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DECEMBER 1997 #63

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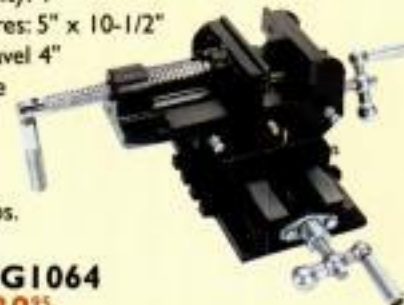
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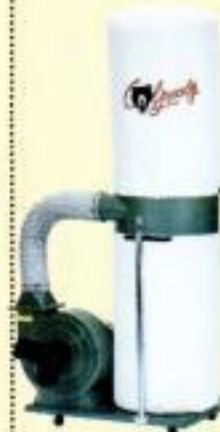
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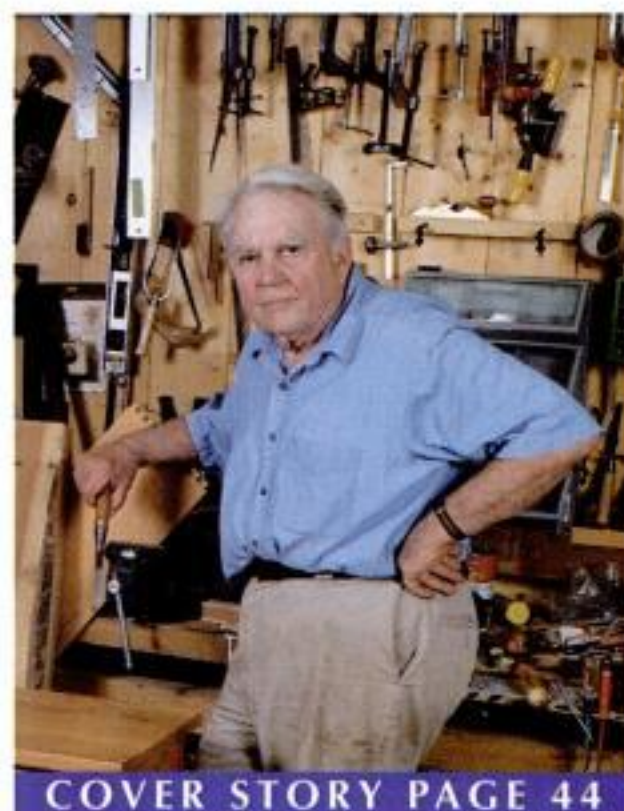
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AMERICAN WOODWORKER™

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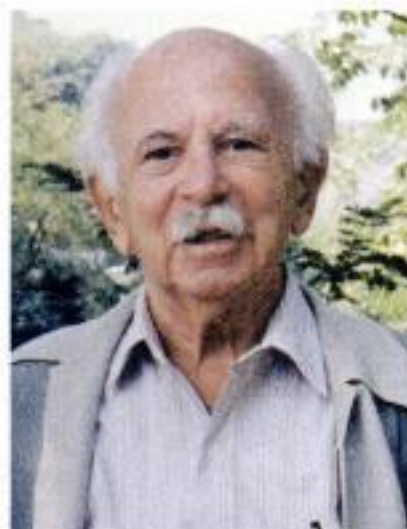
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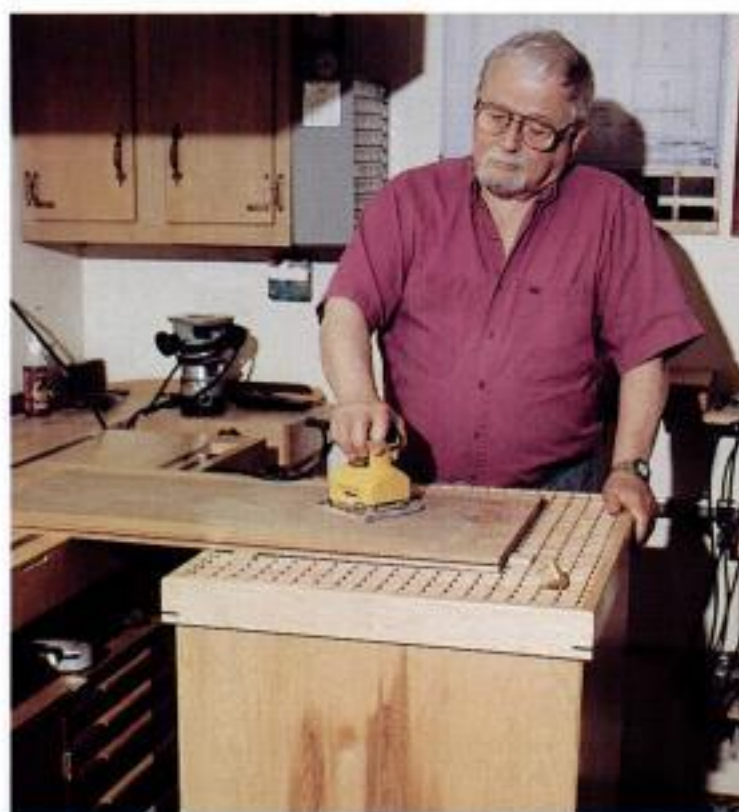
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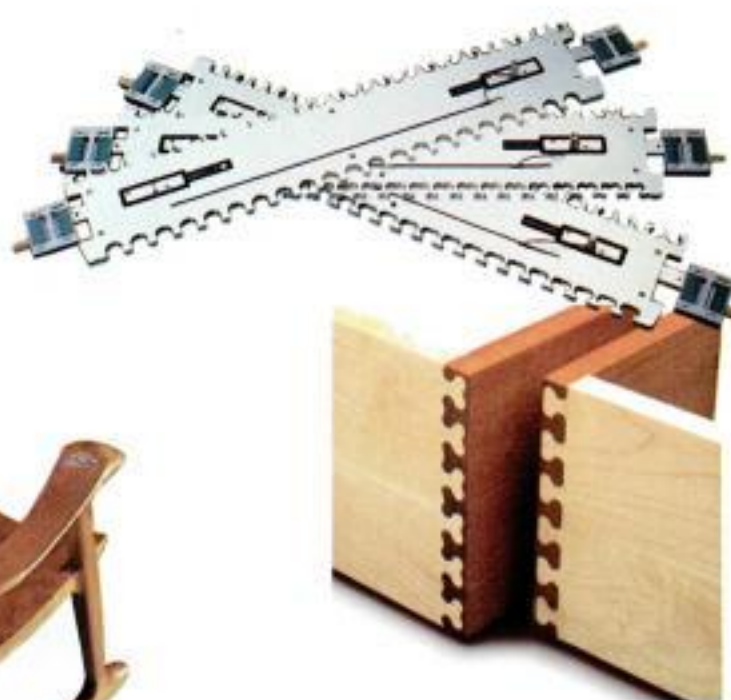
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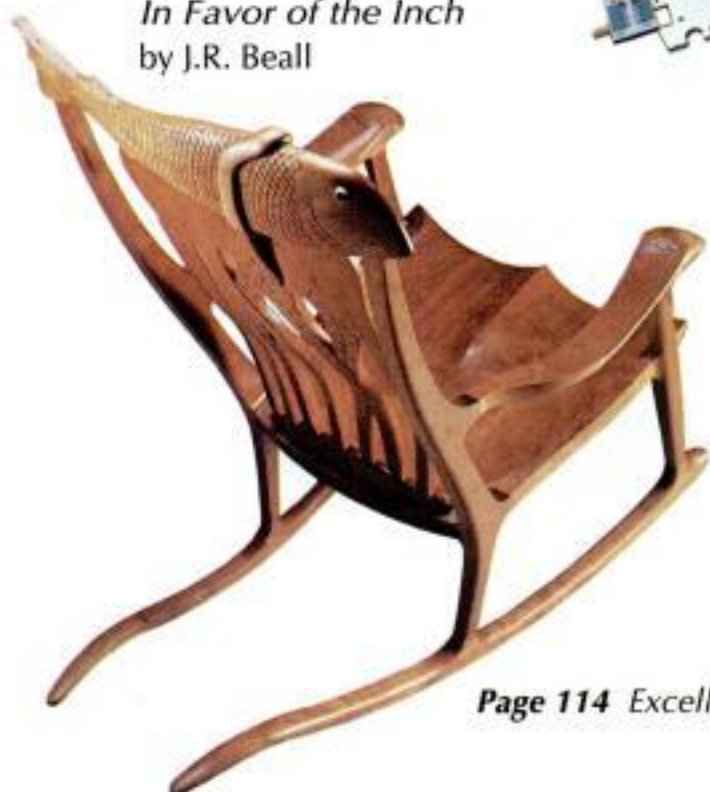
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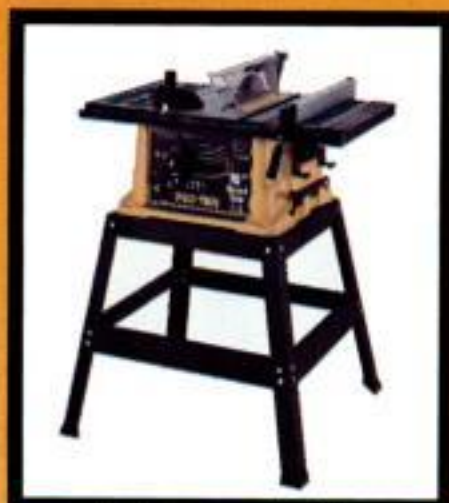
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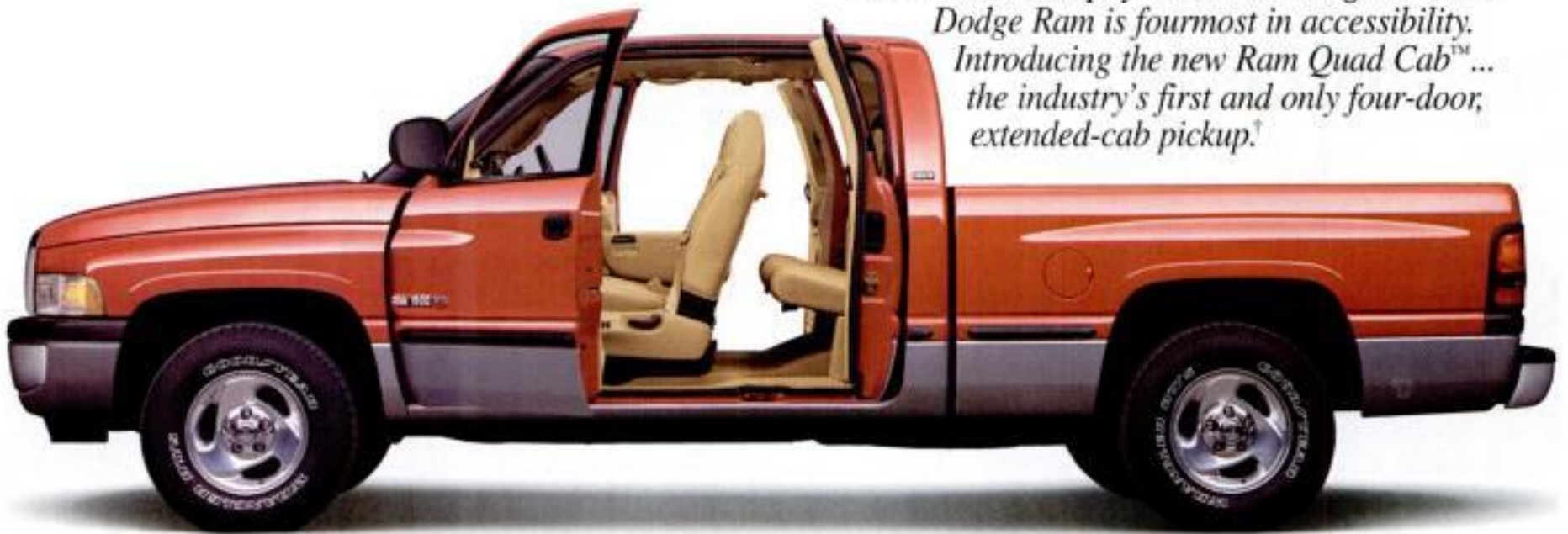
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As 1997 draws to a close, the staff at AMERICAN WOODWORKER would like to thank you—our readers, online visitors and showgoers—for making us your #1 source for woodworking information. We pledge to keep bringing you the best mix of projects, techniques and woodworking news in 1998 and beyond. Happy holidays from all of us to all of you!

Ellis Valentine
Executive editor

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Cradle Comments

I greatly enjoyed the plans for Molly's Cradle in AW #61. It is a beautifully crafted piece. I have only one negative comment. I was very concerned that the pointed ends of the through tenon and the pivot block could end up causing serious damage to a small child. If Robbi Staples' baby daughter were to fall forward near this cradle, she could take her eye out. I would suggest cutting the pointed ends off and softening the look of these pieces.

Mark F. Tomlinson
Racine, WI

Robbi Staples replies: I share your concern and, rest assured, the safety of my daughter is paramount to me. When designing the cradle, I knew that Molly would be in it for only about six months. When she began to crawl, we moved her to a crib, keeping the cradle in our living room as a showpiece, not as children's play furniture. Shaping the pointed ends of the tenons and the pivot blocks to a gentler profile would be pleasing to the eye and reduce the risk of injury.



Auger Outrage



In "Tech Tips" (AW #61), Edwin Borgeson recommended filing down the screw threads and hacksawing off the square part of the shank of old auger bits. Please don't do this. There is a whole community of woodworkers who enjoy using these and other hand tools the way they were meant to be used. Either give your auger bits to some galoot who enjoys using old tools or get a brace and learn how to drill holes by hand. You'll be surprised at how easy (and quiet) it can be. What's next, grinding your chisels down to make handy paint-can openers?

Joe Palazzolo

Good point, Joe. Antique hand tools are a diminishing resource and deserve better treatment.—Eds.

Another Brush Technique

"All About Varnish," by Michael Dresdner (AW #61), is one of the best pieces I've ever read on brush-handling techniques. Michael obviously knows his brush work.

Here's another technique I learned from my father in the forties—called cross-brushing—that worked well with

thinner varnishes and enamels.

First, we'd empty the brush on the surface by making two quick strokes—one in each direction—following the grain on horizontal surfaces or vertically on a wall or door. We'd repeat this process until we had applied as much material as we thought we could spread out. Then we'd vigorously cross-brush the surface until the surface was totally wetted and the liquid evenly distributed.

We'd complete the brushing by again stroking lightly with the grain. I've used this method to put a glass-smooth finish on large tabletops.

Bob Keers
Albuquerque, NM

Rapacious Radial-Arm Saws



I read with interest—and fear—the letters by Peter Scott, Everett Cool and J.T. Curtis defending the use of the radial-arm saw for ripping. As a hand and upper-extremity surgeon, I treat people with hand injuries every day. A significant number of my patients have injured themselves on woodworking machinery, and it seems a disproportionate number have had accidents while rip-

ping with a radial-arm saw.

If I were to offer advice gained from using woodworking tools and observing woodworkers' injuries over nine years of hand surgery, it would be, always respect power tools; never take your eyes off the cutting surface; always consider the way that a board might get stuck in a power tool and try to avoid it; and avoid all distractions while working with power tools. And don't rip with a radial-arm saw!

Steve Leibovic, M.D.

Frank's Last Word

I'd like to answer all who are concerned about shaving thickness and the precision of Ian Kirby's drawer making: Stop worrying about shaving thickness! Working wood is supposed to be fun.

When it comes to hand planing, Ian Kirby is the master of the masters. AMERICAN WOODWORKER is a "how-to" magazine—we're trying to teach techniques and skills. When you teach, you aim for the highest standards.

As an apprentice, I asked my father, "How can you do this so fast and so precisely?" He replied, "Don't worry about it; in ten years, you will be a good beginner yourself."

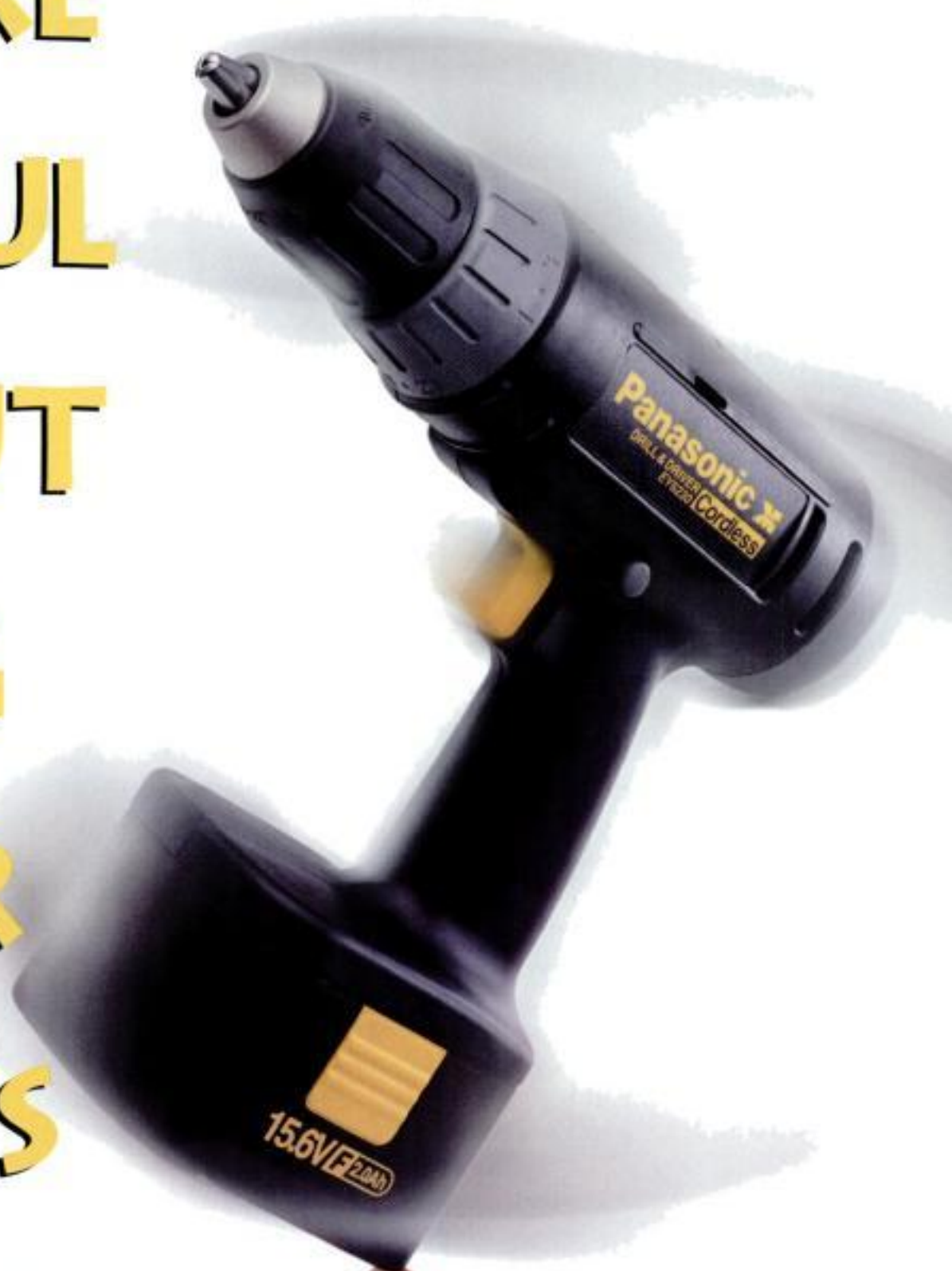
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LETTERS

If you are hand planing effortlessly, and if you are having fun, that is all that really counts.

Frank Klausz
AW contributing editor
Pluckemin, NJ

A Safer Assembly Table

The lead picture of the shop assembly table (AW #61, p. 75) shows a carpenter's square hanging just above the electrical outlet boxes on the side of the assembly table. This could be dangerous. Removing the square from its holder could result in its contacting the prongs of a partially exposed plug. I would suggest installing a piece of 2x3 or a short piece of dowel above each outlet to preclude an accident.

Richard Altaffer
Kent, WA

Tenuous Tenoning

Having sacrificed part of a fingertip to the tablesaw gods some years ago, I was disturbed by the photo (AW #61, p. 48) of an expert woodworker holding his fingers within an inch of a spinning blade, to say nothing of a partially rolled-up sleeve ready to snag the edge of the table. I would suggest he keep an ample supply of bandages plus a phone set to dial 911 automatically.

B. J. Larson
Racine, WI

Molly's dad is going to have a serious accident someday if he isn't more careful where he puts his hands when using the tablesaw. In the photos on pages 45 and 48, the author's fingers are getting dangerously close to the blade. "Ouch, I should have used a clamp."

I don't doubt that the author has cut pins this way—without using a clamp—hundreds of times, and perhaps he will even survive to a ripe old age possessing all ten digits, but I am concerned that readers of AMERICAN WOODWORKER will accept these photos as gospel.

John McAlevey
Tenants Harbor, ME

Slippery Answer



Regarding Michael Dresdner's "Slip-Proof Floor Finish" (Q&A, AW #61): Beware! Ballet studio floors should not be slip-

proof. I am a professor at a university with a large number of dance students. One year, because of high enrollment, ballet classes were scheduled in a gymnasium with a slip-proof floor finish. The first day of class, the teacher attempted to demonstrate a turn. Her body turned, but her foot did not, and she broke her ankle.

Perhaps the best finish for a dance floor is no finish. The bare sanded wood provides about the right combination of slip and friction. Professional dance studios often have floors that are ugly as sin because of the dirt in the wood pores, but they work fine for dance. Mr. Decker was on the right track with the gym seal, but he should have stopped with only one thin coat—just enough to fill the pores and keep out dirt, but not enough to create a glossy finish.

Verne Collins, Ph.D.

Michael Dresdner replies: I heartily agree that leaving the wood with just a water-shedding sealer would be my first choice, too. But the questioner's dilemma was that two coats of non-slip gym seal were too slippery for kids in ballet slippers.

Resaw Either Way



The photos in Mark Duginske's article on resawing (AW #61) show the veneer coming off to his right, on the side away from the fence. The cover photo shows the veneer coming off between the blade and the fence. What gives? Does it matter which way you do it?

Douglas Brenner

Mark Duginske replies: If you're resawing only one piece, it doesn't make any difference which side of the blade it's on, but if you're sawing multiple pieces, it makes sense to set the fence for the thickness of the pieces you want to duplicate. The technique will work either way.

Don't Convert, Transform

Regarding "Running American Tools in Europe" (Q&A, AW #61), I have a small woodshop set up in Germany, and I have had bad luck with voltage converters for running American-made equipment. I lost a computer when the converter put out 184V instead of 110V.

Instead, I use several 220/110V transformers that I took with me from the U.S. On the primary side of the transformer, I installed a cord with a 220V DIN plug to match European outlets, and on the secondary side I hooked up a 110V outlet strip. I unplug the transformer when it's not in use.

Hasso Jauch
Huntington Beach, CA

Business is Business



In AW #61, Michael LeMire asked for advice on starting his own business. The response—to get experience in an established business—was technically correct, but I'd caution that craft experience does not make a good businessman. In fact, the owner of a great woodshop might not even be a craftsman himself.

I'd advise Mr. LeMire to contact the Small Business Administration, his local community college, the Chamber of Commerce and others who can help people learn to run a business—overhead, profit and loss, bottom-line decisions and similar non-craft issues. ▲

Clark Crouch

Corrections

- In our 1998 Tool Buyer's Guide, we listed three incorrect telephone numbers in "Sources," page 144. The correct numbers are:

AMT
(800) 465-8665

Mini Max
(800) 292-1850

Total Shop, Inc.
(864) 288-4174

Also, the customer service phone number for **Baklund-Hellar, Inc.** (see "The Best Tools for Measuring, Marking and Layout," page 13) is (800) 540-6604.

- The correct length of the sides of the Tool Till (AW #60, p. 37) is 9³/₄ in.

- Henry Taylor "Superflute" gouges (see "Adventures in Hollow Turning," AW #61), are available from The Cutting Edge (800-790-7980).

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Making “Tombstone” Glass Lights

Q I am planning to build a cupboard with glass light doors. I'll be using cope-and-stick router bits, as shown in AW #54. I'd like to incorporate “tombstone” style lights in the top of the door. The AW #54 article covered rectangular lights in detail, but not tombstone ones. Do you have any advice for laying out the arched top rail? And are there any special considerations when cutting glass for a tombstone light?

E.J. Blumenthal
Northport, NY

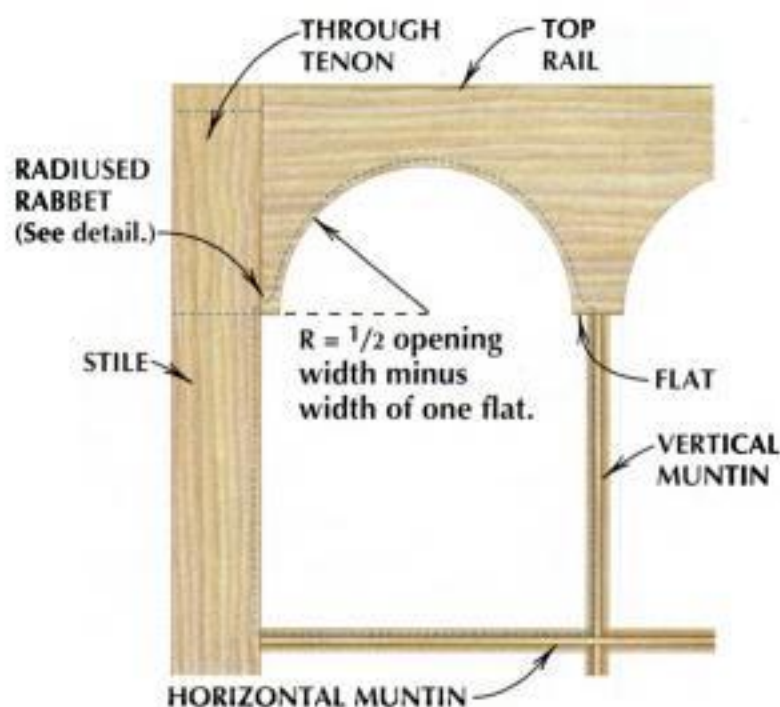
A Making doors with tombstone lights isn't as difficult as you might think. When you include the arch, tombstone lights are typically about 20% taller than the rectangular lights below them.

