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Better Homes and Gardens WOOD

This issue's cover wood grain: White (slippery) elm

APRIL 1988

ISSUE NO. 22

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April 1988 • Vol. 5, No. 2 • Issue No. 22

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**THE EDITOR’S ANGLE**

**NOT EXACTLY NOAH’S ARK... BUT ONE BIG WOODWORKING PROJECT**

Ever since I’ve known Design Editor Jim Downing, I’ve been impressed by his ability to get things done. So I wasn’t surprised when our resident sailor announced a few months back that he was going to build a 30’ sailboat.

It’s been interesting watching him set about accomplishing his goal. First, there were scale drawings of various hull styles on his walls, then section views, then drawings of the interior space, and even a scale model.

After the design phase, Jim decided he wanted to focus his efforts on building the deck, cabin, and interior rather than the hull. A quick call to a fiberglass hull manufacturer in Florida set that part of the project into motion. While the hull was being manufactured, Jim purchased all the makings for a 6-ton, 25’ trailer and built it from scratch.

And since a guy has to have a place to work — especially when he’s undertaking a 2,000-hour project — Jim called on his carpentry skills to “add on” to his single-car garage. To keep the roofline at a standard height and to make it easier to climb in and out of the hull, Jim and his brother, Hal, rented a backhoe and dug a 4x5x24’ pit. Then, they picked up the hull, with a little help from a crane, and lowered it into a cradle Jim had built. He’s now got an 11x56’ all-weather workshop.

It’s been about 6 months since Jim came up with his boat-building idea, and he hasn’t cut one board for the boat yet. But, boy, is he ever ready. I am betting the results will be spectacular. Is all this effort and ingenuity going to pay off? Jim figures he’ll have $30,000 invested in a boat that should be worth $75,000 when it’s finished. That $20 per hour! Gee, I hope he doesn’t take up boat building full time. 🚣

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**Larry Clayton**

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**CARBIDE TIPPED ROUTER BITS**

**PROFESSIONAL PRODUCTION QUALITY**

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RUBBER-BAND DRASTGER A HIT AT FAMILY CAMP

The Rubber-Band Drastrger on page 84 of the April 1987 issue made a very acceptable part of my craft program for a camp group we belong to. I made up several of them for my grandchildren prior to our annual weekend camp and found the rear axle with a nail unacceptable for young children. I substituted a \( \frac{3}{8} \) in \( \frac{3}{4} \) dowel for the rear axle. I carefully drilled a \( \frac{5}{8} \) in hole in the rear axle and glued in a \( \frac{3}{8} \) in \( \frac{3}{4} \) dowel for the pin.

At any rate, I made up 43 kits, put all the parts in plastic bags, and the "kids" from ages 4 to 7 in our family group had a ball painting them all combinations of colors and racing them all afternoon. Thanks for making approximately 65 kids happy.

—Roger D. Bowers, Cuyaboga Falls, Ohio

Roger, sounds like you belong to a fun group! Doweling is an alternative method. We recommended the brad because we felt a \( \frac{5}{8} \) in dowel would weaken the axle too much. In addition, we felt some of our readers would have difficulty accurately drilling the \( \frac{5}{8} \) in hole. On the same project, we also heard from a couple of readers who suggested an additional source of rubber bands for the rear wheels. The rubber bands some growers use to bundle broccoli may be just what you're looking for.

ABRASIVE MANUFACTURERS, NICE PEOPLE

From the "Know Your Woodworking Abrasives" article beginning on page 50 of the December 1987 issue, we have some additional names to add to the source list.

Belts and disks

- Econ-Abrasives, P.O. Box 86501, Plano, TX 75086, 214/377-9779.
- Oxo Abrasives Inc., P.O. Box 690653, Houston, TX 77069, 713/537-2728.

Inflatable and flapper sanding devices

- Northwest Carving Supplies, P.O. Box 407, Manhat- tan, MT 59741; 406/284-6009.
- Sand-Rite Manufacturing Co., 321 N. Justine St., Chicago, IL 60607; 800-521-2318.

TALKING BACK
BRIGHT LIGHT AT THE END OF THE TRAIN TUNNEL

The train-tunnel bookends project on page 80 of the April 1987 issue calls for 14 pieces of ⅜" brass rod cut ⅜" long. The thought of sore fingers and inaccurate lengths was somewhat dismaying. My solution is a ⅜ x ⅜" piece of scrap pine with a table-saw kerf ⅜" deep as shown in the drawing at right. At a right angle to the kerf, I drilled a ¼" hole. When secured in a vise, the jig held the rod snugly while I cut the ⅜" pieces easily and accurately. You can apply this idea to cutting small-diameter rods of various lengths.

—Duane C. Hawk, Rush, N.Y.

PLAUDITS TO A TURNER

After reading your article "Secrets of a Production Turner," February 1986, I got a hold of Bert Thompson and went to Toronto, Ontario to study with him that same month. He is an extraordinary fellow. Bert has his own way of doing things, but he certainly changed my career path. I left knowing that I was going to be a woodturner, and be a good one.

Bert spent a week with me at my home last fall, helping me set up a 14' lathe bed. He did it just to see that I got started right. You might remind readers again that Bert wants to pass on his skills. Someday, that wise old teacher isn’t going to be around.

—Bob Neal, Quality Woodworking, Peoria, Ill.

Bob, thanks for those comments about our old friend, Canadian woodturner Bert Thompson. We saw him awhile back, too, and at a perky 72 years of age, he still seems to have one aim in life—to teach people to turn "the proper way." Bert’s address is Canadian School of Woodturning, 1069 Southdown Road, Mississauga, Ontario L5J 2Y1, Canada.

A CLOSER LOOK AT FILE CABINET DIMENSION

The Bill of Materials for the stackable file cabinet on page 75 of the February 1988 issue incorrectly lists the width of the bottom frame front and back pieces (F) as 2'. The pieces should be 1⅜" wide. If you’ve already cut the parts and assembled the bottom panel, just rip ⅜" off the front and back pieces. The finished length of the bottom frame and panel should be 23⅜". The change does not affect the drawer size. We apologize for any inconvenience this may have caused.
SOFT TOUCH WITH STAIN
Using a paintbrush to apply oil-based stains works well enough, but cleaning the brushes afterward takes time and wastes paint thinner.
TIP: Use scraps of foam rubber as stain applicators. You can buy leftovers at crafts stores for pennies and cut pieces to just the size and shape to fit the staining job. The foam rubber reaches into corners and cracks while your hands stay clean. When finished staining, simply discard the applicator.
—Thornton H. Waite, Idaho Falls, Idaho

ALIGNED RIGHT THE FIRST TIME
When crosscutting with a table saw, it’s not always easy to line up the stock with the blade so the saw kerf occurs precisely on your cutting mark. Positioning the material against the miter gauge may take two or three tries before you get it right.
TIP: Mark the location and thickness of the saw-blade cut or kerf on a piece of masking tape placed a few inches in front of the blade. To do this, lay a straightedge along one side of the blade to mark the tape. Or, clamp a piece of stock to the miter gauge, cut the stock, and use the cut end as a guide for marking the tape. Repeat these steps on the opposite side of the blade to mark the other side of the kerf. Use the marks on the tape to line up stock for first-time accurate cuts.
—Dennis Bennett, Kirtland AFB, N.M.

WHEN DUST GETS IN YOUR EYES
You can get lost in a cloud of dust when working with an orbital or belt sander. The dust obscures your work, to say nothing of restricting comfortable breathing.
TIP: Blow those troubles away with a small, nonoscillating household fan placed 3 or 4 feet away from the sander you’re using. The trick is to turn the fan to a low speed and place it at a right angle to your work and to remove the dust without raising a dust storm. In small shops, however, this may cause an airborne dust problem.
—from the WOOD magazine shop

QUICK FIX FOR LOOSE MITER-GAUGE BARS
It’s unnerving when the miter-gauge bar on your table saw or band saw rattles loosely in the slot. A loose bar also affects the accuracy of the cut. You should replace the bar. Here’s a temporary fix.
TIP: Use a center punch, as shown at right, to put well-spaced dimples in each side of the rail. This removes extra play until the metal raised by the punch wears away.
—Larry Bedaw, North Swanzey, N.H.

Do you have any good tips you’d like to share with our readers? We’ll pay you $25 for each submission we publish. No shop tips can be returned. Mail your tips to:
Shop Tips
Better Homes and Gardens®
WOOD® Magazine
Locust at 17th
Des Moines, IA 50336

Continued on page 14
Sometimes, the difference between a project and a masterpiece is having the proper guidance.

The Delta Unifence® Saw Guide gives you accuracy, versatility, and performance no other fence can match.

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TIPS FROM YOUR SHOP (AND OURS)
Continued from page 12

SLICK SOLUTION FOR RIBBED BAND-SAW TABLES
The grooves tooling into the table surface of some band saws can interfere with the movement of small wood pieces while you're sawing them. This lack of control not only poses a hazard to your fingers, but can botch the cutting job, too.

TIP: Attaching an overlay sheet of 1/4" clear acrylic plastic to the top of the table provides a slick work surface for cutting small pieces. Saw a kerf half-way into the acrylic sheet so it's aligned with all four table edges, as shown. Cut or notch an opening for the table-leveling screw, if necessary. Tape the sheet to the tabletop with small strips of double-faced tape.

—Bob Ward, Lakewood, Ohio

JAWS III
There's a good reason three-jawed Jacobs chucks used on portable electric drills, drill presses, and most lathes have three evenly spaced holes for inserting the chuck key.

TIP: When tightening the chuck, use the key in all three holes—not just one. This applies equally distributed pressure on the jaws, so bit and accessory shanks won't have as great a tendency to slip.

—John Seminoff, Crete, Ill.
THINK ALL C-CLAMPS ARE THE SAME? THINK AGAIN.

Not all C-Clamps are created equal. For a tradition of quality and performance, choose VISE-GRIP® Locking C-Clamps. Old-fashioned screw-type C-Clamps just don't compare with VISE-GRIP clamps. Unique self-leveling swivel pads protect work. They're easy to use, lock on quickly and provide a sure grip on any surface.

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TIPS FROM YOUR SHOP (AND OURS)

SUPER TRACING MATERIAL
Paper and cardboard patterns take a real beating when you trace them repeatedly onto the workpiece.

TIP: Use the original pattern as a master for making a working pattern out of matte acetate. This material looks frosty on its matte side, which has a texture that readily takes pencil marks. Use a slightly dull soft-lead pencil to trace the pattern onto the acetate. Now, tape one edge of the acetate sheet to the workpiece, and slip a piece of carbon paper under the pattern, as shown in the drawing below. Use a pencil or length of sharpened dowel to trace the image onto the workpiece.


HOW TO KEEP STOP BLOCKS IN THE CLEAR
Many woodworkers clamp a square block of wood to their saw or router table to serve as a stop for making repeated cuts. But the accumulation of sawdust and chips against the block results in inconsistent lengths.

TIP: Turn the block so that only a corner of it stops the movement of your workpieces. Waste particles will now blow to the side and back of block, leaving the front clear to precisely stop the cut.

—Richard Kandus, Arcata, Calif.
Just 3 of the 36 Reasons
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**TIPS FROM YOUR SHOP**

**OUT ON THE CUTTING EDGE**

While at your workbench, have you ever needed to cut a piece of
string, cord, or tape—and didn't have a knife or pair of scissors?

**TIP:** Add an integral string and
tape cutter to your bench: To one
edge of the benchtop, glue or tack
the serrated metal strip cut from
an empty box of aluminum foil
or plastic wrap. Position it with the
serrated edge level with the bench
surface, as shown, in a location
where you won't accidentally
bump into it. A used hacksaw blade
will also work, but isn't quite
as sharp.

—Wally King, Oakland, Calif.

---

**ZAP INSECT INVADERS**

"Surprise" insects in carving blocks and other small pieces
of wood can be unpleasant discoveries, particularly when a
finished piece turns out to be infested. There must be a chemi-
cal-free way to get rid of the bugs.

**TIP:** A quick shot in a kitchen
microwave oven will put all in-
truders out of business. Set the
oven on its lowest setting and
turn it on for 1 minute. The result-
ing molecular vibration, not the
heat, kills the bugs. To avoid splits
and checks, be careful that you
don't overheat the wood.

—John C. Monaghan, Goleta, Calif.
A "MITER FINE" CUTOFF FIXTURE

Most table-saw miter gauges have difficult-to-read scales. And more often than not, the setting is just an estimation of the true angle. Not so with the Dubby cutoff fixture. It has a large, easy-to-read Mylar angle scale and a long, sturdy backstop (fence) attached to a sliding platform, providing plenty of support for large workpieces. And, we've never seen a more accurate miter fixture than this one.

What makes the Dubby so accurate? The large, precise scale helps. But here's the secret: When you set up the Dubby, you reference the sliding table, fence, and angle guide to the saw blade, not to the miter slot in the table. We fitted the Dubby to an old Sears table saw with a reputation for inaccurate crosscuts and miters. The fixture enabled the saw to make exact cuts every time, even in wide boards.

The sliding table attaches to a guide bar, which rides in the miter slot on your saw table. When you order the fixture, specify your saw brand and model so the manufacturer can provide the right-sized guide bar and table.

We'd recommend the Dubby to anyone who is interested in doing careful, precision work. We did find that it takes some time for initial setup, which must be done carefully to ensure complete accuracy.

Dubby Cutoff Fixture, $130 p.p.d. from I-In-Line Industries, 661 S. Main St., Webster MA 01570.

LASER-CUT FILIGREE: FANCY!

Dress up furniture, frames, bookshelves, and other projects with these fancy filigree strips from Constantine's. The wood-cutting laser used to make this filigree cuts a precise, intricate pattern out of 1/4" two-faced maple plywood. Each of the 12 samples we ordered were of excellent quality, ready to be stained or painted.


[Continued on page 22]
CARVERS: A NEW WAY TO FIGURE IT OUT

Have you ever tried to carve an anatomically correct human figure, only to have it turn out like the Hunchback of Notre Dame? You could take a course in human figure drawing, but here's an easier way to put your carvings into proportion.

With this human-figure proportion wheel, you simply dial in the overall height of your carving and it automatically gives you the correct proportional dimensions for arms, legs, hands, feet, head, torso, and other body parts for males and females. Includes 2-page instruction pamphlet.

RIG YOUR ROUTER FOR MORTISES

Rig-A-Mortise, a simple, inexpensive router attachment, makes blind mortising a cinch. Here's how it works: The attachment consists of a plastic router base with two adjustable guide pins. You install a straight bit of the desired size, set the router for depth of cut, and then mark the length of the mortise you want on the stock. To center the bit on the stock, rotate the router base until the guide pins contact the sides of the workpiece. Then, turn on the router, lower it into the stock, and cut a perfectly centered mortise.

The set includes instructions for a simple jig that solves this problem shown in the photo at left; also for a jig that enables Rig-A-Mortise to cut tenons.

Rig-A-Mortise; $14.95 p/pd; hardware for mortise-and-tenon jigs 89 p/pd from Tool-Aid, 6950 Eric Lane, Wheatland, CA 95692.

PUT YOUR WORK WHERE YOU WANT IT

Carvers rely on multiposition workstands to position their work for carving, gluing, burning, sanding, and painting. Here's one at an affordable price. Made of die-cast, machined aluminum, the stand clamps to work surfaces up to 2" thick. With a base that swivels 360° and arm that pivots 180°, the workstand positions your workpiece at any angle with single-knob operation.

Multi-Position Work Stand; $24.95 p/pd, extra mounting plate $3.95 p/pd from Woodcraft Supply Corp., 41 Atlantic Ave., PO. Box 4000, Woburn, MA 01888.
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---

Unsatisfied with the factory-ground edge on his Sorby bowl gouges, professional woodturner Liam O'Neill of County Clare, Ireland, reground the gouges to a steeper, more acute angle. By doing this, Liam found the tools easier to use. His special grind angle increases the cutting area of the gouges, which does two things: The tools stay sharp longer, and are easier to control. (The steeper grind allows you to hold the tool at a more horizontal position.)

