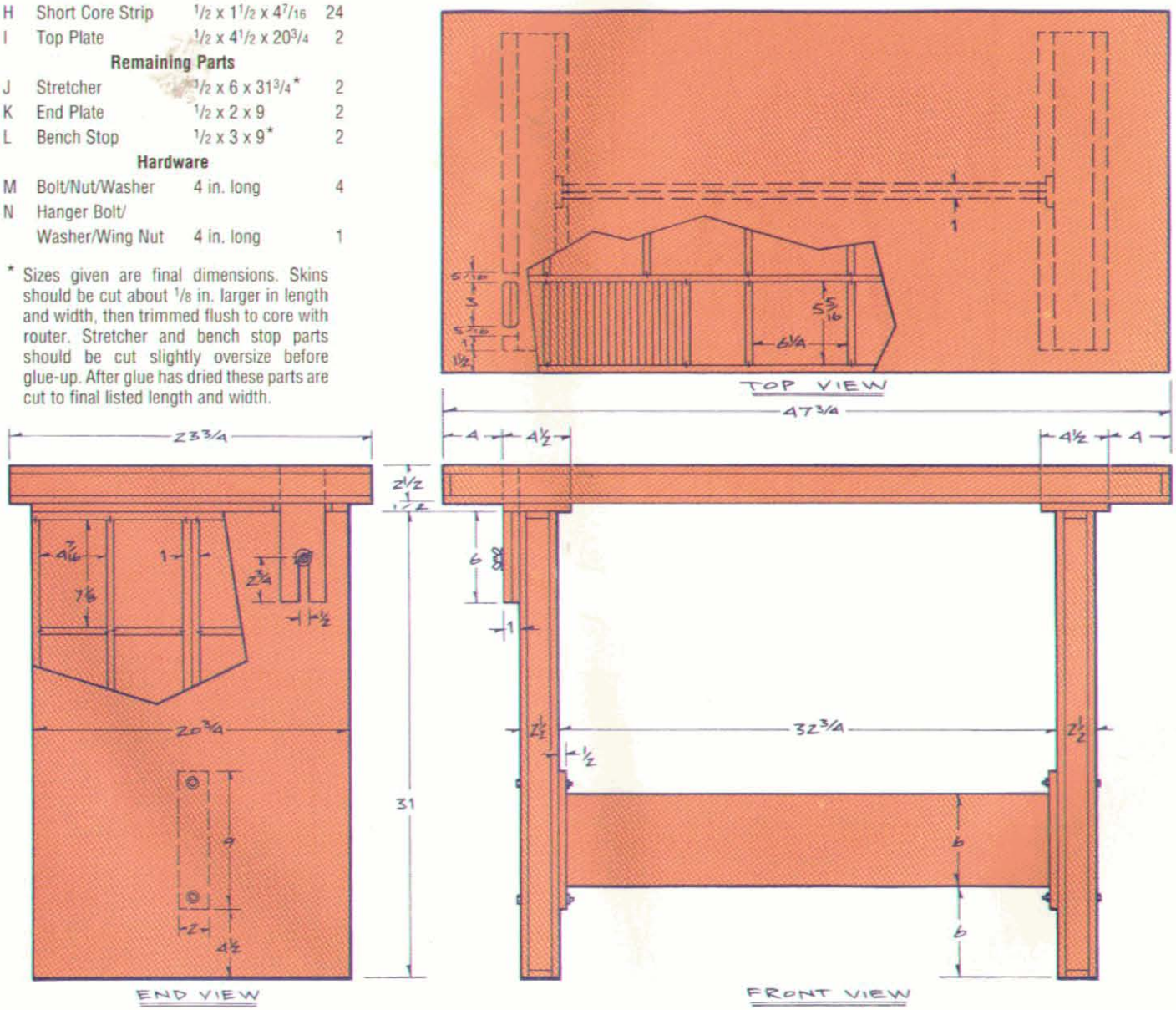
Rout out bench stop mortise in bench top: The best way to cut the hole in the bench top for the stop is using the router, a 1/2 in. diameter straight cutter, and a template. Size the template with respect to the guide bushing that you'll use with the 1/2 in. diameter straight cutter, so that you'll get a cutout that measures 1 in. wide by 3 in. long. The easiest way to index the template correctly (you'll need to make the cut on both sides of the benchtop T-box) is by cutting the template so its edges align with the bench top corner. That way, when you flip the benchtop over to make the cut on the bottom, you can be assured that the template will index perfectly. Once the bench stop mortise is complete, use a 1/4 in. radius rounding-over bit to round the edges of the bench stop to a 1/4 in. radius, matching the radius of the mortise corners.

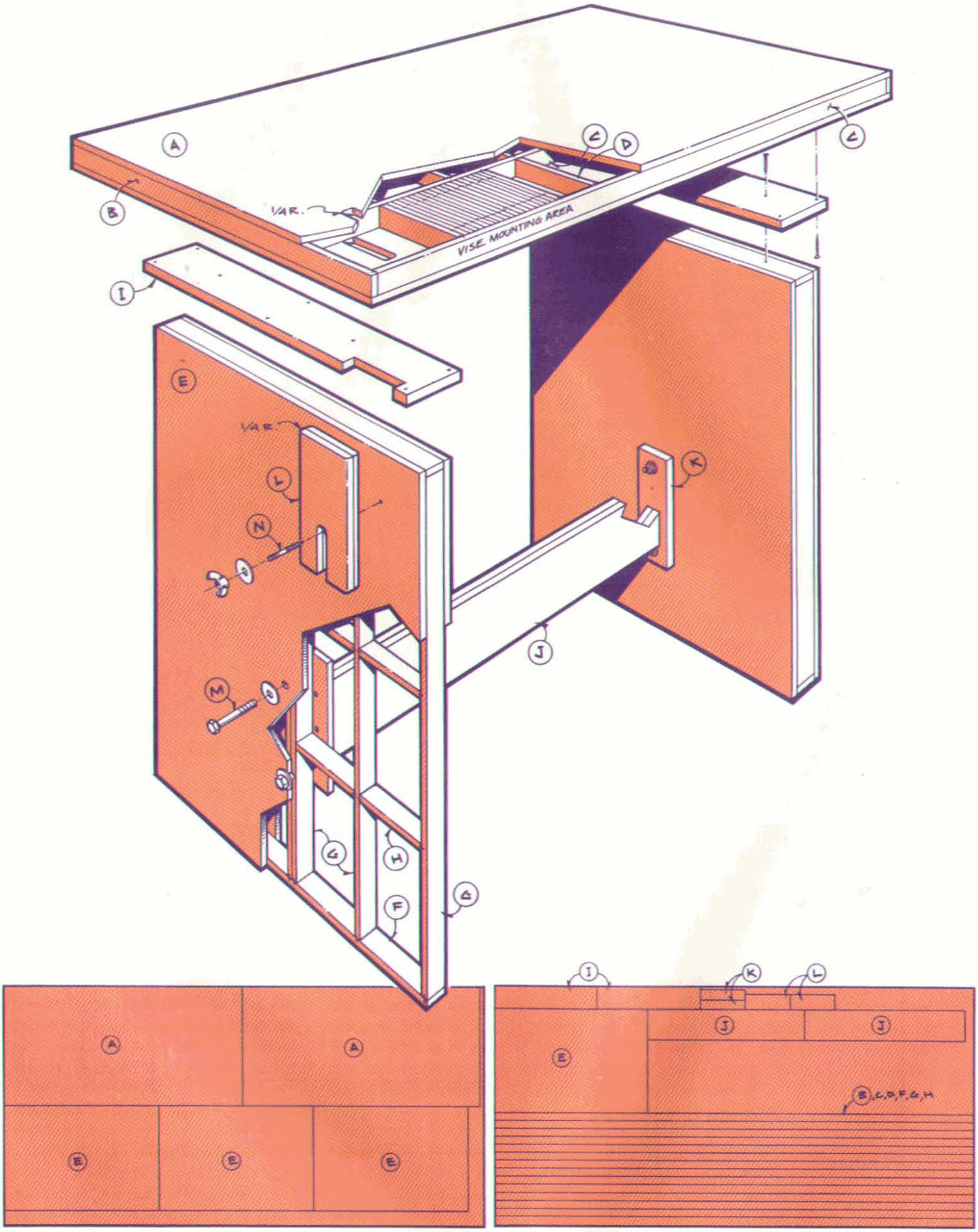
Assembly: Attach the left-side pedestal

Bill of Materials
(all dimensions actual)

Part	Description	Size	No. Req'd.
	Bench Top		
A	Skin	1/2 x 23 3/4 x 47 3/4*	2
B	End Core Strip	1/2 x 1 1/2 x 23 3/4	2
C	Long Core Strip	1/2 x 1 1/2 x 46 3/4	5
D	Short Core Strip	1/2 x 1 1/2 x 5 5/16	42
	Pedestal		
E	Skin	1/2 x 20 3/4 x 31*	4
F	End Core Strip	1/2 x 1 1/2 x 20 3/4	4
G	Long Core Strip	1/2 x 1 1/2 x 30	12
H	Short Core Strip	1/2 x 1 1/2 x 4 7/16	24
I	Top Plate	1/2 x 4 1/2 x 20 3/4	2
	Remaining Parts		
J	Stretcher	1/2 x 6 x 31 3/4*	2
K	End Plate	1/2 x 2 x 9	2
L	Bench Stop	1/2 x 3 x 9*	2
	Hardware		
M	Bolt/Nut/Washer	4 in. long	4
N	Hanger Bolt/ Washer/Wing Nut	4 in. long	1

* Sizes given are final dimensions. Skins should be cut about 1/8 in. larger in length and width, then trimmed flush to core with router. Stretcher and bench stop parts should be cut slightly oversize before glue-up. After glue has dried these parts are cut to final listed length and width.





CUTTING DIAGRAM - FROM (2) 4 x 8' SHEETS MDF (½ INCH THICK)

to the vise end of the bench top, making sure the notch in the top plate is indexed properly to the bench stop cutout in the top. Although you could use both glue and screws, if you use only screws, then you'll be able to knock down the bench at some future date, for moving or whatever. If you plan on knocking the bench down on a frequent basis—such as for craft shows—then use threaded inserts (in the top) and bolts (through the top plates) instead.

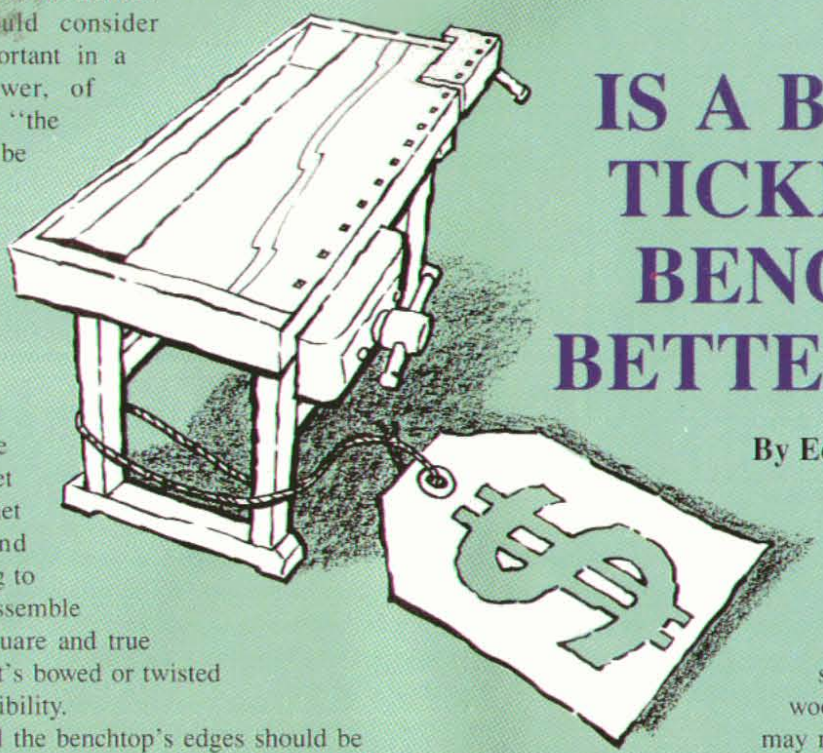
Next, drill the various bolt holes through the pedestals and stretcher end plates, bolt the stretcher assembly to both the left and right-side pedestals, and *then* mount the right-side pedestal to the bench top. Lastly, fit the bench stop through the mortise in the bench top, then insert the hanger bolt (N) that together with the wing nut and washer serves as a lock for the stop.

Finish: MDF should not be left unfinished. It's best to cover all surfaces with some type of protective coating, such as paint or polyurethane. By sealing all surfaces, even if the bench is placed in a moist area—such as a damp basement—it won't wick up the moisture. If there's one negative to using MDF, it's that you can't let MDF come into contact with moisture—the two just don't mix. One added bonus of a protective coating is that you won't need to worry about the inevitable spills—of finish, stain, honing oil or whatever—that all benches are subjected to, sooner or later.

Vise Mounting: The solid core area in the bench top will enable you to mount a vise by either lag bolting from the bottom, or countersinking for bolt heads in the top. Obviously, we've only layed out our core for a single vise. If you plan on adding a second vise at some later date, be sure to add solid core strips at the second vise mounting area. It's important to make these decisions before your make the T-box top, since it's impossible to add extra core strips later on, should you change your mind.

IS A BIG TICKET BENCH BETTER?

By Ed Speas



With so many different styles of workbenches out there, it's hard for the average woodworker to choose what's best. If money was no object, we'd probably all opt for the fanciest, prettiest bench available. But if we stopped and asked ourselves the question "Is the most expensive bench I can buy the best bench to work on?" we might be surprised at the answer.

First, we should consider what's most important in a bench. The answer, of course, should be "the top." It should be strong enough so there's no sag, durable enough to stand up to pounding, abuse and the pressure of clamping workpieces to it, and it must be flat. We work hard to get furniture and cabinet parts flat and straight, and trying to do work and assemble furniture that's square and true on a benchtop that's bowed or twisted is a virtual impossibility.

Furthermore, all the benchtop's edges should be straight, all corners square, and the bench should have a stop to keep pieces from sliding off as we plane or sand. The underframe—the purpose of which is to support the top securely at a given height—should be open enough to allow for getting bar clamps under the top, which makes it easy to clamp pieces to the side of the bench. Finally, the bench should have at least one—or better yet two—good vises.

Beyond the above criteria, there are two more things to consider—size and height. As for size, most of us tend to use the Texas theory: The bigger the better. But, experience shows that the typical Texas-sized bench gets crowded with tools that should have been put away, or scraps that should have been thrown away, and when the time comes to get busy, there we are clearing off a little work area around the vise. For this reason, I prefer a smaller bench.

With respect to height, keep in mind that it's next to impossible to work comfortably on a bench that's too high. We can always bend our knees a bit or lean over a lower bench, but most of us are done growing. For the average person, the 34 in. height shown should be just fine, but you should make adjustments accordingly if you are tall or short.

Now that we've looked at what makes a good bench, let's compare the T-box workbench to a solid wood bench. Initially, both tops can be made equally flat, but by virtue of its solid wood nature (remember, wood moves) the solid wood top may not long remain flat. The T-box top, on the other hand, remains forever stable. If you make it flat, it will stay that way.

But let's not be blind to beauty. That luscious teak or muninga bench will make your workshop look just great. Visitors will swoon. Surely, a master craftsman must be at work here, they'll sigh.

In the end, it all comes down to one simple question. Ask yourself: "Would I rather build pretty furniture on an accurate bench, or build inaccurate furniture on a pretty bench?" Believe me...the more you work on a T-box bench, the prettier it gets.

CD CAROUSEL

This handsome CD Carousel makes use of the venerable revolving New England bookcase concept, an idea that's been used to hold everything from books to wine bottles. The project isn't difficult to build, and you have the choice of making it in either the height shown (which holds 96 CD's), or in a half-height version—holding 48 CD's.

Getting Out Stock

As shown in the Bill of Materials, you'll need only two thicknesses of stock for this project. The top and bottom (A) are 3/4 in. thick; the partitions (B, C) and base (D) are 3/8 in. thick. If you buy 4/4 stock, you should be able to easily obtain two thicknesses of the 3/8 in. material by resawing the 4/4 stock. By the way, although you can make all the parts of your CD Carousel out of whatever wood you select (we chose walnut), you could save a little by using a secondary wood (such as poplar) for the four center partitions.

Bill of Materials
(all dimensions actual)

Part	Description	Size	No. Req'd.
A	Top/Bottom	3/4 x 12 1/4 x 12 1/4	2
B	Side Partition	3/8 x 5 1/2 x 14 1/8*	4
C	Center Partition	3/8 x 5 1/4 x 14 1/8*	4
D	Base	3/8 x 10 x 10	1
E	Swivel**	6 in.	1
F	Insert**	5 1/8 x 6 3/4	16

* Lengths include tenons. Width of center partitions includes 1/8 in. tongue on one edge.
** See Sources

Sources
Swivel and inserts are available from Woodworker's Supply, 1108 North Glenn Rd., Casper, Wyoming 82601; Tel. 1-800-645-9292. The swivel is part no. 240-002 ($2.90), the inserts are part no. 804-844 ($2.80 each). Double-stick tape to apply the inserts is also available from Woodworker's Supply. Order part no. 813-273 ($9.95 for a 75 ft. roll).