To lay out your top rail, follow the drawing at right. Tenon the top rail, then lay out the arches and cut them on the bandsaw or with a good jigsaw. Use a file and sandpaper to clean up the saw marks and fair the curve. Now rout the arches, but save the flats for last. This way, you're less likely to blow out these short-grain portions of the arch.

Tombstone lights are difficult to cut yourself. I recommend taking them to a professional glasscutter. If you want to cut the glass yourself, be sure to buy the glass a couple inches oversize in height. This way, you won't have to cut the arch on a tangent to the top edge of the pane—a nearly impossible task. Also, use a stained-glass cutter (about \$12 from Warner-Crivellaro, 1855 Weaversville Rd., Allentown, PA 18103, 800-523-4242). It makes a

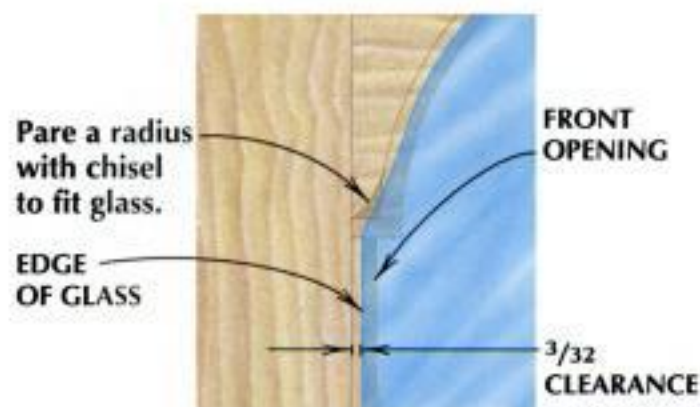
“TOMBSTONE” DOOR ANATOMY

You can adjust any dimension—the size of the tombstone with its arch and flats, or the rail and muntin widths—to suit your own design tastes. A through tenon in the top rail makes the strongest frame. Size your glass $\frac{3}{16}$ in. larger than the dimensions of the front opening.



GLASS RABBET DETAIL

Cope-and-stick cutters for glass light doors produce a $\frac{3}{16}$ -in.-wide rabbet on the back of the door. Size your glass to allow clearance on all sides.



cleaner cut than the regular glass cutters sold at hardware stores—especially on curves.

Unless you have a special glasscutting router with a diamond abrasive bit, it's impossible to cut an inside corner. Instead, radius the portion where the arch meets the flat. When installing the

glass, radius the rabbet corners to fit with a paring chisel. (See detail, above.)

Bill McCarthy
Architectural woodworker
Quakertown, PA

Editor's note: The router bits McCarthy used are available from Freud at (800) 334-4107. Ask for part #99-270.

Gummy Arkansas Stones

Q I recently bought a set of Arkansas stones, which I've been using with honing oil. I used them to sharpen some rusty old chisels and plane blades. Now my tools are fine, but the medium and fine stones are black and gummy and don't work very well. What happened?

Darnell Washington
Hot Springs, AR

A As you surmised, Arkansas stones aren't suitable for rough work such as rust removal. I'd recommend an

India stone or a diamond stone instead.

The black gum indicates that you probably didn't have enough oil on the stone during sharpening—or else you lapped for so long without reoiling that the steel dust and the oil actually glazed the surface. You'll have to clean the gum off before you can remove any rust that may lie underneath it. I recommend spraying on some engine degreaser (“Gunk” is one brand) sold at auto-supply stores.

After the degreaser has had a chance to work, scrub and rinse the stone thoroughly. Then dribble some water onto

the surface. Sprinkle on some Zud Bartop Cleanser—a white rust-removal powder sold at supermarkets and hardware stores. (Oxalic acid will also work, but it's often only available by the pound.) Work up a slurry using a kitchen brush or toothbrush. Then let the stone sit for 45 minutes, occasionally dribbling water onto the surface to keep it damp. After the time is up, scrub the stone and rinse it under clean running water.

If any rust remains, flatten the stone until the rust is gone. You can do this with wet-or-dry sandpaper on a flat

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surface, or with a precision lapping plate (available from DMT, 85 Hayes Memorial Dr., Marlborough, MA 01752, 503-481-5944). Sandpaper costs less but takes longer.

Will Neptune
Instructor, North Bennet St. School
Boston, MA

Matching the Finish on Plywood and Solids

Q I recently built a lectern out of red oak and red oak plywood. When I applied the Danish oil finish, the plywood parts remained much lighter than the solid wood parts. Why did this happen? What can I do to prevent this in the future?

Jack Horrocks
Cincinnati, OH

A Plywood often takes stain and finish differently from solid wood because of the way it's made. The veneer log is first soaked in hot water, then the veneer is sliced off the the log

while a nosebar just ahead of the knife's edge exerts heavy pressure on the wood. The pressure tends to crush the top wood pores shut, making them less receptive to finishes.

The plywood adhesive on the back of face veneers is another barrier to finish absorption. This is why veneered panels often resist both stains and penetrating finishes, even as the adjacent solid wood sucks them up greedily.

To minimize this problem, put the plywood and solid wood through similar preparation. Take both materials through the same sanding sequence to "rough up" all the fibers in the same way. Then raise the grain on both panels and solids by wetting the surface liberally with warm water, wiping off the excess, and letting it dry overnight. Resand very lightly with 220 or finer-grit paper—just enough to remove the raised grain, and no more.

When possible, avoid penetrating oil finishes, which tend to accentuate absorption differences. Instead, stain

with a water-soluble dye stain; or use a pigmented stain only after applying a thin sealer coat. For a more even appearance on clear coats, use a film-forming finish such as varnish, lacquer or shellac.

Michael Dresdner
Industrial finishing consultant
and AW contributing editor
Puyallup, WA

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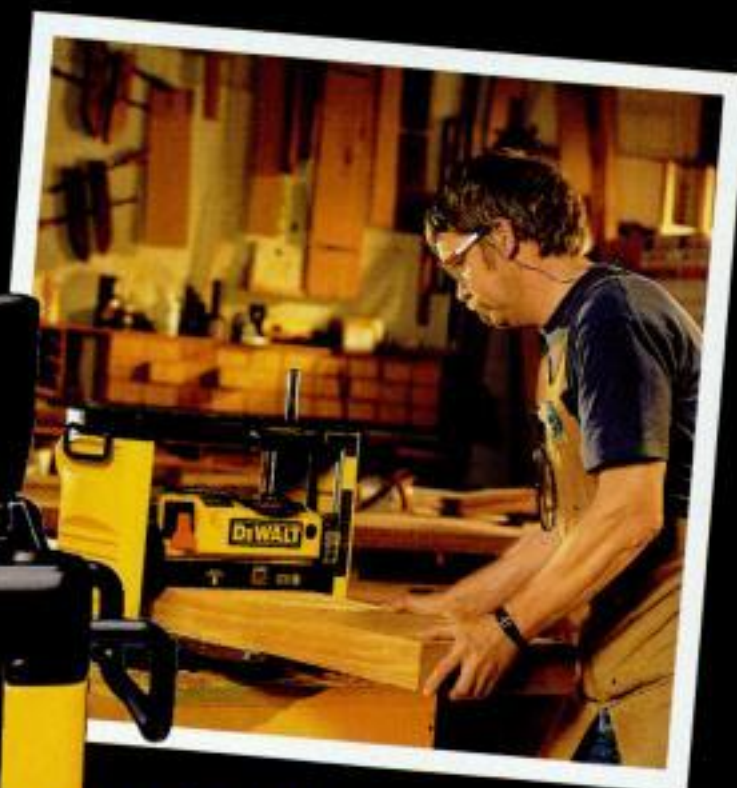
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Kinky Handsaws

Q I just bought four antique Disston handsaws at an auction. Two of the saw blades have mild bends, and one of them has a sharp kink on the bottom of the far end. What's the best way to straighten them?

Louis Martin
Springfield, MA

A Straightening a bent handsaw blade takes some skill and luck. You're off to the right start, since the old Disston handsaws are among the finest ever made. But you can straighten most handsaw blades made of ductile—well-tempered, not brittle—metal as long as the bend runs perpendicular and not parallel to the teeth.

To straighten a mildly bent handsaw blade, bend the blade by hand in the opposite direction, and let it spring back to shape. *Caution: Always wear safety glasses, in case the blade should shatter.*

A really kinked blade is much trickier. It requires hammering, which can easily

destroy the blade's tension, rendering it useless. If you don't want to risk it, you can cut the blade down to get rid of the kink. Otherwise, set the saw blade on top of a vise, so that it spans the jaws. Then hammer the kink lightly with a cross-peen hammer, working toward the center of the kink. Crank the vise jaws closer together as you hammer inward, to support the blade as you near the center of the kink. The center will need a few more hammer strikes to spring the blade back to straight.

Tom Law
Carpenter and handsaw expert
Smithsburg, MD

Gilding Over a Finish

Q After reading David Marks' article on gilding in AW #58, I'd like to try it out. My wife would like me to gild over an old oak picture frame that already has a finish on it. Is it possible to gild over an existing finish?

Nick Peters
Aurora, CO

A Yes, you can gild an already finished frame. Clean the surface with naphtha to remove any dirt or wax. Scrub it with a toothbrush and wipe it with paper towels until there's no grime on the towels. This will probably take several applications of naphtha.

Next, if the old finish is in good shape, isolate it by applying two coats of shellac. (If the finish is chipped or peeling, strip it off instead.) Clear shellac will work, but I prefer Zinsser's B.I.N. white pigmented shellac. It dries faster and helps to fill in the pores.

Once you've isolated or stripped the old finish, proceed with gilding as usual.

David Marks
Gilder and furniture maker
Santa Rosa, CA

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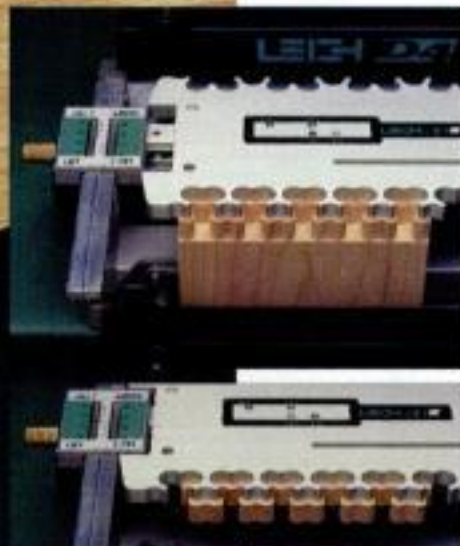
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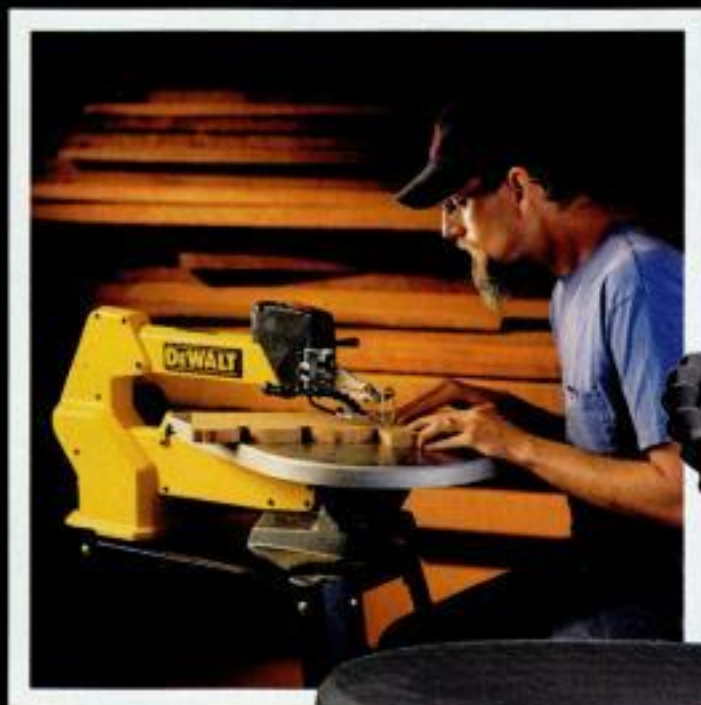
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Look for Jesada's new white (PTFE) coated router bits... If you've never tried their bits, I strongly recommend that you do."

... from Patrick Spielman's *Home Workshop News*, Vol. II, issue 9, © Spielman Publishing Co.

Patrick is the author of more than 50 woodworking books and is the editor of *Home Workshop News*, a bi-monthly magazine.

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... *American Woodworker Magazine*, October, 1997

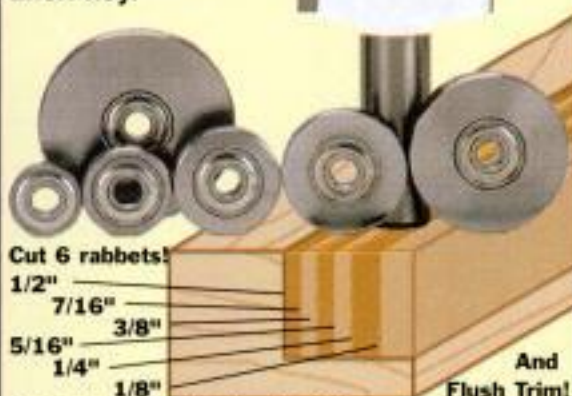
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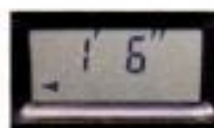
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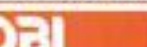
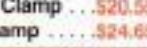
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Micro-Scrollsaw Sweats the Details

Darwin Rossman enjoyed doing fine scrollsaw work, but he wanted to test his limits and see just how fine it could get. So the 82-year-old retired geologist from Charlottesville, Virginia, built himself a micro-scrollsaw that cuts pieces of inlay as narrow as $\frac{1}{100}$ in. with micro-surgery precision. This enables him to make amazingly detailed scenes, such as the butterfly shown at right.

Rossman made the saw out of construction-grade plywood, $\frac{3}{8}$ -in.-thick acrylic sheet, aluminum channel stock and reciprocating gears from a saber saw. To get an ultra-close-up view of his work, he

equipped the saw with a swing-out, 20X dissecting microscope (see photo, right).

Power for the saw comes from a sewing-machine motor, which allows him to vary cutting speed from about 50 strokes a minute to over 200.

Rossman generally uses $\frac{1}{10}$ -in.-thick inlay stock. His favorite scrollsaw blade is a 1-0, which cuts a $\frac{1}{100}$ -in. kerf. He converts these to "skip-tooth" blades by filing down every other tooth with a fine diamond file.



Fine work. Above right, Rossman peers through a 20X microscope mounted on his custom-made scrollsaw to get a closer view of the work. At left, some of the pieces used to make this inlaid butterfly are just $\frac{1}{64}$ in. wide.

PHOTOS BY ELLIS VALENTINE

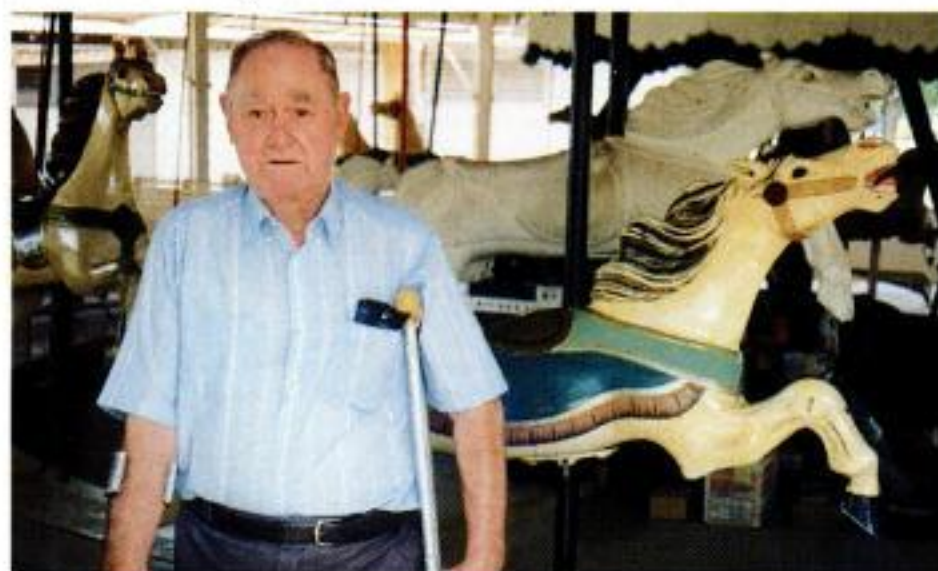


SINGLE-HANDED ACHIEVEMENT

Carving a carousel horse is challenging enough with two hands. Wayne Peters

did it one-handed.

Peters, now 80, lost the use of his left arm and hand



Peters carved these carousel horses one-handed for the children of Giddings, Texas.

in an automobile accident in 1976. But he refused to consider himself disabled. When the Giddings, Texas, volunteer fire department went looking for a woodcarver to help restore a dilapidated carousel it had acquired, Peters offered his services without hesitation. The project took him four years, and he did it gratis.

He carved one horse completely from scratch and restored 28 others, taking them apart and recarving parts that couldn't be saved, before reassembling them—all with his right hand.

—Emily Collier

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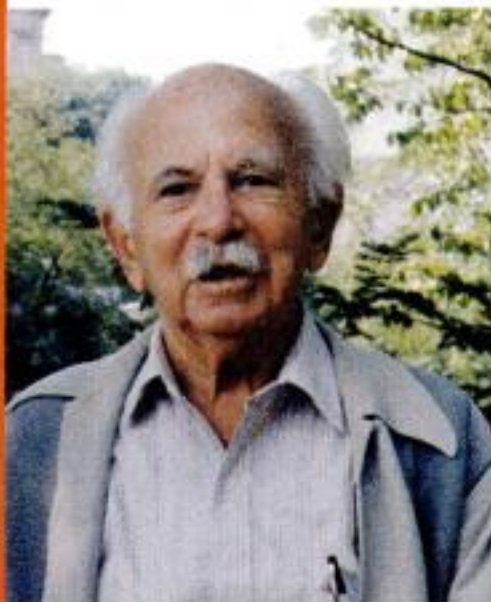
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George Frank 1903-1997 Grand master of finishing



Master woodfinisher, storyteller and author George Frank died September 2, 1997, in Budapest, Hungary. He was 93.

Frank is best known in woodworking circles for his articles in early issues of *Fine Woodworking* magazine and as author of *Adventures in Wood Finishing* (1981, Taunton Press)—an engaging account of his career as a finisher.

Born in Mako, Hungary, on September 16, 1903, Frank

studied both woodfinishing and antique reproduction at the Kaess Guyla Institute in Budapest. He relocated to Paris in 1924—the heyday of Art Deco design—where he specialized in the high-style decorative finishes that were popular at the time. Frank worked for some of the best firms in Paris during the '20s and '30s, including the interior design firm of Maison Jansen.

George Frank moved to New York in 1939 and ran his woodfinishing business in Manhattan until he retired to Florida in 1978. His second book, *Wood Finishing With George Frank*, was published by Sterling Publishing Co. in 1988. In recent years, he and his daughter Eva Frank conducted woodfinishing tour groups to China and Europe.

San Diego Guild Does it Again

This past June, the San Diego Fine Woodworkers Association mounted its sixteenth annual Design in Wood Show at the Del Mar Fair in Southern California. Over 300 pieces vied for more than 60 awards and cash prizes in 17 categories of woodworking. This year, for the first time, AMERICAN WOODWORKER sponsored a \$1,000 cash prize for Best of Show. Ellis Walentine, executive editor of AW, presented the award to Nikolai Ossipov for his turned and carved mahogany and glass goblets in a carved presentation case.

The Del Mar Fair show attracts more than one million visitors each year. For information on the 1998 Design in Wood Show, call Bob Stevenson at 619-422-7338.



Best of show. A goblet of mahogany and glass (above) made by Nikolai Ossipov. His carved presentation case (left) holds four goblets.

✚ WORKSHOP MALADIES ✚

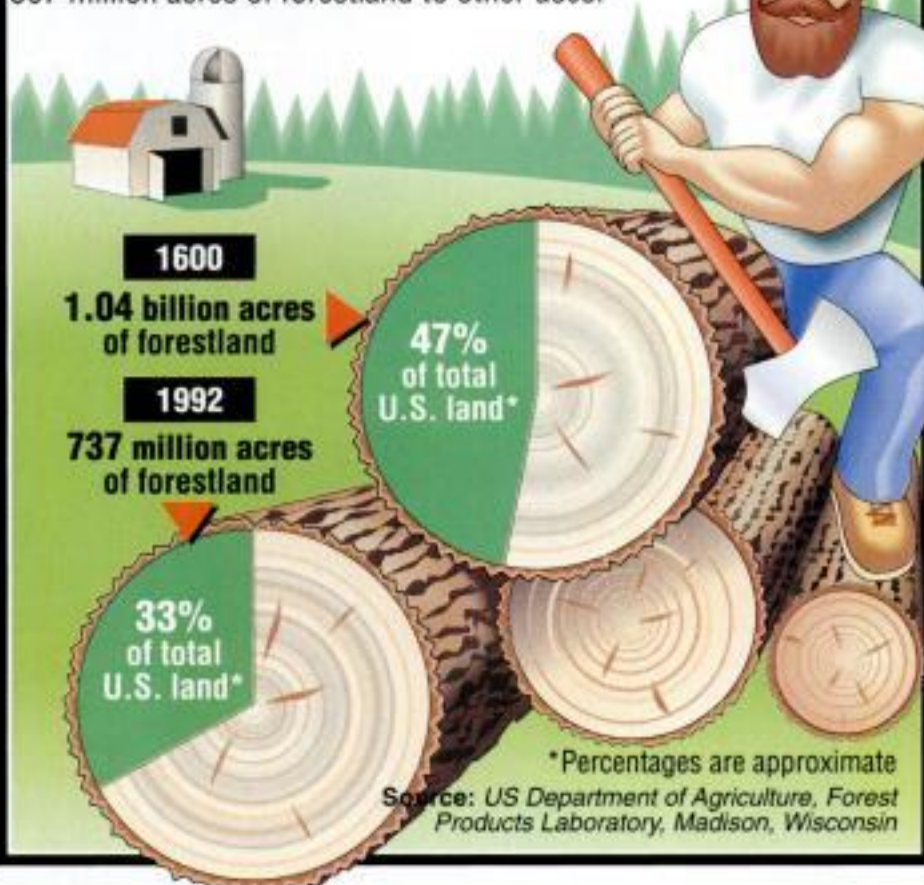
Every day medical researchers make progress in the battle against disease. But cures for the following woodworking afflictions still remain to be found:

- ✓ **Dementia:** An overpowering sickening feeling you get upon realizing that a crucial bit of wood has been cut to the wrong dimensions.
- ✓ **Enteritis:** Anxiety you experience upon entering the woodshop due to fear of making yet another serious mistake.
- ✓ **Ebonics:** Loud screaming brought on by the slow removal of ebony splinters from beneath the cuticle region.
- ✓ **Lumbago:** Intense back pain caused by moving lumber from one stack to another in order to find just the right piece.
- ✓ **Migrain headache:** Severe temporal lobe pain brought on by rearranging several pieces of wood over and over again until you can achieve the perfect grain pattern for glue-up.
- ✓ **Tenonitis:** Feelings of nausea and remorse caused by large, swollen tenons, which force you to sand or rasp to fit mortises correctly.
- ✓ **Joint pain:** Excruciating agony experienced when joints refuse to fit properly.
- ✓ **Men-o-pause:** Once thought to afflict only older females, it is now known to strike women of all ages who enjoy woodworking so much that they stop caring about men.