The acute-angled blade has another advantage: With it, you can finish-cut with the grain on the outside of a bowl where it narrows at the base near the faceplate; a conventional gouge would cut against the grain.

So we don't lead you astray, these tools aren't for the beginning woodturner. But they do make an excellent addition to a dedicated turner's arsenal. You can buy the gouges, autographed by O'Neill, with or without his custom-turned handles.

Sorby Bowl Gouges by Liam O'Neill: 1/4" gouge $38 (without handle), $52 with handle; 3/8" gouge $44, $62 with handle; 1/2" gouge $49, $72 with handle. Order ppd. from Harold Imber, 1005 Meadow Lane, Middletown, PA 17057.
Since the days of clipper ships and the spice trade, shipbuilders have cherished teak as seafaring wood for decks and trim. Yet, any sea story featuring teak pales before the remarkable tale of how this hardwood arrives in the hands of craftsmen.

For much of the world’s finest teak, the journey to market begins deep in a Southeast Asian rain forest. Workers girdle selected trees with a cut through the sapwood. Then, so that the dense and heavy green wood becomes dry enough to float, the trees die and season on the stump for up to three years.

When it’s time to log the trees, elephants play a major role. These great beasts, each able to move a four-ton teak log miles through the jungle to the river, still prove more practical than machinery in remote terrain.

At the river, too low to float logs except during the monsoons, the teak lies for months. When pouring rains finally fill the river, the logs become loosely knotted rafts and begin their float to a major port or city. Because of the seasonal river levels, the logs’ trip from the interior may take five years.

Wood identification
A native of the rain forest in Burma, Cambodia, India, Laos, Thailand, and Vietnam, teak (*Tectona grandis*) was transplanted to other countries by Dutch traders in the 18th and 19th centuries. Now teak grows throughout Indonesia and in Latin America.

After 200-300 years, teak trees growing in the wild reach heights of 100’ and diameters up to 12’. Teak grown on plantations (the Dutch started the practice) becomes taller, though smaller in diameter, but can be cut in as little as 60 years.

If teak’s size were not enough to distinguish it, teak’s leaves surely would. The largest and perhaps the roughest of any tree, teak leaves grow as large as 24 x 36” and natives use them as sandpaper.

Little of teak’s thinline layer, yellow sapwood reaches woodworkers.

Instead, traders and importers prefer the coarse-textured, golden-brown heartwood, often darkly streaked. Silica, which the growing tree extracts from the soil, makes the wood feel oily.

Working properties
Teak has all the properties a woodworker dreams of: rich color, strength of oak, resistance to water, chemicals, and insects, easy workability with all tools, and screw-holding power. However, silica in wood from younger trees dulls saw blades and makes gluing difficult. To assure adhesion, wash the wood with lacquer thinner.

Although teak sands well, it tends to clog abrasives. In finishing, avoid plastic-based products, such as polyurethane, that react adversely with silica. You’ll have best results with oil finishes and lacquer.

Uses in woodworking
Teak found fame in ships, boats, and Scandinavian-style furniture. However, you’ll like it in any project requiring a premier hardwood.

When used in outdoor furniture, teak takes abuse. It will not check or corrode fasteners, but it eventually will weather to a gray color. Sanding renews the color.

Cost and availability
Teak grading and pricing follow standards set by the Burmese a century ago. Unlike American hardwoods, teak’s price per board foot escalates with the width and length of the board. For example, 1” stock 8” wide may cost $7 per board foot while boards narrower than 5” sell for $1 or more less.

Expect to pay top dollar for teak-faced hardwood plywood. Veneers, however, remain moderately priced.

Even though most exotic hardwood dealers stock teak, watch the quality. The best teak to work (and the most expensive) comes from old-growth trees harvested in Burma or Thailand. Much of the silica will have decomposed in these old trees.

Illustration: Steve Schindler
Photograph: Bob Calmer
TRY YOUR HAND AT ONLAY

Use this exciting, wood-stingy technique to create original designs for tabletops, cabinet doors, cutting boards, artistic wall hangings, and more.

Have you ever admired the geometric beauty of a parquet floor—and wondered how you could apply the same idea to furniture or other woodworking projects? We've got the answer! Using our onlay technique, you can lay up panels of any size—in traditional parquet floor patterns or bold geometric designs of your own creation.

HERE'S HOW ONLAY WORKS
You start with boards from one or more species of wood, all the same thickness. (We've found that ¾"-thick stock works best for most projects.) Then, you rip them into ¾"-thick strips and crosscut them into the lengths needed to form your pattern. Next, you glue the pieces to a particleboard or plywood substrate with hot-melt glue.

To complete the onlaid panel, you trim it to finished size and add an edge band to cover the exposed edges. Then, fill the cracks with wood filler, sand, and apply the finish.

And what have you got when you're done? A smooth, continuous panel for a tabletop, cabinet, cutting board, bed headboard, or even a decorative wall hanging.

To illustrate this technique, we made a tabletop with a herringbone design. We also designed a base to support it. You'll find the dimensions for the top and instructions for building the base on page 34. Or, you may want to try the onlay vase project on page 33.

CUTTING THE ONLAY PIECES

Note: No matter what size onlay pieces you've chosen, the boards from which you cut them must all be exactly the same thickness. Otherwise, you'll end up with pieces of slightly different widths. This will result in irregular gaps between the pieces when you glue them to the substrate. Plane the boards, if necessary, to ensure uniformity in thickness.

Ripping the Onlay Strips
If you're starting with long boards, it's easier to rip your onlay strips from them if you first crosscut the boards into manageable lengths for ripping. To make best use of material, cut the boards into multiples of the lengths of your onlay pieces, plus 1" for waste. (For the herringbone tabletop, we cut two 8" oak boards into 26" lengths.)

Now, joint one edge of each board, and rip the boards into ¼" strips as shown in the photo below.

To cut the strips, we used our table saw, equipped with a sharp, carbide-tipped blade. If you're using scrap pieces too short to rip safely on a table saw, we recommend doing it on a band saw. To get the straightest cut possible, use the widest bandsaw blade you have and plane the edge every 4 or 5 cuts.

For uniformity in thickness, rip all the strips you need (plus about 5% extra for waste) at the same time. If you have to come back later and reset the fence to rip additional strips, they may not come out at exactly the same thickness.

Crosscutting the Pieces
Now, crosscut the pieces to finished length. To ensure pieces of uniform length, clamp a stop block to the fence on your radial arm saw or table-saw miter gauge, as shown in the photo below. Check each piece for defects that may not have been apparent before ripping the board. Discard any defective pieces.

On the table saw, position the fence ¼" from the blade, and rip stock into ¼" thick strips, using a push stick for safety.

To cut pieces to identical lengths, clamp a stop to the fence of your radial arm saw or power miter saw.
HOW TO LAY OUT YOUR DESIGN

The design you choose determines not only the size of the onlay pieces you’ll need but also the sequence in which you glue the pieces to the substrate. For most designs, you'll start laying the pieces at the intersection of centerlines marked on the substrate, and then work outward to the edges.

These drawings show the starting layout sequence for four designs, including the herringbone pattern for our tabletop on page 34 and the southwestern Indian design in the photo on the opposite page.

CUTTING THE SUBSTRATE

Mark and cut a piece of particleboard or plywood 1" to 3" larger in each dimension than the finished size of your panel. The larger the panel, the bigger the margin you need to leave. (For the herringbone tabletop, we cut a piece 36x74".) Now, use a chalkline to bisect the substrate in both directions, forming the centerlines for your pattern layout. (Note that the sunburst design above also requires diagonal layout lines.)
TRY YOUR HAND AT ONLAY

clamp the pieces. And, it's much faster and easier to use than messy contact cements or expoxies.

After a lot of testing, we decided to use a Black & Decker yellow hot-melt glue because the glue has a long working time. (See the Buying Guide on page 32.)

Apply a wavy bead of hot-melt glue to the back side of the first piece. Keep the bead slightly in from the edges to prevent the glue from squeezing out from underneath the piece when you press it against the substrate (see the photo below). If some glue does squeeze out, clean it off with a chisel before adhering the next piece.

Immediately after you've applied the glue bead, press the piece down on the substrate into its final position. (We found that, once applied, the glue sets up in 10 to 15 seconds, so you have to work fast!) Hold it firmly in place for about 4 seconds. Then, glue down the remaining pieces in the same manner, following your pattern sequence. Photos 1, 2, and 3 show the sequence in which we glued down the strips for the herringbone tabletop.

Note: When you glue down the first two or three onlay pieces, you must align them precisely—with the centerlines and to each other. If they're slightly crooked or off-center, they'll throw off the rest of the pattern. For the herringbone design, we clamped a framing square to the substrate to align the first two pieces 45° to the centerline, as shown in photo 1, above right.

No matter how carefully you've cut your pieces, a few of them probably will end up a bit too wide, too short, or too long. Or, you may glue down a piece slightly crooked. If you've accidentally glued down an ill-fitting piece, you can pop it off the substrate with a chisel and substitute another one.

Sometimes, cracks between the last few pieces you laid will make the next one too wide, as shown in the photo below center. If you can't remove the problem-causing pieces, plane one edge of the next piece to be fitted, as shown in the photo below right. Check its fit against the rest of the glued-up pieces before gluing it into place.

ONLAY SEQUENCE FOR OUR HERRINGBONE

The following sequence works for all herringbone patterns. Our herringbone tabletop uses ¼ x ¼ x 5” pieces. Be sure you've read the preceding sections on cutting and gluing the onlay pieces before following these instructions.

First, clamp a framing square 45° to your centerline, where shown on the herringbone pattern layout drawing on page 29. Glue the first two pieces on the substrate where shown in photo 1, at right.

Now, using the first two pieces as guides, lay an initial path two strips wide. Work back from the center until you reach the end of the substrate facing you. Then, go back and
CUT THE PANEL TO FINISHED SIZE
After you've glued down all the pieces, belt-sand the entire surface with 80-grit sandpaper. Then, on the top surface, mark the finished size of your panel, minus the width of the edge band or trim. With a square, transfer the marks to the edges of the panel, as shown in the photo below. Then, flip the panel upside down, and transfer the lines to the bottom side.

Now, cut the panel to finished size, using a portable circular saw equipped with a sharp carbide-tipped blade. For each cut, align the saw blade with the marked line, and clamp a straightedge to the workpiece to serve as a guide. See the photo below.

ATTACH THE EDGE BAND
Most onlay projects will need an edge band or trim piece to cover the exposed edges of the particleboard or plywood substrate and the onlay pieces. If you're building the herringbone tabletop, see page 35 for edge-band and spline dimensions.

With a router and slot-cutting bit, rout matching spline grooves in the band and panel edges as shown on the drawing below. Cut the splines to size. Use woodworker's glue and pipe or bar clamps to spline-join the band to the panel. Later, remove the clamps and belt-sand the panel with 100-grit sandpaper.

Mark the panel's finished size, then transfer the marks to the back side.

Clamp a straightedge to the workpiece, and cut the top to finished size.

Note: When laying the pieces in the direction of the arrow formed by the herringbone pattern, you'll need a straightedge to keep them aligned. We used a wood block slightly thicker than the pieces, as shown in photo 2.

After you've glued down the center path, clamp a square to one side, where shown in photo 3. Now, lay a single row of pieces on one side of the center path until you reach the other end. Continue laying single rows on both sides of the center path until you've covered the entire surface of the panel.

ASSEMBLED SECTION VIEW
TRY YOUR HAND AT ONLAY

SAND, FILL, AND FINISH

If you've used all one species of wood, we suggest filling the cracks between the onlay strips with FIX pigmented wood filler after the initial belt-sanding. Force the wood filler into the cracks with a putty knife, as shown in the photo at right, and let it dry. Belt-sand the entire surface with 100-grit paper, followed by 150-grit paper. Finally, finish-sand with a palm sander and 220-grit paper.

When filling cracks between two different wood species, such as the padouk and maple panel shown in the photos below right, we found that a mixture of woodworker's glue and sawdust makes a better wood filler than commercially available ones. Here's how to use the "glue and sawdust" method for filling cracks:

Start by belt-sanding the entire surface with 80-grit, then 100-grit sandpaper. Now, fill the cracks with woodworker's glue. A needle-nosed glue dispenser works well for this. Force the glue into the cracks with a plastic putty knife, as shown in the photo at right. (Don't use a steel putty knife. We found that woodworker's glue reacts with the steel in the knife, causing the glue to discolor.) Use a damp rag to remove excess glue and to force the remainder farther into the cracks.

Before the glue dries, equip a palm sander with 100-grit paper, and sand the pieces to raise a small amount of fine sawdust. With the palm sander still running, force the sawdust into the cracks with the front or back edge of the pad, as shown in the photo far right.

Try not to fill cracks between two pieces of light wood with sawdust from a darker piece. To avoid this problem, use a belt sander to make a small amount of sawdust from the lighter wood. Collect the sawdust, force it into the cracks by hand, and sand the cracks smooth with the palm sander and 100-grit paper. Finish-sand the entire surface with 150-, 220-, and 320-grit paper.

Finally, with the surface sanded smooth, apply the finish of your choice. For tabletops, cabinet doors, and other high-wear surfaces, we recommend two coats of polyurethane sanding sealer, followed by several coats of clear polyurethane. Use 0000 steel wool between initial coats and 600-grit wet/dry sandpaper between finish coats.

For cutting boards, finish with vegetable or mineral oil, or a commercially available salad-bowl finish, such as Behlen's.

BUYING GUIDE

- Black & Decker yellow hot-melt glue for wood. Available at Black & Decker dealers nationwide. Our source: Craft Woods, 10921 York Rd., Hunt Valley, MD 21030. Package of 24 4" sticks (cat. no. 112-0020) $6.95 ppd.

Produced by Jim Barrett and Marlen Kemmet
Photographs: Bob Calmer, Bill Hopkins
Illustrations: Bill Zaan

WOOD MAGAZINE  APRIL 1988
ALL-OCCASION ONLAY VASE

Its design is southwestern, but, sleek lines and good looks allow this vase to fit in with most any setting.

Note: Read the Onlay Technique article starting on page 28 for details on laying up a decorative surface like the one we used on the front and back of the vase.

CUT THE VASE SIDES AND THE ONLAY STRIPS

1 Cut the sides (A, B) to the size listed in the Bill of Materials from 3/4"-thick maple stock.

2 Rip 3/8"-thick onlay strips (C, D, E, F) to size plus 1" in length. Miter-cut strips C and E to length. Miter-cut one end of strips D and F.

APPLY THE ONLAY STRIPS AND FORM THE VASE

1 Mark centerlines on one face of the front and back (B). Mark the lengthwise center on the walnut strips. Apply a wavy bead of hot-melt adhesive to one walnut strip, and glue it to the front piece, aligning the centerlines where shown on the drawing at left.

2 Adhere the other walnut strip (C), the maple strips (D), paduk strips (E), and finally the maple strips (F) to obtain the design shown in the Front View Drawing. Repeat for the back panel.

3 Trim the protruding ends of parts D and F flush with the ends of the substrate. If the onlay strips don’t end up even with the edges of the substrate, joint or rip them flush. Remember, if you decrease the width of one onlay panel, you must do the same with the other panel.

Continued on page 77

Bill of Materials

<table>
<thead>
<tr>
<th>Part</th>
<th>Finished Size*</th>
<th>Material</th>
<th>Qty.</th>
</tr>
</thead>
<tbody>
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<td>A</td>
<td>3/4&quot;</td>
<td>4 1/2&quot;</td>
<td>22 1/2&quot;maple</td>
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<td>3/4&quot;</td>
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<td>4 1/2&quot;walnut</td>
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*Parts marked with an * are cut larger initially, and then miter-cut to finished length. Please read the instructions before cutting.