Size Parts

Once you've thicknessed all your stock, cut the parts to the exact sizes listed in the Bill of Materials. Note that the lengths of the partitions *include* the 1/4 in. long tenons on the ends, and that the width of the center partitions includes allowance for the 1/8 in. tongues that will later be cut on one edge. Since the length of all the partitions is identical, just set up a stopblock on your miter gauge fence, locating it 14 1/8 in. from the blade, to cut all these parts to length (the stopblock setting would be 7 3/8 in. from the blade if you are making a half-height CD Carousel, holding 48 CD's). For the ripping cuts to establish the width of the outside partitions, locate the rip fence 5 1/2 in. from the blade, then move the rip fence 1/4 in. closer to the blade when you cut the four inside partitions to width.

The sizes of the top and bottom must also be exact, since you'll be using a jig to cut the partition tenon grooves in these parts, and any mistake in the size will cause the grooves to be out of alignment.

The Joinery

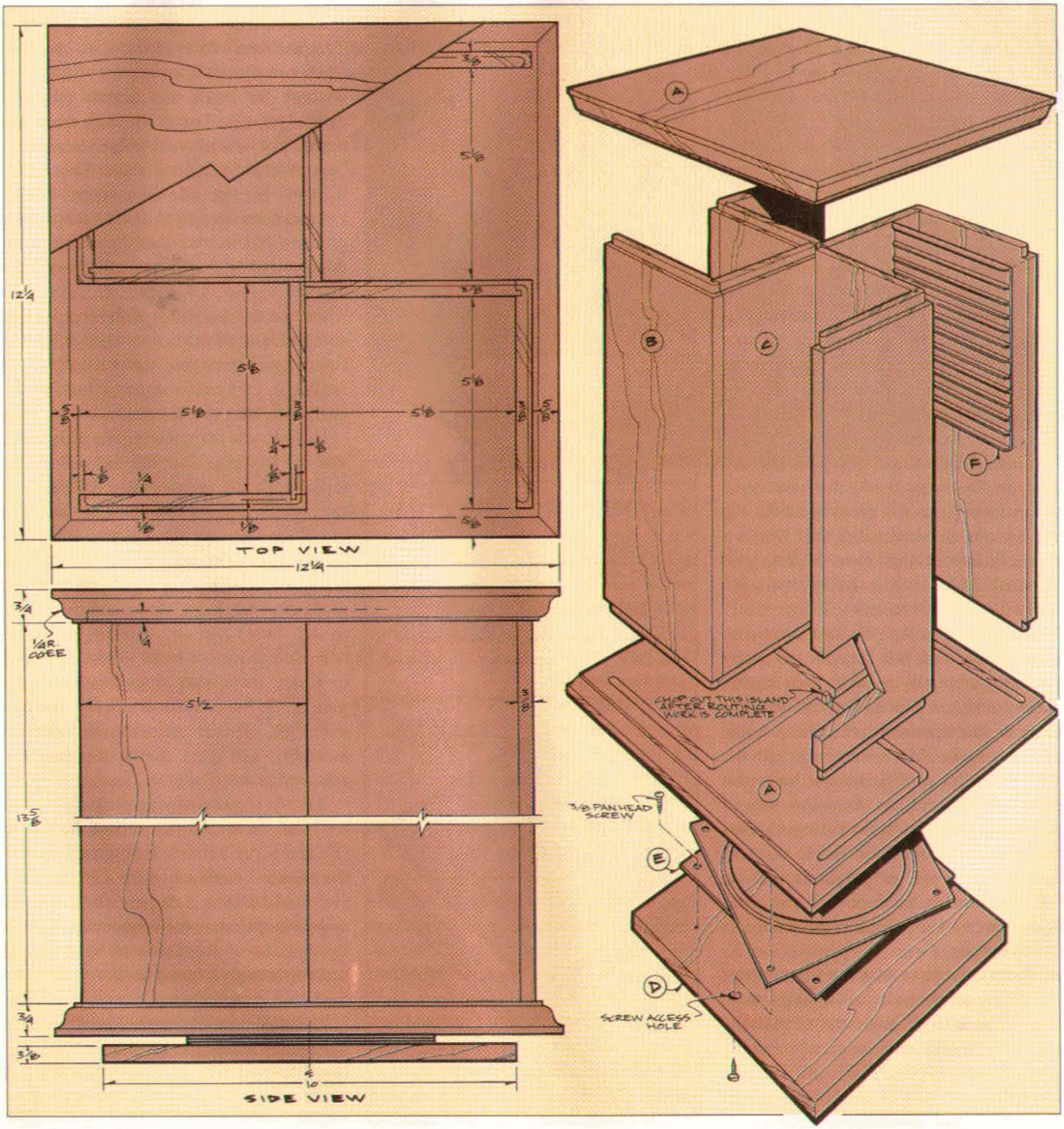
There are two joints that this project uses. The tongue-and-groove joint that joins the side and center partitions is mainly just a way to keep these parts from sliding out of alignment when they're glued together. But the grooves in the top and bottom and the corresponding tenons on the partition ends are what holds this project together, and it's important that they are cut accurately. Here's how we did it. (Our jig method is the preferred method if you are making multiples, but if you want to make just one CD Carousel, skip down to the Another Option section).

Make Our Simple Jig: With a project like this, where you

want to make repetitive accurate grooves, and where you plan to make a number of items, the best way to assure success is with a template jig. As the Router Template detail shows, the jig we used is just a 1/4 in. thick piece of hardboard (the template) measuring 12 in. by 12 in., with a few 3/4 in. square cleats screwed to it to properly index the top and bottom. Our jig is designed to be used with a 1/4 in. diameter bit and a 7/16 in. diameter guide bushing. If you use a different size bushing, please note that you'll need to make the appropriate changes on the hardboard template.

Obviously, if you expect your jig to cut accurate grooves, it must be constructed accurately. We used the router table and a 7/16 in. diameter straight cutter to make the grooves in the hardboard template. Locate the router table fence $1\frac{13}{32}$ in. from the bit to cut the first leg of the L-shaped groove, and set up stops to start and stop the groove as indicated. You'll need to drop the hardboard down over the bit to start the groove. Then relocate the fence so it's $6\frac{13}{32}$ in. from the 7/16 in. diameter bit, set up stops, and cut the second leg of the L-shaped groove. Screw your 3/4 in. cleats (make sure they are *exactly* 3/4 in. wide or all your other careful measurements won't matter) in place flush with the edges of the template, and your jig is ready to use. Obviously, the screw heads must be countersunk so the router doesn't hang up on them.

Using The Jig: To use the jig, clamp the bottom flush into the corner formed by the two cleats, with the hardboard guide



template on top. Then use the router, a 7/16 in. guide bushing and a 1/4 in. diameter straight bit to cut the L-shaped groove. Reposition the jig to each of the three remaining corners on the bottom and repeat the process. All the grooves in the bottom should now be complete.

The same hardboard template is used to rout the grooves in the top, but to make the grooves as a mirror image of the bottom, you'll need to switch the 3/4 in. cleats to the opposite side of the template. Again, countersink for the screw heads so they don't interfere with the movement of the router on the template. Clamp the top into the corner of the jig, with the template on top as before, cut the first L-shaped groove, then relocate the jig on each corner successively to complete the three remaining L's. You should now have a top and bottom that are perfect mirror images of each other. By the way, you'll notice that on both the top and bottom, where the center legs of the four L's converge, you'll have a little 1/4 in. square island of stock remaining. Take a chisel and chop this island out.

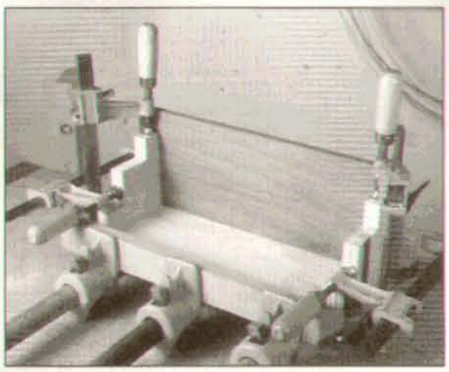
Another Option: If you don't have fancy things like guide bushings for your router, and would rather not fuss with making a jig, don't despair. You can make the grooves using just your router and a 1/4 in. straight bit. Mark the starting and stopping points of all the grooves, then use your router's edge guide to properly index the cuts. The grooves for the four side partitions are made with the edge guide located 3/4 in. from the bit, the four center partition grooves are made with the edge guide located 5 3/4 in. from the bit. Take care to start and stop your grooves dead-on the layout marks that you made. When laying out the grooves in the top and bottom, just remember this: One is a mirror image of the other. Making two identical parts is like having two left feet—it just won't work.

The Partitions: The 1/8 in. tongue-and-groove joints that join the side and center partitions are easily cut with your regular 1/8 in. table saw blade. You can also use the table saw to establish the tenons on the partition ends. Make sure you cut the shoulder (that establishes the tenon on each partition end) on the proper side of the stock. One way to make this process foolproof is to mark the inside faces of each matched pair of partitions with an "X" (remember, each pair of partitions forms an L). All the tenon shoulder cuts are made on the side opposite the X-marked faces. Note that the front end of the tenons on the side partitions must be notched back 1/8 in. and rounded to fit the rounded end of your router-cut groove.

Assembly

Now glue and assemble each pair of partitions (one side partition and one center partition) to form four L-shaped partition sub-assemblies. As the photo on this page shows, a pair of notched right-angle clamp blocks will make certain that the partitions are joined at a true 90-degree angle. Once the four partition sub-assemblies are out of clamps, you can test-fit them into their respective L-shaped grooves in the top and bottom. Note that to fit the tenons into the grooves, you'll need to round the outside corner of each of the L-shaped partition sub-assembly tenons to match the radius at the corner of your L-shaped groove.

And, here's one other important assembly tip. Although you probably won't have much trouble fitting the four partition sub-assemblies into the bottom (you just fit them into their respective L-shaped bottom grooves one at a time), it can be a fussy—and frustrating—task when next you must get the top to fit over all four partition sub-assemblies at once. To ease this part of the assembly, take a sharp chisel and pare a slight bevel on both the inside and outside edges of each L-shaped partition sub-assembly tenon. The bevel should only extend about 1/8 in. up the 1/4 in. long tenon. This makes it easy to get all the tenons started simultaneously into their respective grooves, but insures that they'll be properly located when the assembly is socked up tight.



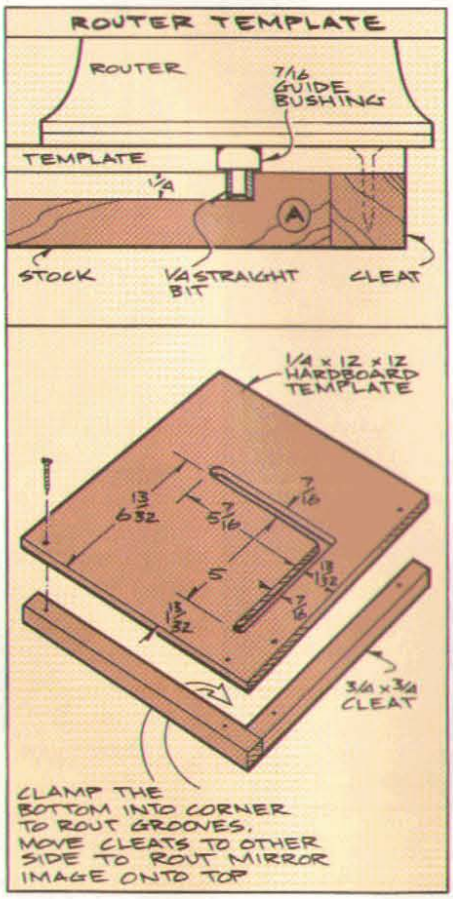
Notched right-angle clamp blocks will aid in gluing up the partitions

Once a dry assembly of the top, bottom and the four partition sub-assemblies has fitted together to your satisfaction, disassemble it, then use an ogee bit to mold the profile on the top and bottom.

How do you complete a glue-up like this without any glue dripping down from the top? Here's the secret. Add a little glue in the bottom grooves only (not too much or you'll be cleaning up squeeze-out), then add the partition sub-assemblies, and the top (but without any glue in the top grooves). Clamp the whole, and set it aside to dry. Don't use any glue at the center where the partitions meet—there's no need to fasten these parts together. Once the glue in the bottom has dried, flip the unit over, lift off the partition and bottom assembly, add glue in the top grooves, reassemble and clamp.

All that remains of your project is to add the base, the swivel (E), mount the inserts (F), and apply a finish. Finish the base and the exposed surfaces of the CD Carousel (we used Minwax Antique Oil), screw the swivel to the base, then mount the base to the bottom of the carousel by inserting screws through a screw access hole in the base (see exploded view).

The plastic inserts can be glued in place, but make certain the glue is not solvent-based or you risk melting the plastic. A better choice is to use double-stick tape (see Bill of Materials).



DESK CLOCK

Scrapwood Project

This handsome clock, with its classical styling, will help make any desk look good, no matter how high the work has piled-up in the in-box. Our thanks to the people at Schlabaugh & Sons of Kalona, Iowa for providing us with the design. They make clocks in a variety of interesting styles, and this is one of our favorites.

To get the strong contrast between light and dark colors, Schlabaugh makes this clock using two different woods. The top, bottom and center are made from wenge, an African hardwood with a rich chocolate-brown heartwood. The base, crown, and columns are made from maple, a light-colored domestic wood. Wenge is sold by a number of mail-order hardwood suppliers.

However, before getting out your mail-order catalogs, we suggest you check your scrapbox, because all the wood you need is likely to be found right there. Chances are you won't find wenge, but you just may have a little walnut, mahogany, or cherry, and they will work perfectly well as "dark" woods. Birch, which has a naturally light color, can be use in place of maple. And, don't be afraid to try some of your other scrapbox woods. With a little experimenting, you may find something that you will especially like.

If you feel that your busy schedule doesn't allow enough time to make this timepiece, consider that it will probably require just an evening or two in the workshop. We've listed Schlabaugh & Sons as a mail-order source for the hard-to-find movement. As an additional option, they will also provide the pre-turned columns. And, if you are really in a hurry, they'll sell you a kit with all the parts precut and ready to assemble. For ordering information see the "Sources" at the end of the Bill of Materials.

Make the Top, Bottom and Base

You'll need 3/16 in. thick stock for the top (A), bottom (B), and base (C). Since 3/16 in. thick stock can be difficult to find, you'll probably want to "resaw" thicker stock.

To resaw wood simply means to reduce the thickness by ripping it into thinner stock. It's a procedure most often done on the band saw, especially when the stock is wide, but for the narrow stock used here (1 1/4 in. wide for the top and bottom, 1 1/2 wide for the base), the table saw is the better choice.

Begin by cutting stock for the top and bottom. For safety's sake, start with a piece of 3/4 in. thick stock that's at least 12 in. long, then rip it to 1 1/4 in. wide.

Now, set up the table saw for resawing. As shown in Fig. 1, locate the table saw rip fence at a point 1/4 in. from the inside tooth of the saw blade, and set the blade to 9/16 in. high. Using a push stick, pass one edge of the stock through the blade (Cut 1), then flip the stock over and make the same cut on the opposite edge (Cut 2). You'll note that 1/8 in. of stock still remains. It's best not to make the final separating cut on the table saw, as the saw blade can sometimes catch a relatively thin cutoff like this and throw it back at the operator. A safer way to make this separating cut is with a band saw or a thin-bladed hand saw.

With the resawing completed, use a sanding block or a hand plane to smooth the rough surface created by the table saw blade and also reduce the stock from 1/4 in. to its final 3/16 in. thickness. Follow the same procedure to cut stock for the base, but start with a piece that's 1 1/2 in. wide and raise the saw blade to 11/16 in. for the resawing cuts.

Bill of Materials
(all dimensions actual)

Part	Description	Size	No. Req'd.
A	Top	3/16 x 1 1/4 x 4	1
B	Bottom	3/16 x 1 1/4 x 4	1
C	Base	3/16 x 1 1/2 x 4 1/4	1
D	Center	1/2 x 1 7/8 x 3 13/16 *	1
E	Column	See Full-size Pattern	2
F	Crown	5/8 x 1 1/4 x 3 1/2	1
G	Movement	1 1/2 diameter **	1

* Length Includes Tenons

Sources

** The movement can be ordered from Schlabaugh & Sons, P.O. Drawer 327, 1307 J Avenue, Kalona, IA 52247, tel. 1-800-346-9663. Order part "MQ-Arabic." The current price is $9.50 postpaid.

For a pair of preturned maple columns, order their part "Sm. Col.-Maple." The current price is $3.50 per pair postpaid.

For a complete kit of precut wenge and maple parts, plus the movement (no glue or finish materials), order their part "Complete Kit." The current price is $19.95 postpaid.