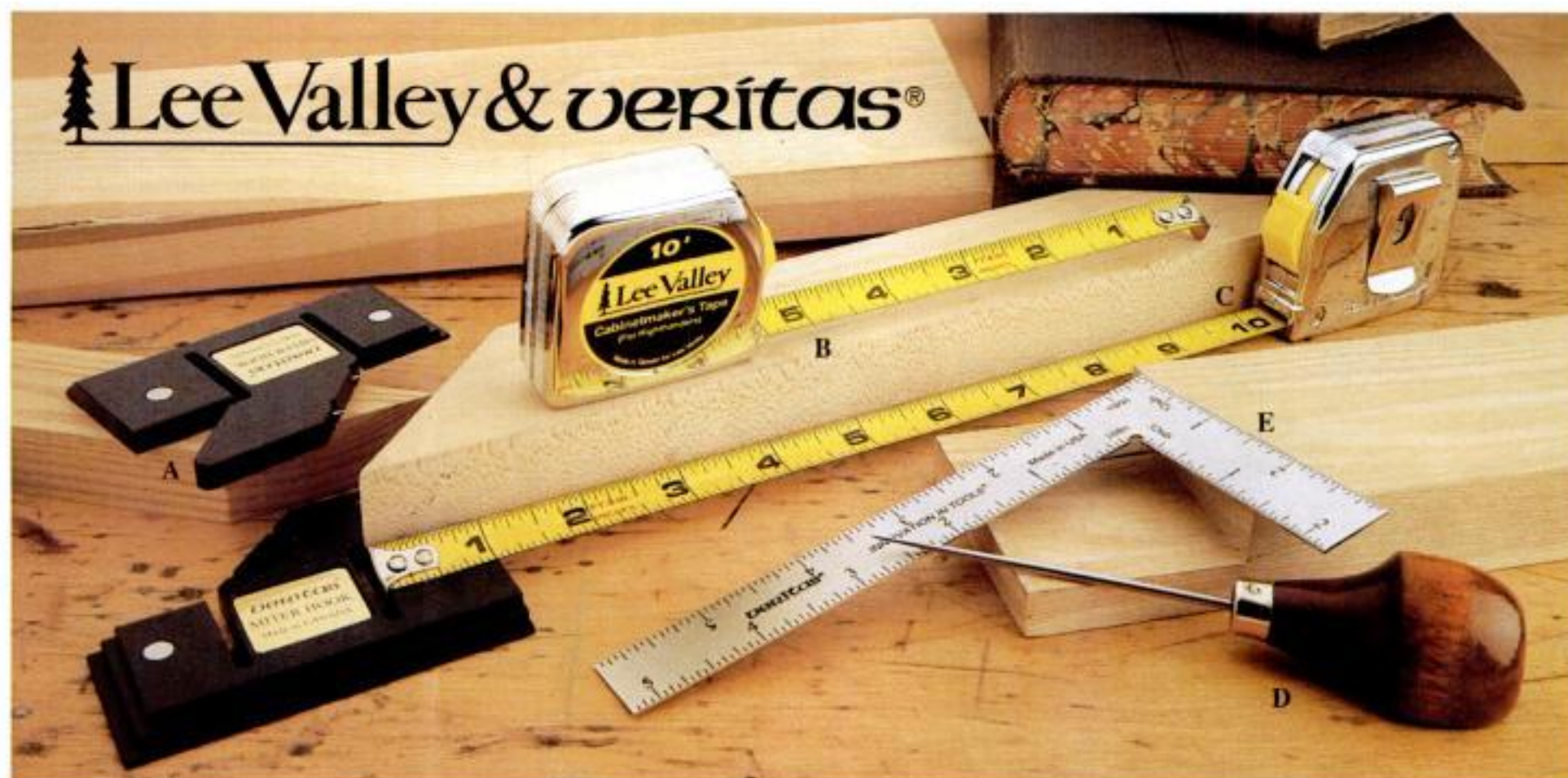
—Ryta R. Weiner

Forestland in United States

Since the year 1600, humans have converted some 307 million acres of forestland to other uses.



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The following 3 pages are a sample of what you can expect in the full-color, 252-page Lee Valley catalog.

A. Veritas® Miter Hook

Measuring accurately from an inside corner is simple with this miter hook developed by a trim carpenter. Just press the pins into the end grain (the pins are slightly angled to draw the hook in snugly) and hook your tape measure into the slot that is exactly even with the miter end. A rare-earth magnet grips the tape as you measure. Also usable for outside corners where the hook works the same way, except pins are not necessary.

The hook is handy in a shop as well — anywhere you need to do mitered corners. Machined from high-impact ABS, it has hardened pins and two rare-earth magnets. It is fully reversible; the magnets are exposed on both sides.

AW315 Miter Hook \$6.95



A Tape for Cabinetmakers

A customer recently wrote to say, in essence, "Why can't you sell a decent 10-foot tape that I can slip in my apron pocket without it weighing me down? Everything you sell is long, wide, and heavy. I want something slim, light, and handy." Here it is and, better yet, we offer it in right-to-left reading version (which we call a "right-hander's" tape) as well as the usual left-to-right reading version (a "left-hander's" tape). The vast majority of tape measures made today read from left to right, which is OK for just measuring, but becomes a major problem when a right-hander needs to measure and mark something; you end up either having to hold the pencil in your left hand or switching the tape to your left hand and then having to read tape markings that are upside down. The solution is a tape that reads right-to-left. Then you can hold the tape in your left hand and mark with your right hand.

This tape is perfect for keeping on the bench or in an apron and, at just over 2½ oz, you hardly notice it in your apron pocket. So that left-handers can enjoy it also, we made it in a left-to-right reading version as well.

B. AW317 RH Cab. ½" × 10' Tape \$3.95
(right-to-left)

C. AW318 LH Cab. ½" × 10' Tape \$3.95
(left-to-right)

D. Fine-Point Scratch Awl

A very neat little scratch awl with a fine, slim tip. The palm handle has a flat to prevent rolling. It makes a lot of sense. 3" blade.

AW319 Fine-Point Scratch Awl \$4.50

E. Veritas® Precision Square

This stainless-steel square is an ideal size for cabinetmaking. But more important, it has the accuracy of an engineer's square — .001" per inch of length. It is graduated on both the interior and exterior faces, and all four faces are ground to the same accuracy. This means that you can use the square for layout or machinery setup. It is also graduated on both sides — the 3" leg in 32nds and the 6" leg in 16ths. The etched markings are permanent and easy to read because the square has a non-glare finish. The relieved interior corner ensures that the square seats well, even over saw whiskers. Excellent value in a superbly made square.

AW312 Precision Square \$11.95

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A. Veritas® Carver's Vise

A good carver's vise should be adjustable in all three axes. This one has full rotation in two axes and 3" of height adjustment in the third axis. It also has controlled release; when you relieve the clamping pressure, the internal springs and O-rings provide residual resistance so that work does not suddenly fall or rotate. Work can be repositioned and adjusted without needing three hands.

The vise can be bolted to a bench, clamped in a vise (it has side flats), or side or top mounted in a 3/4" diameter dog hole with the optional dog-hole mount assembly.



The body is arched to let work overhang the edge of a bench when top mounted, giving maximum flexibility of use. The 3 1/2" diameter by 1/2" thick mounting plate is fastened to a 1/2" diameter steel rod. The body is made from the new alloy ZA-12 (same as our

Tucker Vise) with a solid brass hub and a repositionable gyrotory locking lever. Spare mounting plates are available for quick interchange of workpieces.

AW330 Carver's Vise \$75.00

AW331 Dog-Hole Mount Assembly \$ 7.95

AW332 Spare Plate with Rod \$12.95

B. Veritas® Carver's Knife

This versatile knife has an oval handle with fine grooves for a comfortable grip. The razor-sharp high-carbon blades can be honed many times before replacement. The anodized aluminum body of the knife has a solid brass collet. Blade change is easy and blade orientation is always in line with the major axis of the body. The knife is ideal for whittling, fine detail carving and is equally effective as a shop knife. About 6" long, it comes with a dozen blades, 4 of each style shown.



Grooved oval handle allows for a good grip in your hand.

AW301 Carver's Knife \$12.95
Repl. Blades:

AW302 Pkg. of 10, Spear \$2.50

AW303 Pkg. of 10, Curved \$2.50

AW304 Pkg. of 10, Classic \$2.50

Micro-Plane Rasps

These rasps do an incredible job on wood, plastic and resins. Each blade has hundreds of small, razor-sharp teeth. Each chisel-style tooth is slightly rounded like a scrub plane blade. The teeth are formed by etching and are sharp on three edges. Wood shavings emerge through the throat of each tooth, making a packed rasp a thing of the past. All of these tools are made from tempered stainless steel; they won't rust — the usual cause of dulling of normal files and rasps. These handled rasps are a joy to use for shaping and are indispensable for decoy carvers. The round rasps are available in three sizes: 6 1/2", 8 1/2" and 13" long overall with diameters of 3/8", 1/2" and 5/8" respectively. The square rasps are available in two sizes: 6 1/2" and 13" long overall with blades 1/4" and 1/2" wide respectively. The 6 1/2" long rasps are ideal for controlled stock removal on smaller carvings as they are easily held using only one hand. They have to be used to be appreciated.

C. AW353 Round Rasp - 6 1/2" \$6.50

D. AW352 Round Rasp - 8 1/2" \$7.50

AW351 Round Rasp - 13" \$9.50

E. AW350 Square Rasp - 13" \$9.50

AW354 Square Rasp - 6 1/2" \$6.50

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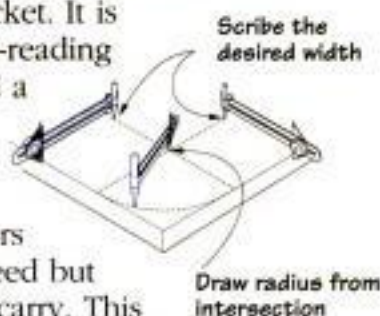
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F. Veritas® Carpenter's Gauge

The Veritas® Carpenter's Gauge was specifically designed to be carried in an apron or pocket. It is both a direct-reading compass and a marking gauge, two things that carpenters frequently need but find hard to carry. This tool has a rotatable head, which locks vertically for use and horizontally for storage and tip protection. It is direct reading, both for radius and diameter, in inches and centimetres. It is useful in a cabinet shop because of the direct-reading feature, which substantially reduces errors, as well as for the fast corner radiusing. Made of brass, stainless steel and high-impact ABS, it is 7½" long overall, and will scribe circles up to 12" diameter.



AW314 Carpenter's Gauge \$14.95

G. Veritas® Wheel Marking Gauge

Avoid the shortcomings of standard pin marking gauges. Our marking gauge will perfectly scribe at any point of its

circumference. Since the hardened steel wheel is both sharp and bevelled only on the inside, it cuts through grain and forces the gauge face against the stock, maintaining accuracy. It cuts rather than tears and leaves a clean mark, even on cross grain. The gauge is easy to set since it has an internal O-ring to keep light but constant friction on the stem. The anodized aluminum head has a ⅛" thick brass face and a brass thumb-screw. A very comfortable gauge to use.

AW320 Wheel Marking Gauge \$18.95

H. Veritas® Sliding Square

This cabinetmaker's layout square simplifies mortise and tenon layouts, hinge inletting, and transferring locations from one face of your work to the other. It provides ample reference face against your work without having to flop the square. You can also work in two axes at once, e.g., measuring in 2" and over 1½" is simple, substantially reducing the possibility of error. The stainless-steel blade is 3" wide and 6" long, graduated on both edges (to 4") and across the end. It has a matte finish, which not only makes it easy to read by eliminating glare, but lets you

record dimensions on it with a pencil. The diamond cut-out in the blade holds a pencil tip in position and makes it particularly easy to draw lines parallel to an edge.

AW310 Sliding Square \$21.95

J. Veritas® Flat-Bob

The most common use of plumb bobs is next to a wall, yet round plumb bobs roll around endlessly, making it nearly impossible to get an accurate line. The Flat-Bob doesn't roll and, because it has a very low center of gravity, it stabilizes rapidly. Because it is thin, the point is easily visible from above, again not the case with a regular bob. The body design also makes accurate marking much easier. You can press it against the wall as you mark a line dead center through the body slot.

The cord spool has 2 open holes that can be used to hang the plumb bob at a given length of cord. For storage, the spool snaps into body slot. All brass fittings on a precision molded ABS body with 8' of braided nylon cord. 3¾" long overall. Usable anywhere — construction, plumbing cabinetry, or for wallpaper jobs.

AW305 Flat-Bob \$9.95

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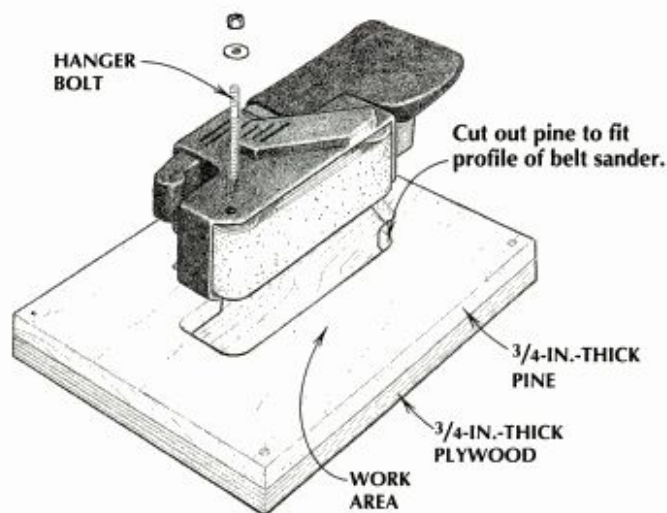
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Belt-Sander Holder

Best tip of the issue

A portable belt sander can be easily converted to the stationary variety with this holder, which is made of pine and plywood. Mark out and then cut the profile of your belt sander in $\frac{3}{4}$ -in.-thick pine, then either glue or screw the pine to a plywood base. If necessary, secure the sander to the base with a hanger bolt through one of the tool's existing holes. Lock the handle switch on to use your sander. Better yet, plug into a switched receptacle—this way, you'll find it easier to switch the tool on and off.

Robert McNair
Oakland, CA

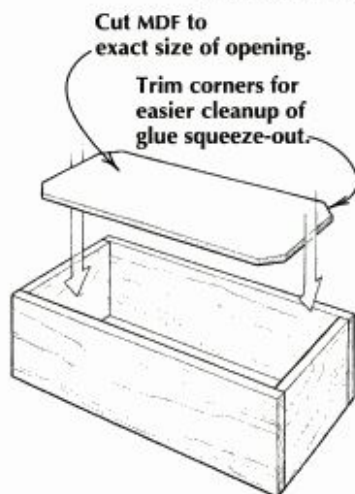


Best tip wins \$200. Know a better way of doing something? Designed a clever jig? Send your original woodworking tips, along with a sketch or a snapshot to: "Tech Tips," AMERICAN WOODWORKER, 33 E. Minor St., Emmaus, PA 18098. We'll pay \$50 for each tip we publish and \$200 for the best tip of the issue.

Squaring Cabinets

Gluing up and squaring a large carcass is an awkward job, especially when you're working alone. Instead of using clamps diagonally, I cut a piece of MDF the exact size of the opening. I place this in the middle of the carcass, and then I know it has to be square.

Ping Sing Li
Redwood City, CA



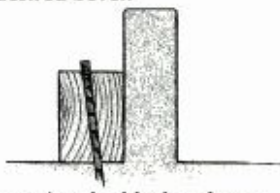
Planing Tapers

I recently needed to plane a taper on a 6-in.-wide by 8-ft.-long board. I first cut two "jack" strips with the same taper I wanted the board to have when done. Using double-sided carpet tape, I attached a strip on opposite faces as

shown in the sketch. I then ran the whole assembly through the planer until I had a clean surface. The upper strip disappeared in the process, but unlike nails or screws, the tape didn't harm the planer knives.

Lawrence Heinonen
Burlington, MI

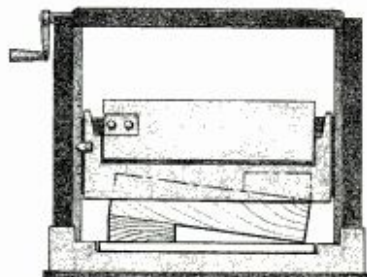
1. Cut jack strips to match desired bevel.



2. Using double-faced tape, attach jack strips to opposite faces of board.

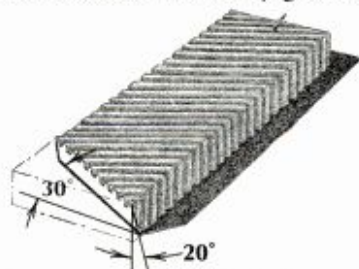


3. Plane away upper surface, including jack strip.



From File to Scraper

The old, dull files that most of us have lying around make fine scrapers for lathe work. First, skew the end by grinding it



to about 30°, then grind the cutting edge to about 20°. You now have a scraper with tiny teeth.

For smooth sideways movement over the tool rest, either grind off the teeth on the undersurface of the file or cover them with a few layers of masking tape.

Michael Burton
Ogden, UT

Cheap Date

When asked to date my work, I drill a shallow hole and epoxy a new penny in place. To make the coin flush with the surface, I chuck a $\frac{3}{4}$ -in. Forstner bit in my drill press and set the depth gauge so the cutting edge just grazes the work. Then I shim the work up with a single layer of pennies and drill again.

Mike Vincent
Littleton, CO

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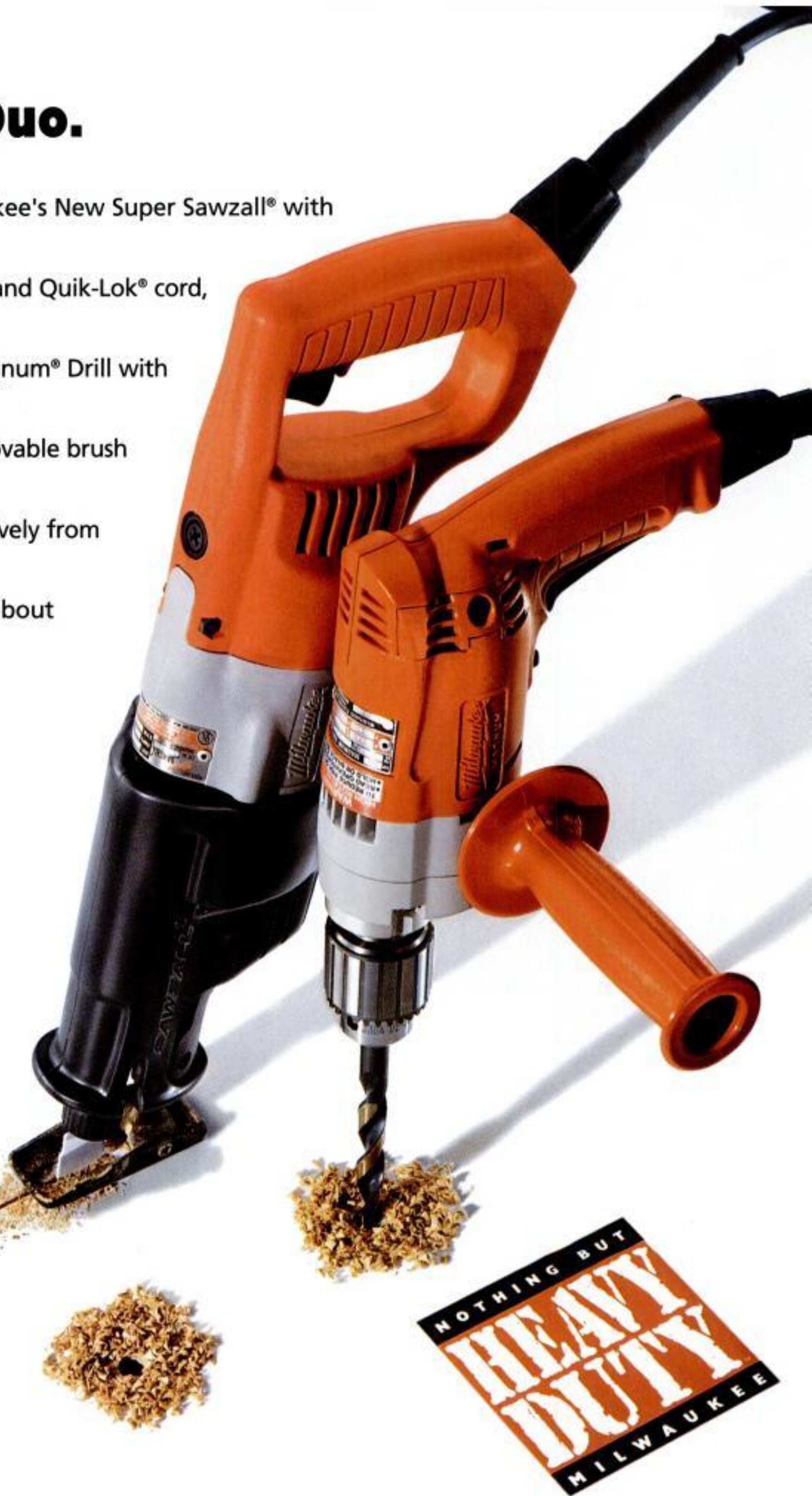
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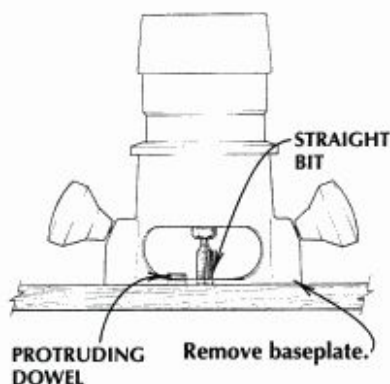
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Flush-Trimming Dowels

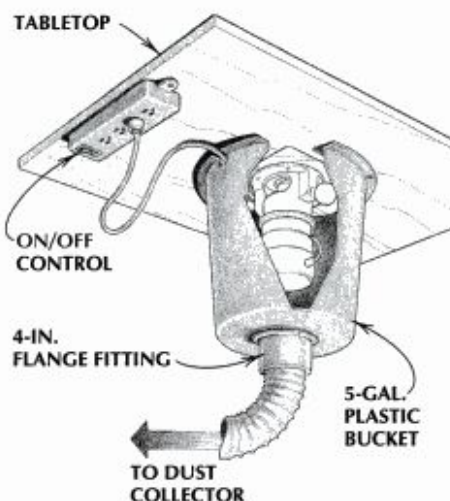
This is a quick way to trim dowels or wooden keys flush with a surface. Chuck a 3/8-in. straight bit and remove the baseplate from the router. If necessary, file off rough spots on the bottom of the router. Place a scrap of paper on the work and lower the cutter until it just grazes the paper's surface. Remove the paper and rout the dowels.

William White
Williston, VT

Router-Table Dust Collector

Needing to collect dust and shavings from my router table, I took a 5-gallon plastic bucket, cut a hole in the bottom and attached a 4-in. PVC flange fitting with pop rivets. Then I screwed the bucket to the underside of the router table. Since the on/off switch was now inaccessible, I notched the side of the bucket and plugged the cord into an outlet strip.

Andy Olerud
Driggs, ID



Flattening Blades

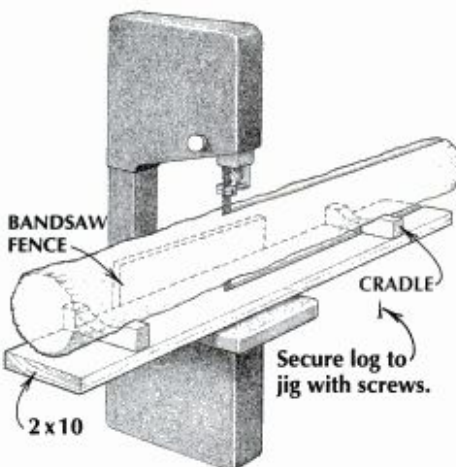
I've found it's best to flatten the back of a plane blade with cloth-backed emery paper. I bought 1-ft.-square marble tiles (available from flooring companies) and used spray adhesive to attach a full sheet of abrasive to each one, in grits ranging from 60 to 220. I use no lubricant, but vacuum the loose particles of metal and grit frequently. Unlike glass, marble doesn't shatter or distort under pressure.

Steven Zawalick
San Luis Obispo, CA

Resawing Logs

Bandsawing a small log freehand is risky, and snapping a chalk line on the rough bark is impractical. We set the log on a 2x10 and make two cradles so it can't rock. We secure the cradles with long drywall screws driven up through the plank and into the log, making sure they're clear of the cutline.

Set the bandsaw fence so the edge of the plank bears against it, and saw right



through the middle of both log and plank. If we need to quarter the log, we repeat the process.

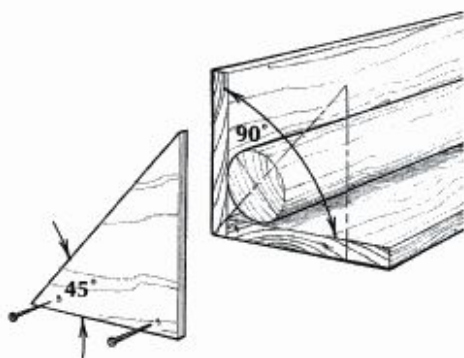
Simon Watts
The Arques School
Sausalito, CA

Center-Finding Jig

Here's a quick and foolproof way to locate the center of square or round stock. First, make an L-shaped jig out of scrap, then tack a thin piece of plywood to one end as shown. Make sure that the cut is exactly 45°. Place the stock in the jig, draw a line, then rotate

the stock 90° and draw another line. The point where the two lines intersect will be the center.

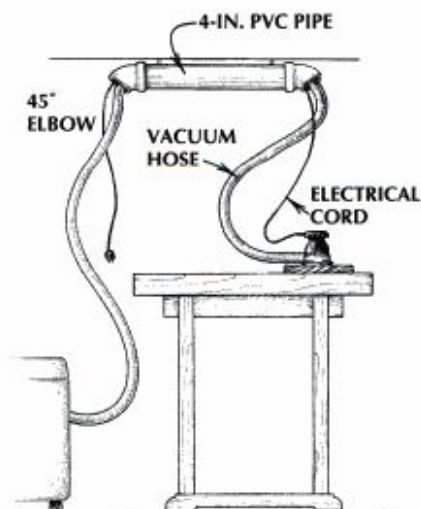
Harold Carpenter
Olympia, WA



Overhead Cords

To help keep my workbench clear, I run electric cords and vacuum hoses through PVC tubing attached to the ceiling. 45° elbows at both ends lessen the chance of a hose snagging on the sharp edge of the tube.