Supplies: hot-melt adhesive, 0000 steel wool, polyurethane.
WE BUILT THIS BEAUTY FOR UNDER $150

FORMING THE FOUR LEGS
1 Rip and crosscut 12 pieces of 1¼"-thick oak stock to 3½" x 29" for the legs (D). With the edges and ends flush, glue and clamp three pieces together face-to-face for each of the four table legs.
2 After the glue dries, scrape off the squeeze-out, plane one laminated edge smooth, and rip the opposite edge for a 3¾" finished width. Now, crosscut ¼" off one end of each leg for a square end. Set a stop, and cut the opposite end so each leg measures 28¾" long.
3 Using a rule and straightedge, measure and mark the saw-cut layout lines on all four faces of one leg where dimensioned on the Leg Drawing on the opposite page.
4 Follow the instructions on Cutting the Leg Tapers Drawing to cut each leg. If you don’t have a taper jig, refer to our shop-built jig on page 45 of the August 1987 issue of WOOD, or see the Buying Guide.
5 Sand the saw marks off each tapered surface. Sand a round-over on the bottom edges of each leg.

MAKING THE APRON RAILS AND ASSEMBLING THE BASE
1 Cut the side rails (E) and end rails (F) to the sizes stated in the Bill of Materials. Cut four corner blocks (G) to size. (We cut a piece of 1¾"-thick oak to 3" wide by 30" long. Then, we bevel-cut each corner block to 7" length from the long strip on the table saw.)
2 Following the steps on the drawing titled Joining the Rails and Legs, join the apron rails (E, F) to the legs with the corner blocks and hanger bolts.
3 Measure the opening, and cut two support rails (H) to size. Cut eight 1¾"-square cleats 3¾" long. Glue the cleats (one on each side) to the ends of the rails. Later, glue the support rails between the long apron rails (E) where dimensioned on the Exploded-View Drawing.
4 Place the tabletop facedown on a workbench or saw horses. Position the base (also upside down) on top of the tabletop. Center the base on the top, and then lightly clamp the base to the tabletop.
5 Using chair-leg braces, secure the base to the tabletop (see the Section Detail accompanying the Exploded-View Drawing for hole and screw sizes). We used four braces along each side and three across each end.

SANDING AND FINISHING
1 With the table still facedown, sand a round-over on the bottom edges of the apron rails and on the corners of the legs. Finish-sand the legs and apron rails. Turn the assembled table right side up, and finish-sand the tabletop and edges.
2 Apply the stain of your choice. Apply polyurethane sanding sealer to the assembly. Follow with several coats of clear polyurethane.

Price a high-quality oak table in any furniture showroom. You could probably buy a good table saw for less money. But, using our lumber-saving onlay technique for the top and the plans for the base shown here, you can be the proud owner of this classic for under $150.

Note: Refer to the onlay technique article starting on page 38 to construct the herringbone tabletop. To size and bend the top, see the Bill of Materials and the Exploded-View Drawing at right for the size of the onlaid panel (A) and banding pieces (B, C).

<table>
<thead>
<tr>
<th>Bill of Materials</th>
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<td>H</td>
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*Parts marked with an * are cut larger initially, and then trimmed to finished size. Please read the instructions before cutting.

Supplies: 14—1×1" chair-leg braces (Stanley part no. 996½) and two #8x⅜" flathead wood screws per brace, #10x1½" flathead wood screws, 4—⅜x⅜" hanger bolts with nuts and flat washers, stain, polyurethane sanding sealer, clear polyurethane, 0000 steel wool.

BUYING GUIDE

Project Design: Marlen Kemmet
Photographs: William Hopkins
Illustrations: Kim Downing, Bill Zaun

WOOD MAGAZINE  APRIL 1988
CUTTING THE LEG TAPERS

Step 1 Adjust the angle of the taper jig so the saw-cut layout line on the leg runs parallel to the fence.

Step 2 Adjust the fence position so the blade lines up with the layout line. Cut two adjacent sides on all four legs.

Step 3 Adjust the angle of the taper jig so the remaining saw-cut layout line on the leg runs parallel to the fence.

Step 4 Adjust the fence position so the blade lines up with the remaining layout line. Cut the other two adjacent sides on each leg.

JOINING THE RAILS AND LEGS

Step 1 Locate center points. Drill a 3/8" hole for hanger bolt and use a #10 screw pilot for the screw holes.

Step 2 Mark a corner-block reference line on both ends of E and F.

Step 3 Position corner block on F, and drill pilot holes. Glue and screw blocks to both ends of both F's.

Step 4 Drill pilot holes, and screw corner blocks to both ends of E.

Step 5 Chamfer the top of each leg.

Step 6 Position the top of the leg flush with the top of the apron rails. Through the 3/8" hole in the corner block, drill a pilot hole into the leg. Fasten each leg to the apron assembly.
SAMULE AARON'S
TIMBER-FRAME JOINERY

WHACK! WHACK! WHACK!

With controlled power, Samule Aarons unerringly slams his wooden mallet into the chisel handle. His eyes, though, never leave the blade to glance where it strikes. "You can't take your eyes off the edge if you're going to keep a mortise line crisp and accurate," the muscled and browned young man advises. As he talks, the wood of the 8 x 10" Douglas fir timber yields, curl by curl, to the knife-edge of the framing chisel.

Nearby, stacked in regimental file, expertly cut timbers—some double the height of a man and nearly as heavy as two—reflect weeks of Sam's work. On some, dovetail tenons stand in rank like soldiers. On others, shadows cast by the late-day sun define the sharp lines of beveled shoulders, bird's-mouth joints, and tenon housings. He has cut the entire rank and file almost entirely by hand with mallet and chisel. As the stacks have grown, so has his anticipation.

Samule Aarons was at least 125 years tardy in following journalist Horace Greeley's advice to "Go West, young man." In 1980, after a summer spent helping build a timber-frame home, Sam was convinced that working wood was more to his liking than studying books. That fall, he exchanged ivy-covered halls and traditional academies in New Hampshire for on-the-job learning in Idaho.

A call from a friend brought Sam to Idaho City, an old mining town ringed by the pine-plated mountains of the Boise Basin. There, the neglected and sagging gold-rush era buildings offered him a unique opportunity. Restoring them, Sam could learn more of the centuries-old skill of timber framing and still make a living. With two antique chisels, a mallet hewn from a 4 x 4", a book on timber framing, and a heap of self-confidence, Sam launched a joinery career. Now, at age 27 an experienced timber-frame joiner and log builder, Sam keeps his chisels busy on new construction in western Idaho. We journeyed to Idaho City and a timber-frame job site to see this modern-day joiner ply his skills on what he calls "BIG furniture."
Left: At the raising of the timber frame, Sam Aarons, the joiner, at left, and Spike Baker, the homeowner, pause to take in the view of the Payette River.

In a few days, without first trying them for fit, Sam, a party of friends, and a rented crane will raise the massive fir timbers and interlock the mortise-and-tenons into a post-and-beam framework. Only driven oak pegs will stay the hand-cut joints for the home overlooking Idaho's Payette River. Sam's work will be over. Someone else will sheath the roof and walls. Sam will head home, pleased in knowing that the same hand-tool skills and techniques practiced during the Middle Ages have crafted another piece of BIG furniture.

Above: To make sure that his hand-cut dovetail tenons lock tightly into the mortise, Sam trims them with his chisel. "You can't slip in a dollar bill," Sam says.

was hired to design and build an entire timber-frame building to serve as a mechanic's garage.

Word of the joiner spread, eventually leading Sam to a job with a timber-frame builder in Montana. There, he was schooled in the fine points of timber-frame craftsmanship. "I chopped a lot of joints," he recalls, "and I learned to sharpen my tools, to scribe, and to calculate framing. I gained a lot of finesse.

"A timber frame," Sam continues, "is an interesting concept incorporating the help of gravity in strengthening the joints, but also defying it in long spans. It has vertical support at given points as well as its own structural integrity to rely on for lateral strength. In a timber frame, the joinery is so strong because it allows movement without breaking apart." (See illustration on page 38.)

Head back, he draws in the aroma of the fir. "Timber frames have a beauty and honesty, too," Sam adds.

QUALITY IS EQUITY
His business card introduces him as a "joiner." The word means someone who connects wood. Sam chose it because it doesn't limit him to one technique. And joinery is all the construction he does.

Sam also chose the symbol of the swan-necked mortising chisel to accompany his name, for the seldom-seen hand tool signifies the handcrafting he relies on for his big-timber joinery. The imprinted

Continued
TIMBER-FRAME JOINERY

motto “Quality is Equity” strikes the heart and investment sense of potential customers.

Sam bids a timber-frame joinery job. Few people would pay him by the hour, knowing that hand craftsmanship goes slowly.

“Doing it by hand, I get a better fit, a better-quality joint, and I have absolute control of the size and shape of the cut. Besides, wood breathes and moves,” he says, sliding his hand over the severed outline of a mortise. “You can’t work it without feeling. I lose that feeling when I use a power tool. But I do live in the eighties!

Sam’s working knowledge of trigonometry allows him to calculate and project timber lengths, dimensions, and configurations into stable structures. “Until you start chopping the joints,” he says, “all the calculations seem pretty abstract. But I live by the fact that it’s easier to raise a pencil than lift a timber.” That’s half the reason why Sam never feels the need to trial-fit joints before timbers join in silhouette against the sky. The other half is the outlining of the joints.

THE SECRET OF TIGHT JOINTS LIES IN THEIR ACCURATE SCRIBING

The contents of Sam’s aged and well-traveled leather tool bag reflect his appreciation of fine old hand tools. However, the tools most important to his craft may be the simple utility knife and small metal square he uses to scribe the outline square he uses to scribe the outline of joints on timber. “Because the scribe line you cut deep into the wood is actually the joint’s finish line, you only use the chisel to take wood away from it,” he notes. “There’s no imprecision as with a pencil line.”

Sam scribes the mortise size right onto the wood with the knife. Then, he reaches for a portable circular saw. With it, he makes two parallel plunge-cuts into the timber about ¼” inside the scribed mortise sides. Next, with a ½” electric drill equipped with an auger bit (his “hole hog”), Sam bores out wood from a series of holes in the center of the mortise. After the boring, he uses a corner chisel to take out wood to within ⅛” of the line. And finally, Sam cleans up the mortise edge with a 1½” framing chisel, occasionally checking with a small square. “The fit is so tight,” he says proudly, “that when the timbers are raised, you can’t slip a dollar bill into the joints!”

What about mistakes? A mismeasurement? “If you miscut some timbers, they’re just gone,” the joiner informs us, “because all wood for a frame is mapped.”

Matted, in the language of timber framing, means accounting for all timbers and incorporating them into the design by length as well as outside dimension. It’s exactly the reverse of drawing up a bill of materials—Sam begins planning his joints based on the size of the mate-

Prior to the mid-1800s, a great percentage of homes and barns were framed with huge timbers (left). Because the joinery (right) stayed firm while the immense timbers expanded and contracted, many timber-frame buildings still stand. As the new nation expanded westward, timber frames declined. Sawmills ripped lumber by the wagonload, and even novice carpenters could build a stud-frame structure faster than a housewright could assemble a post-and-beam frame. Only during the last 20 years has an appreciation for the handmade revived the timber frame.


Above: With an adze, Sam smooths one of the pine timbers for his picnic-table gazebo. He pulls the adze toward him.

ANATOMY OF A TIMBER FRAME
because their size determines girt lengths, and all your posts may not be exactly the same dimension.

"You have to take a good look at your timbers, measure them, take notes, and calculate all outside dimensions. Then, you figure all lengths from there—so far from shoulder to shoulder of each mortise, each joint," that's mapping, he says.

**TOOLS THAT HOLD AN EDGE ALL DAY**

It wasn't many years ago that Sam depended on a flat bastard file to sharpen his chisels. Today, each of his edged tools will shave hairs off your arm.

Sam doesn't have any sharpening secrets. His technique simply requires a lot of time. "I use a grinding, sharpening, honing, finishing sequence," he says. "I begin with a slow grind, and use a grinding wheel (about 200 grit) that runs in a water bath at 200 rpm. That's to shape the edge.

"To sharpen it, I move to a 1,000-grit Japanese water stone to remove all the grinding marks and smooth out the surface. Next, I hone with another Japanese stone of 8,000 grit to further cut down the finish that the 1,000 grit left. That turns the steel into a mirror. If you can see a mirrorlike surface on the steel, the wood you cut will be glass-smooth. For the finest finish, I pass the blade over a leather strop impregnated with green jewelers' rouge. My old Greenlee, the flagship of my chisels, can chop mortises through knots and dry wood all day and still be sharp."

**MORE THAN A LIVING TO CHISEL OUT**

Using hand tools ranging from framing chisels to broad axes and adzes, jack planes to a Stanley 55 combination plow and fillister plane, Sam has made his joinery all-encompassing. For example, he built 14 x 7' frame-and-panel doors for the timber-frame mechanic's garage in Idaho City. For a special order, he constructed a large pine entry door, and smoothed it with an adze. And, combining elements of Japanese astronomy with his hand-tool skills, Sam and a friend, stone mason Bob Wylle, built a ponderosa pine log gazebo and picnic table tuned to the Idaho landscape. "The timber in it has all the different surface textures of the tools," Sam explains.

The timber gazebo and table show Sam's interest in and respect for Japanese architecture, but from most folks it elicits comments such as, "But how would I ever move it?" Yet, the young joiner remains confident and undaunted for future pursuits.

"Expressing what I believe in through my work—that's my only goal," says Sam. "I would like to be comfortable, I would like to make a living, but I don't have any desire to do less than my best." 🕫

Written and produced by Peter J. Stephano
Photographs: David Donnelly
Illustrations: Jim Stevenson

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**Wood Magazine** April 1988

39
TIME MARCHES ON STYLISHLY WITH OUR

CONTEMPORARY TALL CLOCK

Almost everyone loves the striking good looks and chiming melodies of a tall clock, or “grandfather” clock as they’re so nicknamed. Unfortunately, the traditional style of most tall clocks doesn’t blend with every decor. With that in mind, we designed our own contemporary version. The large glass panels draw you inside to watch the brass gears, weights, and pendulum mark time with fine-tuned accuracy. As with the tall clocks of old, this one will no doubt stand the test of time.

LET’S BEGIN WITH
THE FACE FRAME
1 Cut the face-frame stiles (A) and rails (B) to the sizes listed in the Bill of Materials on page 43.
2 Mark the location of, and cut a notch in each stile where dimensioned on the Face Frame Drawing.
3 Drill a pair of \( \frac{3}{4}'' \) dowel holes 1\( \frac{1}{16}'' \) in both ends of each rail (see the Dowel Hole Detail accompanying the Face Frame Drawing for location). Insert dowel centers in the holes, and dry-clamp the frame together to transfer the hole locations to the stiles. Depending on the number of dowel centers you have, you may need to transfer the locations one joint at a time. Remove the clamps, and drill the mating dowel holes.
4 Mark three hinge-hole centerlines where dimensioned on the Face Frame Drawing. (For ease in locating the hinge leaves later, mark horizontal lines across the entire width of the stile.) Bore three 35 mm holes \( \frac{3}{4}'' \) deep where marked for the hinges. (See the Buying Guide on page 78 for our source of hinges and drill bit.)
5 Glue, dowel, and clamp the face frame together, checking for square.