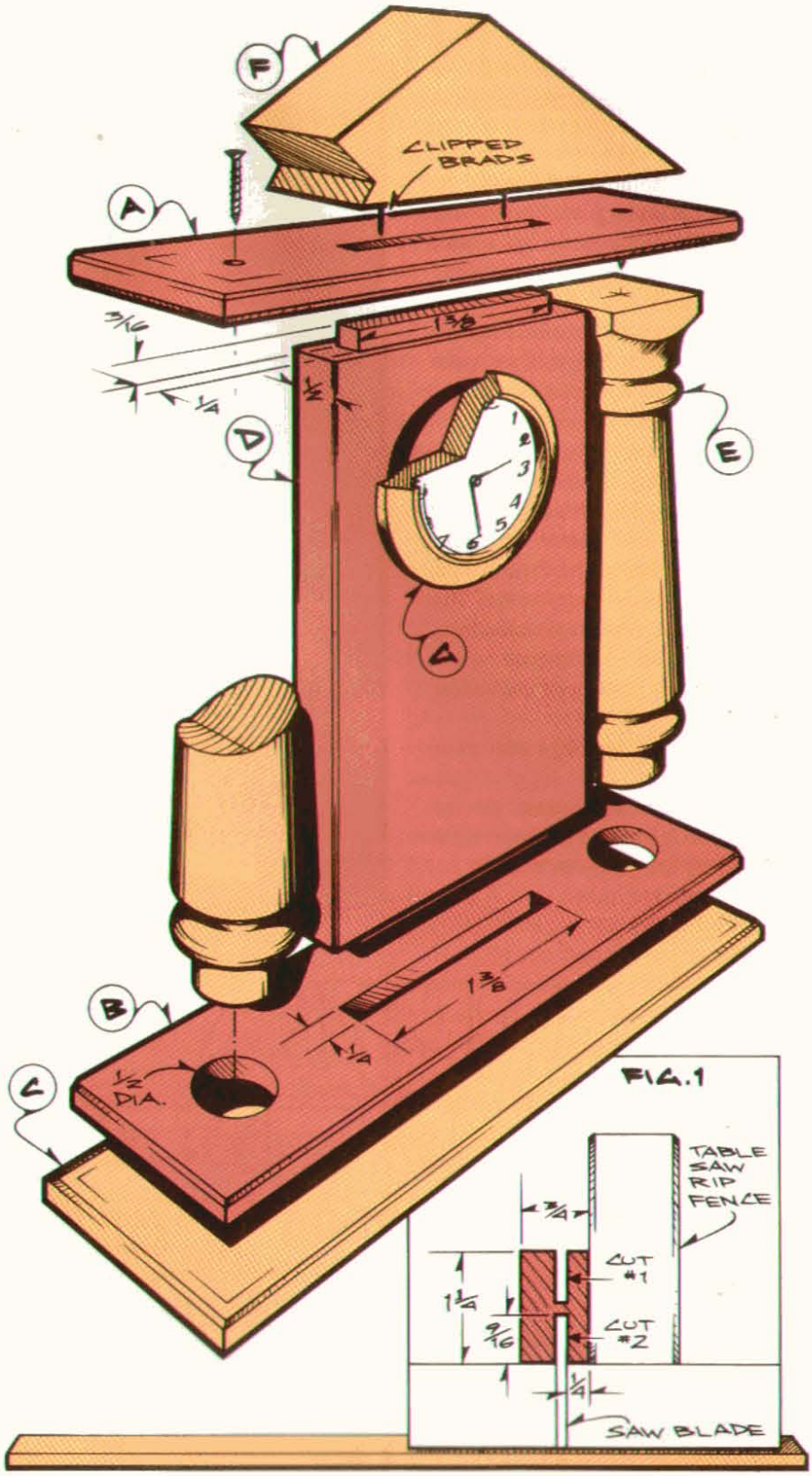


FIG. 1

Next, cut the top, bottom and base parts to the length dimensions shown in the Bill of Materials. Once cut, use the router table and a 1/4 in. diameter straight bit to create the 1/4 in. wide by 1 3/8 in. long through-mortise in both the top and bottom. The router bit makes rounded corners so, after making the cuts, you'll need to square the corners with a chisel.

Also, in both the top and bottom, lay out and mark the centerline location of the two columns. Note that the centerline location is the same in both parts. At the two centerlines marked in the top, bore 9/64 in. diameter countersunk holes to accept the shank of a 5/8 in. long by number 6 flathead wood screw. At the two centerlines marked in the bottom, bore 1/2 in. diameter holes to accept the column tenons.

Make The Center

Using 1/2 in. thick stock, cut the center (D) to the length and width shown in the Bill of Materials. The 1/4 in. thick by 1 3/8 in. wide by 3/16 in. long tenon on each end is best cut using the table saw and the dado head.

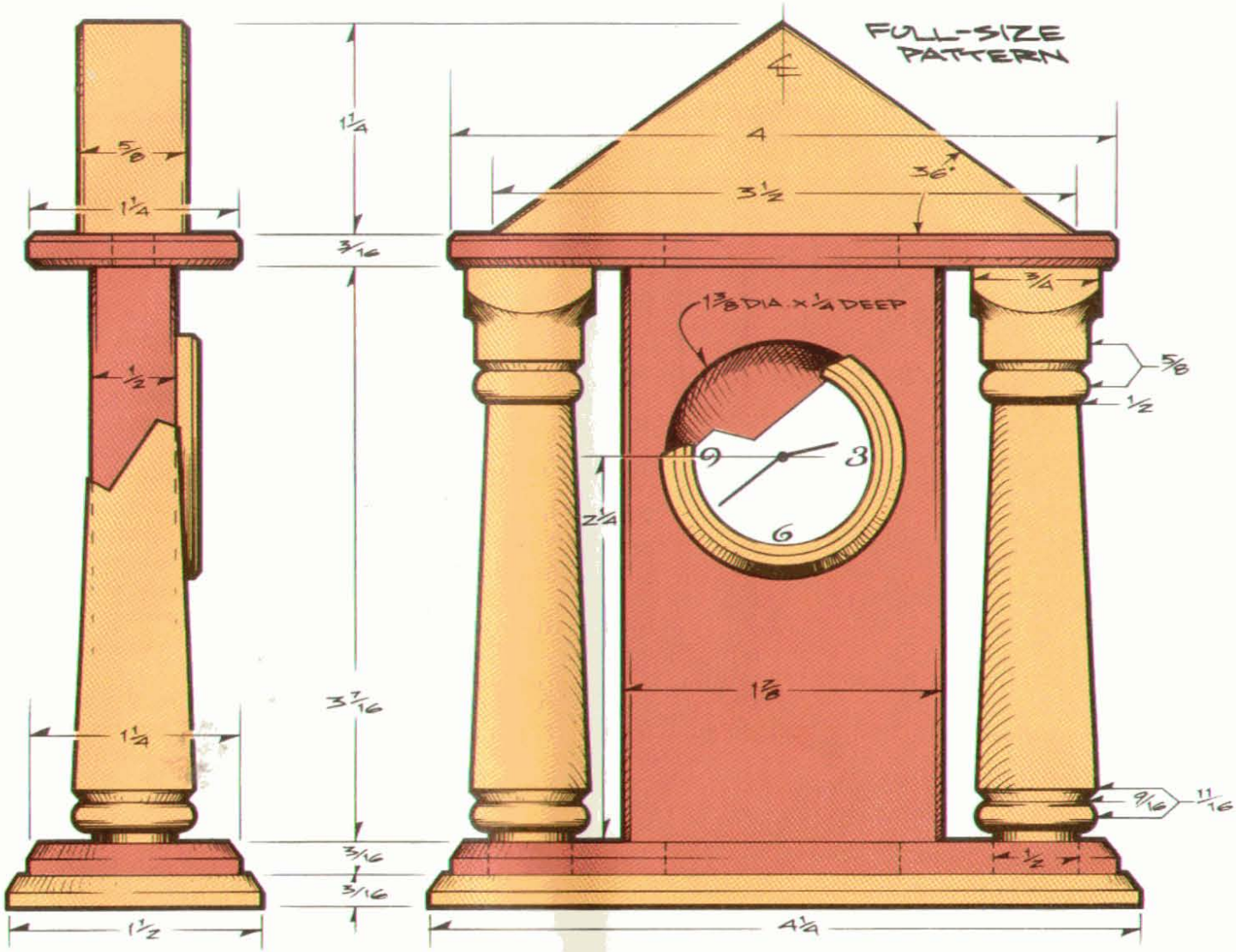
Once cut, check for a snug fit in the mortises that were cut in the top and bottom. Check to make sure that the tenons don't extend through the mortises—if they do, trim the tenons flush using a chisel or block plane.

Mark the centerline location of the hole that will accept the movement. Use a 1 3/8 in. diameter Forstner bit to bore the hole to 1/4 in. deep. We chose a Forstner bit because it has a short center spur, which means it won't break out through the back of the stock.

Turn The Columns

The two columns (E) are made next. Start with a piece of clear stock measuring 3/4 in. square by about 4 in. long. Mount it in the lathe between centers and turn it to the dimensions shown in the front view. Note that the columns are shown full-size in the drawing. Finish sand to 220-grit before removing from the lathe.

Mark the centerpoint at the top end of each column and bore a 5/64 in. diameter by 1/2 in. deep pilot hole for the 5/8 in.



long by number 6 wood screw to be added later.

Assemble the Parts

Make the crown (F) next, using 5/8 in. thick stock. Start with a piece measuring 1 1/4 in. wide and 3 1/2 in. long. Use a straightedge and pencil to mark the angles, then cut them out with the band saw. Make the cuts slightly on the waste side of the marked lines. Once cut, use a disk sander to smooth the cuts exactly to the lines.

As shown in the drawing, the top, bottom, base and center have a very slight chamfer applied to some of their edges. Apply the chamfers by hand with a sanding block, or on the router table equipped with a chamfering bit.

Final sand all the parts, finishing with 220-grit. If the wood you used for the top, bottom and center isn't as dark as you'd like, apply a coat or two of a dark stain at this point.

When the stain dries, add a thin coat of glue to the top and bottom mortises, the center tenons, and the column tenons. (No need to add glue to the top end of the column, as end-grain glue joints have little strength). Assemble the center and the two columns to the bottom, then add the top, screwing it in place with the two flathead screws. Check to make sure the flats on the columns are square to the top and bottom, then apply light clamp pressure to keep the bottom in place while everything dries.

Next, glue the base in place. When applying the glue to the underside of the bottom, use just a thin coat and try to keep it away from the edges. That way, when clamp pressure is applied, the glue is less likely to squeeze out of the joint. Since glue squeeze-out requires a clean-up job, it's always nice to avoid it.

To keep the base from sliding out of position when clamp pressure is applied, drive a couple of small brads into the ends of the column tenons on the underside of the bottom. Then, snip the heads off so about 1/16 in. is exposed. When the base is clamped, the brads will keep it from moving around.

Use the same gluing techniques to add the crown, but drive the brads into the end of the upper tenon as shown in the exploded view. If you find it difficult to apply a clamp to the crown, use a few strips of masking tape to secure it in place. Masking tape generally works fine for small gluing jobs like this.

Finishing Up

Once dry, add a couple of coats of a spray lacquer. You can purchase spray lacquer in small aerosol cans at most hardware stores and building supply centers.

The battery-operated quartz movement (G) is simply pressed into the movement hole. Three small spring loaded tabs hold it securely in place. Should you want to remove the movement, a fingernail will pry it out in short order. As an option, though, you could bore a 1/8 in. diameter hole from the back and into the movement hole. If you don't mind seeing the hole, you'll be able to remove the movement by pushing it out with the point of a pencil. WWJ

Kitchen Message Center

Carving Decorates This Pine Favorite

Build this Message Center and you'll never again have to say to a telephone caller—"hold on, please, while I go get a pencil." That's because this project keeps pencils, pens, paper, even Post-it notes, right at hand. And for those especially important messages, there's a writing surface that measures nearly 12 in. square—plus a place to store the writing pen.

The writing surface we used is a special adhesive-backed plastic that can be easily applied to a piece of 1/4 in. plywood. The trade name for this product is "Expo, Dry Erase Surface" and it's made by the Sanford Corporation of Bellwood, Illinois. If not kept in stock, most office supply stores will be able to order it for you.

To write on the surface you'll need to use a special "dry erase marker", which is also sold by Sanford. A dry cloth or tissue easily wipes off the surface. If you can't get the Dry Erase Surface and marker locally, we've listed a source of supply for a 12 in. by 12 in. piece, plus a marker. The source is listed at the end of the Bill of Materials.

We angled the shelf to make it easier to jot notes. A pair of dividers creates three small "cubbies" for storing the dry erase pens and a wiping cloth, plus there's extra room for pencils, pens, note pads and the like. The bottom provides a shelf for additional storage.

The carved sunflower is a nice detail that's not hard to do—even for a novice. John Ziobro, Sr., a carving enthusiast from nearby Derby, Connecticut, was kind enough to create the sunflower for us. However, if you prefer to make the project without the carving, just start with a top rail that's 1 1/4 in. wide instead of 4 1/4 in. wide.

Clear pine is used for all parts except for the frame back and the writing surface back, which are made from 1/4 in. thick birch plywood.

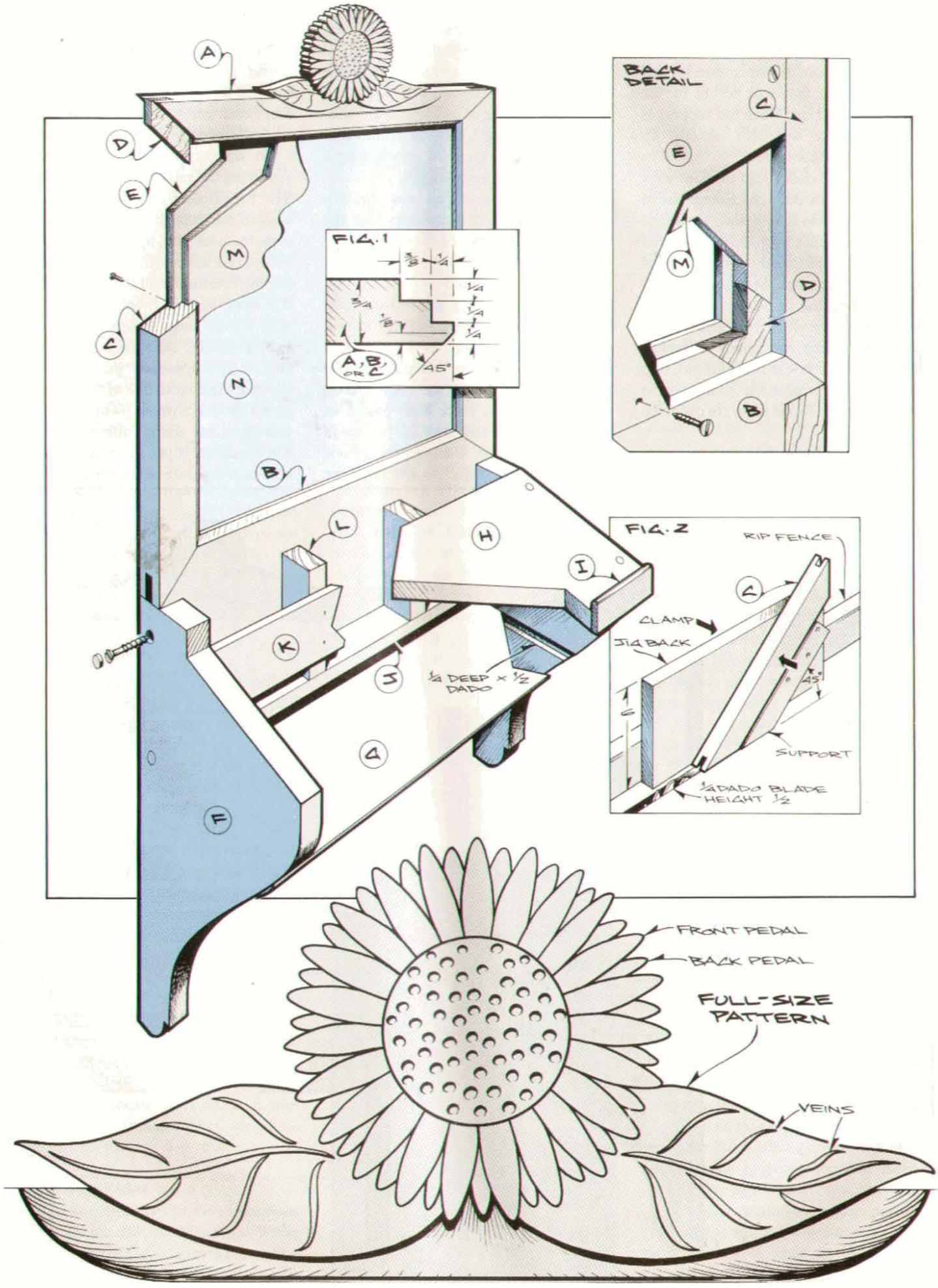
Cut The Frame Parts

The frame parts are made from 3/4 in. thick stock and consist of the top rail (A), the bottom rail (B) and the two stiles (C). The frame is held together with four 1/4 in. thick splines (D).

Start by cutting the top and bottom rails to the length and width dimensions shown in the Bill of Materials. Rip the stiles to width, but it's best to cut them an inch or so long at this point. You'll trim them to exact length when the ends are mitered.