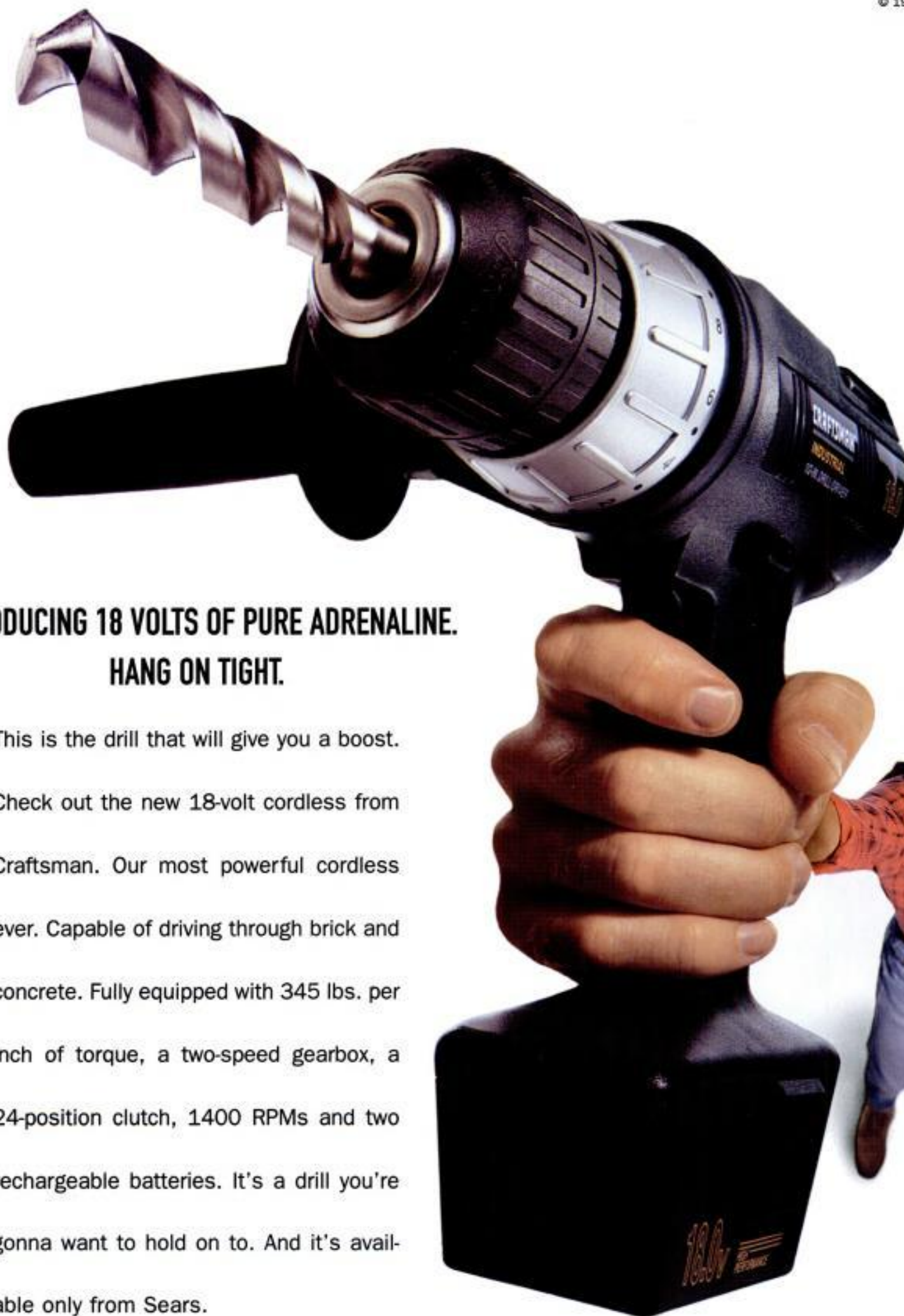
Randy Lee
Fairfield, OH



Shop-Made Guide Blocks

I replaced the metal guide blocks in my bandsaw with blocks made from hard maple. The wood blocks give excellent support to the blade without damaging the teeth. Also, when using narrow blades (1/8 in. or less) I can bury the blade within the blocks for better control. When the blocks become worn, they are easily replaced or trued up on a disc sander.

Lonnie Bird
Gallipolis, OH



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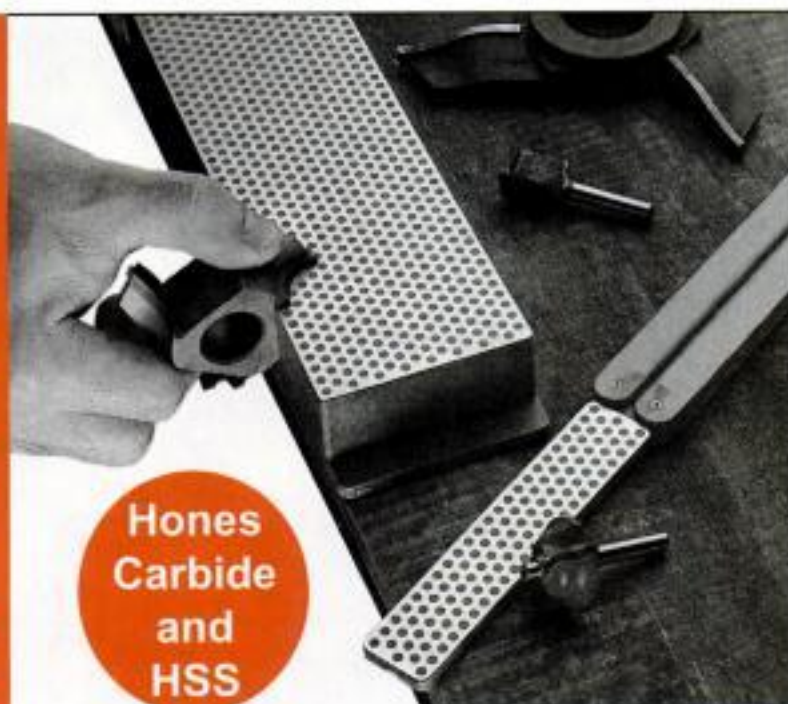
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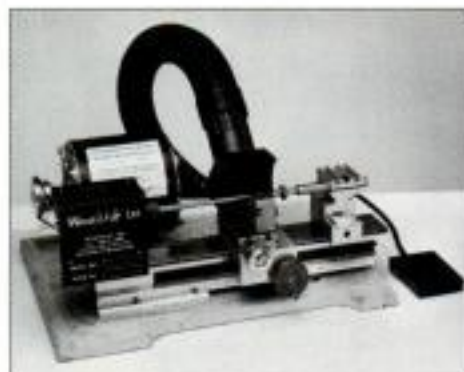
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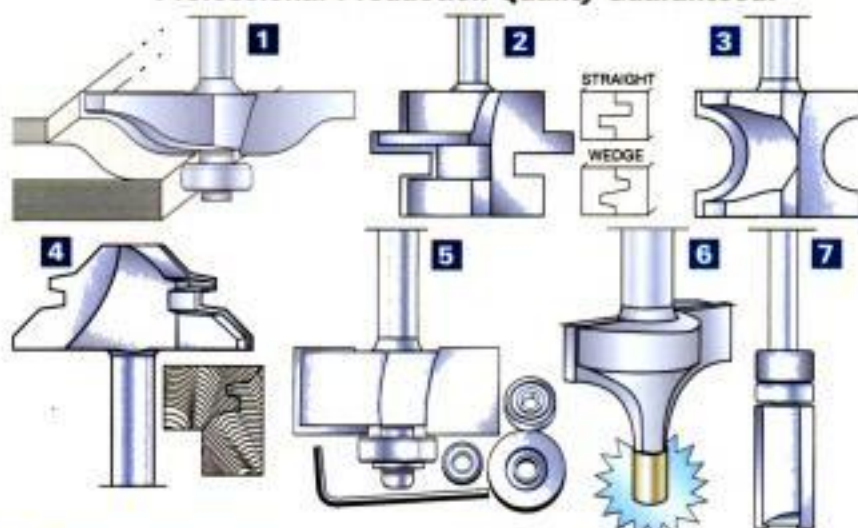
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Display Stand

Paired components and clean lines give this table its Craftsman style

By Hugh N. Montgomery

My display stand owes its origins to the Arts and Crafts furniture movement of the early 20th century.

Repetitive patterns are an important design element in Arts and Crafts work, and although there are 14 separate parts in this table, all of them are repeated. The circular tabletops are duplicates; there are two identical stretcher assemblies, each a pair of members; and the legs are four pairs of identically shaped sticks. Most of the parts are easy to duplicate using MDF templates.

For this project I chose cherry, although most any hardwood, and some of the sturdier softwoods, would do just as well.

Sizing the Parts

I rough size all the parts at least $\frac{1}{8}$ in. oversize in each dimension. After they have had a day to relax, I joint and plane them to final dimensions.

Before planing, however, I make a thickness gauge out of hardwood scrap. Simply set your dado blade to $\frac{5}{8}$ in. and cut a dado in the scrap piece. Then check your planing progress with the gauge as you go, and stop when the pieces fit the dado very tightly.

Dadoing the Stretchers

First cut four $\frac{5}{8}$ by $2\frac{1}{4}$ by 13-in. blanks for the stretchers. I cut the dados before forming the curves.

Using your miter gauge to the left of the saw blade, attach an auxiliary fence that extends past the blade by about 6 in. It will back up the cut to minimize tearout and allow room to clamp a stop block $1\frac{3}{16}$ in. to the right of the blade. Butt the stretchers' ends against the stop block and cut $\frac{1}{8}$ -in.-deep dados across both faces at both ends.

Cutting the Half-Laps

Each stretcher assembly is joined with half-laps. (See Fig. 2.) I first run a $\frac{1}{16}$ -in.-deep by $\frac{5}{8}$ -in.-wide dado across both faces of two of the stretchers, and label these two pieces "A." These shallow dados form shoulders for the half-lap joint. To ensure that these shoulders are perfectly matched and centered, I set the stop block $6\frac{3}{16}$ in. to the left of the blade, and reference off the same end of the stretcher during each cut.

Cut the half-lap in the tops of both "A" pieces, then cut the mating half-laps in the two other "B" stretchers.

Circles and Curves

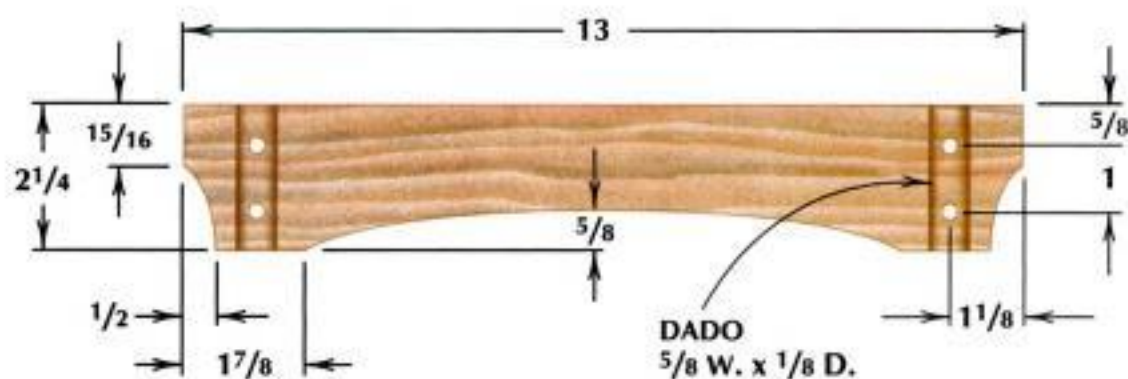
To make the tabletops, I cut out the circles to rough size on my bandsaw; then I drill a $\frac{1}{4}$ -in.-diameter hole, $\frac{3}{8}$ in. deep, at the centerpoint. I clean up the outside edge with a router and circle-cutting jig. It's best to make three or more passes with the router, lowering the bit incrementally for each pass.

On tiptoes. The author's display stand is a Craftsman-style composition of graceful curves, exposed joinery and repeated patterns.

The display stand is made of 14 parts, but there are really only three distinct shapes: stretcher, leg and tabletop/shelf. Each end of each stretcher is sandwiched between two legs and secured with a couple of concealed dowel pins. Two counterbored screws hold the tabletop and shelf to their stretchers.

Technical drawing of a wooden stool showing dimensions and components. The overall height is $31\frac{1}{4}$. The top width is 13. The top thickness is 1. The top width at the base is $2\frac{1}{4}$. The bottom width is 9. The components are labeled: TABLETOP $\frac{3}{4}$ T. x $9\frac{3}{4}$ DIA., LEG, SHELF $\frac{3}{4}$ T. x $9\frac{3}{4}$ DIA., and STRETCHER.

Make four blanks $\frac{5}{8}$ by $2\frac{1}{4}$ by 13 in. Cut the dados and half-lap joints (see Fig. 2) before template-routing the curves.



Technical drawing of a wooden leg showing dimensions and construction details. The drawing includes two views of the leg, one showing the top and side profile, and another showing the side profile with a cutout.

Top View Dimensions:

- Top width: $5/8$
- Distance from top edge to first hole: $13/16$
- Distance between holes: $15/8$
- Distance from second hole to bottom edge: 1

Side View Dimensions:

- Total height: $31\frac{1}{4}$
- Distance from top edge to first hole: 1
- Distance between holes: 1
- Distance from second hole to bottom edge: $5\frac{3}{8}$
- Distance from bottom edge to cutout: 2
- Bottom width: $5/16$

Construction Details:

- Cut curve in outside face only.** (Indicated by a curved arrow pointing to the top edge of the leg.)
- DOWEL HOLE $1/4$ DIA. x $3/8$ D.** (Indicated by a curved arrow pointing to the holes.)
- Note: Drill holes from opposite side on four of the eight legs. (See text.)**
- Cut $1/16$ -d. kerf on three faces (not inside face).** (Indicated by a curved arrow pointing to the cutout.)
- Cut curve in three faces (not inside face).** (Indicated by a curved arrow pointing to the bottom edge of the leg.)

JIGS FOR DUPLICATING STRETCHERS



Template-route the bottom curve. After bandsawing the stretchers to rough shape, use a template jig to rout the long curve.



Rout the two end curves. Use another template jig to rout the finished end curves, flipping the workpiece end-for-end between cuts.

Shaping the Stretchers

I template-route the concave curves in the stretchers on a shaper that accepts router-bit collets, but you can do it just as well on a router table.

I use a pattern-cutting bit and a couple of template-routing jigs to cut identical curves on the stretchers quickly and accurately. One jig cuts the bottom curve and the other jig cuts the end curves. (See photos, above.) Each jig has a base, backstop and endstop made of

1/2-in. MDF. The jig for the bottom curve is 5 by 16 in. overall, and the jig for the end curve is 8 1/2 by 10. Both jigs employ quick-action toggle clamps, screwed to the backstop, to hold down the workpieces during the cut.

When drawing the curves onto the bases of the jigs, extend the line a little beyond the actual cut, so that the router bit's bearing registers on the template's edge before entering the cut and after exiting the cut. One important note

about template-routing curves: Before routing, I'm careful to bandsaw the curve very close to the layout line—about 1/32 in. outside of the line. Then there's very little wood for the router to remove, and that leaves practically no chance for tearout, even when routing against the grain.

Making the Legs

I made another template out of 1/4-in.-thick hardboard to draw the curves at the tops and feet of the legs, so that all eight of them would be uniform in shape. Use Fig. 1 to make the template. I trace the lines onto each leg and bandsaw the waste. Curve only the outside face of the top, but curve three faces of each foot, leaving the inside face straight. I use a 2-in. drum sander mounted on the drill press for the top curve; several passes with the spokeshave clean up the bottom curves.

I make a saw kerf 1/16 in. deep to establish the top of the foot. Kerf only the outer and side faces, not the inside face.

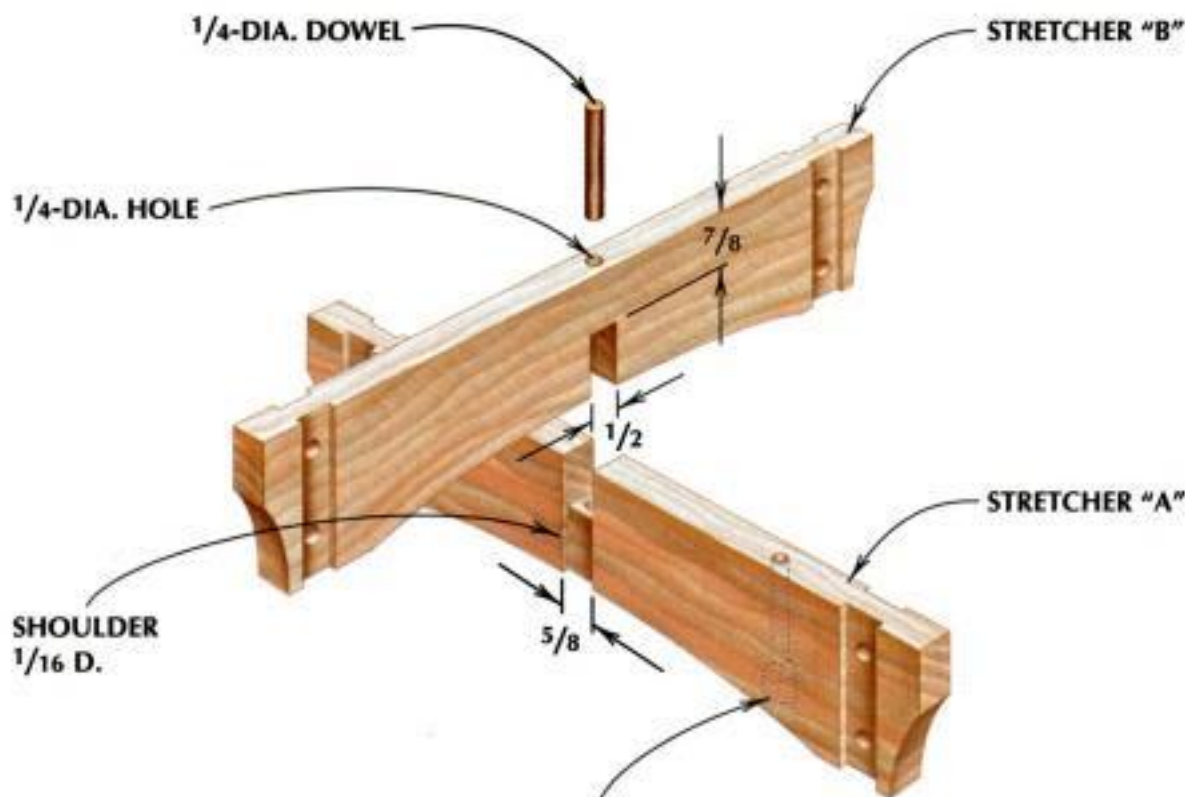
Drilling Dowel Holes

I use dowels in the leg joints not only to add strength, but also to help locate and align the stretchers during assembly.

There are two keys to drilling the dowel holes accurately. First, use a straight-edge fence along the back of the drill-press table. Position the fence 1 5/8 in. off the point of the bit (a 1/4-in. brad-point bit) to drill holes in the stretchers, and 5/16 in. from the bit's centerpoint for the legs. Clamp stops along this fence to index the holes in the stretchers and legs.

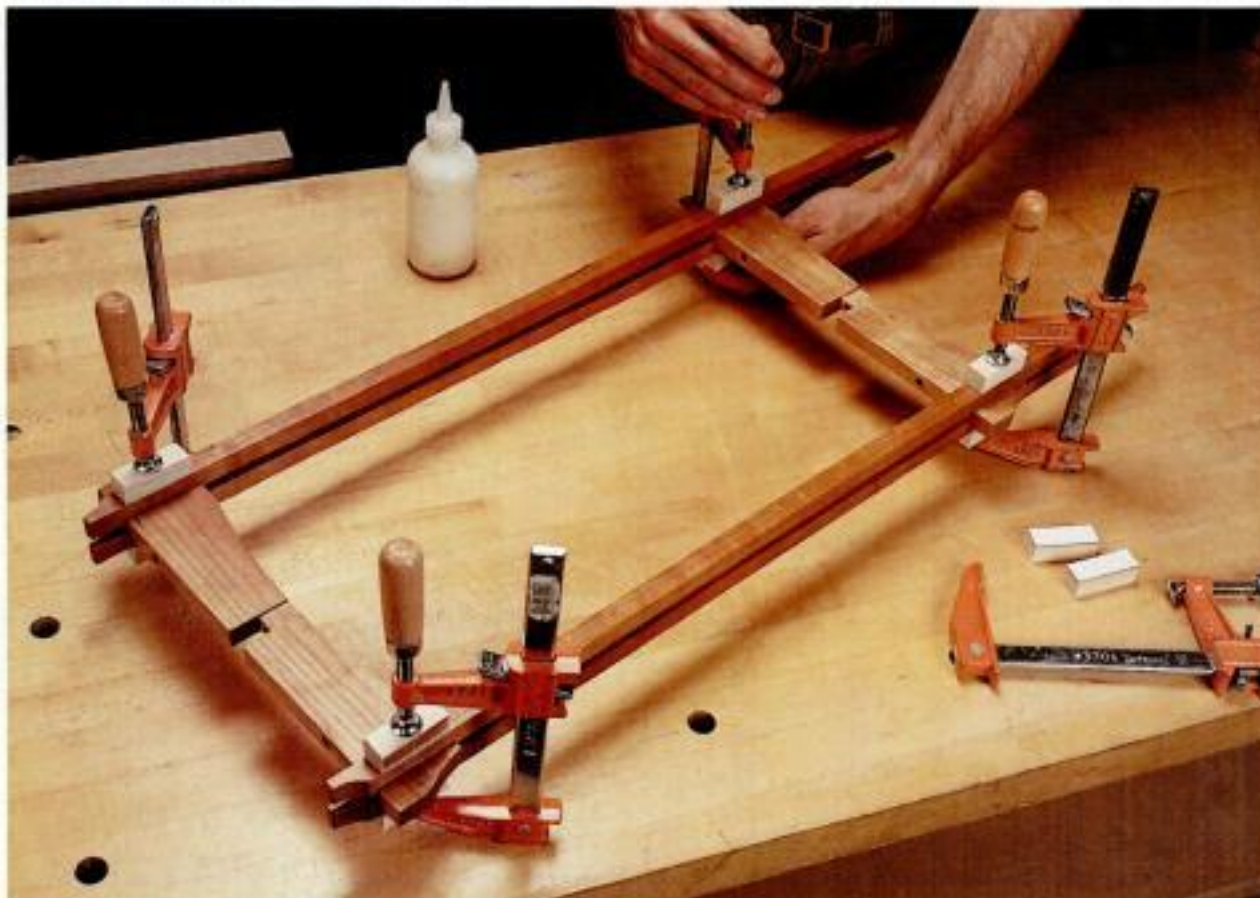
FIG. 2: SHOULDERED HALF-LAP JOINT

To form the shoulders, cut 1/16-d. by 5/8-w. dados across both faces of the "A" stretchers. Then cut the half-laps in the "A" stretchers. Finally, cut the mating half-laps in the "B" stretchers. Make precise cuts to ensure that the joint is flush top and bottom, and the parts fit together with slight friction.



Counterbore holes for tabletop hold-down screws in stretcher "A" only.

LEG AND STRETCHER ASSEMBLY



Stage 1. Glue up two "A" stretchers and two pairs of legs. To avoid marring the finish, you can make padded clamping blocks by gluing cardboard to hardwood scraps.



Stage 2. Glue the "B" and "A" stretchers together, then glue and clamp the remaining legs in place.

Second, make a 1-in. by 12-in. spacer block to set between the stop and the workpiece (or between the fence and the workpiece in the case of the legs) to space holes exactly 1 in. apart. After drilling dowel holes, drill and counterbore holes in the two "A" stretchers for the 2-in. confirmat screws (available from The Woodworkers' Store, 800-279-4441) that hold down the tabletops.

Before finishing, I sand all the pieces, checking frequently to make sure the joints remain snug. Then I dry fit the

two sets of "A" and "B" stretchers together at the half-lap joints and drill a 1/4-in.-diameter hole 1 1/4 in. deep in each set. (See Fig. 2.)

Prefinishing

I finish all the individual pieces with three coats of Waterlox, a water-resistant oil-varnish blend, before assembling the table. I've found prefinishing to be easier and cleaner, because an assembled table has narrow or unreachable spaces and inside corners where the finish tends to build up. A water-resistant finish is important if you plan to display plants (and water them) on the stand.

The trick is to make sure the finish is not applied to any of the glue surfaces. I do that by covering those areas with blue painter's tape, available at paint-supply stores.

Three-Stage Assembly

This is the exciting part: The table finally takes shape and you get to appreciate the fruits of your meticulous labor. Assembly of this plant stand must be approached methodically, in three stages.

Stage one. Grab two "A" stretchers and two legs, one leg with dowel holes on the right and another with holes on the left. Insert a 1/4-in. dowel, 1 in. long, into each stretcher hole. Apply glue into the dowel holes of each leg and all mating

surfaces—sparingly, to avoid squeeze-out. Sandwich the stretchers between the legs so the dowel ends are captured by the holes in the legs. (See photo, above left.)

Then take another left and right leg, add dowels and glue, and mount them onto the opposite ends of the stretchers. Clamp the legs together at each joint.