NOW FOR THE SIDE AND BACK ASSEMBLY
1 Cut the stiles (C), rails (D), and plywood back (E) to size. Cut a \( \frac{3}{4}'' \) rabbet \( \frac{1}{2}'' \) deep along the back edge of each stile (see the Side and Back Assembly Drawing).
2 Mark the dowel-hole center points on both ends of each rail (see the Dowel Hole Detail accompanying the Face Frame Drawing). Drill the holes, and use dowel centers to transfer the hole center points to the stiles (A, C). Drill mating dowel holes in the stiles.
3 Glue, dowel, and clamp both side frames (C, D) to the face frame. Lay the back panel in the rabbet to help square-up the assembly.
4 Glue and screw the back panel to the framework, using the hole sizes and locations on the Screw Hole Detail accompanying the Side and Back Assembly Drawing.
5 So that you can install the glass later, rout a \( \frac{3}{4}'' \) rabbet \( \frac{3}{8}'' \) deep around the entire inside edge of the outside face of each side frame where shown on the Carcass Assembly Drawing. Square the corners with a chisel.

FITTING THE TOP AND BOTTOM
1 Cut the upper cleats (F, G) and lower cleats (H, I) to size. Glue and clamp the upper cleats into position \( \frac{3}{4}'' \) below the top edge of the cabinet frame where shown on the Carcass Assembly Drawing.
2 Glue and clamp the lower cleats into position \( \frac{3}{4}'' \) below the top
edge of parts B and D. Later, belt-sand the bottom edges of the lower cleats flush with the bottom of the tall-clock cabinet.

3 Cut the top and bottom (J) to size from 3/4” oak plywood. Glue them into position on top of the upper and lower cleats.

4 Cut the mounting-shelf supports (K) to size. Glue and clamp the supports in place.

**HERE’S HOW TO CONSTRUCT THE BASE**

1 Cut the base parts (L, M) to size plus 1” in length.

2 Cut a 1/2” rabbet 1/16” deep along the top outside edge of each base part. Miter-cut the pieces to length.

3 Glue and band-clamp the base together, checking for square. Cut four corner blocks to shape (see the Carcass Assembly Drawing and the Corner Block Detail that accompanies it). Drill two mounting holes in each corner block, and then glue and screw a corner block into each corner of the base. Sand a chamfer on the bottom outside edge of the base so it won’t snag the carpeting later.

Continued
CONTEMPORARY TALL CLOCK

4 Drill a ¾" hole, push a ¾" T-nut into the bottom of each corner block, and add the floor glides.
5 Lay the clock cabinet on its back. Glue and screw the base assembly to the bottom of the cabinet flush with the back of the cabinet and centered from side to side. (Refer to the Screw Hole Detail for the screw sizes and location.)

THE DOOR COMES NEXT

Note: We constructed our first door from solid stock and it warped. To keep the door from warping, we found it best to laminate the door parts.

1 From ¾"-thick oak stock, cut four pieces to 2¼x72" for the door stiles (N) and four pieces 2½x22" for the rails (O).
2 Place waxed paper on top of the cabinet face frame. Glue and clamp the door stiles together, using the front of the cabinet as a form (see the drawing above right). This ensures a tighter fit later between the door and cabinet. Mark one stile “left” and one “right” for repositioning on the same sides later.
3 Later, remove the clamps, and scrape the excess glue from each laminated stile. Repeat the same process for the door rails (O).
4 Plane one edge of each stile and rail. Rip the opposite edge of each part for a 2¼ finished width.
5 Set your table saw blade 45° from center, and bevel-rip the front face of each stile and rail to produce a double-chamfered face (see the Section View accompanying the Door Drawing for reference). Sand the chamfered edges smooth.
6 Dado or rout a ¾" rabbet ¾" deep along the bottom inside edge of each door stile and rail.
7 Measure the length and width of the front face of the cabinet frame, and miter-cut the stiles and rails to length. (We test-cut scrap stock first to ensure an accurate 45° angle.)
8 With the cabinet frame still on its back, lay waxed paper on each corner of the cabinet frame. Glue and clamp the door frame members together and to the cabinet.
9 Drill a pair of holes at each corner of the door frame, using the hole sizes and locations given on the Screw Hole Detail accompanying the Door Drawing. Drive the screws.

NOW, HANG THE DOOR

1 Clamp the door frame flush with the right-hand door-frame stile where shown on the Hinge Installation Drawing far right.
2 Transfer the hinge centerlines from the face-frame stile (A) to the door stile (N). Measure over ¾", as shown, and make a leaf reference line. Locate a hinge leaf on the door where shown on the drawing. Mark and drill a pair of leaf pilot holes for each of the three leaves.
3 Screw the leaves to the door frame. Drill pilot holes, and screw the hinges to the face frame. Remove the clamps. Connect the leaves to the hinges, and tighten the mounting screws. Close the door to check the alignment of the door to the face frame. To correct any misalignment, loosen the leaf mounting screws, and adjust the door alignment screws.
4 Once the leaves are positioned correctly, loosen the mounting screws, and remove the door from the cabinet. Now, score the outline.
### Bill of Materials

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<th>Part</th>
<th>Finished Size*</th>
<th>Material</th>
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**THE FACE FRAME**

- A: 1⅜" x 2¼" x 70" oak 2
- B: 1⅜" x 2¼" x 15¾" oak 2

**THE SIDE AND BACK ASSEMBLY**

- C: 1⅜" x 2¼" x 70" oak 2
- D: 1⅜" x 2¼" x 6⅞" oak 4
- E: ⅜" x 1⅜" x 70" oak plywood 1

**THE CARCASS PARTS**

- F: ⅜" x ⅜" x 6⅞" oak 2
- G: ⅜" x ⅜" x 17¾" oak 1
- H: ⅜" x ⅜" x 6⅞" oak 2

**THE BASE**

- L*: 1⅛" x 1⅞" x 1⅞" oak 2
- M*: 1⅛" x 1⅞" x 9⅞" oak 2

**THE DOOR**

- N*: 1⅛" x 2⅞" x 70" oak (laminated) 2
- O*: 1⅛" x 2⅞" x 20" oak (laminated) 2

**MOUNTING BOARD ASSEMBLY**

- P: ⅜" x 6⅞" x 15¾" oak 1
- Q: ⅜" x 4½" x 15¾" oak 1
- R: ⅜" x ¾" x 6⅞" oak 2

**CLOCK FRAME AND FACE**

- S: 1⅛" x 7½" x 15¾" oak 4
- T*: ⅜" x 11⅛" diam. oak plywood 1

**GLASS STOPS**

- U*: ⅜" x ⅜" x 66¾" oak 6
- V*: ⅜" x ⅜" x 66¾" oak 4
- W*: ⅜" x ⅜" x 10½" oak 2

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*Parts marked with an * are cut larger initially, and then trimmed to finished size. Please read the instructions before cutting.

**Supplies:** ¾" dowel pins 2' long, #8 x 3⅛" flathead wood screws, #8 x 1 ¼" flathead wood screws, #8 x 1⅛" flathead wood screws, #8 x 2" flathead wood screws, #10 x 1 ½" flathead wood screws, #10 x 2" flathead wood screws, ¾" dowel stock for trammel pivot pin, waxed paper, ¼" hardboard for trammel base, ¼" x 1⅛" thumbscrew with a ¼" threaded insert, ⅛" x 1⅛" x 66⅞" double-strength glass, #10 x ¾" flathead wood screw, 4—⅛" flat washers, ⅛" x ⅜" turn-buckle with eyes at both ends, ⅛" x 2½" eyebolt hook, ⅛" short hollow wall anchor, ¼" x 17 brads, ⅛"-diameter brass 7½" long for pull rod, masking tape, epoxy, stain, finish.

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**Cutting Diagram**

- 1¼ x 9¼ x 96" Oak
- ⅜ x 7½ x 72" Oak
- 1¼ x 9¼ x 96" Oak
- ⅜ x 5⅛ x 96" Oak

**Note:** Parts U, V, and W are resawn from the scraps of other pieces.

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**FORMING AND INSTALLING THE MOUNTING BOARD**

1. Cut the mounting board (P) and and apron (Q) to size.
2. Using the Mounting Board Drawing as a guide, mark the notch, slot, and push-rod hole locations on the mounting board. Cut the notch and slot to shape, and drill the hole.

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*Continued*
CONTEMPORARY TALL CLOCK

3. Drill a ¾" hole in the apron ½" from the bottom edge and centered from end to end for the thumbscrew that holds the clockface in position.

4. Glue and clamp the apron to the front of the mounting board, with the ends flush.

5. Cut the mounting-board supports (R) to size. Glue and screw them to the cabinet siders where shown on the Mounting Board Assembly Drawing. Install the mounting-board assembly in position on the supports. Drill shank and pilot holes, and screw the mounting board to the cleats.

NOW FOR THE CLOCKFACE FRAME

1. Miter-cut the clockface frame parts (S) to size. Glue and clamp the parts together, keeping the surfaces flush.

2. Trim the bottom edge of the clockface frame for a 15 ¾" height. Drill shank and pilot holes, and drive the screws at each miter joint (see the Clockface Frame Drawing at right for hole sizes and locations).

3. Drill a ¾" hole at the center of the clockface to later mount the trammel base.

4. Cut the trammel base to the shape shown on the Trammel Base Drawing on the opposite page, and drill the two pivot pin holes where dimensioned. Remove the plastic subbase from your router, and mount the trammel base in its place.

5. With double-faced tape, tape the clockface frame to a piece of scrap particleboard. Using the hole in the frame as a guide, drill a ¾" hole into the particleboard. Stick a 2"-long piece of ¾" dowel stock in the hole in the center of the frame and particleboard. Chuck a ½" straight bit into your router, and position pivot hole #1 of the trammel base onto the ¾" dowel in the clockface frame. Rout a ½" circular groove ¼" deep into the front face of the frame. Lower the bit about ¼" per pass until you've routed completely through the piece. Remove the frame from the scrap base.

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6 Use a rabbet bit chucked to your router to rout a \( \frac{3}{8} \)" rabbet \( \frac{1}{8} \)" deep on the back inside edge of the frame. Use a \( \frac{3}{8} \)" round-over bit, and rout a round-over on the front inside edge of the frame opening.

**HERE'S HOW TO MAKE THE VENEERED CLOCKFACE**

1. Cut the clockface substrate (T) to size from \( \frac{3}{4} \)" plywood. Apply veneer to one surface of the substrate (we used flexible walnut burl veneer—see the Buying Guide for our source of veneer and adhesive).

2. Follow steps 2 and 3 on the Clockface Drawing to locate and mark diagonals and centerlines. Now, follow steps 4 and 5 for drilling the holes. Take your time when locating and drilling the holes; it is important that they be located where dimensioned.

3. Using double-faced tape, tape the clockface to a piece of scrap stock. Drill a \( \frac{3}{8} \)" hole through the center of the clockface into the scrap substrate. Stick a 2"-long piece of \( \frac{3}{8} \)" dowel in the hole in the center of the face and scrap. Cut the clockface to shape, using a router fitted with a \( \frac{1}{4} \)" straight bit, pivot hole #2 on the trammel base, and the \( \frac{3}{8} \)" dowel fitted in the clockface center. **Note:** The clock movement isn't available with the brass timing marks and hands as shown in the opening photo. Please see the Buying Guide on page 78 for our source of these custom-made parts.

4. Locate and epoxy the 3-, 6-, 9-, and 12-o'clock timing marks to the veneered face, referring to the Clockface Drawings.

5. Redrill the \( \frac{3}{8} \)" shaft hole to \( \frac{1}{8} \)". Glue the clockface into the rabbet in the clockface frame. To align the clockface in the frame, line up the pencil-marked diagonals on the face with the miters on the surround. Once aligned, glue and clamp in position. Immediately remove any excess glue from the veneer. Later, remove the clamps, and sand away the pencil lines on the clockface, being careful not to sand through the thin veneer.

*Continued*
CONTEMPORARY TALL CLOCK

6 Drill the ⅛" holes in the top edge of the clockface frame—see the Mounting Board Assembly Drawing for dimensions. Insert ⅜" dowel centers in the two holes. Position the front face of the clockface frame flush with the front of the face frame, and transfer the hole locations from the clockface frame to the bottom edge of the frame rail (B). Drill a pair of ⅛" holes ¼" deep into the bottom edge of the frame rail. Cut two 1¼"-long dowels from ⅛" dowel stock. Chuck one of the dowels in the drill press, and sand a bulletlike shape on one end. Repeat for the other dowel. Glue the dowels in the holes in the top edge of the clockface frame.

7 Dry-clamp the clockface frame in place. Working from the back side of the apron, mark through the hole in the apron to mark the threaded-insert location on the back face of the clockface frame. Drill the hole and install the insert.

CUTTING THE GLASS STOPS AND INSTALLING THE GLASS

1 Resaw the glass stops (U, V, W) to size plus 2" in length.

2 Rout a ⅛" x ⅛" decorative rabbet along one edge of each stop (see the Frame Section Detail above right for the location). Miter-cut the glass stops to length.

3 Measure the openings, and order ¼" double-strength glass for the sides and door. (We had ours cut ½" less in width and length than the openings to allow for movement of the wood. We had ours cut to the sizes listed in the Supplies.)

4 Using one of the brads as a bit, drill pilot holes in the stops. Position the glass panel in the door frame. Using a brad set, nail the door stops into position. Sand the stops flush with the surface of the door frame. Do not install the glass in the side frames yet.

APPLY THE FINISH AND ADD THE TRIM

1 Finish-sand all the parts.

2 Mask off both faces of the glass panel in the door. Stain and finish all the wood pieces, including the glass stops. Do not use an oil finish on the veneer clockface; the oil can seep through the veneer and loosen the contact cement.

3 Position the glass, and nail the stops (U, V) in the side frames being careful not to scratch the glass.

4 To make the jig to miter-cut the gold-colored trim, cut a ½" dado ¼" deep in a piece of scrap stock. (See the Buying Guide for our source of trim.) Next, miter-cut each end of the stock at 45° (see the finished jig in the photo at right). Cut the trim to length plus 1". Using the jig, miter-cut one end of each trim piece. Mark the cut line for the finished length on the opposite end, position the block over the trim, and cut the trim with a chisel as shown in the photo.

5 Clean the glass thoroughly. Remove the backing from the trim, and press the trim into position onto the front side of each glass panel. Heat the trim with a hair dryer as you apply it (heating ensures a better bond between the trim and glass).

6 Apply ½"-wide felt tape to the back of the door where shown on the Glass Installation Drawing above. Attach the hinge hardware to the door and frame.

7 Using the Turnbuckle Attachment Drawing as a guide, attach a turnbuckle to the top of the cabinet. The turnbuckle prevents the clock from accidentally tipping for-
ward later. Position and level the clock against the wall where it will stand, and attach the hardware.

**INSTALLING THE MOVEMENT**

**Note:** Refer to the directions accompanying the clock movement and the Clock Works Drawing for details on the following steps.

1. Remove the clockface and frame assembly. Measure up 10 1/4" from the top edge of the mounting board, and place a piece of masking tape on the plywood back panel (E) to act as a reference line. Remove the mounting board assembly.

2. Position the top of the chime-rod block flush with the masking tape, and center the block from side to side. Now, mark the location of and drill four 1/4" holes through the back panel. Screw the chime rod block to the back panel.

3. Reposition the mounting-board assembly on the cleats, and screw it into place.

4. Hold the clock movement above the cable slot, and drop the pulleys through the slot. Finger-tighten the mounting plate screws to hold the movement over the slot.

5. Position the clockface-frame assembly against the front of the clock movement. Move the clock movement until the winding posts and shaft align with the holes in the clockface. Firmly tighten the mounting-plate screws, and remove the clockface assembly.

6. Loosen the chime-rod block, and center the chime rods between the hammers. Retighten the block to the back panel. Bend the hammer arms slightly if necessary to align the hammers with the chime rods.

7. Form the selection-lever pull rod from a 7 1/2" length of 1/4"-diameter brass rod (see the Pull Rod Detail above left for shape).