Set the table saw blade to 45 degrees and, using the rip fence, cut the chamfer on the inside edge of each part (Fig. 1). The miters on the ends of each part are cut next. Return the table saw blade to 90 degrees, then set the table saw miter gauge to 45 degrees and check it for accuracy. Once everything looks okay, miter all the ends. Now, replace the table saw blade with a dado head cutter and cut the double rabbets.

You'll need to make a simple jig (Fig. 2) in order to safely and accurately cut the 1/4 in. wide by 1/2 in. deep spline grooves in each miter. The jig back, made from 1/2 in. or 3/4 in. thick plywood or particleboard, should be cut to about 6 in. wide and 14 in. long. The support is just a piece of 3/4 in. thick scrap stock


A
D
E
M
C
N
B
L
H
I
K
J
½ DEEP × ½ DADO
F
G
FIG. 1
A, B, OR C
45°
BACK DETAIL
C
E
M
D
B
FIG. 2
RIP FENCE
C
CLAMP
JIG BACK
45°
G
SUPPORT
¼ DADO BLADE HEIGHT ½
FRONT PEDAL
BACK PEDAL
FULL-SIZE PATTERN
VEINS

about 9 in. long and 1 1/2 in. wide. The lower end of the support is mitered to 45 degrees, then it's screwed to the back as shown. Make sure the screws are located above the area that will be cut by the dado head later on. Once the support is attached, make sure it's exactly 45 degrees to the saw table.

Now, set the dado head to make a 1/4 in. wide by 1/2 in. deep cut. Clamp one of the frame parts to the jig, then locate the table saw rip fence so that the dado head will cut a groove exactly in the center of the 3/4 in. thick stock. Start the saw and, while holding the jig firmly against the rip fence, run the stock through the dado. Take care to keep your hands well away from the dado while making the cut. Flip the stock and repeat the process. The three remaining frame parts are cut in the same manner.

The four splines (D) can be made from either hardwood solid stock or plywood. If you use solid stock, as we did, you need to make sure the grain runs perpendicular to the miter joint cut. To make the solid stock splines, start with a piece of hardwood that's 3 in. wide and at least 8 in. long, then plane it to 1/4 in. thick. Once planed, crosscut it into four 1 in. lengths (the 8 in. stock length allows for safer crosscutting).

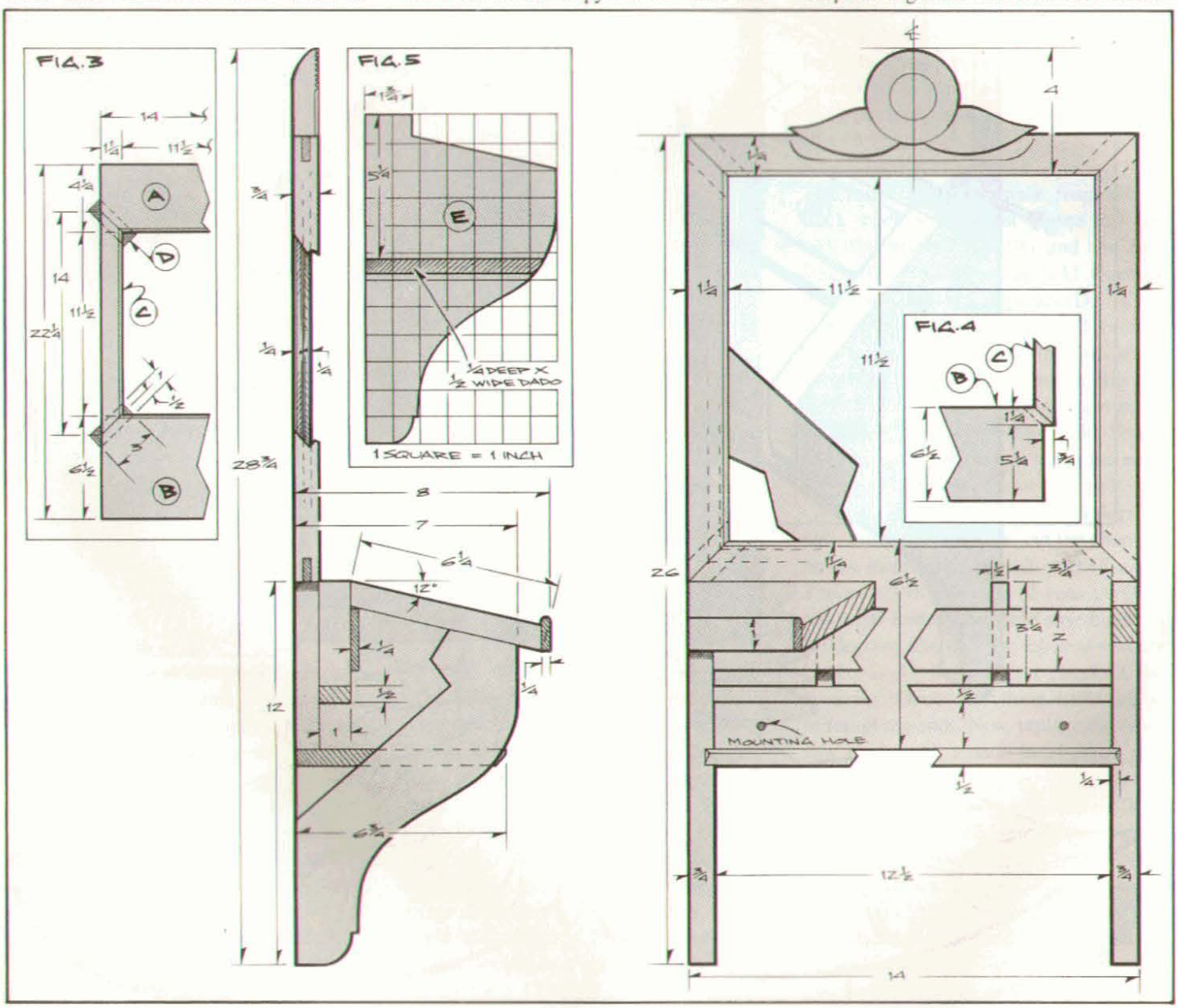
The frame parts can now be dry assembled (Fig. 3). If all looks fine, the top rail can be removed for carving.

Carve The Top Rail

Begin by transferring the full-size pattern from the drawing to the top rail. Perhaps the best way to do this is to photocopy the pattern, then place a piece of carbon paper under the copy, carbon side down. Now, place both pieces of paper on the top rail, with the pattern in it's proper position. Using a pencil, trace the lines on the copy. As the lines are traced, the carbon paper will transfer them to the wood.

Next, use the band saw to cut the outside profile of the sunflower and the two leaves. Also, you'll be cutting in from each end to make the top rail 1 1/4 in. wide on each side of the carving.

To start, create the background by removing the rail stock up to the leaves. The background is shown as a shaded area in the pattern. Note that this area also includes the tips of three petals. First, use a knife to make a cut establishing the bottom line of the two leaves and the three petals. Then, using a gouge with a fairly large sweep, cut up to this line, gradually increasing the depth of cut as you approach the leaves. The depth at the bottom line of the leaves and petals should be about 1/4 in. By the way, just about any sharp knife will do, even a pocketknife. If you have one, though, a chip carving knife would the best choice.



Next, using the same gouge, remove about 1/8 in. of stock from the two leaves. Bring this relief cut right up to the tips of the flower petals. Now, using the gouge like you would a chisel, cut straight down to create the points of the petals above the leaves.

The petals are carved next. Using the knife, cut each of the back petals so that they are recessed about 1/16 in. below the front petals.

Still using the knife, make a shallow (about 1/16 in.) V- shaped cut completely around the line of the 1 1/2 in. diameter circle. Don't worry if the circle isn't perfectly round when you get done.

The flower "seeds" are easy to make with a nail set. Use a hammer to tap the set just enough to form each of the shallow circular marks.

Again, using the full-size pattern, transfer the veins to the two leaves. Then, with the knife, make a 1/16 in. deep incised cut to outline each of the veins. With the veins outlined, use a gouge with a very shallow sweep to remove the background of the leaves. When finished, the veins will be raised about 1/16 in. above the leaf surface.

Assemble The Frame

Give all the frame parts a final sanding, finishing with 220-grit. If your carving cuts are crisp, you probably won't need to do any sanding there.

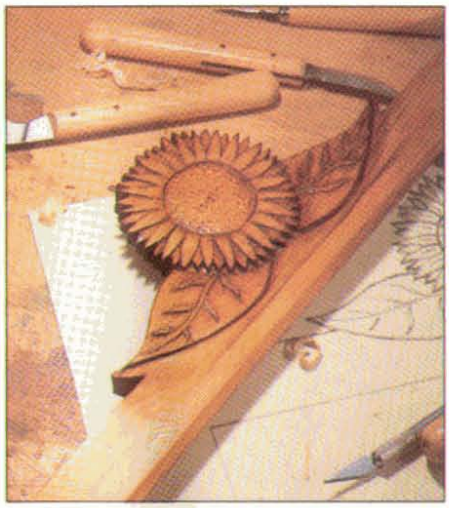
Add glue to the spline grooves and the splines, then assemble and clamp. Check for squareness and set aside to dry.

When dry, trim the splines flush. Now, mark the location of the notches in each end of the bottom rail (Fig. 4) and cut them out. The table saw will give you a nice straight cut on the 3/4 in. leg of the notch. Use the band saw or saber saw to cut the 5 1/4 in. long leg.

Next, from 1/4 in. thick birch plywood, cut the frame back (E) to fit within the outermost rabbet cut earlier in the frame parts. Bore a couple of countersunk holes along each side of the piece to accept 1/2 in. long by no. 4 flathead wood screws. Also, locate, mark and drill pilot holes in the frame rabbet for these screws.

Make The Sides

Cut the two sides (F) to the dimensions shown in the Bill of Materials. While holding each of the side parts in position in the bottom rail notches, mark the



location of the 1/4 by 1/2 in. dado for the bottom. Use the dado head and table saw miter gauge to cut the dadoes.

Transfer the grid pattern (Fig. 5) to the sides, then cut them out on the band saw. In each side, drill and counterbore holes for a pair of 1 1/2 in. long by no. 10 flathead wood screws. Also bore the pilot holes in the edges of the side notches. Once all the holes are bored, temporarily screw the sides in place.

Make The Bottom and Shelf

The bottom (G) can now be cut to length and width. At this point in the construction, you'll want to take the dimensions right from the assembled parts. Note, as shown in the side view, that the bottom extends out the front edge of the sides about 1/8 inch.

Also, cut the shelf (H) to size. You'll need to rip both edges to a 12 degree angle, as shown in the side view. Bore a couple of counterbored holes in each end for securing it to the top edge of the two sides. Now, cut the lip (I), trim its bottom edge to 12 degrees and glue it to the front edge of the shelf.

Bill of Materials
(all dimensions actual)

Part	Description	Size	No. Req'd.
A	Frame Top Rail	3/4 x 4 1/4 x 14 *	1
B	Frame Bottom Rail	3/4 x 6 1/2 x 14	1
C	Frame Stile	3/4 x 1 1/4 x 14	2
D	Frame Spline	1/4 x 3 x 1 **	4
E	Frame Back	1/4 x 12 3/4 x 12 3/4	1
F	Side	3/4 x 7 x 12	2
G	Bottom	1/2 x 6 3/4 x 13	1
H	Shelf	3/4 x 6 1/4 x 14	1
I	Lip	1/4 x 1 x 14	1
J	Divider Bottom	1/2 x 1 x 12 1/2	1
K	Divider Front	1/4 x 2 x 12 1/2	1
L	Divider	1/2 x 1 x 3 1/4	2
M	Writing Surface Back	1/4 x 12 x 12	1
N	Writing Surface ***	12 x 12	1

* Width dimension allows extra for carving
** Width dimension allows extra for trimming after assembly

Source

*** A 12 in. by 12 in. piece of "Expo, Dry Erase Surface" plus a "Dry Erase Writing Pen" is available from Aspen Kits, 6 Hilltop Drive, Old Saybrook, CT 06475; tel. (203) 388-6179. Specify "Message Center Kit." The current price is $10 postpaid. Add $2 per kit for Canadian orders.

Assemble

Disassemble the sides from the bottom rail, then final sand the sides, bottom, shelf and lip. When all is smoothed to your satisfaction, screw one side in place, fit the end of the bottom into the dado, then add the other side.

Cut the divider bottom (J) and the divider front (K) to fit snugly between the two sides. Use glue and finishing nails to join the divider bottom to the two dividers (L), then add the divider front. Note that the 2 in. width of the divider front results in an opening at the bottom. The opening makes it easier to retrieve any small objects that might fall into one of the cubbies.

Next, join this four-part divider assembly to the bottom rail, again using glue and finishing nails. Make sure that the top ends of the dividers will be flush with the shelf when it's installed.

Now, screw the shelf/lip in place, then glue the dowel plugs into all the counterbored screw holes. When dry, sand them flush.

Using 1/4 in. thick birch plywood, cut the writing surface back (M) to fit into the inside rabbet on the frame. Apply the Dry Erase Surface (N) to the writing surface back in accordance with the manufacture's instructions. The kit also comes with instructions.

For a finish, we applied two coats of Minwax's Golden Oak Wood Finish, followed by two coats of satin polyurethane. When dry, fit the writing surface into the inside rabbet, then secure it by screwing the back in place.

A pair of holes bored into the bottom rail (see Front View) serves as a means to mount the project to the wall. Keep in mind that, by themselves, screws won't hold well in wallboard or thin paneling. Unless you are screwing into a wall stud, you'll probably need to include wall anchors to insure adequate strength.

Feathered Friends Mobile

SCROLL SAW PATTERN PROJECT

Looking for a just-for-fun project? This fanciful bird mobile, by Trumansburg, New York woodworker Gunther Keil, may be just the ticket. The birds in the mobile shown are all cut from 1/8 in. thick solid wood stock. Keil uses a different wood for each bird, adding a red aniline dye to the cutout of the cardinal. Quartersawn stock is best for scroll saw cutouts in thin stock like this, because it's less likely to cup or warp. You can also make the cutouts in 1/8 in. plywood, and then paint or dye each bird to approximate its natural color. All holes are drilled with a 1/16 in. diameter bit.

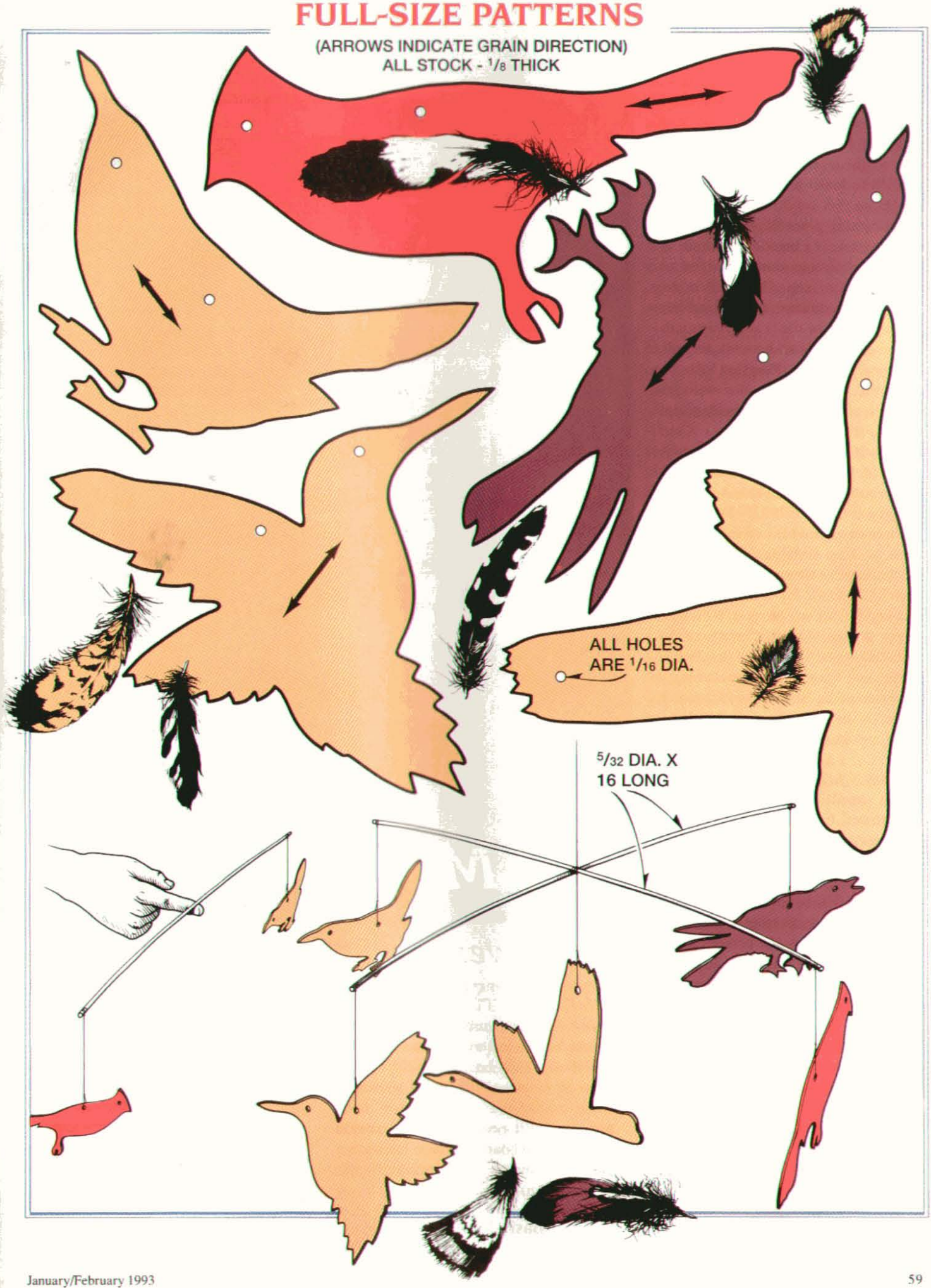
The easiest way to make cutouts like this is with templates. Make a photocopy of the pattern page, paste it onto a page-sized section of 1/8 in. or 1/4 in. thick plywood, then cut each pattern out with the scroll saw. To transfer the pattern of each bird to your stock, all you need do is orient each bird template properly on your stock with respect to the indicated grain direction, trace around the template with a sharp pencil, then carefully cut the profile out. Save your templates and you'll be able to easily reproduce the mobile any time you like.