Stage two. Glue the "B" stretchers into the center half-lap joint of the "A" stretchers. (See photo, above right.) Then glue and clamp the remaining legs to the "B" stretchers, as you did in stage one. You'll find it easiest to do this with the stand in the upright position.

Next, glue a 1/4-in. dowel into each center half-lap joint. Leave each dowel 1/4 in. proud to engage the center hole of the circular tops.

Stage three. After the glue dries, screw the tops to the "A" stretchers from underneath, using the confirmat screws mentioned earlier. Be sure to drill accurate pilot holes for the screws, to avoid splitting the tops. ▲



Stretcher-leg joint. Two dowel pins, spaced 1 in. apart, strengthen the joint and help align the stretchers and legs during assembly.



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In the shop with

Andy Rooney

60 MINUTES' star commentator builds beautiful furniture and confesses to board hoarding

by Tim Snyder

Andy Rooney is a woodworker. References to woodworking are sprinkled among the gems of wisdom that this famous journalist has dispensed over a career spanning more than half a century. Rooney has even alluded to his woodshop activities on television's *60 Minutes* news program, where his astute, amusing and often irreverent remarks are enjoyed by millions of viewers.

Investigating the woodworking rumor, I learned that Rooney has two workshops. His "small" shop is at his year-round home in Connecticut. The centerpiece here is a Shopsmith combination machine given to Rooney in 1951 by Arthur Godfrey, a popular TV personality during the 1950s who shared Rooney's passion for wood.

I managed to wrangle an invitation to visit the larger workshop where Rooney does most of his work. It's located in upstate New York, not far from the Albany area where he grew up. I found the famous writer as you see him here—up to his ankles in offcuts, with one small table just completed and another one underway. Tables of all types are a Rooney specialty. "I pay a lot of attention to the top and to the drawer fronts," he explains. "That's where you have the chance to show off your most beautiful wood."

Rooney still does a great deal of his writing on a manual typewriter that's as old as he is. But he hasn't resisted the progress of power tools for woodworking. A Powermatic cabinet saw and jointer hold down central positions on the shop floor. Rooney uses a Makita resaw bandsaw to cut lumber from trees felled on his own property, and he relies on a 15-in. planer for thicknessing. Both of these machines can move around on mobile bases that Rooney fashioned from hardwood and heavy-duty locking casters.

The rest of Rooney's shop is filled with the familiar clutter that would make any serious woodworker feel right at home: clamps, hand tools, encroaching lumber, coffee cans full of small stuff and objects whose purpose can no longer be determined. The 24-ft. by 24-ft. building is bursting with many years of woodworking history. A second structure, clearly built for auto shelter, has already given over one of its bays to a wood rack built to hold an impressive stash of cherry.

The farmhouse on Rooney's upstate property is full of beautiful boards that have been thoughtfully coaxed into fine pieces of furniture. A cherry sideboard in the dining room shows off a bank of drawer fronts cut from a single board with a light stripe of sapwood running through it. In the living room, my host showed me an end table with an incredible top of bird's-eye maple. Inspired by the work of George Nakashima, Rooney believes that a board's beauty needs to lead the way into the design process.

Our talk about woodworking always seemed to lead back to the wood itself. At right, Andy describes some of the more noteworthy pieces in his wood collection and presents a convincing defense of board hoarding. ►

A BIT ABOUT MY WOOD

By Andy Rooney

When I come home with wood I have found in some obscure sawmill, lumberyard or farmer's barn, my wife invariably asks one of two questions: "Don't you have enough wood?" or alternately, "What are you going to do with it?"

The answer to the first question is, "I'll have enough wood when Imelda Marcos has all the shoes she wants."

The answer to the second question is, "I have no idea what I'm going to do with it. Nothing, maybe."

For me, having wood is an end in itself. I own boards that I would rather have hanging on my living room wall than a Rembrandt painting.

At the bottom of my wood rack, I have stuck seven cherry boards 14 ft. long and 25 in. wide at their widest point. I used to have eight, but I made two tables out of one of them.

I like the tables, but they do not give me any more pleasure than do the seven boards. I have looked down at that cherry several thousand times in the ten years I've had it and derived pleasure on every occasion. What would I do with them that could be better than that?

My shop is a small museum of wood. I know a lot about it, but if the great wood expert Bruce Hoadley made house calls, I'd invite him over to tell me more about my wood.

Here's a partial inventory:

✓ About thirty pieces of bird's-eye and curly maple. These boards vary in



Never enough room. Above, Rooney's wood supply threatens to take over his shop space. The end table is a recently completed project.

width from about 6 in. to 11 in.

✓ One extravagantly figured rosewood plank 48 in. long.

✓ 800 board feet of seasoned cherry. I had to eliminate one car from the garage when I built the rack to accommodate it. I bought this wood from a man who had kept it in his barn for 20 years.

✓ Several heavy ebony blocks 23 in. long and four heavy pieces of macassar ebony sent to me by a wood sculptor in Seattle.

✓ One great 6-ft. plank of English oak.

✓ A piece of mahogany 6 ft. by 49 in., my widest board.

✓ A dozen pieces of teak in assorted shapes. One board is 15 ft. long and 23 in. wide by only $\frac{7}{8}$ in. thick. I could never cut this.

✓ Eight very old pieces of wide, thick yellow pine barn flooring with nails in it.

✓ Assorted lengths of red oak. Two trees behind the house died several years ago, and a local sawyer sliced me a pile of boards with one of those mobile saws.

✓ A 4-ft. by 24-in. piece of cocobolo left over from a coffee table I made, in the process of which I had a severe allergic reaction that caused a rash and curtailed

my television career for three weeks. I like it, but I don't touch it with a ten-foot pole. I have several ten-foot poles.

✓ An assortment of spalted maple.

✓ One 6-ft. piece of Australian lacewood. I make drawer fronts from it because it looks like bird's-eye maple but more so.

✓ Nine pieces of apple just 30 in. long and 7 in. wide, from a fallen tree. It's difficult to get a long piece of apple.

I am certain that I have more wood than AMERICAN WOODWORKER has space for me to describe. My pile of offcuts runneth over. ▲



Contractor's Saws

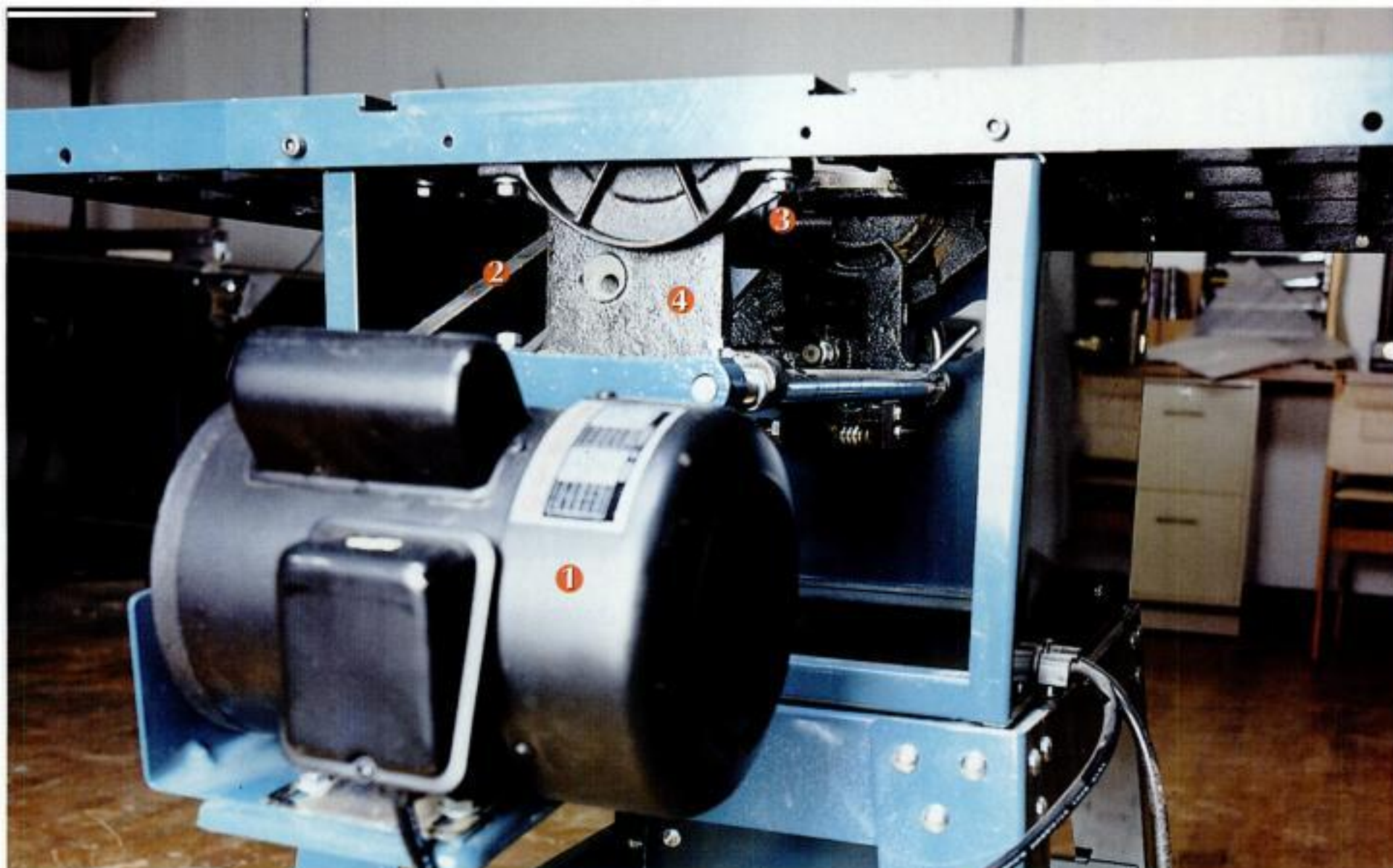
We rate 9 fully equipped models

Well-equipped for woodworking.

The contractor's saw earned its name on construction sites, but today's models are available with accessories designed for woodworkers. Better fences, bigger rip capacities, broader tabletops and improved dust collection are the major benefits.

On the tablesaw family tree, the contractor's saw fits between the portable benchtop tablesaw with its direct-drive universal motor and the cabinet saw with its enclosed base and multiple V-belt drive. On a contractor's saw, the motor hangs out the back, bolted to a hinged mounting bracket that's connected to the saw's trunnion assembly. A single V-belt transfers power from the motor to the arbor. (See top photo, opposite.)

The contractor's saw earned its name during the housing boom that followed World War II. Builders



Anatomy tells the story. On a contractor's saw, the weight of a 1½- or 2-HP motor ① maintains tension on a single V-belt ②, which transfers power to the blade arbor ③. The trunnion mechanism ④ that holds the arbor is bolted to the underside of the tabletop; it's designed to allow for height and bevel adjustments.

needed a rugged, reliable tablesaw that could travel in the back of a pickup truck. They soon came to rely on this jobsite workhorse to rip and crosscut all kinds of material, from rough sheathing and dimension lumber to plywood siding and trim stock for doors and windows. Many builders even made bookshelves, cabinets and molding with their saws, using molding heads and different cutting profiles in addition to saw blades. (See AW #60.)

Souped-Up Saws

Lighter, less powerful and less expensive than most cabinet saws, the contractor's saw has become the tablesaw of choice for many woodworkers. For this Buyer's Guide, we selected nine popular contractor's saws. All our test saws are fully equipped models; they come with some important added features. Lower-priced, "stripped-down" versions are also available. (See chart, page 48.)

Is it worth paying the extra money for a souped-up saw? You bet. The added features will bring you real gains in accuracy, capacity and convenience. Here's a basic description of the add-ons that make a big difference.

•**A first-rate fence.** Top-quality fences come as standard equipment on the saws in this test. This means easier, safer, more precise woodworking. We rated each fence for straight and square alignment, an easy-to-read scale, and overall ease of use. We found the best fences on the Bridgewood, Delta Contractor's Saw and Delta Contractor's Saw II, Jet and Powermatic models. (See chart.) For more on aftermarket tablesaw fences, see AW #61.

•**More rip capacity and larger tables.** The fences on our test saws have long rails to provide greater rip capacity than you'd have with most base-model saws. Three of the saws in our test also came with extension tables mounted between the rails on the right side of the saw. These plastic laminate-topped extensions (on the Jet, Delta Contractor's and Contractor's II saws) nearly double the effective work surface of your tabletop, making it easier to support large workpieces. On the other six saws, you have to make and install your own extension table between fence rails.

•**Dust collection.** Because a typical contractor's saw has an open stand, sawdust can end up on the floor. But most

of our test saws were different. All but the Sunhill, Star and Delta Contractor's II came with a dust-collection panel that closes off the bottom of the saw and allows you to connect a hose from your dust collector. The Star's enclosed base has a dust chute that can easily be fitted with a dust port. To test collection efficiency on the six saws with dust panels, we connected them to a 1½-HP



Smooth power transmission. On the Grizzly saw, machined pulleys and a link-belt drive get the spin from motor to blade with minimal vibration.

Contractor's Saws

Brand & Model	STREET PRICE		PERFORMANCE RATINGS					OVERALL RATINGS					SPECIFICATIONS		Table Wing Type	
	Base Model (if avail.)	Model as Tested	Power	Fence	Fit & Finish	Miter Gauge	Hands On	1	2	3	4	5	Rated HP @ 115V	Amps		Table Size D x W (in.)
 Delta Contractor's Saw 34-445	#34-444 \$599	\$928 includes 30-in. Unifence, extension table and legs.	3	4.5	4.5	4	4						1½	12.8	27 x 30¼ (27 x 62½ w/ ext. table)	Sheet steel
 Jet JWTS-10CW-PF	#JWTS-10JF \$549	\$799 includes Xacta Home Shop fence, extension table.	3	4.5	4.5	4	4						1½	18	27 x 30¼ (27 x 54½ w/ ext. table)	Solid cast iron
 Delta Contractor's Saw II 36-640	#36-630 \$499	\$628 includes 29-in. Precision Saw Guide fence, extension table.	3	4.5	4.5	4	4						1½	12.8	27 x 30¼ (27 x 54½ w/ ext. table)	Sheet steel
 Grizzly G1022Z	#G1022Z \$449	\$599 includes Shop Fox Fence.	3	4	4	4.5	4						1½	13.4	27 x 40½	Webbed cast iron
Powermatic Artisan 64	—	\$760 includes Home Shop Accu-Fence.	3.5	4.5	4	3	3						1½	18	27 x 39¾	Webbed cast iron
Craftsman 29951	#29931 \$499	\$799 includes Exact-I-Rip fence.	3	4	4.5	4	3						1½	13	27 x 44	Webbed cast iron
Bridgewood TSC-10C	\$490	\$739 includes 30-in. General Home Shop Fence.	3	4.5	3.5	1.5	2.5						1½	14.2	27 x 40	Webbed cast iron
Sunhill MS10BF	MS10L \$349	\$498 includes Proform fence.	3	3.5	3	2	2.5						1½	20	27 x 39¾	Webbed cast iron
Star 3205	#53201 \$365	\$499 includes fence, extension table stand.	3	3	3	1	2.5						2	24	27 x 41	Webbed cast iron

GUIDE TO THE RATINGS

5=Excellent; 4=Very Good; 3=Good; 2=Fair; 1=Poor

Power—Ability of saw to cut through different materials without bogging down.

Fence—Straightness and squareness to table, parallelism to blade, scale readability, ease of use.

Fit & finish—Flatness of table and extension-table surfaces, quality of machining, overall fit of parts.

Miter gauge—Precision, squareness to table, ease of operation.

Hands-on—Overall ease of use, including convenience and safety of switch, blade bevel and height adjustments, blade-guard operation, vibration.

single-stage dust collector. We found that the open backs on these saws made vacuum pickup less effective than on cabinet saws. You can expect some sawdust to escape out the back of the saw when cutting, due to the turbulence generated by the blade. And sawdust will accumulate on ledges inside the sheet-metal case. But our dust collector kept most of the sawdust off the floor. The verdict: The dust-collection panels and ports were welcome additions on the saws we tested.

Features to Consider

The tablesaw is the most important machine in just about any woodworking shop, so buying a new one is a major decision. We'll discuss what's important, and explain the procedures we used to rate the models in our test.

Price—Affordability is a big reason for the popularity of contractor's saws. The fully-equipped models in this test cost between \$498 and \$928. To buy a similarly equipped cabinet saw, you can expect to pay \$1,000 to \$2,000.

Power—Here's where you'll find the biggest difference between contractor's saws and cabinet saws. To measure power, we made test cuts in plywood,

hardwood and softwood of different thicknesses. We used identical 50-tooth, carbide-tipped combination blades from Amana—the type of blade that many woodworkers keep on their saws for general-purpose use.

Here's what our test cuts turned up: The 1 1/2- and 2-HP motors on these saws had no trouble powering through 3/4-in. plywood and 1-in.-thick hardwood. But getting through 2-in.-thick hardwood required slower feed rates. And we were able to stop the blade on all of our test saws by increasing feed pressure. Some saws stopped because a circuit breaker tripped—either on the motor or at the breaker box. Others stopped because the saw's V-belt began to slip on its pulleys, creating the telltale smell and smoke of burning rubber.

It took our test saws between 13 and 17 seconds to rip through a hard maple board 2 in. thick and 36 in. long. Cutting the same stock on a 3-HP cabinet saw took an average of 6 seconds—two to three times faster. If you often cut dense hardwood that's thicker than 2 in., it makes sense to save up your money and buy a cabinet saw. (See AW #49.) But if you work primarily in thinner stock, you'll find that all of the saws in

Max. Cutting Capacity (in.) at 90°, 45°	Max. Rip Capacity (in.)	Dust Panel (Y, N); Port Dia. (in.)	Weight (lbs.)
3 1/16", 2	31 3/4	Y; 5	260
3 1/4", 2 3/16"	30	Y; 4	324
3 1/8", 2 1/8"	29	N	202
3 3/16", 2 1/8"	25 1/4	Y; 4	295
3", 2	28 1/4	Y; 4	325
3 3/8", 2 1/4"	29 1/4	Y; 2 1/4"	244
3 5/16", 2	32 1/2	Y; 4	242
3 1/8", 2 1/8"	24	N	282
3 1/8", 2 1/8"	35	N	350



A good miter gauge makes a difference. The Grizzly miter gauge (far left) has a cast-iron body with a flat guide face. The Grizzly gauge's bar adjusts to fit in its table slots. The Star gauge (near left) has a lighter-weight aluminum body and minimal angle markings.

our test will deliver adequate power.

When you do need to cut a lot of thick, dense stock on a contractor's saw, a thin-kerf blade will let you use faster feed rates and put less strain on your motor. Another way to reduce motor strain is to rewire the saw to run on 230-volt current. All the motors on our test saws can be wired for 115V or 230V. And in our opinion, the motors on the Grizzly and Star *should* be rewired for 230V. Both of these saws tended to trip 20-amp, 115V breakers, either upon startup or under load.

Miter gauge—A good miter gauge is crucial for precise crosscutting work, and the gauge that came with the Grizzly saw was the best of the bunch. The Grizzly miter gauge was the only one in our test group with a body made from cast iron, which our testers preferred for its weight and solid feel. All the other miter gauges had lighter aluminum bodies. The Grizzly's miter gauge was also the only one in our test group with a bar that could be adjusted to fit in its table slots—a feature that promotes precision.

Other findings: The guide faces on the Bridgewood and Star miter gauges weren't machined square with the table

surface. And the miter-gauge bars on the Sunhill and Star saws didn't slide smoothly in their slots. We improved the fit with a few taps from the hammer and some filing.

Quality of cut—Smooth-sawn surfaces are what woodworkers look for in a tablesaw, regardless of its size, price or type. Our test cuts yielded smooth results with blades set at 90°. But things changed when we began to tilt the blade. We found that material up to about 3/4 in. thick could be cut smoothly with the blade tilted at different angles. But bevel cuts made in thicker stock produced some saw marks and burning, especially with the blade tilted to its maximum angle of 45°.

We checked and adjusted blade alignment, but still couldn't eliminate the burning and saw marks. In fact, this Achilles' heel is common in contractor's saws. When you tilt the blade, the motor tilts as well, and its cantilevered weight causes the trunnion assembly to rack slightly, at the same time making it more prone to vibration. This causes the blade to cut less evenly. The bottom line: If you're cutting steep bevels in material thicker than 3/4 in., the beveled

Text continued on page 53.

HIGHS AND LOWS

BEST INSTRUCTION MANUAL: **Bridgewood**

WORST INSTRUCTION MANUALS: **Star and Sunhill**

BEST MITER GAUGE: **Grizzly**

LEAST VIBRATION: **Grizzly**

FLATTEST TABLE SURFACE: **Delta Contractor's Saw**

BEST FIT & FINISH: **Craftsman, Delta Contractor's Saw, Delta Contractor's II and Jet**

BEST SWITCH: **Delta Contractor's II**

GREATEST RIP CAPACITY: **Star (35 in.)**

LEAST RIP CAPACITY: **Sunhill (24 in.)**

BEST BLADE GUARD: **Craftsman**

EASIEST BLADE CHANGING: **Star**

MOST DIFFICULT BLADE CHANGING: **Delta Contractor's II**

DELTA CONTRACTOR'S SAW 34-445 (800) 438-2486 Circle #608

Street price: \$928. Includes 30-in. Unifence, extension table and legs.



PROS: Top-rated fence; top-rated fit and finish; flattest table; minimal vibration; very good miter gauge; blade bevel-adjustment screws on tabletop; largest tabletop surface in test; lockable switch; good instruction manual.

CONS: 5-in.-dia. dust-collection opening needs adaptor to fit standard 4-in.-dia. pipe.

FINAL CUT: The "original" contractor's saw at a premium price. You couldn't ask for a better fence than Delta's Unifence, itself an Editors' Choice winner. Overall, this saw is as solid as a contractor's saw can be.

All photos show saws equipped as tested.



JET JWTS-10CW-PF (800) 274-6848 Circle #609

Street price: \$799. Includes Xacta Home Shop Fence and extension table.



PROS: Top-rated fence; top-rated fit and finish; very good miter gauge; minimal vibration; only saw in test with solid cast-iron extension wing.

CONS: No saw blade supplied; extension table legs are optional (\$49).

FINAL CUT: This saw got excellent all-around scores. The top-rated fence, highly polished tabletop and cast-iron extension wing just might fool you into thinking you're working on a cabinet saw.



DELTA CONTRACTOR'S SAW II 36-640 (800) 438-2486 Circle #608

Street price: \$628. Includes 29-in. Precision Saw Guide fence and extension table.



PROS: Top-rated fence; best controls; top-rated fit and finish; minimal vibration; very good miter gauge; blade bevel-adjustment screws on tabletop; safety lock on switch; very good instruction manual.

CONS: Difficult blade changing; dust-collection panel is optional (\$15); extension table legs are optional (\$45).

FINAL CUT: Delta's lighter-weight version of their Contractor's Saw delivers comparable quality and performance at a lower price. We were suspicious of the lighter-weight trunnion and motor support assembly on the "Con II," but we couldn't induce any failings in performance or precision. A top-notch saw.



GRIZZLY G1022ZF (800) 541-5537 or (800) 523-4777 Circle #610

Street price: \$599. Includes Shop Fox Fence.



PROS: Very good fence; least vibration among test models; best miter gauge in test; large handwheels make blade adjustments easy; only saw in test with machined pulleys and link-belt drive; very good instruction manual.

CONS: Fence difficult to remove from saw; throat plate difficult to remove; 230V wiring required for best performance.

FINAL CUT: This saw ran like a top. Excellent controls, a great miter gauge and a smooth-working fence make the Grizzly a Best Buy, even though it's not the lowest-priced model.

POWERMATIC ARTISAN 64 (800) 248-0144 Circle #611

Street price: \$760. Includes Home Shop Accu-Fence.



PROS: Top-rated fence; above-average power; good instruction manual; two wrenches make blade changing easy.

CONS: Throat plate difficult to remove; blade guard is sturdy but blocks view of blade; inconvenient switch location.

FINAL CUT: An average saw with a top-rated fence.

CRAFTSMAN 29951 See your local Sears store. Circle #612

Street price: \$799. Includes Exact-I-Rip fence.



PROS: Very good fence; top-rated fit and finish; very good-quality miter gauge comes with hold-down clamp; blade bevel-adjustment screws on tabletop; large handwheels are easy to use; safety lock-out key on switch; best blade guard.

CONS: Too many turns (59) to tilt blade from 90° to 45°; quality of cut slightly below that of other saws; throat plate difficult to remove.

FINAL CUT: Good safety features—the lockable switch is a plus, and the blade guard is a cut above the others in this test. The Craftsman 29951 is the only model in our test group with a left-tilting blade, so if you favor that feature, give this model a serious look.

BRIDGEWOOD TSC-10C (800) 235-2100 Circle #613

Street price: \$739. Includes 30-in. General Home Shop fence.



PROS: Top-rated fence; very smooth table surface; best instruction manual; only saw with magnetic switch.

CONS: Inconvenient switch location; table extension wings needed to be installed with shims to make table flat; miter gauge not machined square to table.

FINAL CUT: This saw fits solidly into the middle of the pack—a notch below the Grizzly, Delta and Jet saws, but a notch above the Star and Sunhill saws.

SUNHILL MS10BF (800) 929-4321 Circle #614

Street price: \$498. Includes Proform Fence.



PROS: Lowest price of tested saws; two wrenches make blade changing easy.