8. Hang the weights, pendulum, and selection lever. Insert the thumbscrew, and tighten it to hold the clockface firmly against the mounting-board assembly.

9. Attach the hands to the clock shaft (see the Buying Guide for our source of custom-made hands).

*Continued on page 78*
The One People Love To Touch

FERN WEBER'S SATINY-SMOOTH

We asked this Kansas City carver how on earth she gives her projects such a heavenly look. Now that she's told us, we're passing along the good finishing news to you.

Carving competition judges don't give out ribbons for the best finish on a carving, but if they did, you can bet your bottom dollar that Fern Weber would win her share of blues. In fact, we think it's partly her expertise at finishing that helped her and her husband, Walt, walk off with the Best Overall Display Award at last year's Kansas City-Area Woodcarvers' Show. Of course, having top-quality carvings beneath that finish didn't hurt the Missouri couple, either.

When Fern enrolled in a tole-painting class a decade ago, she never dreamed of getting involved in carving, or finishing for that matter. About the same time, Fern convinced her soon-to-be retired husband to sign up for a wood-carving class to keep him busy. To her surprise and delight, Walt really took to carving—and became very good.

The only thing is, it seems Walt liked to carve a lot more than he liked applying the finish to his projects. That's when Fern offered her help, and ever since then she's been "tidying up" and finishing Walt's—and now her own—carvings.

Fern says that it was her tole painting instructor who impressed on her the importance of properly preparing a project for finishing. "She was very, very particular," says Fern, "and I've always been a thorough person, too—a characteristic I picked up over the years from my mother."

While obviously it helps to be meticulous in approach, Fern gives part of the credit for her success to a set of riffler files she uses to smooth the surface after the carving is complete. "They're the greatest thing I've ever found to smooth projects. They come in all sorts of shapes—I've got a couple dozen of them, I suppose. They're a must for anyone who wants to do good-quality work."

But there's more to this amazingly smooth finish than careful preparation of the surface. As any good wood finisher, Fern has definite preferences when it comes to the products she applies to her carvings. After a lot of trial and error over the years, she's settled on—and swears by—McCloskey's Stain Controller and Wood Sealer, Deft Semi-Gloss Clear Wood Finish (a brushing lacquer), and Butcher's Boston Polish Paste Wax. (See the Buying Guide at the end of the article for information on where to purchase these products, as well as the riffler files Fern uses for smoothing wood surfaces.) How good is Fern Weber's brushed lacquer finish, really? She and Walt sell many of their carvings over the counter at mall exhibitions, crafts fairs, and the like, and she says, "We always encourage people to pick up our projects and feel them. That's what usually closes the sale." One recent customer said, according to Fern, that "once you feel the finish on one of Fern's carvings, you've just got to have more." That same customer has just placed an order for another $450 worth of Fern's carefully crafted carvings.

If you or one of your friends uses a finishing system you'd like to crow about, why not drop us a line. Write to: "In Search of the Perfect Finish," 1716 Locust Street, Des Moines, IA 50336. Who knows, maybe we'll do an article about you.
BRUSHED LACQUER FINISH

Here's How Fern Finishes Her Projects—Step-By-Step

1 Because Fern executes sleek and stylized carvings, they just have to be smooth. She removes any evidence of knife cuts and gets into all those grooves and hard-to-get-at places with her set of riffler files. "They're a must," Fern says, "if you want to do good-quality work. They make very fine cuts, so smooth in fact that I almost never need to use coated abrasives coarser than 220-grit."

2 When she deems the piece ready for sanding, Fern exchanges the riffler files for sandpaper. "I try to sand with the grain whenever possible, and I gauge the final readiness by feeling the project rather than looking at it. You can feel when it's ready; don't hurry," she says. Note the "remodeled" Rubbermaid Spice Carousel that Fern uses to store her carving tools. Walt bored holes in the carousel so the tools stand upright.

Continued
With her carefully prepared project in hand, Fern applies one coat of McCloskey's sealer with an inexpensive nylon brush. "I wipe off the excess sealer with a clean, lint-free rag and let the sealer dry for 24 hours," Fern notes. "That drying time is important; the following coat of Deft will bubble if you put it on before the sealer has dried completely," she adds. "In fact, the label on the sealer says not to use McCloskey's under a lacquer finish, but it works well for me." Fern buys this product in quart containers, then divides the contents into several small jars with tight-fitting lids. Doing this, she says, prevents the sealer in the unused jars from congealing.

When applying the Deft Semi-Gloss Clear Wood Finish—sometimes up to ten coats—Fern takes great pains to brush the lacquer in one direction only. And she insists on a camel's hair lacquer brush. "Less-expensive brushes just don't lay down the finish as smoothly as the camel's hair," Fern advises.

"I like to wait at least an hour between coats, and don't forget to steel-wool and tack-cloth your project between coats," she says.
5 After each coat of Deft, Fern sands all surfaces, including the cracks and grooves with 0000 (the finest) steel wool. "Doing this," she says, "removes the hairlike grain the Deft finish raises. The softer the wood the more severe the grain raising." A careful wiping of the surface with a tack cloth removes all metal shards left as the result of sanding.

Medieval dragon carved and finished by Fern

6 "After the final coat and a light rubbing with steel wool, I apply three coats of the Butcher's Wax," Fern counsels. "I leave each coat of wax on for about 20 minutes before buffing it with a clean cloth. Old diapers work well here."

BUYING GUIDE
- Rifflers (files). Several sets available from Woodcraft, 41 Atlantic Avenue, P.O. Box 4000, Woburn, MA 01888.


- Butcher's Boston Polish Paste Wax (Amber). Call 800-225-9475 for the name of the nearest distributor.
If you're like most American woodworkers, you probably think in terms of single-purpose stationary tools: a table saw for straight-line sawing, a band saw for curved cuts, a drill press for drilling, a jointer for surfacing stock, and so on. But it's a different story in Europe. There, woodworkers have learned how to make small shops work big. For decades, European tool manufacturers have made woodworking machines that combine two or more functions.

The most popular of these—the combination woodworking machine—combines the five tools most often used in small cabinet shops: a table saw, jointer, thickness planer, shaper, and slot mortiser. And, the entire unit fits into the space ordinarily occupied by a table saw. So, if you're tight on shop space, a European combination tool may be the answer.

Although these imports are still relatively new in this country, the multitool concept isn't. Back in 1947, Shopsmith introduced their lathe-based 5-in-1 combination machine, which converts to a table saw, drill press, horizontal boring machine, and disk sander. Since then, the Shopsmith has gained a strong, loyal following among home woodworkers. Total Shop and Master Woodcraft later introduced similar machines.

And now, importers of the European combination machines bet that they, too, can capture a share of the multimachine market. That's why at any given woodworking show, you'll see one or more importers demonstrating their units. After watching several of these demonstrations, we decided it was high time to take a closer look at these tools, and get a bit of hands-on experience with them. For this report, we tested models from six of the importers. Here's what we found:
WORKING MACHINES
-PURPOSE STATIONARY TOOLS-

HOW DO THEY WORK? EASIER THAN WE IMAGINED!

Never having worked with this type of machine before, we anticipated a lot of complex procedures to switch from one tool to another. But we were pleasantly surprised. Typically, you select the tool or function you want by operating a dial, button, or lever. Each of the combination machines works a bit differently in this respect. In some instances, you also must attach or detach fences and guards when switching from one tool to another. Here’s how they work:

TABLE SAW: COMPLETE WITH A SLIDING TABLE
On all machines except the two Kitty models, the table saw and shaper share the same table. So you have to lower the shaper spindle and remove the shaper fence and guard to use the saw. While this may seem like a hassle, we found the switchcove takes less than a minute on the machines we tried.

All of these units—except the Kitty models—include a sliding table as standard equipment.

JOINTER/THICKNESSER: A COMBO THAT MAKES SENSE
All of the European-built combination machines include a jointer/thicknesser that share the same cutter block. This combination makes the overall machine more compact, and gives you the same capacity for both the jointer and the thicknesser—a plus for truing wide boards.

MORTISER: MORTISING AND MUCH MORE
Although you might think of a mortiser as an extravagance for your shop, it can do more than cut mortises and bore holes. You also can fit the mortiser with disk- and drum-sanding attachments and grinding wheels for tool sharpening. Except on the Toolmax and Kitty K5, the mortise chucks have either a right-hand chuck rotation (counterclockwise as you face the chuck) or reversible (left- or right-hand) rotation. Several of the tools come with metric chucks (usually 16 mm), but most of the manufacturers also offer 9/16" or 3/4" chucks, so you can fit the mortiser with ordinary drill bits and attachments (see chart on page 56).

To use the mortiser, you clamp the workpiece to the mortise table, adjust the table height, and set the stops on the table carriage for mortise depth and length. Two levers control table movement: One moves it front-to-back for mortise depth; the other moves it side-to-side for mortise length.

ROUGH STOCK TO FINISHED MOLDING—IN 4 EASY STEPS

While testing the European combination machines for this report, we invited several of the tool importers to our WOOD® magazine shop to demonstrate their machines. In these photos, Ray Owen from Toolmax transforms rough stock into a finished molding, using four of the five tools on his machine. With few variations, the other combination machines operate in much the same way as this one.
WE PUT SIX MACHINES TO THE TEST

FELDER BF5/41: THE MERCEDES OF THE MULTIS
Tools: 12" tilting-arbor saw; 16" jointer/thicknesser; 1 1/4" tilting-arbor shaper; mortiser with 16-mm (5/8" optional) shank capacity.

Without a doubt, this high-priced Austrian machine outclasses all the rest in size and quality. With three 3-hp motors (4-hp optional), this ton-and-a-half behemoth delivers more than enough power to drive its industrial-size components. Also, the precision, double-milled cast-iron tables and extensions for the saw, shaper, and jointer/thicknesser have plenty of capacity for the size and power of these tools.

We especially liked the sturdy rip fence, which slides unobstructedly from the saw blade to the far side of the jointer table, providing a full 39" rip capacity to the right of the blade. Also, the shaper has a removable quill, so you don't have to lower it below the table to use the saw. This way, you can keep the cutters on the quill and maintain the exact height setting, should you later want to duplicate a molding. The tilting arbor increases the versatility of your shaper cutters.

The chart on page 56 lists the many other superlative features the BF5/41 offers. But as much as we operate an electric clutch that transfers the drive from one tool to the other. We found the DD by far the easiest of the machines to operate. The smaller Kity K5, shown at near right, employs the same modlar principle, but you must manually change the drive belt to switch functions. Unlike the Kity DD, you can't buy the K5 components separately.

KITY DD: THE MODULAR APPROACH
Tools: 9" saw (tilting table); 10" jointer/thicknesser; 3/4" shaper; mortiser with 5/8" shank capacity.

Unlike the other machines, the French-made Kity DD consists of individual components mounted on a common stand. The jointer/thicknesser, saw, and shaper share a common motor; a separate motor powers the mortiser.

MINI MAX C30: PRECISION PLUS
Tools: 8" fixed-arbor saw; 8 1/2" jointer/thicknesser; 3/4" shaper; mortiser with 16-mm (5/8" optional) shank capacity.

The exceptionally smooth, positive operation of the controls, and accurate machining of all parts makes the Mini Max C30 a joy to work with. We like the extra-large sliding table, which comes as standard equipment on this model.

To switch functions on this one-motor machine, you slide a lever to the appropriate setting, then twist it to engage the drive belt. A second lever locks the belt in position.

We found all the Mini Max components easy to adjust and use, and the motor has plenty of power to drive them. We do consider the fixed-arbor saw a limitation. Mini Max also offers a larger, two-part machine, the FSB35/MC90. You can buy the two units separately.

TOOLMAX T310: MORE CAPACITY FOR YOUR MONEY
Tools: 10" tilting-arbor saw; 12" jointer/thicknesser; 1" shaper; mortiser with 5/16" shank capacity.

Powered by three 3-hp motors (with a separate 1/4-hp motor to drive the thicknesser feed rollers), the Toolmax delivers as much capacity and power as machines costing almost twice as much. Features on this Belgian-made tool include large, rugged cast-iron tables and positive, easy-to-use controls—change the planer to thicknesser in about 20 seconds! You can split the Toolmax into two separate machines (jointer/thicknesser/mortiser and saw/shaper), making it easier to transport through small doorways.

We found the combination rip fence for the saw/jointer somewhat flimsy and awkward to move from one tool to the other. But Jerry Spangler at Toolmax tells us they're introducing a Vega rip fence, com-

ZINKEN MIA 6: FOR THOSE WHO THINK SMALL
Tools: 6" saw; 6" jointer/thicknesser; 3/4" shaper; mortiser with 13-mm (5/8" optional) shank capacity.

Five stationary tools in 22x32" of bench space? You bet! And this scaled-down Italian machine has all the basic features of the bigger machines, including sliding tables. The tiny collet chucks for the shaper accept 1/4" and 3/8" router bits, plus two metric sizes. Zinken offers a large selection of cutters for the shaper. Cast-aluminum tables, fences, and guards contribute to its light weight (106 pounds).

The Zinken had a surprisingly amount of power for its size, and
drooled over this precision powerhouse, its $14,900 price tag puts it beyond the reach of most home woodworkers we know. Although we wanted to show you the top of the line, we consider one of the smaller, lower-priced Felder machines more practical for the home woodworker (see the chart on page 56). The smaller machines offer the same rugged construction.

Above: Tilting-arbor shaper is a Felder exclusive; rip fence for table saw slides to far side of jointer table, providing a 39" rip capacity.

Right: Felder BF5/41: Largest and most expensive machines.

Left: Kitty K5: To switch functions on this inexpensive, one-motor machine, you change the drive belt from one component to another.

Right: Kitty DD: You can begin with the basic drive unit and one or two machines, then add the rest as need and budget allows.

Center: Central control panel on the Kitty DD operates electric clutch (at bottom of photo) to switch functions.

Left: Mini Max C30: We like the Italian precision quality and the large sliding table with a long bed of travel.

Right: Lever-operated clutch on the Mini Max C30 (see arrow) enables you to switch functions without shutting off the motor. A second lever locks the belt.

patable with the Toolmax table, which should be a tremendous improvement. Toolmax also has plans for a lathe attachment for the mortiser chuck.

The mortiser chuck has a left-hand rotation, which means you must buy special left-hand mortise bits (available from Toolmax). Also, you can't use standard drill bits or router bits with the mortiser. Despite this drawback, we consider the Toolmax an exceptional bargain.

Right: Toolmax: At $3,895, this sturdy machine gives you plenty of power and capacity for the money.

The components worked as accurately as some of the better single-function bench-top tools.

We think the MIA 6 would be a great apartment-size tool for small projects, but it's somewhat pricey for what you're getting ($2,095 retail, usually discounted to about $1,500).

Right: Zinken MIA 6: This workshop on a bench top has the same five components as the big boys.
### COMBINATION WOODWORKING MACHINES

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1. Does not include motor for power feed on thicknesser.
2. Most homes are wired for 1-phase power only. Specify phase when ordering: Felder tools require a phase converter for 1-phase operation.
3. (Tilting) (Fixed): Kity machines & Zinken ZC 21 have a tilting table.
4. (Lever)-Handwheel (crank)
5. Both tools.
7. Front-to-back table travel.

### ROBLAND K260

**Tools:** 10" tilting-arbor saw; 10" jointer/thicknesser; 1" shaper; mortiser with 3/8" shank capacity.

Although we weren't able to bring one of the Robland machines into our offices for testing and photos, we did get a chance to work with the Robland K260.

We found the K260 to be a smooth-running, powerful machine comparable to the Toolmax T310. Features we liked include a quick-release level to adjust the table saw blade height, easily adjusting shaper guard fence and a 4-clamp self-centering chuck on the mortiser.