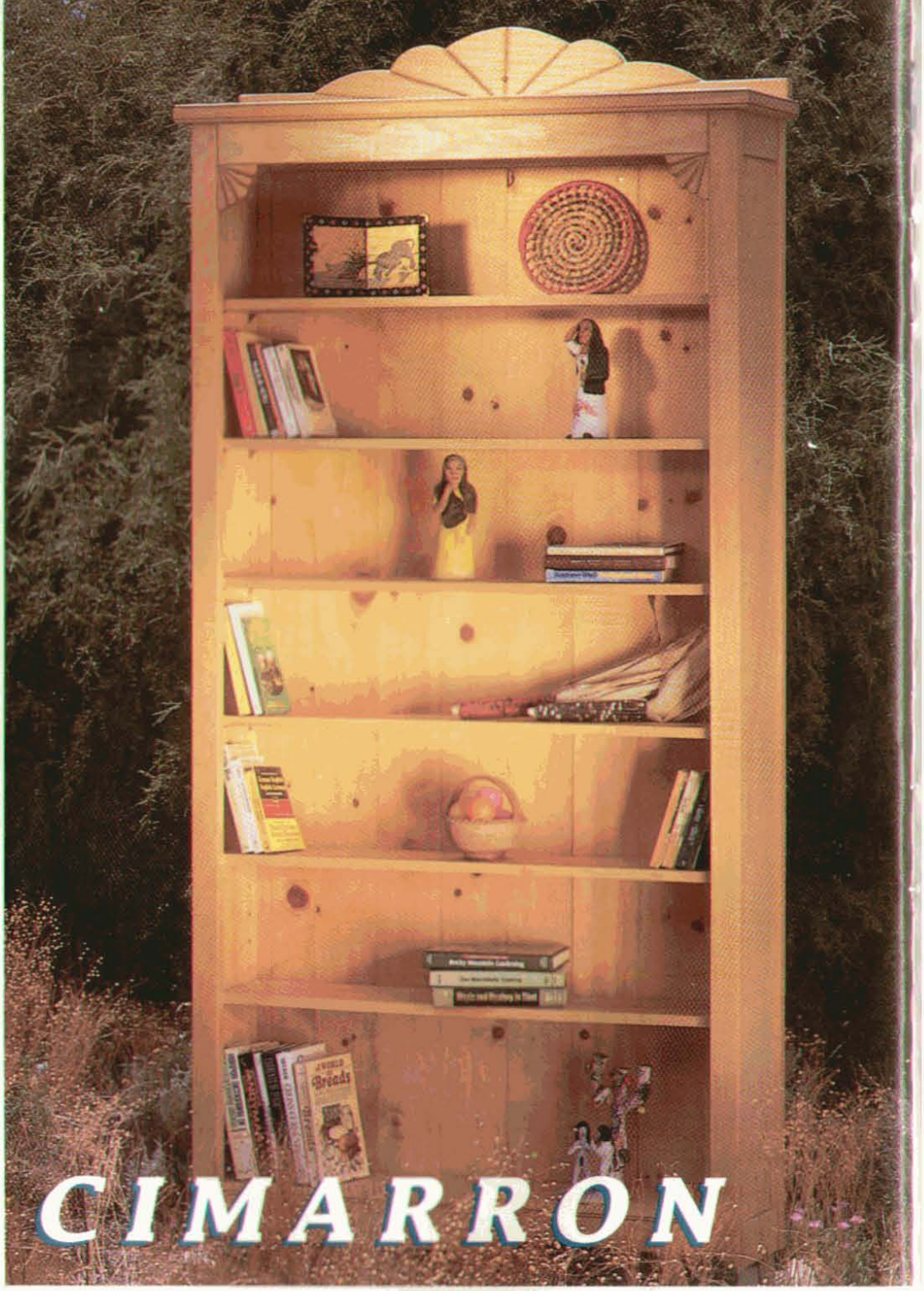
Two lengths of 5/32 in. diameter by 16 in. long dowel rod serve as crosspieces. Hold the center section of each rod length over the spout of a vigorously boiling kettle and steam-bend a gentle arc in each. Hang the birds from the rod ends, find the center balance point of each rod by using your finger (as shown in the illustration), then tie the rods together at their balance points with a string, allowing sufficient length at the bottom of the string for the fifth bird and at the top to fasten the mobile to whatever you plan on hanging it from. A dab of glue at the point where the two rods cross will keep them—and the string—from sliding out of alignment. Make final adjustments to balance the mobile *after* it has been hung, then use a dab of glue on each of the string-to-rod attachment points to final anchor the bird positions.

Mobiles like this are a great way to get the family involved with a project. The scroll saw is one of the safest tools to use, and even if the littlest ones may not be old enough to use it, they can always have fun painting the birds, or tying the strings.

FULL-SIZE PATTERNS

(ARROWS INDICATE GRAIN DIRECTION)
ALL STOCK - 1/8 THICK





Southwestern-Style Bookcase is an Instant Library

Even here in New England, Southwestern-style furniture is popular. Just down the road a bit from The Woodworker's Journal offices, there's a store specializing in this style, and now a second similar store has opened in a nearby hamlet. We won't pretend to know just why this style has caught on, but we do know this: from a woodworking point of view, the Southwestern-style is a breath of fresh air. It is typified by strong, simple designs, uses a minimum of superfluous decoration, and favors traditional mortise-and-tenon joinery.

The design shown here is courtesy of Kingsley Hammett. Kingsley hails from Santa Fe, New Mexico—the wellspring of much of today's most popular Southwestern-style work. Called a Cimarron—or bookshelf—the piece shown is made of pine, but other woods could easily be substituted. Although as with all projects, our Bill of Materials and illustrations provide specific dimensions, you can easily make alterations to fit available wall space and your own book collection. By making the piece deeper, it can even be an entertainment center. A pair of these Cimarrons looks especially great flanking a fireplace. As with any freestanding bookcase, we recommend that you anchor the case top to the wall with an angle bracket, to avoid any danger from tipping over.

Buying Stock

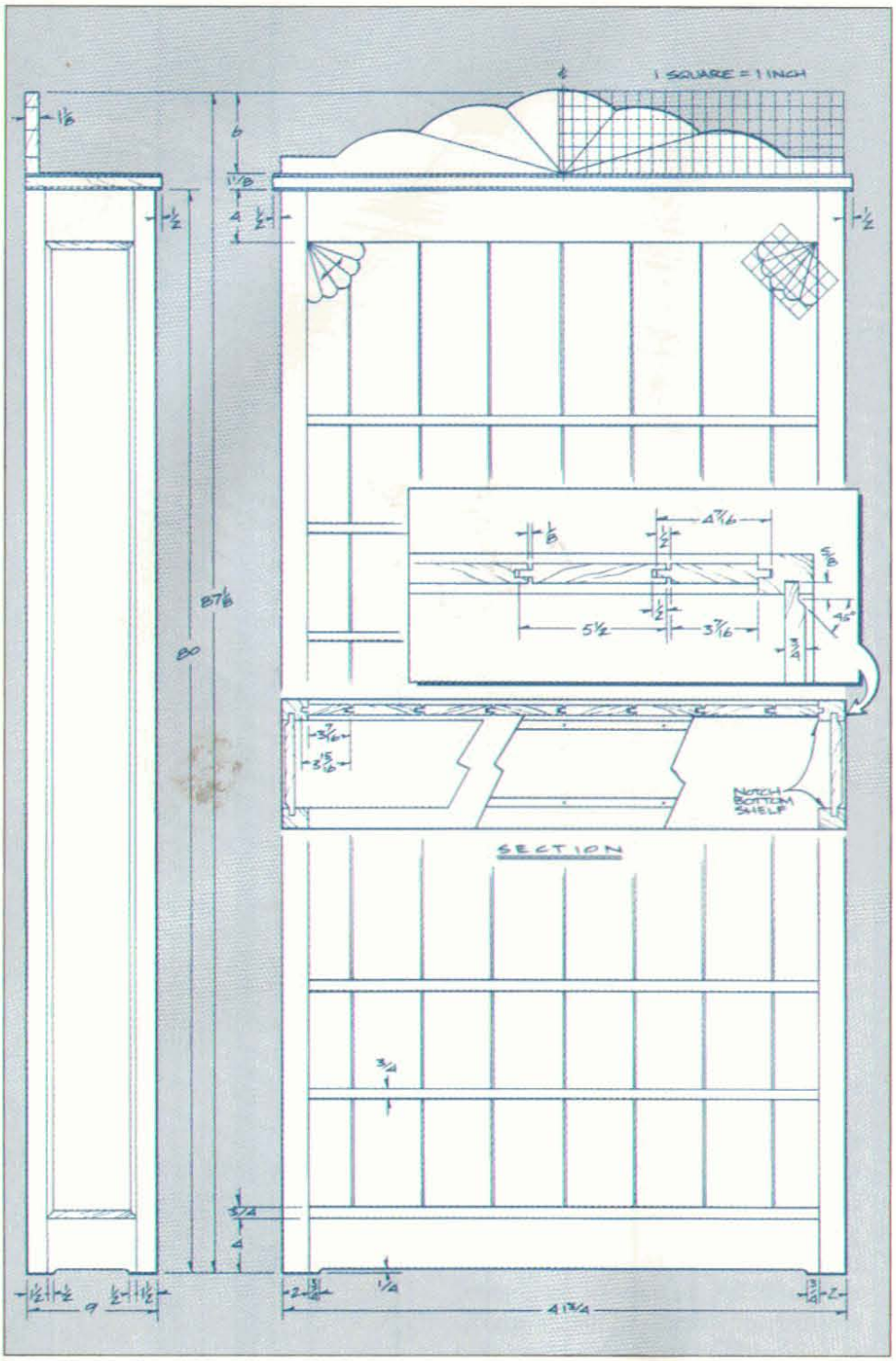
You'll need several different stock thicknesses for this piece. If you are buying rough board stock, the stiles (A), front and back rails (B) and side rails (C) are cut from 8/4 stock; the panels (D), back parts (E), bottom (G), shelves (H) and cleats (I) are cut from 4/4 stock, and the top (F), top fan (J), and corner fans (K) are cut from 5/4 stock. But if you don't have a thickness planer, or access to one, don't despair. The 1 1/2 in. thick stiles and rails can be obtained by laminating two thickness of 3/4 in. stock, and all the remaining parts can also be cut from 3/4 in. thick boards. No one will ever notice if you make the top, and the top and corner fans, 3/4 in. thick instead of the 1 1/8 in. thickness listed in the Bill of Materials.

By the way, whatever way you prefer to buy your stock, keep in mind that you'll save some time if you use 1 by 6 tongue-and-groove pine boards for the back. You can use the tongue-and-groove boards just as they are for the six centermost back boards, simply cutting them to length and tenoning the ends. However, for the two outermost back boards, you'll need to cut the outside edge off each board, and then establish a tongue, as shown in the Section Detail, in addition to tenoning the ends.

A Bit of Basic Joinery

Stiles & Rails: The structure of the Cimarron is basically just a pair of frame-and-panel subassemblies, joined by front and back rails. As the exploded view and the joinery details show, the four stiles are nearly identical, the exception being that the two back stiles also have a 1/4 in. wide by 1/2 in. deep groove, to accept the tongue on the outside edges of the two outermost back boards.

The 1/2 in. wide by 1/2 in. deep groove in the stiles for the side rails and panel is



easily cut with the table saw and a dado head. The same table saw setup can be used to establish the panel groove in the side rails. Use the same rip fence setting for the mortises in the stiles to accept the front and back rails, but raise the height of the dado head to 3/4 in. and clamp a stopblock on the rip fence, 3 1/2 in. from the front most point of the dado head, as shown in Fig. 1 (pg. 63). The stopblock will limit the cut to 3 1/2 in., which will clear out most of the mortise, though you'll still need some chisel work to chop out the mortise end square.

To establish the 1/4 in. wide groove for the back boards, you'll need to change the dado head width to 1/4 in., relocate the rip fence so the cut is centered across the 1 1/2 in. stock thickness, and lower the dado head height to 1/2 in. Note that this 1/4 in. wide by 1/2 in. deep groove is cut in both the two back stiles and in the two back rails. Naturally, when cutting the tongues and grooves on the back boards, you'll also need to establish the 1/4 in. thick by 1/2 in. long tenons on the top and bottom ends of all the back parts.

Once you've cut all the mortises, established the corresponding tenons on the rail ends, and cut the tongues, grooves and tenons on the back boards, all your joinery work for this project is complete. But one detail still remains—making a 1/4 in. deep relief cut into the bottom edge of the lower rails, so the cimarron rests on four points (this makes it less likely to rock on uneven floors). The relief cut is easily made with a 1/2 in. straight-cutter, using the router and a straight edge. Clamp the straightedge to the rail so the centerpoint of the 1/2 in. diameter bit is flush with the edge of the rail, then just start and stop your cuts 3/4 in. from the tenon shoulders on the front rails and 1/2 in. from the tenon shoulders on the side rails.

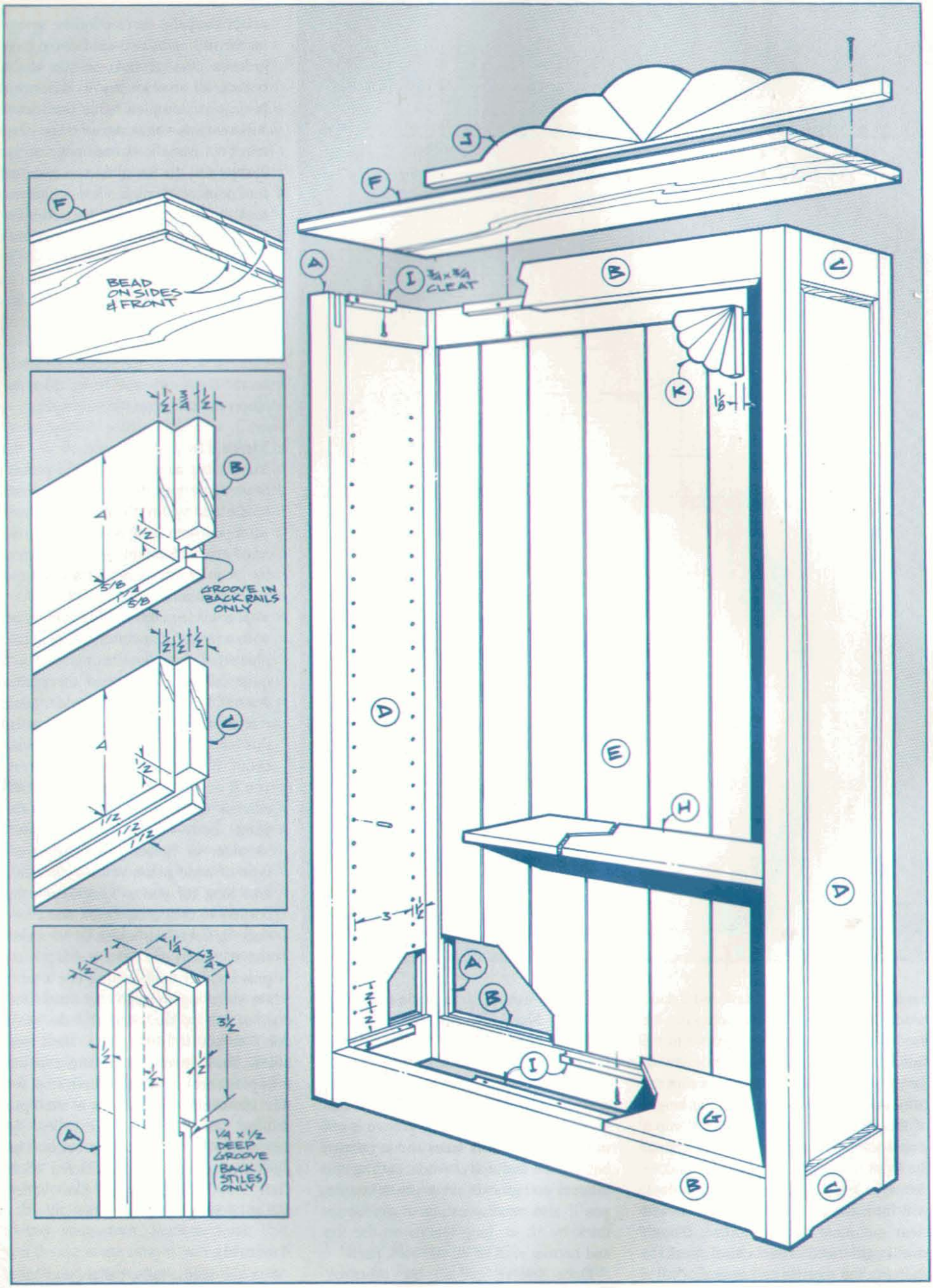
Make The Panels

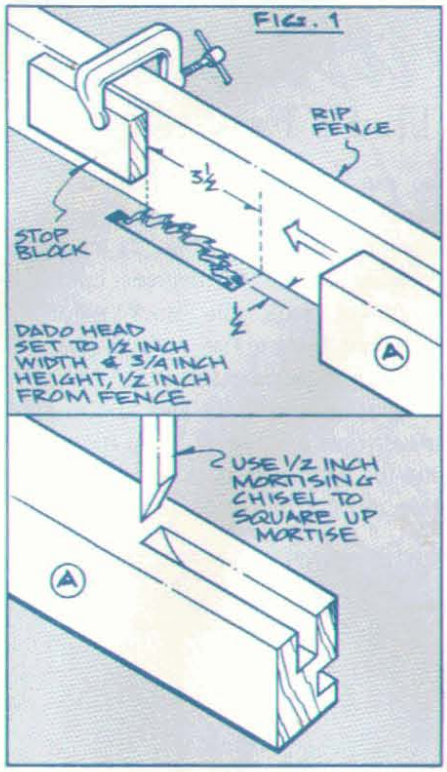
You'll also need to make the panels. Start by cutting the panels to overall length and width, then use the router equipped with a rabbeting bit and an edge guide to establish a 1/4 in. deep by 5/8 in. wide rabbet all around the panel perimeter.