CONS: Left face of rip fence 0.013 in. out of flat; small plastic handwheels make blade adjustment more difficult than on other saws; dust-collection fitting not included; throat plate difficult to remove; poor instruction manual; saw blade not included.

FINAL CUT: Can't beat the price, but quality and performance are not up to par with other saws.

STAR 3205 (888) 678-8777 Circle #615

Street price: \$499. Includes fence and extension table stand.



PROS: Long, strong extension table frame and legs; greatest rip capacity (35 in.); fence has micro-adjustment; two wrenches make blade changing easy.

CONS: More vibration than other saws; 230V wiring required for best performance; poor miter gauge; dust-collection fitting not included; owner must supply extension tabletop; poor instruction manual; saw blade not included.

FINAL CUT: The Star's dust chute deposits dust and debris to the side of the saw instead of underneath it—a good feature if you're without a dust collector. Otherwise, this saw is an average performer that offers great rip capacity at a low price.



Bevel stops in tabletops. On the Craftsman saw and both Delta saws, a pair of setscrews in the tabletop lets you set stops for 45° and 90° blade settings without reaching under the table.

surface may require a cleanup pass on the jointer or with a hand plane.

Capacity—The contractor's saws in our test have essentially the same capacities as cabinet saws. Maximum cutting depth is between 3 in. and 3³/₈ in. with the blade at 90°, and between 2 in. and 2³/₁₆ in. with the blade at 45°. The Sunhill saw has the least rip capacity (24 in.), while the Star has the greatest (35 in.). Each saw arbor can accept a 1³/₁₆-in.-wide stack-type dado blade and a molding head.

Fit and finish—Well-fitting parts and a smooth, flat table surface are important fit and finish considerations with tablesaws. All our test saws rated good or better in this category. The Craftsman, Delta Contractor's Saw, Delta Contractor's II and the Jet earned the highest fit and finish ratings.

Table wings and extension tables—You'll find three types of table wings on contractor's saws: solid cast iron, "webbed" or gridded cast iron, and sheet steel. (See chart.) Sheet-steel wings make the saw lighter and easier to move around, but they don't have the solid feel of cast wings. Webbed wings offer a good compromise between weight and solidity, but you can't place small parts on them. Also, you can get your fingers pinched in the webbed framework when moving a workpiece through the blade. If heavy weight isn't a problem, you'll appreciate the flat, smoothly machined surface of the Jet's single wing; it's made of solid cast iron,

just like the wings on a cabinet saw. For \$100 less, you can buy the Jet with sheet-steel wings.

An important note about wing installation: The wings are bolted to the edges of the tabletop, which aren't always square to the top surface. To keep the total table surface flat, it may be necessary to insert shims between the wing edge and the tabletop edge. The Bridgewood and Grizzly instruction manuals describe this procedure clearly.

Four of the saws came with extension tables or stands. (See chart.) The steel channel stand on the Star was by far the sturdiest, but you have to make and install your own extension tabletop. On the Jet and Delta Contractor's II saws, extension tables are supported by the fence rails alone. We recommend buying the optional legs (\$49 for the Jet; \$45 for Delta) to give these tables extra stability. Or you can simply make your own legs.

Blade guards—Safety is a major concern with tablesaws, but manufacturers aren't sending that message with their blade guards. The generic design still includes a splitter that is difficult to align with the blade, anti-kickback pawls that can be skinny enough to slip into the saw kerf, and blade covers that block too much of your view. The clear plastic covers on both Delta saws provided a better view. Unfortunately, they won't stay out of the way when you need to change blades. When will manufacturers take the plunge and come up with a decent guard?

The hands-on rating—Our hands-on rating gives an idea of what it's like to use the machine day in and day out. To come up with the hands-on rating, we considered switches, bevel and blade-height adjustments, blade changing, blade guards and vibration.

The highest hands-on scores went to the Grizzly, Jet, Delta Contractor's and Delta Contractor's II saws. The Grizzly ran with the lowest vibration of any of our tested saws, thanks to a link-belt drive and pulleys that are machined rather than cast. Link belts and machined pulleys to fit most contractor's saws are available from In-Line Industries (800-533-6709).

The Delta Contractor's II earned high marks for its switch, which is super-accessible and very easy to turn off—a good safety feature. On both Delta saws and the Craftsman saw, we liked the ease of setting stops for 90° and 45° blade angles—you simply adjust a pair of setscrews in each saw's tabletop. (See photo, left.) On the other saws, you've got to reach underneath the tabletop with a wrench to set the stops.

On the downside, we didn't like the 59 handwheel revolutions necessary to tilt the Craftsman's blade to 45°. You can reach maximum bevel on the other saws in about 30 turns. Blade changing is easiest on the Powermatic, Star and Sunhill saws because these saws use two wrenches—one to hold the arbor and the other to loosen the arbor nut. To adjust the arbor nut on the "single-wrench" saws, you have to hold the blade with a rag or jam it against a scrap block of wood.

Recommendations

Three contractor's saws earned our Editors' Choice award—best overall performance regardless of price—the Jet JWTS-10CW-PF, the Delta 34-445 Contractor's Saw, and the Delta 36-640 Contractor's Saw II. The identical overall scores of these three winners tell the whole story. (See chart, page 48.) They were all a pleasure to use, and they'd stand up well as the mainstay of any small or medium-size workshop.

The Best Buy award—best performance for the price—goes to the Grizzly G1022ZF. The fence and miter gauge are a winning combination on this saw, and all our testers appreciated how smoothly this machine ran. It's a great deal for \$599. ▲



Hardwood slides complement a finely crafted drawer. These ingenious drawer slides allow the drawer to extend completely. You can make them with offcuts, and they don't require painstaking precision.

Wooden Drawer Slides

Shop-built, full-extension "hardware" fit for the finest drawer

by Sandor Nagyszalanczy

I love the convenience of full-extension drawer slides on a chest or cabinet. They let you easily reach in and get at the stuff that inevitably ends up all the way at the back of the drawer.

Unfortunately, nothing can ruin the look of a custom-made wood desk more than using metal full-extension slides for the drawer hardware. I know one excellent craftsman whose stunning figured-maple desk was juried out of a very prestigious show simply because he had fitted metal full-extension slides on its drawers.

But what's a woodworker to do? Traditional designs for all-wood, full-extension slides usually involve complex interlocking parts, such as butterfly keys

that fit between dovetail-slotted strips mounted on the carcass and drawers. Even if you make and fit these with great care, the wooden mechanism can bind up with rises in humidity, making it difficult or impossible to open and close a drawer.

That's why I was excited to discover the clever all-wood, full-extension drawer slide system shown in the photo above. I found it on a dining-room credenza I was measuring for reproduction. The piece was designed by William Purcell around 1912. Extension slides were necessary because the credenza's top overhangs the drawer fronts by several inches, making access to drawer contents difficult otherwise.

To my great delight, I found that this attractive extension slide system works well on both frameless and face-frame cabinets—although it's a little easier to install on frameless cabinets.

The beauty of this system is that the connecting parts don't have to fit snugly to work properly: A small amount of clearance between parts allows for expansion and contraction in the wood, preventing binding.

I'll show you how to build this full-extension slide system and dimension the parts to work for the basic boxlike (parallel-sided) drawers used in most dressers, desks and cabinets. I'd say that the minimum drawer size for this system is about 10 in. long and a few

inches high. For heavy-duty applications such as file cabinets, or for small pieces such as jewelry boxes, you'll have to beef the parts up or scale them down as necessary.

Drawer Dimensions

This slide system is simple to build. There are just a couple of requirements regarding the dimensions of the carcass and drawer. First, the drawer must be between $1\frac{1}{16}$ in. and $1\frac{1}{8}$ in. narrower than the drawer housing or face-frame opening in the carcass. Second, the back end of the drawer must be $\frac{1}{16}$ in. lower than the height of the drawer housing or face-frame opening.

Extension Slides

The slide system consists of three pairs of components: support cleats, extension slides and guide rails. (See Fig. 1). I suggest making these parts out of the same wood as the drawer sides, or any sturdy hardwood.

Each extension slide is made from three pieces of $\frac{1}{2}$ -in.-thick stock: a wide lower section and two small ears attached to the top edge of the front and back. Note that the dimensions of the ears are fixed, but the length and width of the lower slide section will vary according to the overall height and length of the drawer.

Before attaching the ears, cut a stopped rabbet in the top edge of each lower slide section. It's easiest to cut this with a straight bit or rabbeting bit chucked in the router table. Note that each drawer has one right-handed and one left-handed extension slide—mirror images of each other—so cut the rabbets and perform all subsequent steps accordingly. After routing, square up both ends of each rabbet with a chisel.

Glue the ears atop the ends of the lower section, their long grain running parallel to the length of the lower section. I suggest reinforcing the joints with dowels, splines or small plate-joinery biscuits.

Next, cut a $\frac{1}{8}$ by $\frac{3}{16}$ -in. slot in the top edge of each rear ear and glue a $\frac{1}{8}$ by $\frac{3}{8}$ by $1\frac{5}{8}$ -in. tongue into it. Cut the tongues from pieces of hard maple. For strength, the grain of these small tongues should run perpendicular to the ears.

Support Cleats

Each cleat has a $\frac{9}{16}$ by $\frac{9}{16}$ -in. rabbet on its lower edge. Two countersunk flathead screws mount the cleats to the drawer

HOW THE SLIDES WORK

The drawer and cleats move first, then the slides.

CLOSED

Cleat rests between front and rear ears.



PARTLY OPEN

Cleat meets front ear and starts to pull slide forward.



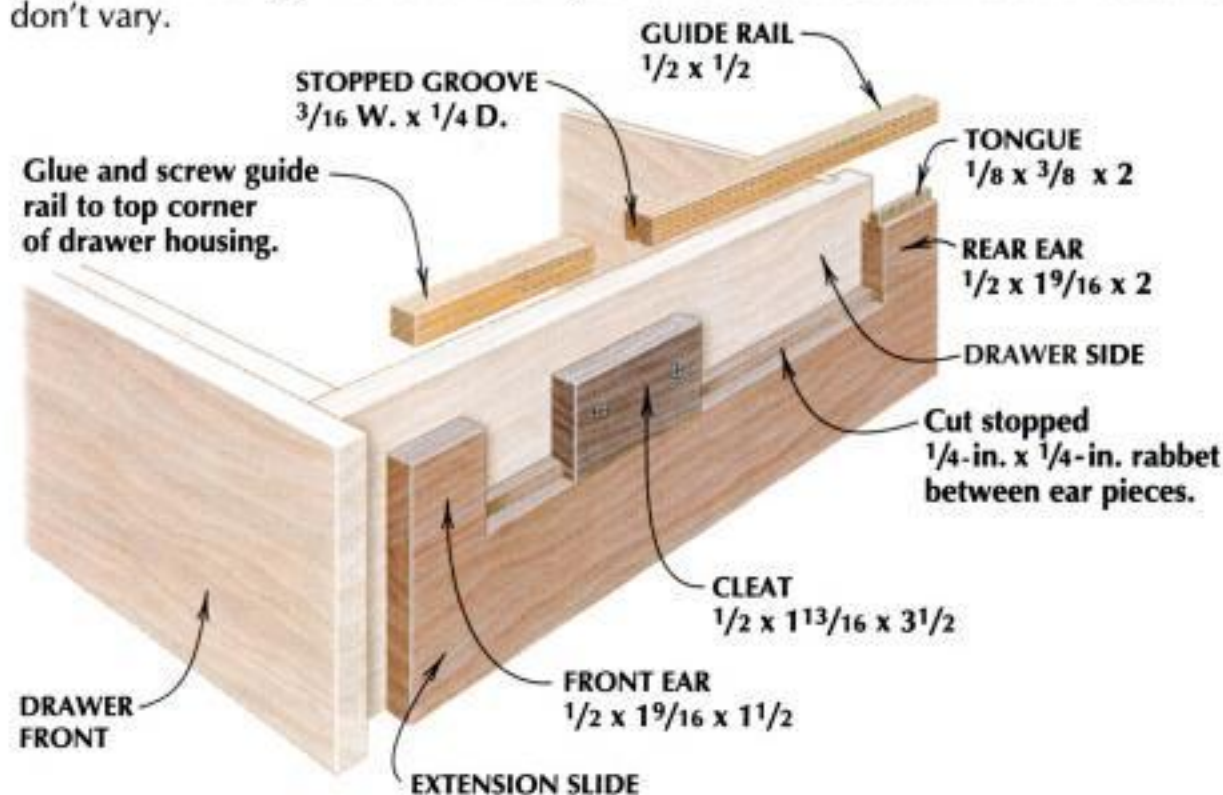
FULLY EXTENDED

Tongue in rear ear meets end of groove in guide rail.



FIG. 1: HARDWOOD EXTENSION SLIDE SYSTEM

You can adapt this slide mechanism to work with drawers of all sizes, including inset and overlay drawers. The extension slide (including the ears) is $\frac{1}{2}$ in. shorter in overall height than the drawer side. The slide is as long as the drawer side; the guide rail is $\frac{1}{16}$ in. shorter in length than the slide. Cleat and ear dimensions don't vary.



sides. Drill the pilot holes for the screws—in both the cleats and the drawer sides—but leave the cleats off until final assembly. Regardless of the drawer size, the cleats mount $\frac{1}{2}$ in. from the top edge of the drawer sides. (See Fig. 2.)

Guide Rails

The guide rails control the travel of the extension slides. I cut mine from strips of $\frac{1}{2}$ by $\frac{1}{2}$ -in. rock maple, but any similarly strong, durable wood will work. For

overlay drawer fronts, make the strips about $\frac{1}{16}$ in. shorter than the full depth of the drawer opening. For flush-fitting drawer fronts, make the strips the depth of the drawer opening minus the thickness of the drawer front, minus $\frac{1}{16}$ in.

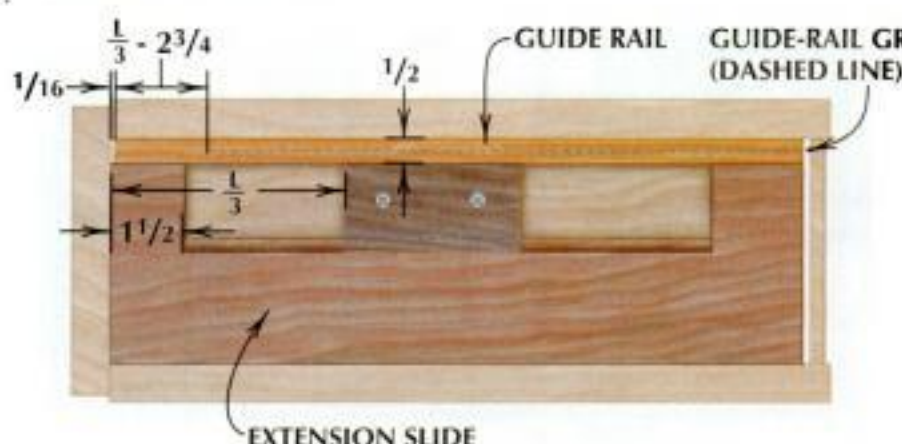
The centered, stopped groove on the underside of each rail is easiest to cut on the router table. Square up the stopped end of the groove with a small chisel.

The way that the guide rails are mounted in the carcass depends on the

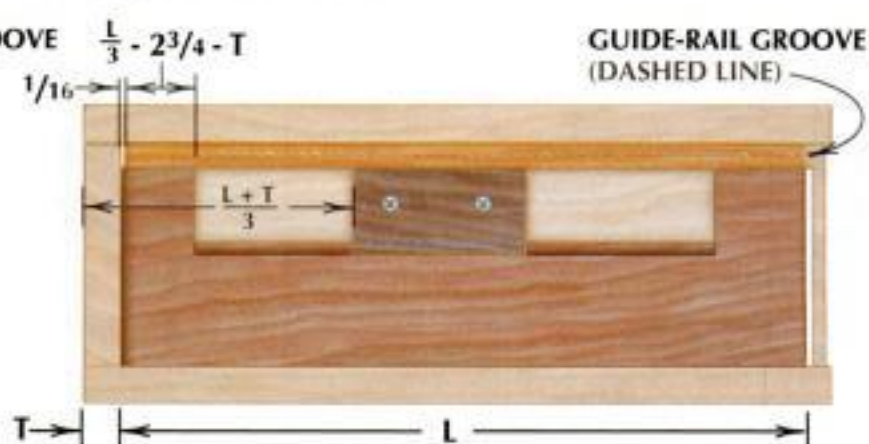
FIG. 2: GUIDE-RAIL AND CLEAT LOCATION

Mount the guide rail $\frac{1}{16}$ in. behind the drawer front when the drawer is closed. To determine where to stop the guide rail's groove, use one of the formulas shown below. Locate the cleat one-third of the way back from the back of the drawer front for overlay drawers, or from the face of the drawer front for flush drawers.

OVERLAY DRAWER



FLUSH DRAWER



KEY: L = Length of drawer side. T = Thickness of drawer front.



Slide installation. Slip the slides into the drawer opening at an angle, so you can engage the slide's tongue in the guide-rail groove.

construction of the carcass. If the drawer housings are basically plywood boxes that the drawers fit snugly into, you can simply glue the rails into the top corners of the housing, then drill and drive a countersunk screw through the ungrooved portion at the front of each strip into the plywood.

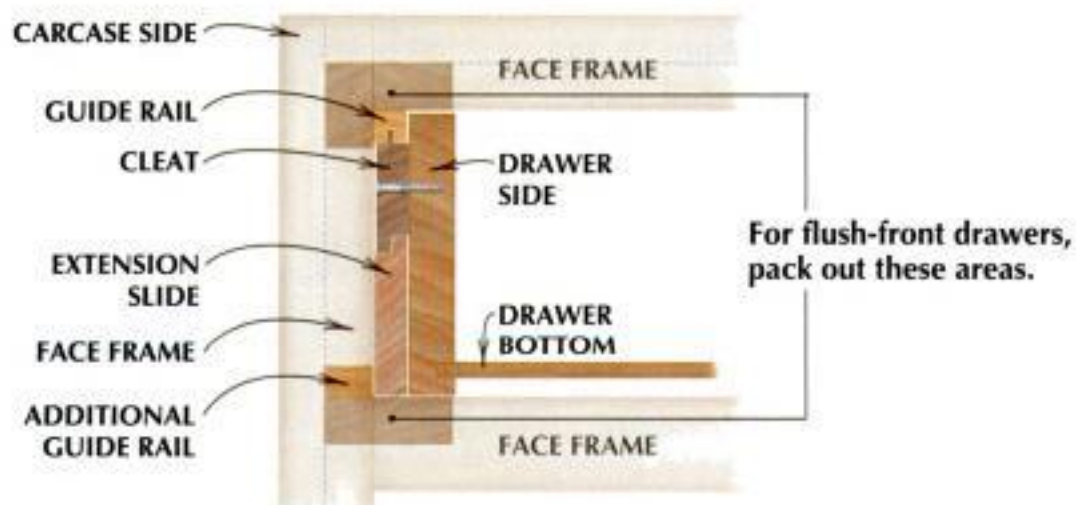
If the carcass has a face frame, you can glue and screw the guide rails into the corners of the face frame at the front. (See Fig. 3.) At the rear end, you can screw the back end of the rail into the frame above, or anchor the rail to the back of the carcass by screwing into the end of the rail.

Face-frame construction also calls for two guide rails at the bottom corners of the drawer housing, to keep the extension slides running true. (See Fig. 3.) These strips run the full depth of the drawer housing. If you're using flush-

FIG. 3: FACE-FRAME CONSTRUCTION

Face-frame construction requires an additional guide rail at each bottom corner of the drawer housing to keep the slides properly aligned. In some cases—if the drawer front fits flush, for example—you'll also have to pack out the areas behind the face frame.

SECTION THROUGH CLEAT



front drawers with a face frame, you may also need to pack out the areas behind the frame.

Installation

When the drawers, carcass and slide parts are assembled and finished, you can install the drawers and slide assemblies. Attach the guide rails first. Then insert the extension slides, after rubbing a little paraffin wax on the bottom edge and into the top rabbet and tongue of each to reduce friction.

Slip the extension slides into the drawer openings at an angle (see photo, above left), then twist them sideways, engaging their tongues in the guide-rail grooves. Check that the extensions slide smoothly in and out of the carcass. If not, trim their bottom edges as necessary.

Next, pull both slides out fully and slip the drawer into the opening. (Some wax rubbed on the bottom won't hurt.) Screw on the support cleats using the pilot holes you drilled earlier. The drawer should slide smoothly. If the extension slides bind, you may need to plane them slightly thickness-wise. Plane the inside surfaces, so tool marks won't show. To remove the drawer in the future, unscrew the cleats and pull it out. ▲



SANDOR NAGYSZALANCZY is a California furniture designer/craftsman and author of several woodworking books.

How to make and use a Bowsaw

A traditional tool for curved cuts or straight

by Yeung Chan

As a boy growing up in China, one of my favorite pastimes was watching itinerant woodworkers ply their trade, moving from job to job making simple furniture or doing repair work. I loved peeking inside the wooden toolboxes these craftsmen carried. That's how I saw my first bowsaw.

With its large wooden frame and narrow blade, a bowsaw was the tool a craftsman relied on for all of his sawing tasks, from rough work such as ripping and crosscutting large planks, to the delicate tasks of sawing tenons and dovetails. Even curved cuts were possible.

The bowsaw shown here is very similar to the one I saw as a child, and it's proved to be just as versatile. (See photos, page 59.) It can cut more aggressively than a conventional handsaw because its thinner blade doesn't cause as much friction. The tensioning mechanism is adjustable and foolproof, and I enjoy the gentle sounds it makes compared to my noisier power tools. And as you'll soon see, this timeless tool is easy and inexpensive to make.

Choosing a Blade

Buy or make your blades before you make any of the parts for the saw. The dimensions shown in the drawing on the next page are for a frame that will hold a 24-in.-long blade. If you buy a longer blade, you can grind it to fit the frame, or you can adjust the length of the stretcher to suit any length of blade.

To get the most from your bowsaw, I recommend keeping two blades on hand. I most often use a 1/4-in. by 9-tpi, standard-tooth blade. This narrow blade is great for general-purpose work as well as for ripping and curved cuts. For finer, straight cuts, I use a 3/4-in. by 11-tpi blade. This is the one I use for crosscutting as well as for sawing tenons and dovetails.

Both of these blades are available from Garrett Wade (800-221-2942). But you can also make your own from a length of bandsaw blade.

Making and Assembling the Saw

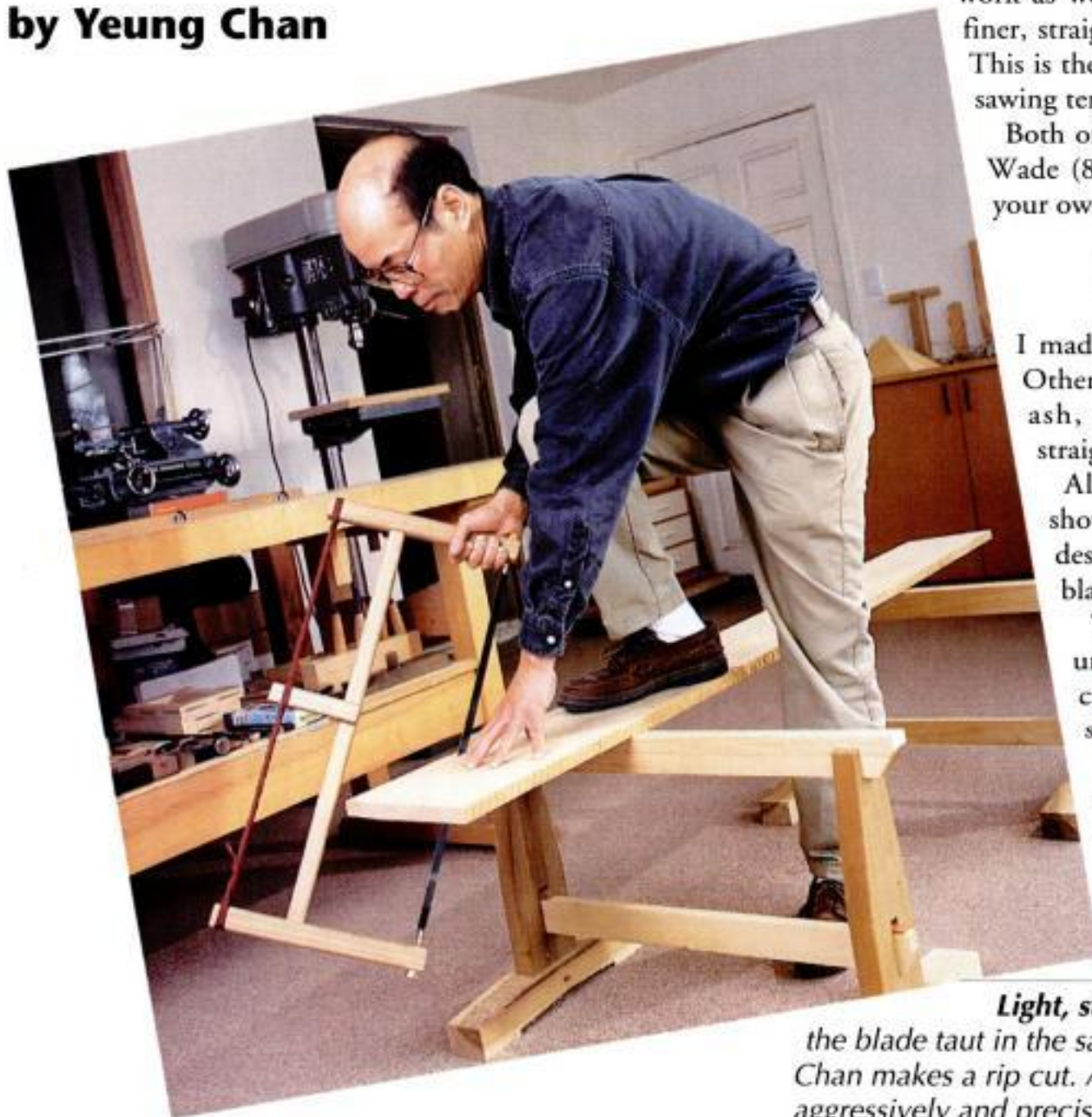
I made the saw shown here from white oak. Other strong hardwoods, such as hickory or ash, will also work if they're clear and straight-grained.