An emergency stop button on both sides of the machine immediately switches off the motors—a safety bonus. Robland literature also highlights a special tenon cutter accessory that mounts on the shaper spindle.

Unlike the Toolmax, the jointer feeds from the same direction as the table saw. The Robland machines include some standard accessories (saw blades, shaper cutters, and mortise bits) that other distributors sell as options. Don't overlook Robland's prepaid freight bill when comparing prices. The freight ticket on many combination machines can be more than $225.

However, you probably won't be able to purchase the K260 in 1988. An upgrade model, the X310 (not to be confused with the K310 on the chart), is essentially the same machine as the K260 but with one significant difference: The 10 1/4" jointer/thicknesser upgrades to 12 1/4". The X310 suggested list price is $4,950 including freight.

**The Robland K260**

![Robland K260](image)
### VITAL STATISTICS

<table>
<thead>
<tr>
<th>SHAPER</th>
<th>MORTISER</th>
<th>WORK TABLES</th>
<th>ACCESSORIES</th>
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<tr>
<td>Collected Speed (RPM)</td>
<td>Maximum peripheral (in.)</td>
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<td>8,000</td>
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<td>5,500</td>
</tr>
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</table>

**WHAT ABOUT COST?**

Most of us buy our woodworking machinery piecemeal, either as we need it or as we can afford it. So the price tags on combination machines may, at first, take your breath away.

But you can look at it this way: you're buying five large stationary tools at once. Generally, the combination units cost less than the stationary machines they replace, given the same quality and capacity.

Presently, most of the importers sell these machines by mail order. (Robland picks up the freight charges, others don't—see the chart above.) So if you're serious about buying a combination woodworking machine, we suggest you first watch a demonstration.

### FOR MORE INFORMATION

**FELDER**
Advanced Machinery Imports, Ltd.
PO. Box 312
New Castle, DE 19720
302/232-2225

**ROBLAND**
LAGUNA TOOLS
2081 Laguna Canyon Road
Laguna Beach, CA 92651
800-345-5952
(In California, call 600-522-5952)

**KITTY**
Farris Machinery
2315 Keystone Drive
Blue Springs, MO 64015
816/229-3055

**TOOLMAX**
Atlantic Wood Products, Inc.
2441 Front St.
West Sacramento, CA 95691
800-535-4786
(In California, call 800-325-8330)

**MINI MAX**
SCMI
5933-A Peachtree
Industrial Blvd.
Norcross, GA 30092
404/448-1120

**ZINKEN**
Zinken International Corporation
P.O. Box 459
Marengo, IL 60152
815/568-8988

**Lathe-based Multimachines**

**MASTER WOODCRAFT MACHINE CO.**
PO. Box 669
Harbor City, CA 90710
900-424-2467
(In California, call 213/549-0761)

**SHOPSMAITH**
3931 Image Drive
Dayton, OH 45414
800-526-6900

**TOTAL SHOP**
PO. Box 17859
Greenville, SC 29606
800-845-0358
(In South Carolina, call 288-4174)

Written by Jim Barrett; Technical Consultant: George Granse; Photographs: Jim Kascoutas
GET IT RIGHT EVERY TIME WITH OUR
BLADE-HEIGHT GAUGE

Not long ago, a woodworking friend of ours claimed that "a shop aid that really works is worth its weight in ebony." We couldn't agree more! That's why we're so anxious to share this blade-height gauge with you. With it, you can easily set your table-saw blade to exactly the right height.

**Note:** When cutting the parts, we cut everything extra long for machining safety. By cutting to the lengths stated, you'll have enough material for an extra gauge—perhaps for a woodworking friend.

CONSTRUCT THE SUPPORT AND SLIDING BAR

1. Cut a piece of ¾"-thick oak to 3/4" wide by 14" long for the support (A). Cut a ½" groove ½" deep centered along one edge where shown on the Step 1 Drawing below.

2. Rip a ¼"-thick strip from the edge of a piece of ¾" oak stock, and crosscut it to 14" for part B.

3. Rub paraffin wax on the inside edges of the ½" groove you cut in part A (this will help to keep the glue from sticking to them). With the edges of parts A and B flush, apply glue sparingly, and clamp them together (see the Step 2 Drawing). Immediately after clamping, remove any glue from the groove with a thin piece of wood.

4. Using a ¼" dado blade, cut a ¼" kerf centered from side to side the length of the support where shown on the Step 3 Drawing.

5. Cut a 6¼" piece from the laminating (don't forget, you'll have enough material for two supports).

6. Drill a ¾" hole through the support (A) where shown on the Exploded-View Drawing. Don't drill through the two strips (B).

7. Cut a piece of ¾"-thick oak to 1/8" to 1½ by 1½, 14". Follow Step 4, 5, and 6 drawings to form the sliding bar (C). (Note that the kerfs in the sliding bar are offset to align one edge of the bar flush with the surface of the metal rule.) Check the sliding bar's fit in the support, and sand the mating edges if necessary. Cut the sliding bar to length.

NOW, LAMINATE AND CUT THE BASE

1. Cut a piece of ¾"-thick oak stock to ¾" wide by 19" long for the base (D). Cut three 3" strips from this piece (if you're building two gauges, cut 6 strips).

2. Position three strips around the support where shown on the drawing at right. Mark a reference line across the top of the two outer strips. Spread a thin film of glue on the mating edges, realign the pieces (without the support this time), and clamp the base pieces together.

3. Using the dimensions on the Exploded-View Drawing, mark the shape of the base on the laminating, and cut it on the band saw.

4. Using a flat-bottomed bit (we used a Forstner bit), bore a pair of ¾" holes ½" deep on the bottom of the base for the magnets.

---

**STEP 1**

- A ¾" dado blade
- ¼" dado blade

**STEP 2**

- A ¾" dado blade
- ¼" dado blade

**STEP 3**

- A ¾" dado blade
- ¼" dado blade
Bill of Materials

<table>
<thead>
<tr>
<th>Part</th>
<th>Finished Size*</th>
<th>Material</th>
<th>Qty.</th>
</tr>
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<td>1</td>
</tr>
<tr>
<td>B*</td>
<td>⅛&quot; × ¼&quot; × 6¾&quot;</td>
<td>oak</td>
<td>2</td>
</tr>
<tr>
<td>C*</td>
<td>⅝&quot; × ⅜&quot; × 6¾&quot;</td>
<td>oak</td>
<td>1</td>
</tr>
<tr>
<td>D*</td>
<td>¾&quot; × 2½&quot; × 3&quot;</td>
<td>oak (laminated)</td>
<td>1</td>
</tr>
</tbody>
</table>

*All the parts are cut larger initially, and then trimmed to finished size. Please read the instructions before cutting.

Supplies: 2—¾"-diameter round magnets, epoxy, ¼" thumbscrew ½" long, 6" metal rule (Sears catalog no. 9GT40135, $4.50), paraffin wax, ¼" threaded insert, ½" dowel stock, finish.

---

5 Epoxy the magnets in place in the ¾"-diameter holes in the base (see the Buying Guide for our source). When dry, sand the bottom of the base flush with the magnets.

**FINAL ASSEMBLY**

1 Glue the support into the notch of the base, checking for square.
2 Sand the back of the rule for better adhesion. Epoxy the metal rule to the support where shown on the Exploded-View Drawing (the bottom edge of the rule should be flush with the top of the base).
3 Finish-sand all the pieces.

---

STEP 4

Saw blade (⅛" thick)

---

STEP 5

Saw blade

---

STEP 6

Saw blade

---

Scribe a line across the sliding bar even with the bottom of the rule.

threaded insert, and apply a clear finish to all the pieces.

6 To allow the bar to slide freely in the support, wax the mating edges, and fit the sliding bar into the groove in the support. Place the ½" dowel in the hole in the threaded insert. Thread the thumbscrew into the threaded insert.

---

**Putting the gauge to use**

Position the height gauge on the table saw with the sliding bar above the highest point of the blade (directly above the arbor). Raise the blade, which raises the sliding bar, until the scribed line matches the desired height.

---

**BUYING GUIDE**

- Height-gauge hardware kit. 6" metal rule, 2 disk magnets, ¼" thumbscrew, ¼" threaded insert. Catalog no. 7451, $10.75 ppd. for one kit, $18.75 ppd. for two kits.

Meisel Hardware Specialties, P.O. Box 70, Mound, MN 55364.

Project Design: Paul L. McClure
Photographs: Bob Calmer
Illustrations: Kim Downing, Bill Zann

WOOD MAGAZINE APRIL 1988 59
ONE ARIZONA FAMILY'S DAILY GRIND
HIGH-TECH SAW-BLADE MANUFACTURING

In Chandler, Arizona, the Woodburys keep their noses to the family grindstone in their tool-manufacturing business, Cherokee Tool Company. Leo and Joy (at center, above) and sons (from left) Nick, Neil, Nathan, and Nolan showed us what goes into making a leading-edge, carbide-tipped, circular saw blade. They threw in some advice on what makes a great blade, and gave us pointers on how to care for one.

"Cherokee Tool wasn't started strictly as a moneymaking business. I simply wanted my sons to have a trade. I thought I owed that much to them, and to society," recalls Leo Woodbury about the company's 1969 startup.

Five years earlier, Leo had sold his tool-sharpening business in Cherokee, Iowa (for which he named the company). To benefit one of his young sons who had asthma, Leo moved his family to Arizona. Leo and Joy's oldest son, Neil, now 39, had just returned from the navy, and Nick, presently 35, had just graduated from high school. Leo figured the sharpening "shop/school" would last only long enough for the trainees to pick up his skills. Then, the boys would get "real" jobs utilizing their training. He was in for a surprise: Their work volume grew to a point the Woodburys never imagined possible.

As the three Woodburys continued to sharpen and repair tools, Cherokee Tool evolved into a custom saw-blade manufacturer, first filling the needs of woodworkers who wanted a blade they couldn't find on a store shelf. Then, they expanded their manufacturing scope to metalworking tools—carbide shaper cutters, saw blades, and router bits. They also began retooling operations for electronics and aerospace corporations, such as Motorola and Martin Marietta.

"Our bottom line was 'Sharpen the tool better than it was ever built.' In many ways, that's what led us to making tools ourselves—our way," explains the elder Woodbury.
A saw blade begins as part of a rolled steel bar that weighs 1,200 pounds. A liquid-cooled band-saw blade slices the blanks.

Cherokee Tool now counts 20 employees, including the oldest sons Neil and Nick, and younger sons Nathan, 30, and Nolan, 27, who have been "schooled" in the company, too. Joy manages the finances in the office.

The Woodburys don't always make tools the fastest way. They also don't make inexpensive ones. Their carbide-tipped circular saw blades cost more than a few bucks — $119 for the combination planer, $72 for the ripsaw.

Says Nolan, as family pride surfaces in a smile, "We're delivering a tool that will do the job it's supposed to do...and our customers keep coming back."

GEOMETRY STARTS SAW BLADES SPINNING
A circular saw blade seems like a simple-enough tool: a body with a center hole and teeth with cutting edges. But a blade's simplicity proves deceptive when you learn more about how it's made. "First, you have to engineer the blade for the specific job," says Nick, who oversees saw-blade engineering and manufacturing. "We have lots of what I call 'tooth geometry' — figuring out what one saw tooth is going to look like from all the options.

"Just the tip geometry for the tips includes alternate bevel, flat tops, triple chips, and primary clearance angle. After that, the object is to make all the teeth just like that one tooth. But, we have lots of machinery to help us," he adds.

Although the Woodburys work with steel instead of wood, woodworkers would feel at home with much of the equipment in the first stage of saw-blade manufacturing. When a large order for a particular blade comes in, manufacturing starts by slicing blank saw plates with a band saw from 10'-long cylinders of steel, left. Called hot rolled billets, each cylinder weighs in at about 1,200 pounds. For
SAW-BLADE MANUFACTURING

smaller orders, Cherokee Tool buys top-quality blanks and then brazes on their own engineered carbide tips. No matter whether blades begin as billets or blanks, Nick, who directs mach-ne-tool manufacturing, happens to be pretty selective about the steel.

"Before carbide tips, woodworkers demanded high-carbon steel blades because they stay sharp longer," Neil comments. "Now, even with carbide tips, some folks think the blade still should be that hard." He continues, "Ours is a special alloy tool steel that won't become brittle when the tips are brazed on. In tooling vernacular, it's called roll-tensioned, heat-treated, high-carbon steel. Tensioning," Nick explains, "means adding stress to the steel by stretching it mechanically so that the blade won't warp, or even worse, crack."

The band saw cuts each steel blank saw plate to within $\frac{3}{64}$ of its final thickness. Automated metal-working lathes then turn the plates down to within .003-plus inch, and fine-tune the diameter.

Another lathe turns out the center hole. "The center hole of a blade should be given respect," says Nick. "It is the basis of the saw because the teeth revolve around it. If the hole isn't exactly at center, all the teeth won't cut as it revolves on the arbor." For that reason, the tolerance on blades with a $\frac{3}{8}$ inch hole is within .0005".

SHAPING UP A SAW BLADE

With the next step, blanks begin to look like saw blades. On a milling machine, cutter heads whirl to shape the edges of the blank into teeth and gullets, photo, below.

Gullets, the deep cutouts between teeth or series of teeth, gather and hold sawdust chips until the blade exits the wood. In general, the less space taken by the gullets, the slower the sawing. For instance, on a ripsaw, which produces large chips, you need a larger gullet than on a crosscut blade.

Cherokee stands behind a rounded, rather than a V-shaped, gullet. They believe the rounded shape produces more efficient chip release and less chance of the chips packing together in the gullet.

Cherokee cuts expansion slots in crosscut and other types of blades that don't have deep gullets. The long slits prevent the blade from warping or buckling in use by allowing the metal to expand and contract. Cherokee Tool mills an expansion hole into the end so that the slots themselves don't crack. Then, to keep the blades from "singing" while cutting, each hole receives a plug.

In the next manufacturing step, a surface grinder grinds the evolving blades perfectly flat, a process

Below: Each pass of the milling machine creates a tooth and a gullet on the steel billet. Here, the machine mills thick, industrial cutters.

Top: To braze on the carbide tips, Nick heats the silver brazing alloy to the melting point for a bond between the steel blade and the carbide tip.
called leveling. To the woodworker, this step means that a blade will cut true to the line and not "walk" in the kerf. Leveling also unifies tooth thickness around the blade.

"Every cutter head and saw blade goes through this grinding process to make sure both surfaces are absolutely parallel," says Nick. "They're surface-ground to within .0005." According to Nick, some manufacturers sandblast blades to level them, rather than grind.

**THE HARDEST OF THE HARD WON'T WORK**

Tungsten-carbide-tipped teeth stay sharp longer than teeth of high-carbon tool steel. That's a well-known fact, but a misleading one. According to Nick, who hand-brazes carbide tips onto teeth, photo, left, all tungsten carbides aren't the same. The harder the carbide, the longer it retains an edge. Yet, the harder the carbide, the greater its brittleness, and thus, the less its shock resistance (the pressure it will stand per square inch). For woodworking purposes, C-4-grade carbide happens to be the hardest used; C-1 the softest.

"The softest grade of carbide will cut the hardest wood, that's no problem," Nick explains. "The appropriate grade of carbide, however, has more to do with how the blade will be used than with the type of wood being cut."

For instance, Nick chooses a C-2, or medium grade of hardness for Cherokee's rip saw. Because of the angle at which rip saw blades cut, more pressure is exerted on their teeth than on the teeth of other blades. He brazes C-3-plus tips onto their combination planer blades.

**DIAMONDS ARE A BLADE'S BEST FRIEND**

To obtain the smoothest cut possible, the folks at Cherokee Tool shape and sharpen their carbide-tipped saws with precision grinding machines that use specially designed and formulated diamond wheels. Human eyes and hands still control much of this work, although computerized programming has been installed.