The 45 degree bevel is cut by hand with a plane. You can use your block plane for this, but the plane won't quite cut all the way to the rabbet bottom, so a small shoulder will remain at the bevel edge. Actually, this shoulder is an attractive little detail. If you want to cut a full bevel, you'll need a plane with a blade that extends out flush to the edge of the plane body—such as a bullnose, shoulder or rabbet plane. Whatever type of hand plane you use, it won't take long for you to knock back the corners to create the bevel, and every once in a while it's nice to see those shavings curl out from a sharp hand plane, rather than gritting one's teeth while suffering through the whine and dust of the router. And, by the way, don't forget to drill those shelf peg holes. You'll need a template and the drill press, set up with the depth stop, for this. However, if you do a lot of shelf pin drilling, Veritas makes an excellent jig that simplifies the whole process. The jig is available from either Garrett Wade (Tel. 1-800-221-2942) or Lee Valley (Tel. 613-596-0350).

Assembly

With the stiles, rails, panels and back


F
BEAD ON SIDES & FRONT
B
GROOVE IN BACK RAILS ONLY
C
A
1/2
3/4
5/8
1 1/2
3 1/2
1/4 x 1/2 DEEP GROOVE (BACK STILES ONLY)
J
I 3/4 x 3/4 CLEAT
K
1 1/8
D
E
H
3
G



boards cut, you can assemble the case. First make the two frame-and-panel subassemblies, each consisting of a front and back stile, a pair of end rails, and a panel. Dry assemble each frame and panel first, to check for fit. As a practical matter, it's always a good idea to trim your tenons back so they are just a bit shorter than the depth of the mortise into which they must fit. This allows a little space for the excess glue, and insures that the tenon shoulders on the rails will fit snugly to the stiles. Check that each frame and panel is square before setting it aside to dry.

Once the two frame and panel subassemblies are out of clamps, you can join them with the front and back rails and add the back boards. Glue and clamp the two front rails and the bottom back rail, then fit the back boards into place, and finally add the top back rail. Run a bead of glue into the groove in the back stiles that accepts the corresponding tongue on the outermost back boards, but don't use glue on any of the remaining back boards. Later on, we'll space these boards out and anchor them with brads. For now, just make certain the boards are all in place. Check that the entire assembly is square by measuring point-to-point across the diagonals (the measurements should be identical).

While you are waiting for the case to dry, space out the back boards so they are about 1/8 in. apart, then drill for and insert a small brad through the back rails (both top and bottom) and into the centerpoint of the 1/4 in. tenon on the ends of each back board. These brads will anchor the back boards and maintain their proper spacing, regardless of any dimensional changes that may occur as the wood responds to changes in humidity.

Bill of Materials
(all dimensions actual)

Part	Description	Size	No. Req'd.
A	Stile	1½ x 2 x 80	4
B	Front/Back Rail	1½ x 4 x 39¼*	4
C	Side Rail	1½ x 4 x 7*	4
D	Panel	¾ x 6¾ x 72⅞**	2
E	Back	¾ x 5½ x 72⅞**	8
F	Top	1⅛ x 9½ x 42¾	1
G	Bottom	¾ x 7⅞ x 39¾	1
H	Shelf	¾ x 6 x 39¾	6
I	Cleat	¾ x ¾	15 ft.
J	Top Fan	1⅛ x 6 x 41¾	1
K	Corner Fan	1⅛ x 4½ x 6	2

* Length includes tenon(s).
** Panel is sized ¼ in. less in width, and back and panel are sized ⅛ in. less in length than actual groove-to-groove measurements, to allow for wood movement. Back boards are 1 by 6 tongue-and-groove pine; note that the two outermost back parts are cut narrower.

Add The Top, Bottom and Shelves

The top is just a board, cut to length and width, with a bead cut on the top and bottom edges of the front and ends (see detail). The easiest way to make this bead is with your table saw molding head, which should include a 3-bead cutter in the standard set. Set the saw up so that all but one bead is buried in a high auxiliary molding-head fence. You can also make the bead with a router equipped with an edge beading bit, (available from MLCS, tel. 1-800-533-9298) or by hand with a beading plane. Whether you use the table saw, the router, or the hand plane, just be sure to make the cuts on the ends of the top *before* you make the cuts on the edges. This is standard practice with all edge molding work, and minimizes any tear-out that your end-grain cuts produce.

The bottom and shelves are both cut to the same length, but the bottom width is sized so that it fits flush against the back and even with the front. This means that the bottom must be notched at the corners to fit around the stiles. The notch at the back corners is ⅜ in. by 1 in.; the notch at the front corners is 1½ in. by 1 in. You may need several tries before the bottom will slip into place. Note that a series of ¾ in. by ¾ in. cleats are used to secure both the top and bottom.

We show six shelves, but make as many as your needs dictate. Although you can simply use dowel pins to support the shelves, with bookshelves (which typically must support considerable weight) a system of metal shelf pins that fit into sleeves that are permanently mounted in the holes is a far superior, better-looking and stronger option. Both Garrett Wade and Lee Valley carry these pins and sleeves.

Decorative Details

All that's left is to make the top and corner fans. There are many ways to accomplish this, but the simplest is to start with a board that's 6 in. by 41¾ in. for the top fan, and a board that's about 6 in. by 20 in. for the two corner fans. The oversize source board for the two corner fans makes it easier to work on these parts. Lay out a 1 in. grid pattern on both boards, then using our pattern as a guide, mark the fan profiles and lay out the rays. Note that the grid pattern on the corner fans is aligned with their grain direction. Laying out the corner fans so their grain direction runs diagonally across the corner gives these parts equal glue strength on both glued surfaces. Now, using a straight edge as a guide, take a sharp knife (a utility knife is ideal) and make a pair of cuts to lift out a V-shaped chip. Cut the outside profile of the fans, sand to gently round the sharp edges of the V-cut rays and the cutout profile, then glue and clamp the fans in place. As the photo shows, the two corner fans are located so they're flush with the bookcase front.

Finish

A bookcase usually needs a good, durable finish, such as lacquer or polyurethane. Penetrating oil finishes are fine for hardwoods, but with softer woods—such as the pine you probably used for this piece—a hard, protective surface finish is a big asset. Pine that isn't well protected nearly always seems to end up looking beat, since every little knock or scuff leaves its mark. WWJ

Hammered Dulcimer

A Classic Instrument That's Easy to Build

There's something magical about using your woodworking skills to create something that does more than just hang on a wall or sit on the floor. If you build a musical instrument, when that instrument is played, your woodworking expertise vicariously becomes a source of joy and sharing, not only for the one playing the instrument, but also for all the listeners.

This handsome hammered dulcimer, by Connecticut woodworker David Moretti, is an ideal first instrument. It is very easy to build, since all the joints are just butted and glued. And to make the project even more trouble-free, we've arranged for a kit company to put together a parts kit (See Kit Source) that includes everything you need—except the wood.

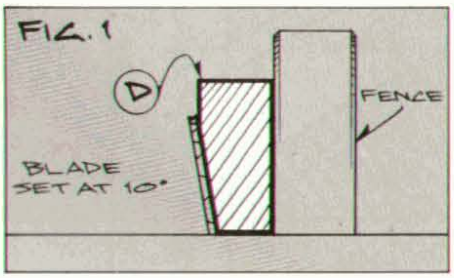
The instrument shown is made primarily of cherry and maple. But don't feel bound by the woods we used. Your own stockpile will no doubt yield something equally pretty.

Make The Box

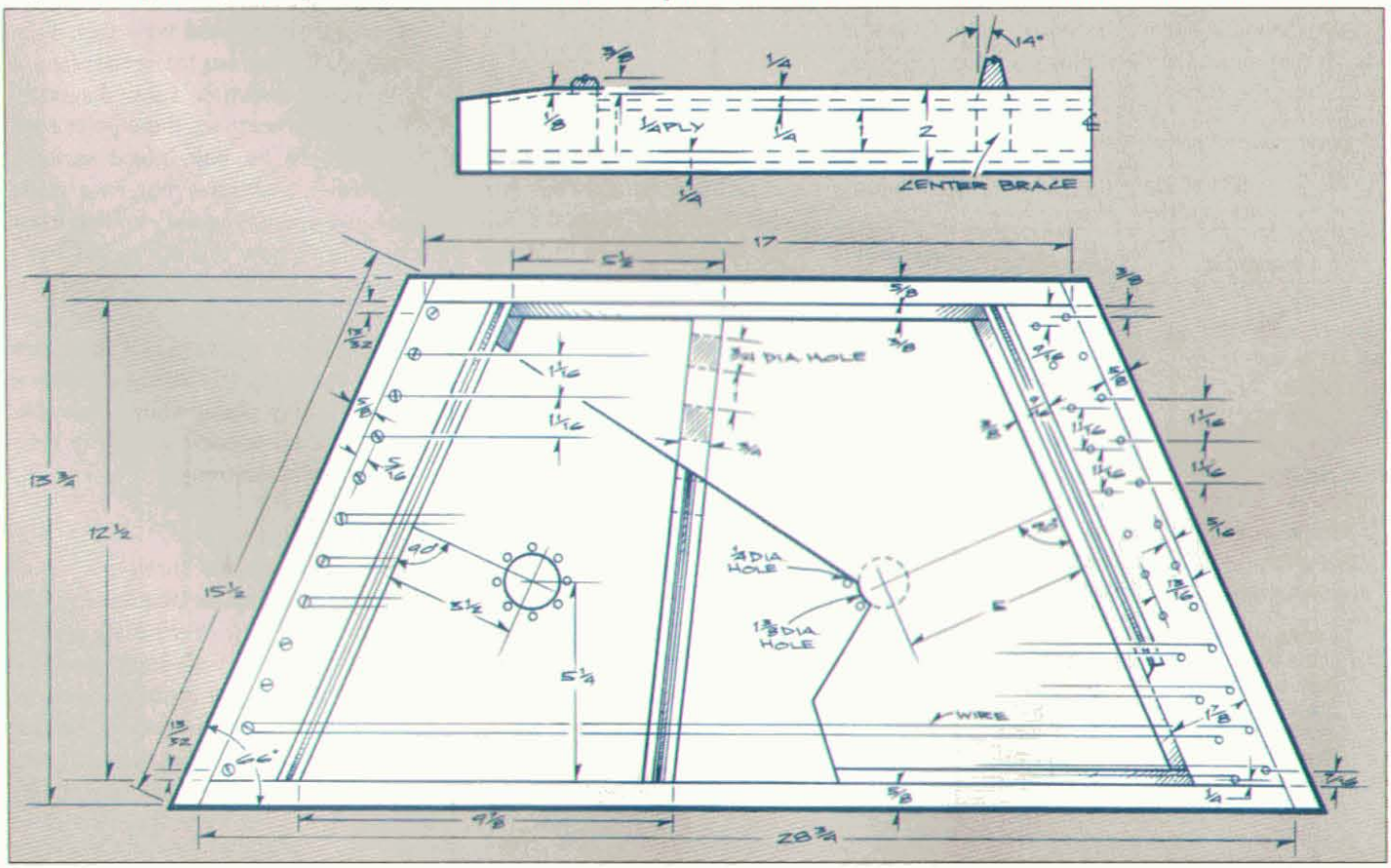
If you were puzzling through on your own, trying to figure out how to make the box assembly—consisting primarily of the front (A), back (B), ends (C), pin blocks (D), ledger strips (E), bottom (F) and soundboard (G)—you might be stumped. After all, where angles other than 90 degrees are involved, it's nearly impossible to just cut all the parts to exact final length and expect everything to fit together perfectly. However, we've worked out a very simple system that will insure your instrument assembly goes together as effortlessly as ours did.

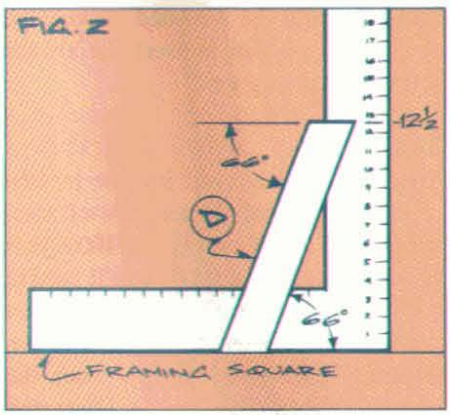
Start by getting out stock for the front, back, ends, and pin blocks. Cut all the stock to thickness and width, establish the 1/4 in. wide by 1/4 in. deep groove in the front, back, and ends (note that this groove is stopped on both ends) for the plywood bottom, but make all your length cuts oversize (except for the front), as indicated in the Bill of Materials. Now, with the pin block stock on edge, tilt your table saw blade over 10 degrees from vertical, and as shown in Fig. 1, establish the bevels. Next, establish the 66 degree angle on the bottom ends of the two pin blocks. Then with the pin blocks on end, and using a framing square to check the measurement (as shown in Fig. 2) trim the opposite end at 66 degrees until the height of each pin block piece as measured from a flat surface (such as your saw table) is exactly 12 1/2 in.

Next, as shown in Fig. 3, insert a spacer (just a scrap of 1/4 in. plywood) into the bottom grooves in the ends, and glue the pin blocks to the end pieces.

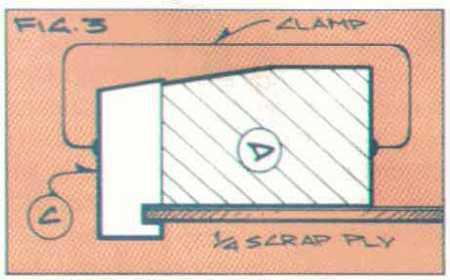


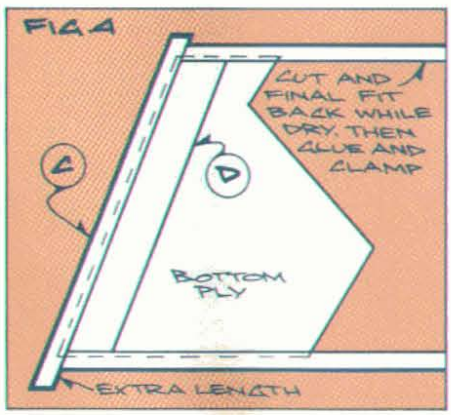
The spacer in the bottom groove will keep the pin block registered properly across the width of the end, and the extra length provided for on each of the end parts assures that there's sufficient stock overhanging to accommodate the front and back, which will be added next.



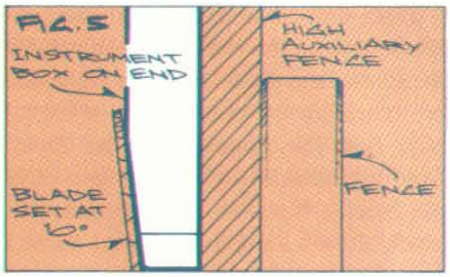


Cut the length of the front to exactly 28¾ in. (point-to-point from the 66 degree end cuts), cut the bottom to size, then dry assemble the front and the pair of end/pin block subassemblies around the bottom, so you can cut and final fit the length of the back (Fig. 4). The way to fit the back is to cut it a bit long at first, and then just make trimming cuts until the fit is perfect. If everything fits as intended (and it should) add glue, clamp the whole assembly, and set aside to dry.