All of the construction information is shown in the drawing, but two areas that deserve mention are the stretcher and the blade-holding mechanism.

To prevent the stretcher from bending under tension, I create a slight belly in its center when bandsawing the part to shape. (See drawing.)

The blade-holding device consists of one bolt, one threaded rod and two metal pins. Hacksaw a 3/4-in.-long slot in the center of the bolt and the rod, for the blade to slip into. You'll need a strong steel pin to hold the blade to

Light, strong and fast. A twisted cord keeps the blade taut in the saw's lightweight, three-piece frame as Chan makes a rip cut. A bowsaw like this one can cut both aggressively and precisely.





Start lightly. Begin a cut with light or no pressure, using your thumb and index finger to guide the blade. Once the blade is in the kerf, you can saw with more pressure and speed.

the bolt and rod. I made my pins from an old $\frac{3}{32}$ -in.-dia. drill bit, but any hardened steel rod will work.

Once you've made all the parts, assemble the two arms and the stretcher, and install a blade. Then wrap the cord around the arms as shown in the drawing. Check to see that the arms are parallel to each other. If not, make the necessary adjustment by turning the wing nut on the threaded rod. Then insert the tensioning stick inside the cord, and rotate the stick to tension the saw blade. Tuck the free end of the stick behind the stretcher to prevent it from spinning. The blade is tensioned properly when you can "pluck" it and produce a high, even tone.

Using a Bowsaw

Used correctly, a bowsaw is one of the fastest handsaws in the shop. And despite its size, you'll find it capable of precise work, too. Though bowsaw technique takes longer to learn than that of

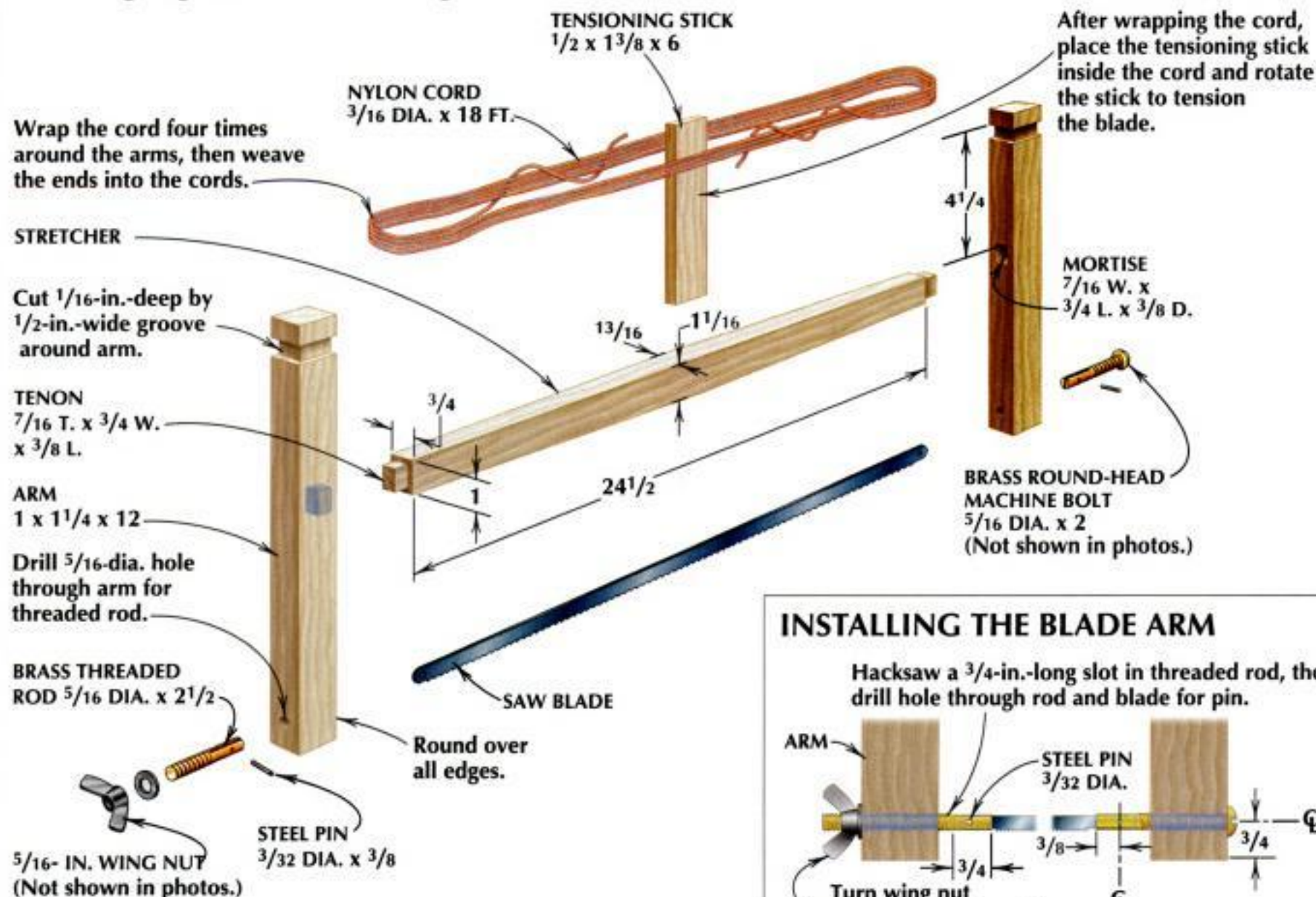
other handsaws, once you get the hang of it you will use it for most of your cutting. All cutting with a bowsaw is done on the push stroke, with the teeth facing away from you. The key is to hold the saw with a light grip and let the blade do the work.

Your first inclination may be to align the blade vertically with the arms of the frame, but don't. Instead, angle the blade 10° to 30° to the frame, so the stretcher clears the work and you have a clear view of the cutline. The exact angle isn't critical; use the one that feels comfortable to you. If you need maximum clearance, such as for a wide rip cut, you can angle the blade all the way to 90° . Make sure both ends of the blade are in line with each other to prevent any twist in the blade.

You can do all your sawing at the bench, using clamps or bench vises to hold the work. For heavy cuts such as rip cuts, I find it convenient to saw on a pair of low sawhorses. This arrange-

BOWSAW

This bowsaw can be made from oak or any other suitably strong hardwood. The dimensions shown are for a standard 24-in.-long blade. By rotating the stick around the cord, you create tension on the blade and the frame, keeping the stretcher tight against the arms without glue.



SAWING A TENON



Start on an angle. Rip the cheeks by beginning the cut at 45°, following your layout lines on one side of the stock. Repeat the cut from the other side of the workpiece.



Then level the blade. With the blade held horizontally, saw straight across to the bottom of each cheek.



Crosscut the shoulder. Hold the blade perpendicular to the stock, and saw to the depth of the shoulders.

ment lets me use a hand as well as a foot to clamp the work, and allows me to get my upper body over the saw to power the cut. (See lead photo, page 57.) Some bowsaw users like a two-handed approach for really heavy cuts—both hands on the arm, one hand near the blade to power the cut and the other hand at the top of the arm to guide the saw.

Whether you're ripping or crosscutting, start a cut by angling the blade about 45° to the workpiece. Use the thumb and index finger of your free hand to guide the blade along the cutline. (See photo, previous page.) Pull back to establish a kerf in the workpiece, then push forward to make the cut. Don't apply pressure to the blade at this point; let the blade do the cutting.

Once you've cut a kerf, the blade will follow the path you've established and you can apply more pressure to speed up the cut. Continue to hold the saw at an angle. This keeps fewer teeth in the cut, which also speeds up the cut.

Besides general ripping and crosscutting, the bowsaw excels at a wide variety of sawing tasks. As shown in the photos on this page, you can use your saw to cut tenons, to resaw and to cut curves and dovetails. ▲



YEUNG CHAN
is a winner in this year's Excellence in Craftsmanship® Competition. (See page 74.)

RESAWING



Rip straight. Mark a line on the edge of the stock and clamp the piece vertically in a vise for sawing. Now saw to the line. Use a wide blade to keep the cut as straight as possible.

SAWING CURVES



Corner cut. Use a narrow blade for curved cuts. Holding the blade slightly off vertical, saw partway along the curve. Reposition the workpiece to continue the cut.

SAWING DOVETAILS



Watch the blade. Keep the blade to the waste side of your layout lines, and sight along its length to keep your cuts accurate.

SELF-WINDING TOP

A simple mechanism puts a new spin on an old toy

by Fred Matlack

HOW IT WORKS

Pull the string, holding the ring with your other hand. When the string is fully extended, let go of it. The ring rewinds the string.

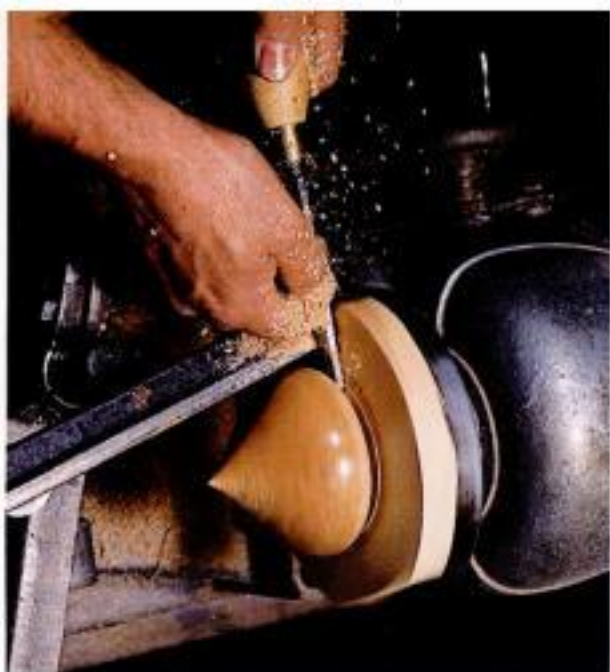
Toy tops are a big hit with the younger kids in my family, and they make great gifts. My top takes only an hour or less to make, and it spins easier and better than the average top. Unlike most tops, this one rewinds itself, so it's always ready to go.

The secret is the copper ring that fits loosely on the top's stem. (See drawing, opposite page.) It spins separately from the body of the top, helping the string to rewind itself. The drawings above show how it works.

Materials—You'll need some attractive offcuts for the body, and some less valuable scrap to mount the blank on your lathe's faceplate. You'll also need a few inches of brass rod for the stem; a short length of dowel for the plug; a ring cut from copper pipe; and 18 to 20 in. of silky nylon cord for the string. Drill a $\frac{3}{32}$ -in. hole in the stem as shown in the drawing opposite.

Lathe setup—A section view of the lathe setup is shown opposite. Cut a scrapwood disc to go on the faceplate of your lathe. Drill an accurately centered $\frac{1}{4}$ -in.-dia. hole in this disc to receive the top's stem. To do this, I mount the disc on the lathe, turn it on, and find center with the most acute skew chisel I have. I carefully start a hole in the center, and when I've created a little indentation I take the disc to the drill press and





Turn down to the stem. After applying the finish, carefully part to the brass stem. Then stop your lathe and pull the top away from the disc.

center a $\frac{1}{4}$ -in. bit on the hole to finish boring it out.

Stock preparation—After laminating and squaring up your blank, drill a hole in the center of one end, and epoxy the stem into the blank. Roughen the stem with coarse sandpaper to help the epoxy bite. Use plenty of glue—squeeze-out is what keeps the blank mounted on the scrap disc. About $1\frac{3}{16}$ in. of the stem should protrude from the blank. Jam the stem into the hole in the disc, and clamp it in place with the tailstock center.

Turning the top—I turn most of the top body with a gouge, but you could also use a skew. I use a parting tool to work in the cranny between the blank and the scrap disc.

When you've parted almost to the stem, sand the top and apply a light coat of finish to the whole top. I use a Hut™ wax stick (available from Hut Products for Wood, 15361 Hopper Rd., Sturgeon, MO 65284, 800-547-5461) because it goes on quickly and fills tiny scratches.

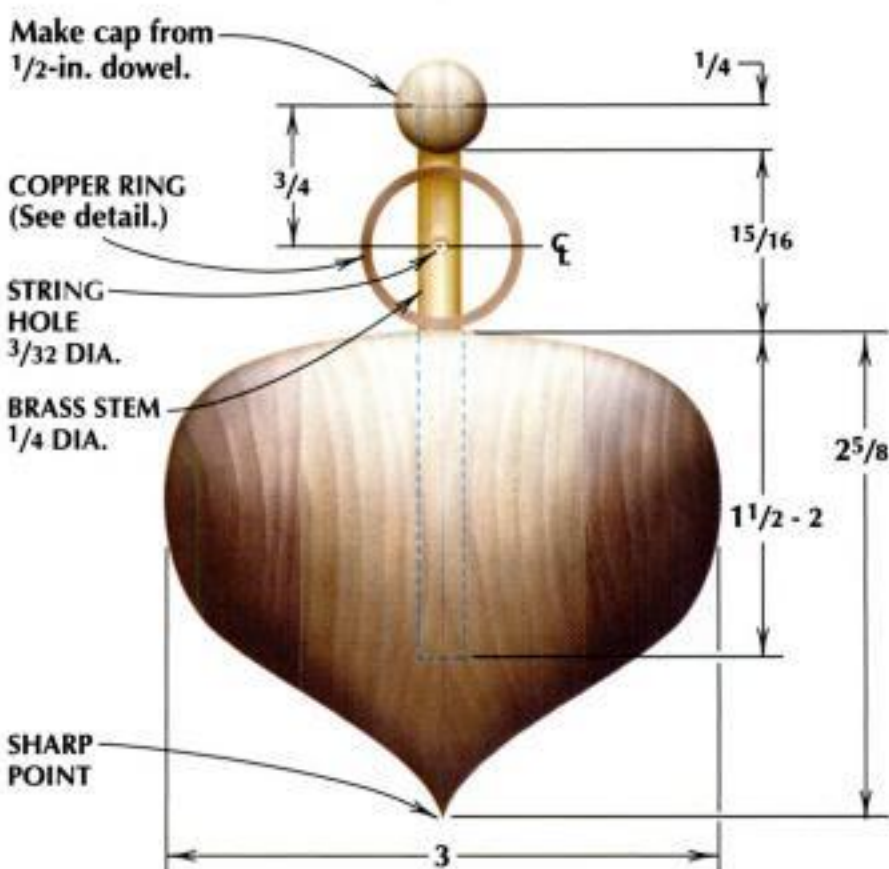
Now, part to the stem and pull the top away from the disc. I chuck the stem in my drill press so I can sand and finish the hard-to-reach places. Wax the stem itself last, so the ring will spin easily.

Making the ring—I use a tubing cutter to cut a $\frac{1}{2}$ -in.-long section of copper tubing. Then I drill a $\frac{17}{64}$ -in.-dia. hole through the center, holding the ring with a wooden handscrew in the drill press. (See bottom right photo.) A regular drill bit will cut better in copper if you grind it as shown in the sidebar at right.

To make the cap that keeps the ring on the stem, first drill a $\frac{1}{4}$ -in.-dia. hole about $\frac{1}{4}$ in. deep in the end of a $\frac{1}{2}$ -in. dowel. Epoxy the stem into this hole,

SELF-WINDING TOP

A free-spinning copper ring on the stem rewinds the string as the top spins around.



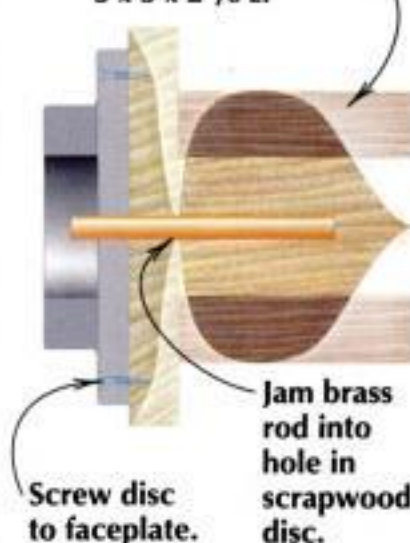
RING DETAIL

Drill $\frac{17}{64}$ hole through ring.



LATHE SETUP SECTION VIEW

LAMINATED BLANK $3 \times 3 \times 2\frac{5}{8}$ L.



GRINDING A BETTER BIT

The cutting edge of a regular drill bit is designed to shear, not scrape, which is great for wood but not for nonferrous metals like the copper ring on this top. The cutting edge of the bit hits the surface like a plane blade—a little too aggressively—making a mess of the hole.

By grinding the bit's edge to a slight negative angle, I make it work more like a scraper blade. This produces a less aggressive cut that's much easier to clean up.

Hold the bit's cutting edge against the flat side of the grinding wheel, and take a tiny amount off the front edges of the bit. When you're finished, it should look like the photo at right. —F.M.



then saw the dowel to its finished length and shape the outside of the dowel with sandpaper.

Finally, attach the knotted end of the string to the stem with a dab of epoxy, and your top is ready to spin. ▲



FRED MATLACK

is part of the AW Design Shop team.



Drill the ring. To drill the hole through the copper ring for the stem, mount the ring in a wooden handscrew on your drill-press table.

Trebuchet!

Build a working scale model of a medieval siege engine

by Russell Miners

In the Dark Ages, before the invention of gunpowder, the trebuchet was the most powerful artillery weapon in the world. A successor to the catapult, the trebuchet ("tre-boo-shay") acted as a giant sling to hurl 2,000-pound boulders, red-hot irons, and (on some occasions) unsuccessful negotiators over fortress walls 500 feet away.

My "treb" is a downsized version of a typical Dark Ages model. It can hurl small stones up to 70 feet. I'll also attest that it can heave a grape across a formal banquet hall.

Regardless of size, all trebuchets work on the same principle, which any kid who has played on a seesaw can understand. When you place a rock (projectile) on the low end of a seesaw and force the high end down abruptly (apply a counterweight), the low end accelerates upward and the stone gets tossed in the air. The main difference with a trebuchet is that the projectile end of the treb's beam, which is longer than the counterweight end, has a sling attached that increases leverage and typically doubles the throwing range. Also, the axle is high enough to let the counterweight swing all the way down without hitting the ground. (See "How a Trebuchet Works," below.)

How to Build It

I built my treb from oak, but you can use almost any wood species. Many medieval trebuchets were built with interlocking joinery. A small model like this one can do fine with

glued butt joints that are reinforced with dowels or with a few screws at strategic locations.

I have provided dimensions for this particular model. (See Fig. 1.) If you want to build a bigger trebuchet, beware: you can not simply scale it up proportionately. Big trebs require stronger joinery, for one thing, and the bucket's volume should be proportionately smaller in a larger treb.

You can build your own treb in four stages: counterweight bucket, beam, base and firing mechanisms.

Start with the bucket. Early trebuchets had a fixed counterweight at the short end of the beam, until it was discovered that a hinged counterweight provides greater downward thrust and stability. So I made a bucket with suspension arms and an axle, so it can swing from the short end of the beam.

To make the suspension arms, I laminated two 1/2-in.-thick pieces together, but you can use 1-in.-thick stock if you wish. Glue and screw the suspension arms to the bucket sides before assembling the bucket. During assembly, keep the suspension arm's axle holes aligned with a 1/2-in. dowel, but don't glue the dowel in place.

I filled 13 plastic 35-mm film canisters with lead shot and loaded them in the bucket. This brought the bucket's weight to 7 1/2 lb. You can also use steel bar stock, washers or any other compact counterweight.

Text continued on page 66.

HOW A TREBUCHET WORKS

1. READY, AIM.

The beam is cocked before firing. The trigger's prong hooks into the beam's trigger ring. The projectile nests in the pouch on the trough, with the sling's end ring hooked over the beam's sling-release peg. The suspended counterweight is the potential energy.



2. FIRE.

The trigger is pulled and the falling weight of the bucket rotates the beam, pulling the sling outward and upward.



3. RELEASE.

The sling swings around the end of the beam, and the sling's end ring is pulled off the beam's sling-release peg, liberating the projectile.



PHOTOS BY PAUL PEARSON

A man with a long, grey beard and a blue knit hood is operating a wooden trebuchet. He is wearing a black tunic with a silver, scale-like pattern on the chest. The trebuchet is a large wooden structure with a long arm that is raised high, ready to launch a projectile. The background is a rough, stone wall. The lighting is dramatic, with strong shadows.

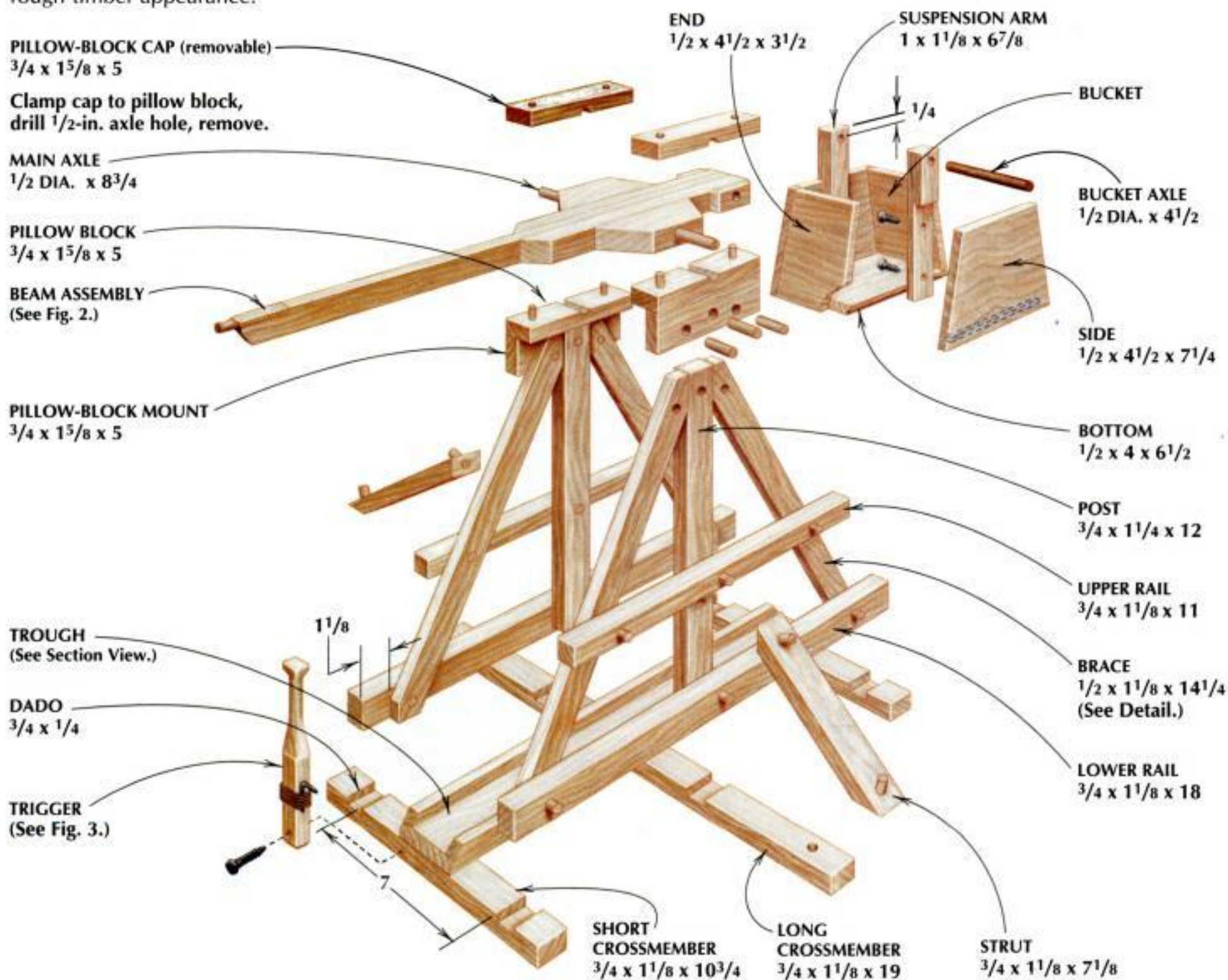
A crusader's cannon. When knights were bold, giant versions of this trebuchet launched projectiles over castle walls. This scale-model trebuchet works just like a full-size version, harnessing leverage and gravity to heave an object.