Nick explains the difference Cherokee's precision grinding makes. "If you just go out and pick up a blade retail, you'll find that most have teeth ground straight and flat. The thing that makes a saw like our combination blade special is alternate-face beveling. It cuts down on the pressure exerted from the saw blade to the wood," Nick explains. "That means that on a delicate piece of material like plywood, it results in less damage to the wood. It's a severing cut that won't tear and chip the wood."

"As far as I know, we're the only saw manufacturer that puts an alternate-face bevel on a stock combination planer saw blade," Nick adds. "Even when comparing blades you must look hard to see it, but you'll feel the difference, hear the difference, and you'll see the difference in the work."

**NO TOLERANCE FOR INTOLERANCE**

After the extensive grinding process, each blade undergoes a close-up inspection by one of the company's tool experts, photo, left. An optical comparator and measuring machine projects the magnified image of the blade against a grid, comparing the blade to its blueprint to make sure that everything that was supposed to happen in manufacturing did happen. To point out how carefully they treat quality control at Cherokee Tool, Nick explains that a sheet of paper measures .005" thick, while many stages of their final inspection measure to tolerances within .0002".

"One of our strong points, we believe," says brother Neil, "is that we use the same tolerances for our woodworking tools—whenever feasible—as we do for the aerospace and electronics industries. And to think that some folks believe all we do is stamp out saw blades!" ♠

Above: Peering into a 100-power microscope, Leo makes the final inspection. He checks for microscopic cracks in the brazed joints.

See page 80 for related article on saw-blade care

Written by Emily Freeman Pinkston
Photographs: Jeff Welcker
A HONEY OF A PROJECT

TEDDY BEAR

Note: When making the sculpted bear, you'll end up with enough pieces for two of these little critters. So you may want to go ahead and build two clocks while you're at it.

BUILDING THE CLOCK FRAME
Note: You'll need some thin stock for this project. You can resaw or plane thicker stock to the correct thickness.

1. Cut a strip of 1/8"-thick oak stock to 1 3/4" wide by 30" long for the outer-frame parts (A). Miter-cut the parts to length (7¼").
2. Glue and clamp the oak frame parts together. Be sure to check the frame for square.
3. Cut a piece of 3/8" walnut to 2 x 30". Resaw a 1/4"-thick piece from it. Cut a 1/4"-wide piece from the 2" width for the inner-frame parts (B). Miter-cut the inner-frame parts to fit inside the oak frame.

Glue in position, flush with the front edge of the oak frame.

4. Cut the clock face (C) to the size of the opening less 1/16" in width and length to allow for movement of the wood.
5. Draw diagonals on the clock face to find its center. Drill a 3/8" hole for the clock movement shaft at the marked center point. (The shaft size of your particular movement may require a different-sized hole.)
6. Refer to the dimensions on the Exploded-View Drawing below: mark the center point for the 3-, 6-, 9-, and 12-o'clock dowel locations. Drill a 3/8" hole 1/4" deep at each center point. Cut four 1/2" walnut plugs 3/8" long (or cut the pieces from 3/8" dowel stock), and plug the holes. Sand the plugs flush with the oak and walnut frame.
7. Sand the clock frame smooth, sanding a slight round-over on all sharp edges.

DON'T, we repeat DON'T show the photograph of this clock to your spouse, or children unless you're ready to build a few. This oak and walnut clock has proven to be simply irresistible, and for some reason, it's not just the children who seem to want one.

The chubby little bear has its parts cut to shape on a scroll saw and shaped with a drum sander. All-in-all, it shouldn't take but a few hours to build and a lifetime to enjoy.

Bill of Materials
(The Bear Essentials)

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<th>Part</th>
<th>Finished Size</th>
<th>Material</th>
<th>Qty.</th>
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<td>F</td>
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<td>oak</td>
<td>1</td>
</tr>
</tbody>
</table>

*Parts marked with an * are cut larger initially, and then trimmed to finished size. Please read the instructions before cutting.

Supplies: carbon paper, 1/4" plywood or hardboard for backing board, double-faced tape, sawtoothed hanger with 2—#3 x 3/4" roundhead wood screws, silicone sealant, finish.

WOOD MAGAZINE  APRIL 1988
WALL CLOCK

FORMING THE BEAR PARTS
1 From 1/4"-thick walnut and oak, cut two 5"-square pieces (D, E).
2 Cover one face of the oak with double-faced tape, and stick the walnut to it. Using carbon paper, transfer the full-size bear pattern below to a piece of 5x5" paper. Using spray-on adhesive, adhere the pattern to the top piece.
3 Drill 1/16" holes through the walnut and oak where shown on the drawing below. Cut the parts to shape. For the nose and eyes, insert the scroll-saw blade through the start holes, and make the cuts. Make accent cuts to form the mouth. Separate the pieces, and remove the tape.

ASSEMBLING THE BEAR PARTS
1 Round-over the front edges of the parts with a drum sander. Finish-sand the parts by hand.
2 Cut two pieces of 1/8" plywood to 4½ x 5". Mix the walnut and oak parts, and position them on the 1/8" backing. Trace each bear's outline on the backing, and remove the parts. Cut the backing slightly smaller than the marked outline.
3 Apply woodworker's glue on the backing, and position all the parts except for the muzzle and nose. To elevate the muzzle, cut and glue a 1/4 x 1/4"-diameter filler block in the opening. Glue the muzzle to the top of the filler block. Put glue in the muzzle hole, and position the nose so it sticks up about 1/4" above.
4 Sand the 1/8" backing at the edges to make it less noticeable.

FINAL ASSEMBLY AND FINISHING
1 Cut the mounting block (F) to size, and glue it to the frame. Finish-sand the clock frame and face.
2 Apply finish to the frame, face, and bear. Sand the front of the mounting block, and glue the bear to it. Lay the frame, face side down, and center the face in the opening. Hold the face in place with a small bead of silicone.
3 Fasten a sawtoothed hanger, and install the movement. If you use the movement listed below, trim the hands to length, and attach.

BUYING GUIDE
- Clock movement. QC18 movement with #17 black hour and minute hands and SH4 brass, second hand. 89 ppd from Precision Movements, 2024 Chestnut St., RO. Box 689, Emmaus, PA 18049, or call 215/967-3156 to order. ♦

Project Design: Karen and August Caryl
Photographs: Bob Calmer
Illustrations: Kim Downing; Bill Zaun
TRUMPET SPRING'S ARRIVAL WITH OUR COUNTRY-STYLE SWAN NECKLACE

Here's a necklace project you'll want to dive into. It has that certain country charm not often found in jewelry. Using the full-size photograph as a pattern and your scroll saw or band saw, you're on your way to a sure-to-be appreciated gift.

1 Using carbon paper, transfer the full-size swan outline (as photographed on this page) to 3/16"-thick stock (we planed down 3/4" birch).

2 With a scroll saw or a band saw fitted with a 3/16" blade, cut the swan to shape.

3 Chuck a 3/16" brad-point bit in your drill press. Then, clamp the swan piece in a handscrew clamp, position the swan below the bit, and drill a 3/16" hole through the head and neck where shown in the drawing above right.

4 Hand-sand the swan smooth, sanding a slight round-over along the front face.

Note: Most hobby shops and craft stores stock the lacing and wooden beads (used for macrame) noted in the following steps and shown in the photo.

5 Paint the swan and the beads to the colors shown in the photograph (we used artist's acrylic paint).

6 Cut a piece of lacing (we used white rattail cord; narrow satin ribbon also would work) to 30" long. Thread the lacing through the 3/16" hole in the swan. Center the swan on the lacing, and tie one knot at the front of the head and another at the neck to keep the swan centered on the lacing. Tie two more knots 2" from the first ones where shown on the photograph. Next, add wooden beads onto the lacing on each side of the swan, and tie two more knots to hold the beads in place.

Project Design:
Marie Fredrickson
Photograph: Jim Kascoutas
1. Draw a 1" grid measuring 7 x 14" on paper, or see the note at the end of this article for a full-size pattern. Using the Front View Grid for reference, lay out separate patterns for the head and upper body (A), nose (B), teeth (C), and one eyebrow (D). Mark the center points for the two hanger dowels, eyes, and nostrils. Cut the patterns to shape.

2. Spray the back side of the paper patterns with spray adhesive. Adhere the head, nose, and eyebrow patterns to ¾"-thick stock (we used cedar) and the teeth to ⅛" pine. Cut the pieces to shape. Use the nose piece (B) as a template to mark the second nose piece. Then, cut it to shape.

3. Band-saw the ¾"-thick eyebrow piece in half to form two thinner pieces (D). Glue and clamp the two nose pieces together.

4. Tilt your drill press table 30° from center, and drill two ⅛" holes ½" deep for the hanging dowels in the head piece. Drill holes for the eyes and nose. Remove the paper patterns from the wood pieces. Drill two angled holes in the back of the head for hanging.

5. Drum-sand or cut the back surface of the teeth (C) to the shape shown on the Side View Drawing. Sand all the pieces smooth.

6. Glue the teeth to the bottom of and flush with the front of the nose piece. Later, clamp the nose-teeth assembly in a handscrew clamp, and band-saw a ⅛"-deep kerf in the front edge. Glue and clamp the nose and eyebrows to the head.

7. Cut to length, and glue two ⅛" dowels in the holes in the head and upper body. Apply the finish.

Note: For a free full-size pattern, send a self-addressed, stamped No. 10 business envelope to: Whimsical Wabbit, WOOD Magazine, Locust at 17th, Des Moines, IA 50326.

Project Design: Janet Betts
Photograph: William Hopkins
Illustrations: Kim Downing, Bill Zaun
HITCH 'EM UP AND HAUL 'EM OUT
HORSE LOGGING IN

"I walk a lotta miles in a day, you know. Following these horses, you get a lot of miles on. Never go fast. It's better that you go just steady and easy so they don't play themselves out. Just like a man... he pushes himself half a day, then he's played out. You gotta use judgment with horses."

—Paul Dicob, logger, in the Adirondack foothills near Loewville, New York

WOOD® OFF THE ROAD

My "Giddap!" moves two tons of Belgians and a hemlock log.

With horses, the jingle of logging chains and the squeak of harness substitute for engine roar. "Gee" and "Haw;" the universal shouts for directing draft animals, fail to silence forest sounds. And natural smells replace diesel smoke.

For a guy like me, who spent lots of time in large, commercial logging operations, horse logging was a refreshing experience. From the moment I spotted a man and his team coming from the stand of hemlock, I thought I'd gone back in time. What a great feeling! Combine it with the thrill of directing a team down a logging trail, and that visit last spring ranks right up there with the best times of my life.

—Peter J. Stephano, Features Editor
Paul Dicob, of Lowville, New York, has been working horses in harness for nearly 50 years. He uses his Belgian draft horses to log the surrounding Adirondack Mountains year-round, except "when the snow's up to their brisket" or spring melt turns the turf to greasy muck. He sees the growing demand where he lives for skidding logs with horses, and believes in its possibilities.

"If you like to work alone, one man could make a real healthy livin', financially," he says. "A man and a team...it costs you 30 quarts of grain per horse a day, a bale of hay per horse per day, and about 30 gallons of water each a day. Now, if you rent a skidder [a specialized tractor], you got fuel expense at over $1 a gallon on top. And when you rent them and bust them, you got to fix them. You break one down, it ain't like breaking a strap on a harness."

**SKIDDERS OUTPULL BELGIANS, BUT THE WORK ISN'T NEARLY AS PEACEFUL**

Horse logging faded into memories after World War II in the face of machinery for high-volume logging. Now, logging with horses seems to be making a comeback. Paul Dicob says it's happening in the East. And there's indication of a Midwestern revival.

Why the turnaround? According to Lee Ekstrom, a consulting forester in Michigan, horse logging sometimes happens to be the most practical way to get logs out, such as in steeply hilled country. Also, environmentally minded landowners, those with small timber stands, and folks selling only prime hardwood for selective cutting, tend to prefer loggers with draft animals. There's no way to measure the renewed interest, but Lee says he knows five loggers within a 50-mile radius of him who now use horses.

Yet, mechanized loggers bring out four times the wood in a day that horses can. Working two teams of huge Belgians, the best daily haul Paul figures on runs about 6,000 board feet of saw logs (20-30), or enough logs to equal the 15 cords...
HORSE LOGGING

of pulpwood (a pulp cord measures 4' x 4' x 17') it takes to fill a flatbed trailer.

"Belgians will pull double their weight," he notes. "My team weighs about 40-hundred [4,000 lbs.]. They'll slide 80-hundred pretty good. A team can't do too much at a time, compared to a skidder." Pausing, he adds: "But, I like it in the woods with horses. It's kinda peaceful, and I like their smell. You gotta like horses to work with them, and have patience."

As a boy on the farm, Paul worked his dad's field horses in the woods during the winter. He hasn't been far from horses since. And he favors Belgians. "I think a Belgian is chunkier than a Percheron...more short-legged and blocky for pulling. If you're a horse lover, though, you like all horses," he says.

Of all the horses he has owned, Paul doesn't designate one a favorite. He does prefer to work behind Prince and Charlie, though, rather than another team he could pair from his other Belgians—Dan, Dick, and Banner. He's had Prince for several years. Charlie is a relatively recent addition, and he didn't come cheap.

"A good horse is high priced," Paul states. "You have to give at least $2,500. That's what I gave for Charlie at a sale. He was a hitch horse, for pulling wagons, and lots of people wanted him for show. Charlie was mistrained some, but he got over it."

Paul runs his hand over his horses' haunches, just as a father would pat his children's heads, and continues. "These two got a lotta ambition, anyway. My other ones are bigger, but easier going."

IN THE WOODS, HORSES GET FREE REIN

Paul bids on all kinds of timber, from cherry and yellow birch down in the river valley that he sells to a factory for furniture stock, to pine and aspen for paper pulp. When he buys a job, he hires Hilary Widrick, 66, and his team of Belgians, and Elmer Zehr, 45, who cuts fast enough with his chain saw to keep two teams hauling.

Left: For the camera, Paul, Elmer, and Hilary demonstrate how logs were loaded onto wagons in the old days. Each log has a chain run around it that goes to the team. Peavies at the ready, Paul and Elmer stand by.

Explaining his purchase of the standing hemlock he, Hilary, and Elmer were working when we visited, Paul says, "A fella can pay more for stumpage in an area like this, where you can get to the logs pretty fast. With horses, you only want to go about 1,000' [about three football fields] into the woods from the landing where the logs are stacked for hauling. Over 1,000', that's quite a distance for pulling. A skidder can go deeper, pull a cord per hitch, and make money."

Paul shakes his head, and adds: "You take around here, though, some people don't want skidders in
the woods 'cause it tears them up. But it all depends on the operator. A rough operator, he don't care."

Some of the hemlock in the stand, the smaller ones, will become paper pulp. The big trees, a local sawmill will buy for lumber. Paul knows roughly how much wood they'll get. "We'll pretty well clean 'er," says the woodsman. "Maybe 100 cord of pulp, 75,000-100,000 board feet of saw logs."

At 7:30 a.m. Paul, Hilary, and Elmer are at the logging site, already at work. The pile of logs in the clearing at the edge of the woods tips passersby as to what's going on behind the screen of trees. The horse trailers parked nearby name the loggers and proclaim the method.

The buzzing of the chain saw back in the woods changes locations every hour or so. Every few minutes, the jingle and clink of chains announce either Paul or Hilary's emergence from the trees, a log in tow behind their team.

Methodically, the drivers direct the flexing horses to cross in front of the pile of tree trunks. "Whoa" stops them. The log is released, the team swung around, and back into the woods they go. And so they work, hour after hour.

"We break about eleven for lunch in the clearing," Paul announces. "Have to feed the horses and water them. Take about half an hour out, then we're going again. Gotta grain 'em pretty heavy. They gotta have something, too, just like a man when he's working hard."