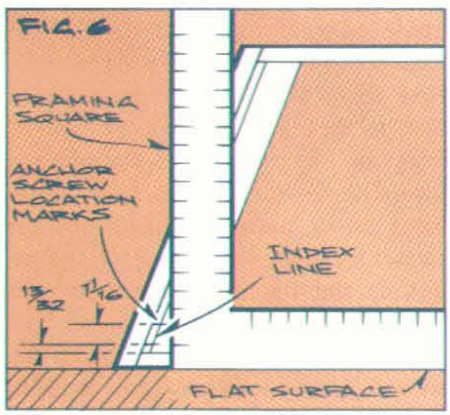
Once the glue has dried, you can trim and sand the extra stock on the ends overhanging the front and back. Then, using the same 10 degree blade angle setting that you used to cut the bevels on the pin blocks, establish the matching bevels on the ends of the instrument box (Fig 5). A high auxiliary rip fence comes in handy for an operation like this, where you are advancing a large assembly on end and need maximum stability.



Filling In The Pieces

With your box complete, the remaining work is all just cutting and fitting. Rip sufficient stock to yield the ledger strips, then cut and glue them around the inside of the box. The purpose of these ledger strips is to create a ledge for the soundboard to rest on. The soundboard is not glued in place, but rather is held tight to the ledger strips by the presure of the strings on the center bridge.

Although fine instrument soundboards were traditionally made of quartersawn Sitka spruce or—more recently—quartersawn redwood, quartersawn stock in a width of 12½ in. is just about impossible to obtain without edge-gluing several narrower boards. We've arranged for Folkcraft Instruments (see Kit Sources) to offer a soundboard kit that includes two separate Sitka spruce boards, which you then edge-glue to yield the required width. If you prefer, any good-quality ¼ in. thick hardwood plywood, such as oak, walnut, birch or cherry, will serve as well, though no doubt those with a tuned ear will notice the tonal difference.



Cut the soundboard to size and locate and bore the sound holes in it, as shown. Also, bore the various holes in the pin blocks for the tuning pins (O) and string anchor screws (P). The locations of the screw and pin holes are shown on the overhead view. The easiest way to mark

for these holes is to draw a series of indexing lines.

First, draw a single line on each pin block, one on the left side pin block for the screws and the other on the right side pin block for the outside row of tuning pins. Both these lines should be 5/16 in. from the outside edge of the respective pin blocks. Next, on the right side pin block, draw a second line for the second row of tuning pins, locating this line 13/16 in. from the edge of the pin block—or 1/2 in. from the first line.

Now that you've made the index lines for the anchor screws and tuning pins, you can mark their actual locations. The easiest way to do this is with your framing square. Butt the front of the hammered dulcimer up against a flat surface (such as your saw's rip fence), lay the framing square on the top of the instrument (with the bottom leg of the framing square also butted tight against the rip fence) and make an initial mark on the pin block, 13/32 in. up from the inside edge of the front. This is the location of the first anchor screw hole. Now move the framing square over a little to the right, measure up 1 1/16 in. from the 13/32 in. mark, and make a second scribe mark at the point where the 1 1/16 in. measurement crosses the screw location index line. Continue moving the framing square over and measuring up 1 1/16 in. from each last scribed screw hole point, until all the anchor screw locations are marked. Now, move the square to the tuning pin side of the instrument and repeat the same general procedure (using the measurements given on the overhead view) to mark the tuning pin locations. Then drill for the screws and tuning pins. A drill press is recommended for drilling these holes. Test fit the screws and tuning pins, then back them out.

Next, cut and fit the brace (H). This is just a length of 3/4 in. by 1 in. stock, cut to fit inside the instrument, and positioned under where the center bridge (J) will be. Drill a series of 3/4 in. diameter holes through the brace (to allow resonance throughout the chamber), then cut, fit and glue the brace in place.

Now cut and fit the remaining parts—the center bridge and the two side bridges. Note that the bridge parts all have a V-groove, which is easily cut on the router table using a V-groove bit. The bit height setting should be only about 1/16 in.—just enough to cut a groove deep enough to hold the brass rods (Q) and the Delrin rod (R), which fit on the side and center bridges, respectively. The side bridges are glued in place, but the center bridge and soundboard are held in place only with the string tension.The center bridge must be free to move since fine tuning the instrument requires that this bridge be located exactly, with the final position really dependent on the tuner's ear. By the way, if you're wondering what Delrin is, it's a type of plastic. On the center bridge, the Delrin rod is a better choice than brass (for tonal quality).

All that remains of the actual construction is to make the hammers (yep, that's why it's called a hammered dulcimer) and glue the four felt feet (S) in place. The wooden hammers (K), which are used to strike the strings, can be band or scroll-sawed from 3/8 in. thick stock. Then glue the leather hammer pads (T) in place on the hammers. The leather pads are included in your hardware kit.

Bill of Materials
(all dimensions actual)

Part	Description	Size	No. Req'd.
	Wood		
A	Front	5/8 x 2 x 28 3/4	1
B	Back	5/8 x 2 x 17	1
C	End	5/8 x 2 x 15 1/2*	2
D	Pin Block	1 3/8 x 1 7/8*	2
E	Ledger Strip	3/8 x 1**	about 6 ft.
F	Bottom	1/4 x 13 x 29**	1
G	Soundboard	1/4 x 12 1/2 x 24** ***	1
H	Brace	3/4 x 1 x 11 7/8**	1
I	Side Bridge	3/8 x 9/16 x 14**	2
J	Center Bridge	3/4 x 1 x 12 5/8**	1
K	Hammer	See Full-Size Pattern	2
	Hardware* **		
L	Steel String	18/1000 thickness	25 ft.
M	Steel String	20/1000 thickness	15 ft.
N	Steel String	22/1000 thickness	18 ft.
O	Tuning Pin	As Shown	24
P	Anchor Screw	No. 8 x 1 in. long	12
Q	Brass Rod	1/8 x 14**	2
R	Delrin Rod	1/8 x 12 5/8**	1
S	Felt Foot	3/8 dia.	4
T	Leather Pad	3/8 x 2	2

* Width of end parts is before bevel is established on instrument ends. Starting length of ends should be at least 16 in. Extra is trimmed and sanded after assembly. Starting length of back should be about 17 1/2 in.; then trim to final length as needed to fit a test dry assembly of ends, pin blocks and back. Rough starting length of pin blocks is 16 in.

** Lengths of ledger strips, brace, side bridges and center bridge are cut to fit based on assembled box. Soundboard and bottom panel are also cut to fit. Lengths of brass rods and Delrin rod are cut to fit the side and center bridges, respectively.

*** These items (parts L through T) are all included in a hardware kit (see Kit Sources). Soundboard also available as a kit (see Kit Sources).

Kit Sources

Hardware kit (including all parts L through T) is available from Aspen Kits, 6 Hilltop Drive, Old Saybrook, CT 06475; tel. (203) 388-6179. Specify Hammered Dulcimer Hardware Kit; Cost is $30 postpaid; checks or money orders only (Canadian orders add $3 per order). For a tuning wrench, add $6 to your order.

Soundboard Kit includes two top-quality quartersawn Sitka spruce boards. You edge-glue to yield panel large enough for hammered dulcimer soundboard. Order from Folkcraft, Box 807, Winsted, CT 06098; Tel. (203) 379-9857. Cost is $35 postpaid; please specify Woodworker's Journal Hammered Dulcimer soundboard kit.

The Finish

Our hammered dulcimer has a lacquer finish, which is ideal for instruments such as this, since it affords a measure of protection while allowing the beauty of the wood to show through. Obviously, the soundboard and the movable center bridge should be finished separately. Once dry, you can reinsert the anchor screws and tuning pins.

Tuning

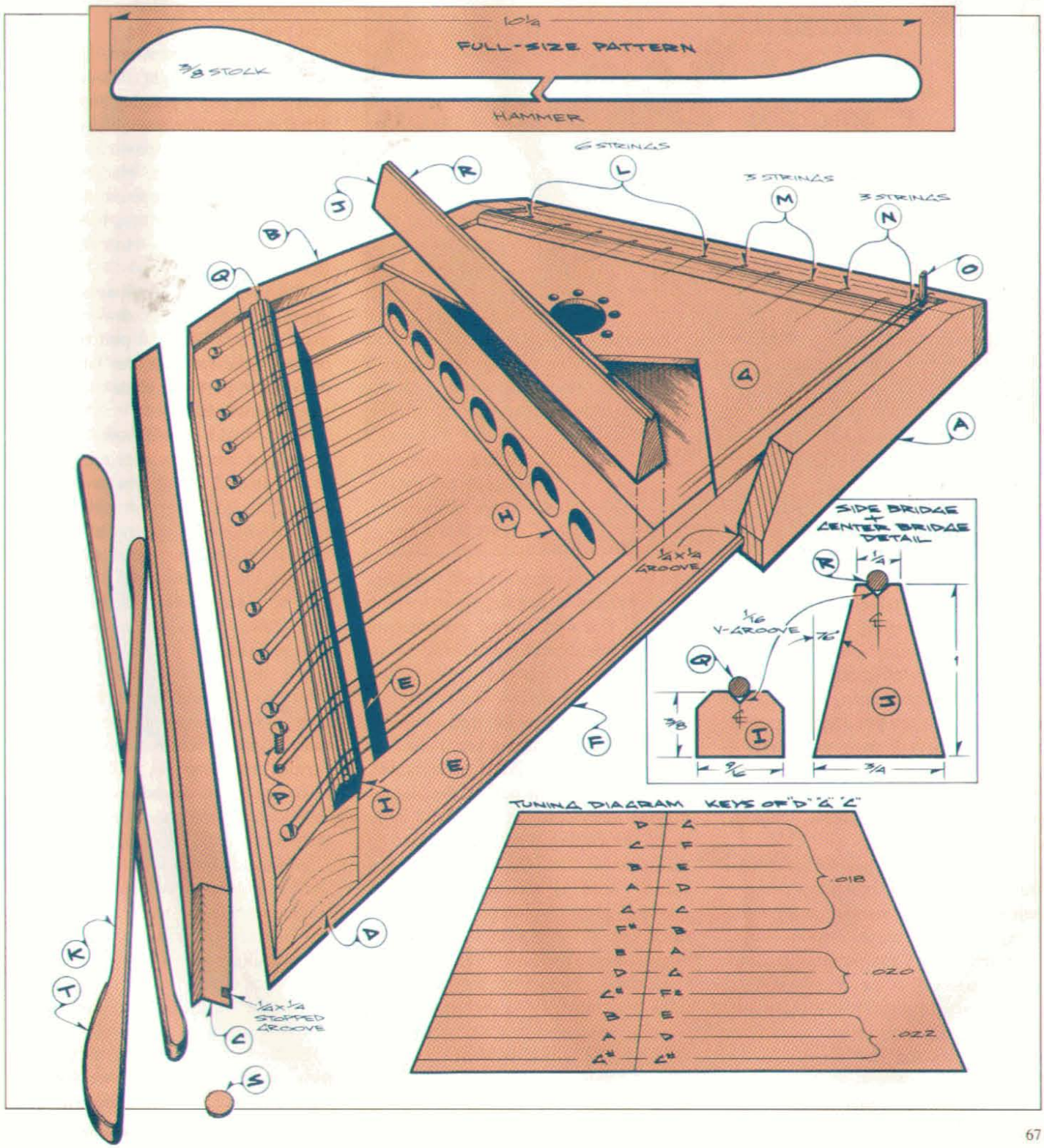
Your hardware kit will include lengths of three different thicknesses of steel strings—18/1000 (part L), 20/1000 (part M), and 22/1000 (part N). You'll need to cut six strings from the first, or thinnest string, three strings from the medium thickness, and three strings from the heaviest gauge (see Tuning Diagram). Once the strings are mounted, each separate length will actually be two strings, side-by-side, but for tuning purposes, these pairs are each treated as just a single note.

To mount the strings, first lay the brass and Delrin rods in place on their respective bridges and roughly locate the center bridge. As shown, all the strings are wrapped around the tuning pins so the pins must be turned clockwise to tighten the strings, with the strings then ending up at the top of all the tuning pins. For each individual string, insert the end of the string in the hole in the topmost of the two tuning pins that will anchor that string, wrap the string several times *counterclockwise* around that

pin, bring the string around the anchor screw, wrap it several times *clockwise* around the bottom most of the pair of tuning pins, clip the string for length, and insert the end through that tuning pin hole. You can now turn this bottom most tuning pin several times *clockwise* to tighten the string. Repeat this procedure for the remaining strings.

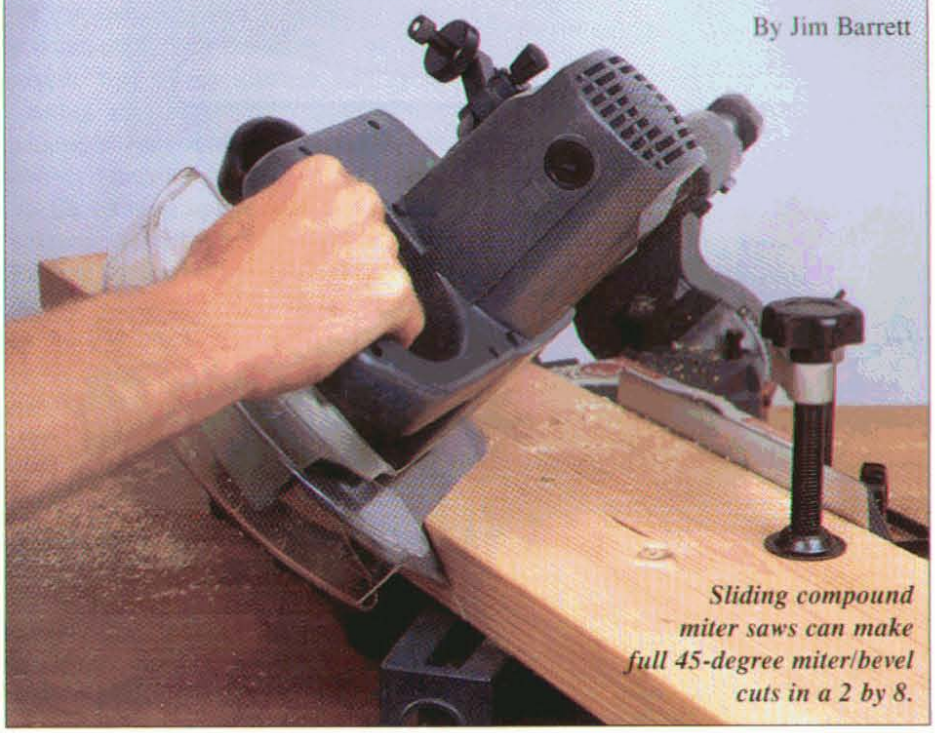
Tune your instrument to the scale shown on the Tuning Diagram. A regular adjustable wrench can be used to both mount and adjust the pins, but with an instrument that has so many tuning pins, you'll soon appreciate the ease of use that a dedicated tuning wrench provides. It's just a few dollars additional over the hardware kit cost (see Kit Sources). Locating the center bridge to just the right spot is a matter of trial and error; gently tap it one way or the other until the setting is perfect.

If you'd like to know more about playing the hammered dulcimer, there are several excellent books available on the subject. We recommend three books, *Striking Out and Winning*, by Lucille Reilly, *The Hammered Dulcimer Instruction Book*, by Phil Mason, and *Tunes For the Hammered Dulcimer*, by Linda Lowe Thompson. All three of these books also include instructions on tuning your hammered dulcimer. For prices and additional information—including a list of audio tapes that are available with several of the books—write or call Musicmaker's Kits, 423 South Main St., Stillwater, MN 55082; Tel. 1-800-432-5487.



SLIDING COMPOUND MITER SAWS: ARE THEY BETTER THAN A RADIAL-ARM SAW?

By Jim Barrett



Sliding compound miter saws can make full 45-degree miter/bevel cuts in a 2 by 8.

While many woodworkers rely on the table saw for most of their cutting chores, most of these machines simply aren't designed to crosscut very efficiently. And, who wants to waste time changing setups on the table saw when you switch between the two most common procedures—ripping and crosscutting? It's even more of a hassle to switch over if you have the saw set up with a dado blade, tenoning jig, or similar fixture.

For these reasons, woodworkers have usually relied on a radial-arm saw as their second power saw for cutoff work, from simple crosscuts to miters to compound cuts. Then, power miter saws (or "chop saws" as they're called in the trades), started appearing in many woodworker's shops, even though they were initially marketed for on-site house framing and molding work. These lightweight benchtop tools could make quick, accurate crosscuts from 0 degrees to 45 degrees in moldings and framing lumber. The next logical development was the compound miter saw, which could make compound (miter/bevel) cuts in these materials. Both saws are basically nothing more than a blade/motor assembly (cutting head) attached to a rotating table insert or turntable, which is set into the base of the tool for making miter cuts. On compound miter saws, the cutting head can be tilted to make bevel cuts. On both types, the cutting head is attached to a short pivoting arm that drops the circular blade into the workpiece in a chopping motion, hence the name "chop saw."