Back among the hemlock after the noon break, Elmer decides which tree to drop next, and where to lay it down. Paul explains the planning. "He drops most trees so we can go straight out with them. Sometimes, though, there's trees in the way. Then, he better line up and drop the logs so we can swing 'em.

Continued
HORSE LOGGING

You can't swing these or you'll get bound in between." He points to a 20' length of log lying between two trees. "It ain't like a skiddler. They keep on a-going. Smash everything."

To skid a log out of the woods, Paul first backs his team up, just like a truck. "Back Charlie, Prince!" he barks. The Belgians reverse hesitatingly, feeling their way across the roots and stubble. Once in place, Paul drops the reins and grabs the tongs fastened to the end of the log chain and opens them. Whunk! He buries their points into the end of the log—below center so the pull will raise it slightly from the ground.

Standing behind and to the side of the team, the reins still on the ground, Paul bellows "Giddap Charlie, Prince!" The horses launch themselves forward in a straight pull. The log breaks from the brush. "Whoa!" Paul shouts. The team stops. But not every log comes out as easily.

When there's a standing tree in the way, blocking a direct pull to the trail, the team must pull the log at a 90-degree angle. The log then has the standing tree for a pivot. And when the team pulls, the log swings around like a boomerang, clearing limbs from its path.

"You can get pinned in a hurry if you're not watchin'. That's one of the most dangerous things there is," Paul advises. "I never been hurt by horses. Usually, when you holler 'Whoa' they stop. With horses, you get in a tight place, you just let the reins go. Holler 'Whoa' they'll stop, yep."

DANCING DOWN THE SKIDDING TRAIL, LOGGERS SOMETIMES MISS A STEP

Following two draft horses hitched to a log down the skidding trail isn't much different from a walk in the park. Paul could let go of the reins if he wanted to. The horses know which way to head.

Yet, with reins in hand, he can stop Charlie and Prince about every 20 yards for a break. "You don't have to rest them long, just enough to catch their wind. It's better if you don't
stand them long, 'cause just like a person, they'd get stiff," he says.

Gently holding the reins also keeps your mind from wandering, something you don't want to do when you're walking next to a moving log, according to Paul. He describes his backwoods ballet: "Horses go to the left, you got to jump over onto the right side of the log. Otherwise, you get your feet taken out from under you, and maybe the log on top. You yell 'Whoa,' but it might be too late."

One log at a time, trip after trip, Paul and Hilary guide their animals to the landing where the logs are piled. The skidding trail, despite becoming scraped of cover, displays no ruts. The trees bordering it show no bruises from passing logs. Odors of sweat, leather, manure, and hemlock boughs mix pleasantly.

For awhile toward the end of the day, Hilary switches from one-log hauling to the travois, which can carry two. Sometimes called a "log boat," the sled-like travois allows him to bring a few more logs out to complete a truckload. It also means that loading takes twice as long as hitching up to a single log. From years of experience, Hilary believes a travois has its time and place.

About 4:30 p.m., when the sinking sun warms open spots in the woods with orange light, Paul, Hilary, and Elmer follow the skidding trail for the last time. After the teams drop their logs at the pile, and fail to head back down the trail, they edge closer to the trailers. The four Belgians know the day has come to an end.

The men will head home to clean up for supper. But Paul and Hilary first care for their horses. "After I get the horses home," Paul declares, "it ain't a good idea to wash them down. They'll catch cold. I go over 'em with a curry-comb. They like they're backs itched. But what a horse likes best is to turn right out to pasture. They roll—itch their own backs, you know. They'll lay down and dig away with their back, get up and shake, then lay down on the other side and roll some more. After that, they'll go to eating. They're satisfied."

Produced and written by Peter J. Stephan
Photographs: Fred Schneider
CARVE A SERVING BOARD

A MEDIEVAL DRAGON MOTIF
BY ELSE BIGTON

Else Bigton and her husband, Phil Odden, live amidst the timber surrounding Barronett, Wisconsin. In their Norsk Woodworks, they build and carve Scandinavian-style furniture.

Else trained to become a professional woodcarver in her native Norway. There, decoratively carved wooden serving pieces and utensils continue to be widely used. According to Else, the stylized dragon symbolized power and was a commonly featured motif during the Middle Ages.

True to Scandinavian tradition, Else selected birch for her project. "Scandinavian carvers prefer lighter-colored woods. Birch is also food safe and hard enough to stand up as a cutting board on the noncarved side," she explains.

Tips on carving the dragon board

Enlarge the half-size pattern, then trace it onto a 3/4 x 8 1/2 x 17" birch board. Saw the board to shape and drill the 1/2" hole.

Else uses a V-tool to carve low-relief designs such as this. A chip carving knife will work, too.

To maintain the light, natural wood color, Else doesn't use a stain. Instead, she prefers a clear, nontoxic oil, such as Behlen's Salad Bowl Finish. Hang the finished board as a usable accent in your kitchen, den, or family room.♠

One in a collection of regional carving patterns from the nation's top carvers

Design: Else Bigton
Photographs: Chip Peterson, Darrell D. Henning

Note: For a full-size pattern of the dragon board, send a self-addressed, stamped envelope to:
DRAGON CARVING PATTERN
WOOD Magazine
1716 Locust St.
Des Moines, IA 50336

Each square = 1/4"
ONLAY VASE

Continued from page 33

Belt-sand the panels. If any small cracks exist, see the photos on page 32 for our crack-filling remedy.

4 With the ends and edges flush, glue and clamp the sides (A) to the onlay panels.

5 Cut the top and bottom (G) to size. Chuck a circle cutter to your drill press and cut a 2 1/2”-diameter hole through the top piece as shown in the photo below.

Clamp the vase top firmly to the drill press table, and use a circle cutter to cut the opening.

6 Fit your table-mounted router with a 1/2” round-over bit. Now, as shown in the photo below, firmly grip the walnut square, and rout a round-over around the 2 1/2”-diameter opening.

Rout the 1/2” round-over along the edge of the opening in two passes, raising the bit the second path.

7 Glue and clamp the top and bottom to the vase. Later, sand the edges of the top and bottom flush with the vase sides. Rout a 1/2” round-over along all but the bottom edges of the vase. Sand the vase, and apply the finish.

Project Design: James R. Downing
Photographs: William Hopkins, Bob Calmer
Illustrations: Kim Downing, Bill Zaun

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TALL CLOCK

Continued from page 47

Buying Guide

- **Hinges and bit.** Frame-mounted hinges, catalog no. TEC82, $7.80 for three. High-speed steel bit for drilling a 35 mm hole for TEC82 hinge, catalog no. DB35, $11.95, $29.75 ppd. for hinges and bit from Constantine, 2050 Bronx, NY 10461, or call 800-223-8087 (800-822-1202 in New York) to order.

- **Walnut-burl veneer and adhesive.** Flexible veneer (much easier to apply than regular veneer), 24x24", catalog no. A5057, $27.25. Contact cement, one pint, catalog no. N2900, $6.75. The Woodworkers' Store, 21801 Industrial Blvd., Rogers, MN 55374, or call 612/428-2199. Minimum order $7.50, plus $2.50 handling charge per order.

- **Felt tape.** 1/2" wide x 17" long, catalog no. D1717, $.70. The Woodworkers' Store, address and ordering requirements above.

- **Floor glides.** Catalog no. C1405, four needed, 75 cents each. T-nuts, 3/4"-18, catalog no. D1306, $1.65 for a package of 10. The Woodworkers' Store, address and ordering requirements above.

- **Clock movement.** Eight-day movement featuring 12 tuned chime rods that play Westminster, Whittington, and St. Michael's melodies. Catalog no. 13904, $399.95 ppd. Klockit, P.O. Box 629, Dept. WD381, Lake Geneva, WI 53147, or call 800-556-2548 to order.

- **Clock timing marks and hands.** Made from solid brass, catalog no. 67925, $14.95. From Klockit, see the address and phone number above.

- **Decorative gold trim.** Flexible, durable vinyl, 3/4" wide by 20' long. Stock no. 15-9868U (page 132), $.89 per kit (2 kits needed). $21 ppd. for two kits from J.C. Whitney & Co., 1917-19 Archer Ave., P.O. Box 8410, Chicago, IL 60680, or call 312/431-6102 to order.

Produced by Marlen Kemmet
Project Design: James R. Downing
Photographs: William Hopkins
Illustrations: Kim Downing, Bill Zann

WOOD MAGAZINE APRIL 1988

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This isn't what you think!

You're probably looking at this machine thinking to yourself, "Oh, it's one of those all in one tools that takes forever to set-up and really isn't practical." Think again. This is the Toolmax T310. The T310 is a quality woodworking tool that requires almost no set-up and meets almost any commercial quality specification for individual equipment. The T310 has 4 separate motors which power the 10" Table Saw, 1" Spindle Shaper, 12" Jointer, 12" Planer, and Mortiser.

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HOW TO KEEP YOUR CARBIDE BLADES ON THE SAW—NOT OUT FOR SHARPENING

See related article on page 60

Make your carbide blades work better and last longer by following this advice from the folks at Cherokee Tool:

- Use a blade only for the cutting it was designed to do. For instance, don't rip with a crosscut blade because excess heat will build up and warp the blade.
- Use a carbide blade only for the job it was made to do. Cutting anything but wood may break off the tips — a real safety hazard.
- To lessen the chance of dropping it, hold the blade just as you would a record album, with thumb in center hole and middle finger at the edge.
- Clean blades after use, especially when working oak (because its tannic acid erodes carbide), plywood, or particleboard. Soak the blade in laundry detergent and water for an hour, then scrub it with a toothbrush, and let dry thoroughly. Other cleaners include fingernail polish remover, oven cleaner, carburetor cleaner, and lacquer thinner.
- To prevent rust, oil a blade before storing, but wipe it off before using. Oily blades slip.
- Never lay a blade down on metal, and never stack blades.
- Clean the saw's arbor and stabilizing collar when you change a blade. Built-up sawdust and wood slivers can shim out a blade and cause it to wobble, as well as damage the arbor hole.
- Be sure to tighten the arbor nut securely when installing it on the arbor. Otherwise, it will run off center and the center hole will wear unevenly. Overtightening won't bother blade operation, but could result in accidental damage during removal.
- When a blade binds, always stop feeding stock and turn off the saw, then back the blade out. Never force the cut.

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like any other precision tool, a saw fence is an investment. And when it comes to choosing investments, cheaper isn't better. Better is better. So T-Slot owners sigh silently count themselves among the ranks of professionals who have high standards and are willing to pay a bit more to maintain them. A hefty saw fence... and a more accurate one. The Excalibur T-Slot saw fence will correct your table saw into a precision wood-cutting machine.
cause allergic reactions in some individuals.

Since you can use shorter pieces for cutting boards, your scrap bin and the discounted “shorts” at many lumber yards are excellent sources for wood.

2 Make ‘em thick! Unfortunately, many cutting boards are made by edge-joining 3⁄8”-thick stock. This results in a lamination thinner than 3⁄4” after scraping and sanding. A cutting board this thin is much more likely to warp than a thicker lamination. To make thicker boards, rip pieces at least 1 3⁄4” wide, and then glue and clamp them together face to face (not edge to edge). This way, even after scraping and sanding, you’ll end up with a cutting board more than 1 3⁄8” thick. Plus, I’ve found that thicker boards sell better than thin boards.

3 Don’t worry about the glue you use. Many sources recommend against water-soluble glue; I’ve always used regular woodworker’s glue (Titebond) without a joint failing. The key is not the glue, but sealing the board later so water can’t get to the wood and glue joints.

Apply glue to both mating surfaces. Then, hold the pieces together, and rub them back and forth to form a thin, even film of glue on both pieces. After a bit of practice, you learn to put just the right amount onto the wood so the squeeze-out after clamping is minimal.

Continued on page 84
CUTTING-BOARD WHIZ

(Continued from page 83)

4 Clamp the pieces together flat. When clamping the pieces together, keep the top and bottom edges of all the pieces flush. Careless clamping creates lots of needless scraping and sanding to achieve a flat surface.

5 Rout a round-over on the edges. A routed round-over along all edges not only makes the cutting board smoother to handle, it also gives the lamination a cleaner, more attractive look.

6 Add feet for convenience. Not all cutting boards need be destined to lie flat on a counter. Raising a cutting board even 1/2" or so with wood or rubber feet makes it easier to pick up the board and food, and enhances many distinctive designs.

7 Use the right finish. Due to the numerous recommended finishes, you can get confused easily as to which one to apply. I've tried mineral, peanut, cottonseed, and corn oil, all with good initial results. But each requires frequent reapplications to keep the board properly sealed. Then, I applied a product that seemed too good to be true, Behlen's Salad Bowl Finish. Even with heavy daily use, a cutting board finished with Behlen's should last at least a year before it requires touch-up sanding and another coat of finish.

8 Keep your cutting boards dry and clean. Improper cleaning and neglect ruin more cutting boards than any other cause. To clean a board, scrub it with a damp (not soaking wet) cloth, and then dry the board with a clean, dry towel. Never submerge a cutting board in water or wash it in a dishwasher. You must keep the wood sealed against moisture. If your board was originally sealed with an oil, frequent reapplications (every two to three weeks) are a necessity.

Photograph: Bob Calmer
WOODWORKING FACTS, FACES & FABLES

FLEET-FOOTED FURNITURE
During the turbulent Middle Ages, battles and hasty retreats dictated that craftsmen design furniture for quick escapes. Glueless joints assured disassembly in a jiffy.

The ultimate piece of fleet-footed furniture was a simple board attached to a wall. Called a sideboard, it was the forerunner to the ornate cabinet of later centuries.

CONCRETE FACT: A SOLID LATHE
“When you need a tool to do something specific, you make it,” believes Denver Ulery, a physics and woodshop teacher at Overlake School in Redmond, Washington. So, when Denver’s bowl-turning hobby demanded a vibration-free lathe, he built one. Made with a concrete base, his face-plate lathe weighs in at 1,500 lbs.!

He says he has turned a 28” diameter burl bowl (it will handle 32” with the tool rest at an angle) without a shake or shimmy. Friends in Denver’s woodturner’s club have borrowed his plywood forms to pour bases for their own lathes, and he helps them round up the parts. No doubt, Redmond boasts the steadiest turners anywhere!

TAKING A LOOK AT YOUR TIMBER
At least in theory, as a U.S. citizen you own a few acres in America’s 191 million acres of federally owned national forests and grasslands. And you won’t have to travel far to see them. The system includes areas in 43 states.

For a map of all the national forests and grasslands, as well as a listing of regional headquarters, write: Director of Recreational Management, U.S. Dept. of Agriculture, Forest Service, PO. Box 2417, Washington, D.C. 20013.

AT WEST POINT, FORESTRY INCLUDES THE ROCKETS’ RED GLARE
Thriving under a management plan dating to 1889, the 12,756-acre forest at the U.S. Military Academy in West Point, New York has become the only parcel of federal land to certify as an official Tree Farm. Among the nation’s nearly 60,000 privately owned forests that make up the American Tree Farm System, the academy’s stands alone as the only one where sound forestry includes combat training.

Each year the acreage yields a selective harvest of mixed hardwoods for saw logs and veneer. A thinning program promotes growth. Yet, a forestry plan allows for ambushes, artillery barrages, small-arm’s fire, and foxholes.

Says Joe Deschene, West Point’s forester, “Most people don’t think of the Department of Defense as a manager of natural resources. But, the department does take care to see that their land is productive for wood, wildlife, and clean water.”

The American Tree Farm System, an organization sponsored by the American Forest Council, encourages and recognizes good forestry practices on more than 88 million acres of private land.

West Point cadets parade against a backdrop of marketable hardwood.

U.S. Army photo