However, compared to radial-arm saws and table saws, the crosscutting capacity of chop saws and compound miter saws is limited by their maximum blade diameter: For example, most 10 in. saws won't make 90 degree cuts in anything much larger than a 2 by 6, nor 45 degree cuts in anything larger than a 2 by 4. Several companies offer saws with larger diameter blades, but, from a practical standpoint, you can't continue to increase blade diameter, and motor size, without sacrificing portability and cost. The tool simply becomes too large and heavy, and the blades alone would cost you an arm and a leg.

Well, several years ago, some tool designer got the bright idea that if you attached the saw's pivoting cutting head to a sliding carriage assembly, you could increase the saw's crosscut capacity without increasing the blade diameter. Enter, the sliding compound miter saw. At the time of this writing, four companies have these tools—Hitachi, Makita, Ryobi, and Sears.

The photos on these pages provide clues as to how these saws work: To make the cut, you first pull the raised blade to the front of the table, chop down, then push the blade through the stock, front to back.

Why would you choose a sliding compound miter saw over a radial-arm saw? After all, radial-arm saws can do everything a sliding compound miter saw can, plus rip. And, radial saws can be fitted with a variety of accessories, such as sanding disks and drums, dado cutters, shaper cutters, molding heads, jigsaw attachments, and a host of other nifty gadgets.

The answer is, because radial-arm saws share the same basic drawback as a table saw—you have to spend valuable time switching setups to execute these various procedures. So, while radial-arm saws are often touted as "do-it-all" saws, most woodworkers end up using them for crosscutting only.

While radial-arm saws do give you a few more inches crosscut capacity than a sliding miter saw, most are relatively large, expensive, stationary machines; the saw, along with it's large table takes up a good deal of shop space. In my experience, many of these saws also require continual fussing with various adjustment screws in order to maintain their cutting accuracy. After working with a variety of radial-arm saws over

the years, I'll admit that I had to get used to the chop/push action of a sliding compound miter saw. Once I did, however, I found these saws to be much quicker and easier to set up and use, especially for making compound cuts. And, after you're through using the saw, you can lift it off the bench and store it out of the way.

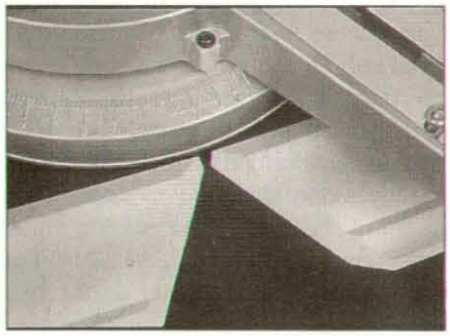
Features To Look For

Cutting Capacity: There's not much difference between the four saws here: all have a 12 in. crosscut capacity at 90 degrees; and roughly $8\frac{1}{2}$ to $8\frac{5}{8}$ in. at 45 degrees (see chart). The 10 in. Makita and $8\frac{1}{2}$ in. Ryobi have the same depth of cut at 90 degrees; the Ryobi has $\frac{3}{8}$ in. more depth of cut at a 45-degree bevel, despite it's smaller blade. The Sears has about $2\frac{1}{2}$ in. depth of cut at 90 degrees; $1\frac{3}{4}$ in. at 45 degrees; the Hitachi about $\frac{1}{16}$ in. more depth at each angle.

Cutting Performance: All of these saws made clean, precise cuts straight out of their shipping boxes, with the factory-supplied blades (initial adjustments are made at the factory). However, all have adjustment screws or bolts for squaring the blade to the fence and table, which you should check before operating the saw. All had plenty of power, easily slicing through the fir 2 by 8's I used for my tests.

What impressed me most were the sturdy, well-machined sliding carriages on these saws: the Hitachi, Ryobi and Sears have twin-rail carriages mounted above the table; the Makita has a single sliding rail mounted beneath the table.

Although the carriage on the Makita looks as though it might be less stable than the others, it isn't: all of these carriage assemblies worked smoothly, with absolutely no detectable slop or side-play. The only inherent drawback I could see in these designs is that the sliding rods require periodic lubrication with machine oil, which attracts sawdust like a magnet. So, you have to clean the rods frequently to keep them operating smoothly. Ryobi has partially solved the problem by covering the carriage rods with a dust shroud.



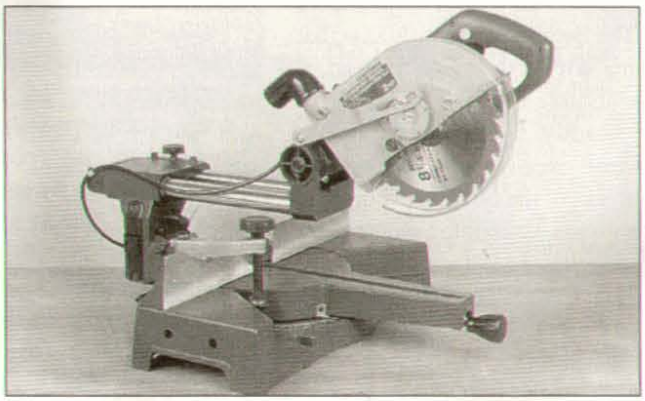
Hitachi (shown), Delta, and Ryobi include positive miter stops for cutting standard crown molding.

Miter/Bevel Adjustments: Each of the saws are designed a bit differently in regard to the location of the miter and bevel lock knobs. On the Hitachi, Ryobi, and Sears saws you lock the miter turntable by means of an easily accessible twist knob attached to the front of the table; on the Makita the table lock knob is located on the right side of the fence. On the Makita, Hitachi and Sears, the entire carriage assembly tilts to make bevel cuts; these have a bevel-lock lever

Hitachi C 8FB

Makita LS1011

Ryobi TSS-220



Sears 23488

(and bevel scale) at the back of the saw where the carriage attaches to the turntable. Of the three rear-mounted levers, the large one on the Makita is the easiest to access and operate. To make bevel cuts on the Ryobi, you tilt the cutting head only: it's attached to a trunnion on the front of the carriage assembly; this arrangement puts the bevel lock lever and scale toward the front of the saw, readily accessible to the operator.

Other Features: The sliding miter saws reviewed for this article have all of the modern features found on the best conventional compound miter saws: electric blade brake, spindle lock button (for one-wrench blade changing), locking trigger switch, and retractable lower blade guard. All have a spring-loaded pin that locks the cutting head in the "down" position to facilitate transport, as well as locking knobs to prevent the carriage from sliding back and forth when you carry the saw. The carriage lock is also used to keep the cutting head stationary when doing "chop cuts" in narrower stock and for any other cuts where the sliding action isn't required. The Hitachi and Ryobi have convenient carrying handles. Another feature I liked on the Makita is it's long, "full-grip" trigger switch, (the long trigger can be comfortably squeezed with the entire hand) and top-mounted switch lock button. I noticed this right off because I'm left-handed. (On the other saws, the switch lock is located on the left side of the handle, opposite the switch—you lefties know what I'm talking about.)

Accessories include side-mounted material supports/stop blocks for repetitive cuts (optional on all machines), and hold-down clamps (standard on the Makita and Sears; optional on the Hitachi and Ryobi). In my book, the hold-down clamps are a vital safety feature when working with short pieces of stock. The Sears was the only saw that didn't come with a dust bag; instead, it has an adjustable 90 degree elbow to direct the sawdust away from the operator (or toward over-curious bystanders). Another aspect of the Sears that could be a plus or a minus, depending on how you use the saw: it's heavy cast-iron base provides extra stability when cutting large stock, but adds considerable weight to the tool (see chart). The other saws have lightweight aluminum bases.

Specifications: Sliding

Make	Model	Blade Dia. (in.)	Arbor	No-load Speed (rpm)	Amps @ 120V	Crosscut Capacity[1] (inches) 90°	45°	45° x 45°	Depth of Cut[2] (inches) 90°	45°
Delta[5]	33-060	6 1/2	5/8	5,500	12	12	9 1/2	9 1/2	1 3/4	1 5/8
Hitachi	C 8FB	8 1/2	5/8	4,900	9.5	12	8 5/8	8 21/32	2 9/16	1 25/32
Makita	LS1011	10	5/8	4,600	12	12	8 15/32	8 15/32	2 15/16	1 9/16
Ryobi	TSS-220	8 1/2	5/8	4,500	10	12	8 11/16	8 11/16	2 15/16	1 15/16
Sears	23488	8 1/4	5/8	5,000	10	12	8 5/8	8 5/8	2 1/2	1 3/4

[1] 90° = crosscut; 45° = miter; 45 x 45° = compound cut (miter/bevel)
[2] 90° = square cut; 45° = bevel cut
[3] W = width of saw base, end-to-end (without table/fence extensions). D = Maximum depth of saw, front-to-back, with sliding carriage fully extended at rear of saw; H = overall height with cutting head in "down" position.

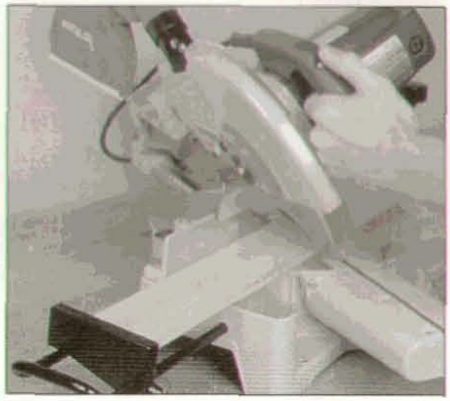
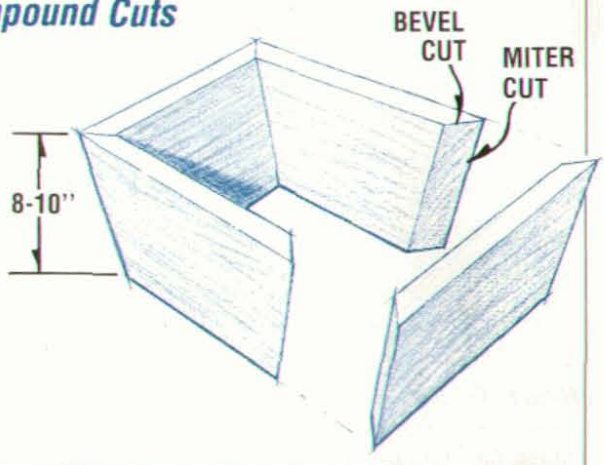


Table extention/material stop is optional feature on these saws.

Full-grip trigger switch and top-mounted switch lock on the Makita is convenient; designed for left-or right-hand use.

A Few Notes On Compound Cuts



Simply defined, a compound cut is a combined miter (angle cut across the width of the workpiece) and bevel (angle cut through the face or thickness of the workpiece). Setting up a compound cut is tricky because the miter and bevel angles are interrelated, that is, when you change the miter angle, you must also change the corresponding bevel angle, and vice versa. Once you figure out the correct angles (practice on scrap material first!), repetitive cuts are a cinch to make on a compound miter saw. The tapered box shown here is one example of the type of project that a sliding compound miter saw (remember that these saws have a larger crosscut capacity than conventional compound miter saws) is perfect for.

You'll note in the tool chart that the Delta Sidekick, Hitachi and Ryobi have positive miter stops at 31.5 or 31.6 degrees, left and right. If you've done much finish carpentry, you probably know what these stops are used for: making compound cuts in standard 38 degree/52 degree crown molding. While the Sears and Makita have no miter stops at these positions, the letters "CM" are marked on both the miter and bevel scales of the Sears to indicate both required settings (31.6 miter, 33.8 bevel, left and right). If you're a bit confused at this point, don't worry: the owner's manuals for all the saws provide clear instructions on how to cut inside and outside corners for standard crown moldings.

Compound Miter Saws

Max. Miter (Left/Right)	Positive Miter Stops	Overall Dimensions[3] (W x D x H)(in.)	Table Ext.[4]	Net Weight (lbs.)	List Price[5]	Street Price[5]
45°L, R	0,22.5,31.62,45° L, R	26 3/4 x 30 1/2 x 14 3/4	O	42.0	$499	$399
45°L, 57°R	0,15,22.5,31.6,35.3,45°L,R	20 11/16 x 38 x 17 17/32	O	37.4	$921	$459
45°L, 57°R	0,15,22.5,30,45°L, R	20 x 29 5/16 x 20 3/4	O	34.8	$870	$460
52°L, 57°R	0,15,22.5,31.5,45° L,R	20 7/8 x 34 x 14	O	44.1	$966	$499
47°L, 50°R	0,15,22.5,30,45° L, R	20 1/2 x 38 x 15 1/4	O	71.0	—	$420

[4] O = optional accessory
[5] List price = Manufacturer's suggested list price; Street price = actual or average selling price
[6] Not a "true" sliding compound miter saw; see sidebar below.

Material hold-down clamp comes standard on Sears (shown) and Makita; is optional feature on other saws, a must for clamping short workpieces.

Hitachi (shown) and Ryobi saws have carrying handles: large knob at right of photo locks cutter head in "down" position; bolt and wing nut (below handle) is a cut depth-stop control.

Sources

Delta International Machinery Corp.
246 Alpha Drive
Pittsburgh, PA 15238
Tel. (412) 963-2425

Hitachi Power Tools, U.S.A. Ltd.
4487-E Park Dr.
Norcross, GA 30093
Tel. (404) 925-1774

Makita
14930-C Noartham St.
La Mirada, CA 90638-5753
Tel. (714) 522-8088

Ryobi America Corp.
1424 Pearman Dairy Rd.
Anderson, SC 29625
Tel. 1-800-323-4615

Sears
Sears Tower
Chicago, IL 60684
Tel. 1-800-366-3000

Delta Sidekick: A Different Approach

While sliding compound miter saws have been on the market only a few years, the basic concept isn't new. You may be familiar with the venerable Delta "Sawbuck" Frame and Trim Saw, a unique beast that marries the portability of a compound miter saw with the cutting capacity of a radial-arm saw. The cutting head slides on a twin-rail carriage supported at the front and back of a rotating turntable. Like a sliding compound miter saw, the entire carriage tilts to make bevel cuts, and the turntable rotates 45 degrees left and right, to make miter cuts. Unlike a sliding compound miter saw, which you "chop and push" to make the cut, you pull the blade through the work from behind the fence, like a radial-arm saw.

While not a conventional sliding compound miter saw, the Delta Sidekick Frame and Trim Saw (model 33-060) makes all the same cuts.

While the Sawbuck isn't nearly as compact as a sliding miter saw (the overall length of the base is 52 in.) optional folding legs and wheels set on one end of the base make it portable. However, as I was writing this article, Delta had just introduced their mini version of the Sawbuck, dubbed the Sidekick Frame and Trim Saw (model 33-060). It works just like the Sawbuck, so it's not a "typical" sliding compound miter saw. But, it does make the same type of cuts and has similar cutting capacities as the other sliding miter saws in this article (see chart above). It's also about the same size and weight as the others, making it a true benchtop machine.

While the Sidekick has the smallest blade of the lot (6 1/2 in.), it offers the same crosscut capacity as the others (12 in. at 90 degrees), and about an inch more miter capacity at 45 degrees, due to a longer carriage. The small blade has a limited cutting depth (about 1 in. less than the other sliding saws; it won't cut anything much thicker than nominal 2-by stock).

The Delta has several neat features, one is a large, easy-to-read miter scale with positive miter stops (including crown molding angles). Another is a slotted leg set that fits neatly over a pair of sawhorses. It's the only saw I tested that has a scale (in inches) and a built-in stop block on the fence. It has an articulated leaf-type blade guard: you squeeze the bail handle to lift the guard out of the way for easy visibility when aligning the blade to the stock. There's even a label on the base that shows illustrated instructions for cutting crown moldings.

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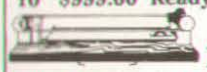

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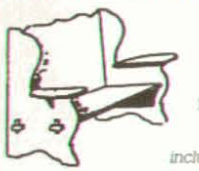

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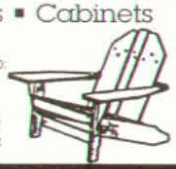

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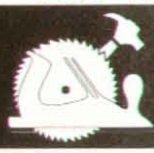

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Next Issue...

The coming of Spring needn't mark the passing of the woodworking season—if you've got some fabulous summertime project plans to work on. The sawdust has really been flying here in our shop lately as we work to complete what we're sure will be two very popular pieces—the handsome **Redwood Garden Arbor/Trellis** (you can build it with or without the seat) and the charming **Kid's Adirondack Set.** But our upcoming March/April issue offers much more than irresistible outdoorsy projects. It's also got a classic **Granddaughter's Clock**, a handy **Fold-up Drying Rack**, a folksy **Display Box**, and a **Super Tenon Jig**, plus several more project plans.

Add to all this a great lineup of features—including a must-read how-to article on building boxes and a revealing look at electric motor maintenance that could save you big bucks—and we're sure you'll find our March/April issue is just the ticket to quickly rekindle your spring woodworking fever.