CAUTION

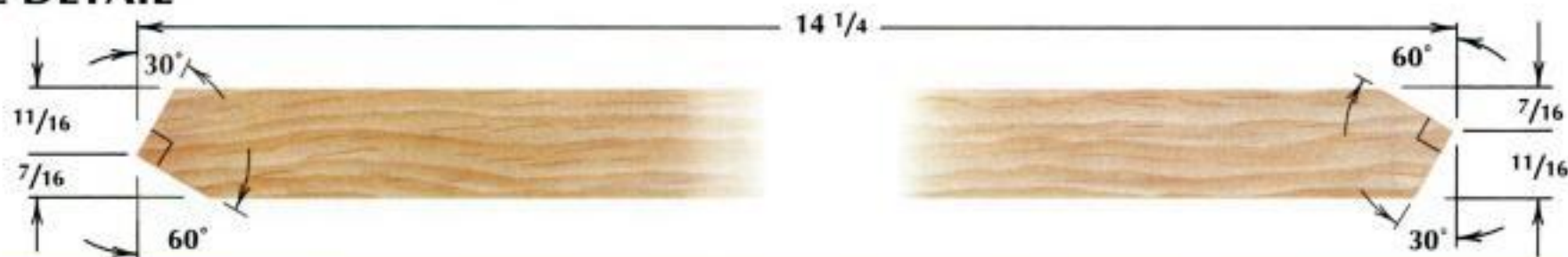
The trebuchet isn't a children's toy. The projectile end of the beam whips around with startling force. Exercise care and stand clear to the side when operating it, don't aim it at anyone, and NEVER lean over the trebuchet while it's cocked.

FIG. 1: TREBUCHET

The beam assembly's main axle pivots on pillow blocks, which sit atop two A-frame assemblies. The A-frames in turn rest on dados cut in the three crossmembers. A pair of struts pegged to the A-frame posts and the longer (middle) crossmembers stabilizes the treb. Most of the joints are simple butt-and-peg. Sharp edges and corners are rounded with a knife to create a rough-timber appearance.



BRACE DETAIL



SECTION THROUGH TROUGH SIDE VIEW

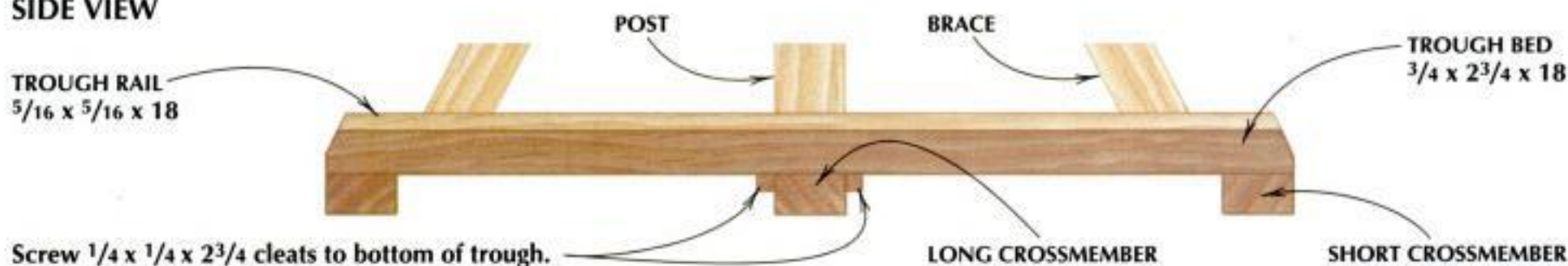


FIG. 2: BEAM ASSEMBLY

Taper the long end of the beam first. Then glue on the beam reinforcers, main axle supports, spacers and axle. Sand or plane the supports and spacers after assembly, if necessary, to prevent binding against pillow blocks and suspension arms. The sling-release peg is removable, so you can modify its shape or replace it.

TOP VIEW

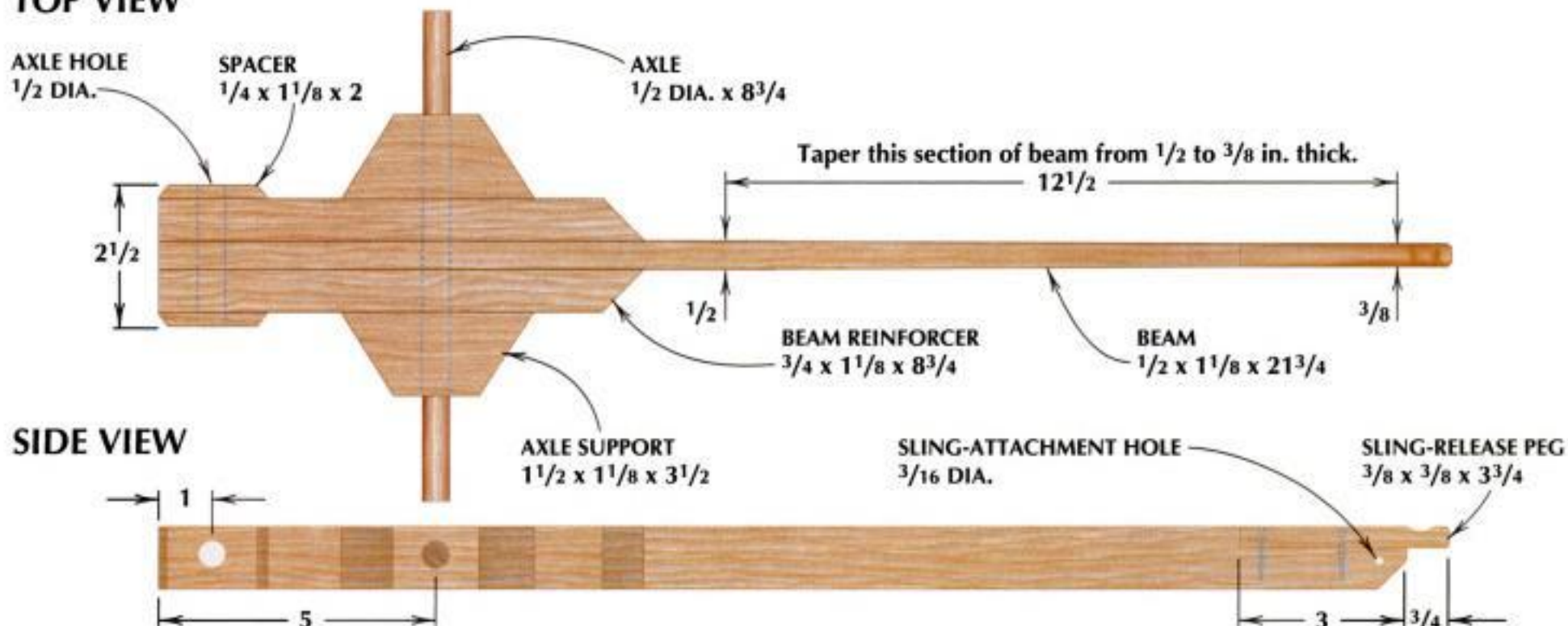
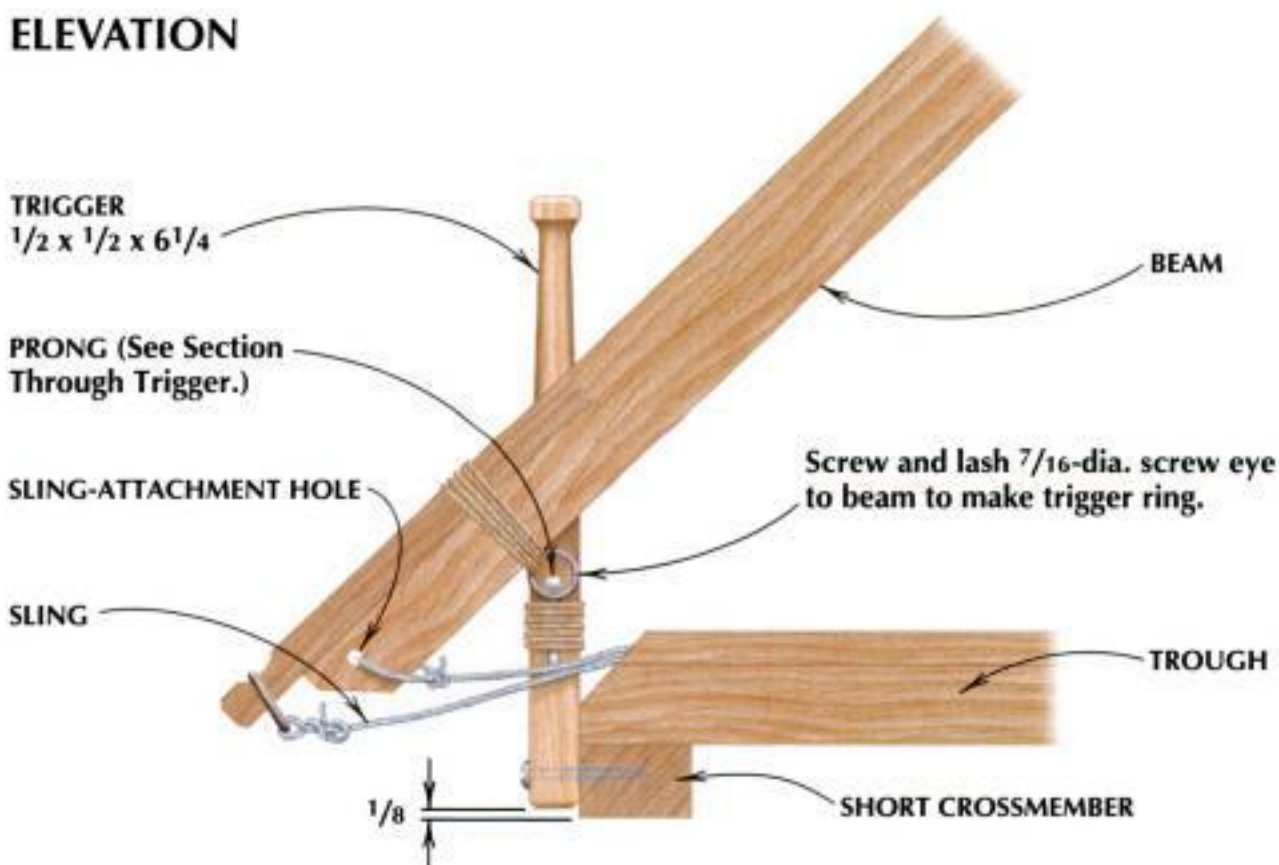


FIG. 3: FIRING MECHANISM

Install the prong, trigger and trigger ring accurately to ensure smooth operation of the trebuchet. Here's how:

1. Install the prong on the trigger as shown in the section drawing. Lash the prong to the trigger with twine.
2. Lower the long end of the beam. Position the trigger on the edge of the short crossmember, so that it stands vertically, touching the beam. Drill a pilot hole and screw the trigger to the short crossmember. Don't tighten the screw too much—the trigger must pivot easily.
3. Lower the beam again until the sling-attachment hole is level with the trough's bed. Position the trigger ring (a $\frac{7}{16}$ -in.-dia. screw eye) underneath the beam, so that the prong will hook the trigger ring and keep the beam cocked. Install the screw eye and lash it to the beam with twine.

ELEVATION



SECTION THROUGH TRIGGER

Clip off the head of a 6d nail and bend it as shown.

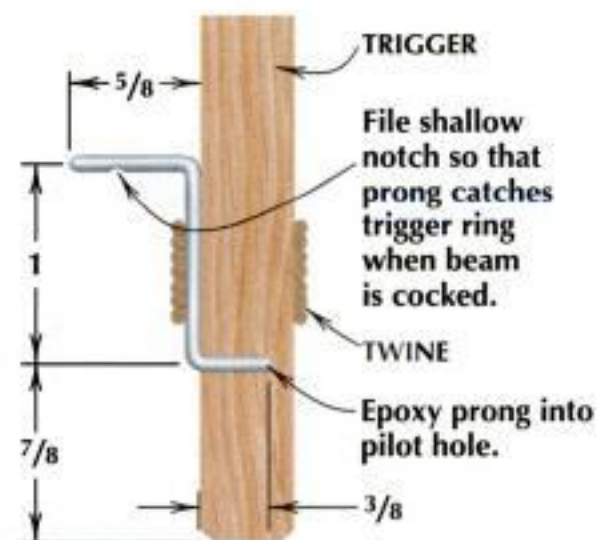
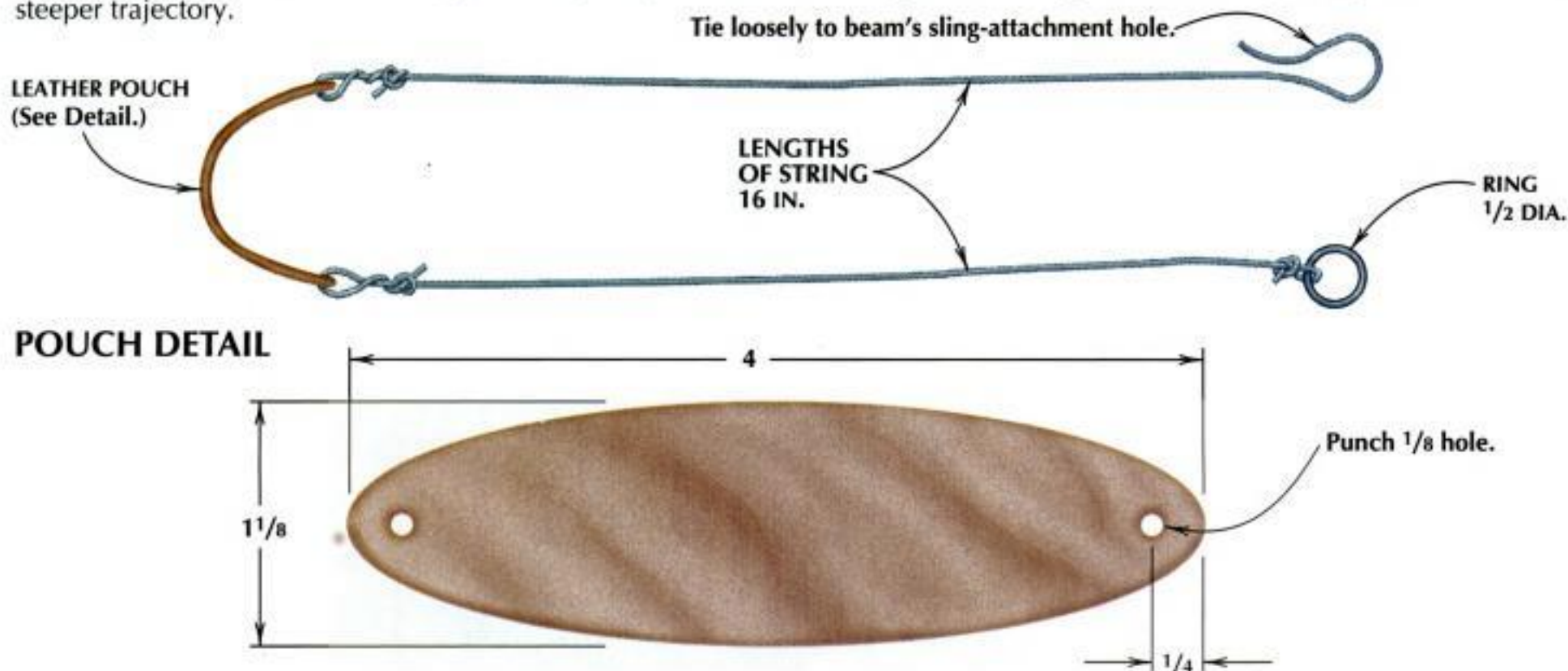


FIG. 4: SLING (TOP VIEW)

The sling length shown here will yield a trajectory of about 45°. Lengthen the sling for a lower trajectory; shorten it for a steeper trajectory.



Make the beam. The beam should be as light as possible at the throwing end. I started with a 22-in.-long workpiece and tapered 12½ in. of the length slightly with a handplane, from ½ in. down to ⅜ in. at the lighter end.

Carve the sling-release peg's end round, with a slight hollow as shown in Fig. 2, so that the sling's end ring (see Fig. 4) will not slip off when it's ready to launch. The hollow must be shallow so that the ring will slip off *during* launch. Screw the peg into a notch cut at the end of the beam. If you discover that you've made the hollow too deep, unscrew the peg from the beam and carve another one.

Build the base. The base consists of two A-frames that support the pillow blocks, three crossmembers (one long and two short) that hold the structure together at the bottom, and two struts that brace the A-frames sideways.

I glued the pillow blocks to their mounts first, then began assembling each A-frame. The easiest way is to lay

the pillow-block mount and lower rail on a flat surface, and glue the post and two braces on top of them. Make sure the vertical and horizontal pieces are square to each other. Reinforce the joints with dowel pegs.

Then gang the three crossmembers together to cut the dadoes for the lower rails. Spread glue in the dadoes and erect the A-frames. Check for square, glue the struts in place, and glue the upper rails above the top ends of the struts. Then peg the remaining joints.

The launch trough. The trough acts as a runway for the pouch and its projectile. The trough's surface must be smooth, so this is the only part of the trebuchet that needs to be fine-sanded and finished.

I built the trough with two bottom cleats that straddle the center crossmember, instead of gluing or pinning it in place. (See Fig. 1, "Section through Trough.") This way, you can adjust the trough side to side to align it with the treb's beam, which may or may not stay centered during its lifetime.

Sling, ring and trigger. To complete the trebuchet, you need three more items: the sling, the trigger and the trigger ring. (See Fig. 3.)

String made of natural fiber works best for the sling—knots won't slip loose as they would with nylon. For the pouch, use thin, pliable leather you can cut with a utility knife and punch with an awl.

You might have to experiment a little when you shape the end of the prong—it should slip through the trigger ring easily and hold it cocked, but it should also slip back out easily when you pull the trigger.

Finally, I put a coat of Danish oil on my treb. After the oil cured, I applied a dark glaze to make it look old and worn.

Loading and Marksmanship

Use your finished trebuchet safely. When you load the projectile into the pouch on the trough, put your hand in from the end of the trough. Don't reach through the A-frame. Keep the sling taut and untangled on the trough bed before launching. The pouch should lie on its edge with both ends the same distance from the end of the trough, as shown in Fig. 4. If necessary, trim the appropriate sling cord to align the ends. ▲

FOR MORE INFORMATION

For more information about the history and science of trebuchets and other medieval siege weapons, see the following:

- ▶ "The Trebuchet," by Paul Chevedden, Les Eigenbrod, Vernard Foley and Werner Soedel, *Scientific American*, July 1995, pp. 66-71.
- ▶ "It's a Bird! It's a Plane! It's a Case of Spam!" by Paul Kvinta, *Outside*, August 1995, pp. 80-84.
- ▶ *Medieval Siege Warfare*, by C. Gravett (1990, Osprey Military Elite Series, Reed International Books, Unit 6, Citadel Place, Spring Gardens, Tinworth Street, Vauxhall, London SE11, 5EH, England.)
- ▶ The Grey Company Trebuchet Website: www.iinet.net.au/~rmine/gctrebs.html



RUSSELL MINERS

is a chemistry-lab technician in Western Australia and a member of the Grey Company, a historical reenactment group.



Torsion Boxes

Plywood skins and a gridded core make rigid tabletops and shelves

by Ian J. Kirby and John Kelsey

Strong, light and stable. Torsion boxes outperform solid wood in many applications. Building a wall shelf like this one is an excellent way to learn about torsion box design and construction.

Like an airplane wing, a torsion box is made by sandwiching a grid of ribs between two thin skins. The torsion box exploits the best qualities of solid wood, plywood and glue, offering amazing strength and rigidity with minimum weight. Torsion boxes make excellent substrates for veneer, plastic laminate or leather. And they can serve as versatile construction elements for all kinds of furniture, from simple shelves like the one shown here to giant conference tables and case pieces. "T-boxes" also make good shop furniture, such as flat assembly tables and platens for veneer presses.

The term "torsion" means twisting, and that's exactly what a properly made torsion box won't do, thanks to the rigidity created by combining its elements. (See Fig. 1.) Covered with veneer, a torsion box can be made to look like solid wood, but it's different in four important ways:

FIG. 1: TORSION BOX ANATOMY

The torsion box is a structural assembly of core pieces, skins and glue. It can be made any width, length and thickness. Softwood, plywood and MDF are excellent core materials. The torsion box shelf featured here has a pocket along one edge to fit over a ledger board. Pockets and ledgers are also used to join separate torsion boxes together, or to join them to other structural elements.

SKIN

Plywood or MDF,
painted or veneered

DECORATIVE EDGING

The edge treatment
conceals the core.
See Fig. 3.

POCKET FOR LEDGER

LEDGER

Size to fit snugly
between torsion box skins.
The ledger connects the box
to the wall or to other elements.

STAPLES

Wire staples connect
core pieces until
skins have been glued.

LONG CORE

SHORT CORE

END

LOCATING BLOCK

Hot-glued squares
index the skins
to the core.

LAG SCREWS

Use minimum 3/8-in.-dia. screws
and washers to attach ledger
to wall framing. At least 2/3
of screw shank should extend
into framing member.

—You get total control over dimensions. The torsion box can be any size, in length, width and thickness.

—The box is dimensionally stable—it doesn't move in length or width, and only minimally in thickness. (It won't move at all with a plywood core.)

—Once you glue up, you don't want to change your mind about the size of the torsion box. Ripping a completed box in half or trimming a couple of inches off an end could compromise the overall strength of the box.

—Torsion boxes can't be joined in any of the usual ways. Generally they require a system of blocking or ledgers that are glued and screwed into built-in pockets.

Torsion boxes can be built quickly and easily, as you'll see on the pages ahead. All you need in the way of tools are a tablesaw, staple gun, glue roller and some clamps.

The Core

The core is a simple framework of lightweight wood, stapled together without glue. The staples aren't structural; they merely prevent the core



Completing the grid. No glue is necessary here. Outside joints get two staples; inside joints get one. Use a spare core piece to space and align the core pieces. Drive all staples below the wood surface.

SKIN TREATMENT



Alignment blocks for easy glue-up. Clamp the completed core atop a plywood skin, and hot-glue alignment blocks to the skin in corner and center core sections.



Spreading the glue. A small roller is a good application tool. Coat every top edge on one side of the core, attach the skin, then flip the assembly and glue on the other skin.



Clamp it up. Combine clamps and clamping cauls to distribute clamping pressure evenly. Make sure to glue up the box on a flat surface such as a workbench top.

pieces from flopping around while you attach the skins. The core has to include whatever ledger pockets are necessary for joining the box to the building or to other furniture elements. Thus the geometry and dimensions of the core must be worked out on paper at the start of the project. (See Fig. 2.) There is no room for fiddling and figuring as you go along.

Good core materials are softwoods such as pine, low-density hardwoods such as poplar or alder, or strips of ply-

wood or MDF. The thickness of the core material can be anywhere from 1/4 in. to 3/4 in. The width of the core stock, plus the thickness of the two skins, is the finished thickness of the torsion box. The core spacing depends on the thickness of the skins. A good rule of thumb is to keep the on-center spacing of core pieces no more than twelve times the skin thickness. This is good insurance against deflection of the skin between core pieces.

The core material must be accurately

cut to length and thickness, and must have dead-square ends. A smooth finish is not important—the material can come straight from the saw. These characteristics make the core an ideal tablesaw product.

With a solid wood core, wood movement might seem to be an issue, but in practice it isn't. When the box is complete, the core is sufficiently isolated from the atmosphere for changes in humidity to have little or no effect.

Staple the core together one side at a time. (See photo, page 68.) Use a 1/2-in.-wide crown wire staple. An air stapler works best because it drives the staple into the surface of the wood. A spring-loaded staple gun may leave the staples a bit proud, so hammer them down flat. It's important to pull the pieces tight together, and to keep them vertical, but absolute squareness is not important. Make several extra pieces of core material to use as spacer blocks. The spacer blocks make it easy to position the core pieces and keep them vertical while you staple them in place.

The Skin

The skins of a torsion box are man-made sheet material—plywood or MDF—so there will be no problem with shrinkage or expansion. Since the shape of the skin will be the shape of the finished box, the skin has to be cut accurately. As mentioned earlier, skin thickness determines core spacing. It is generally better to have a thinner skin and a densely gridded core than to design a T-box with thick skins and a core of widely spaced pieces. The dense grid/thin skin combination offers more strength with less weight as a result of the increased glue area provided by the core pieces.

Whatever your core spacing, it's important to avoid inferior skin materials, because if the skins delaminate, the box could fall apart. After constructing the box, you can surface the skin with any wood veneer, or with leather, plastic laminate or paint.

Small locating blocks, hot-glued to the skins, take the grief out of the glue-up, as shown in Fig. 1. Align the core on one end and one edge of the skin and clamp it. Now glue a locating block in each corner, plus a couple in the center. (See top left photo, above.) Then flip the core onto the other skin, align the same end and edge, and add another set of locators. Make index marks on

FIG. 2: DIMENSIONING A TORSION BOX SHELF

STEP 1: DETERMINE THE LENGTH

For a shelf that will be installed on a wood-frame wall, length should be a multiple of the stud spacing (either 16 in. or 24 in.) plus 4 in. to 6 in. This will provide maximum support, especially near each shelf end.

STEP 2: DETERMINE THE WIDTH

What do you want to store on your shelf? The finished width of the box will be the width of the skin plus the thickness of the lipping.

STEP 3: DETERMINE THE THICKNESS

For furniture, the minimum thickness is two skins plus a $\frac{3}{4}$ -in.-thick core, or about $1\frac{1}{8}$ in. There is no maximum.

STEP 4: DETERMINE CORE SPACING

Make core pieces anywhere from $\frac{1}{4}$ in. to $\frac{3}{4}$ in. thick, spaced 2 in. to 4 in. apart. Make the grid spacing square, so it's easy to assemble. The grid should be close enough so the skin doesn't sag, so it will vary according to skin thickness. When in doubt, make the spaces smaller.

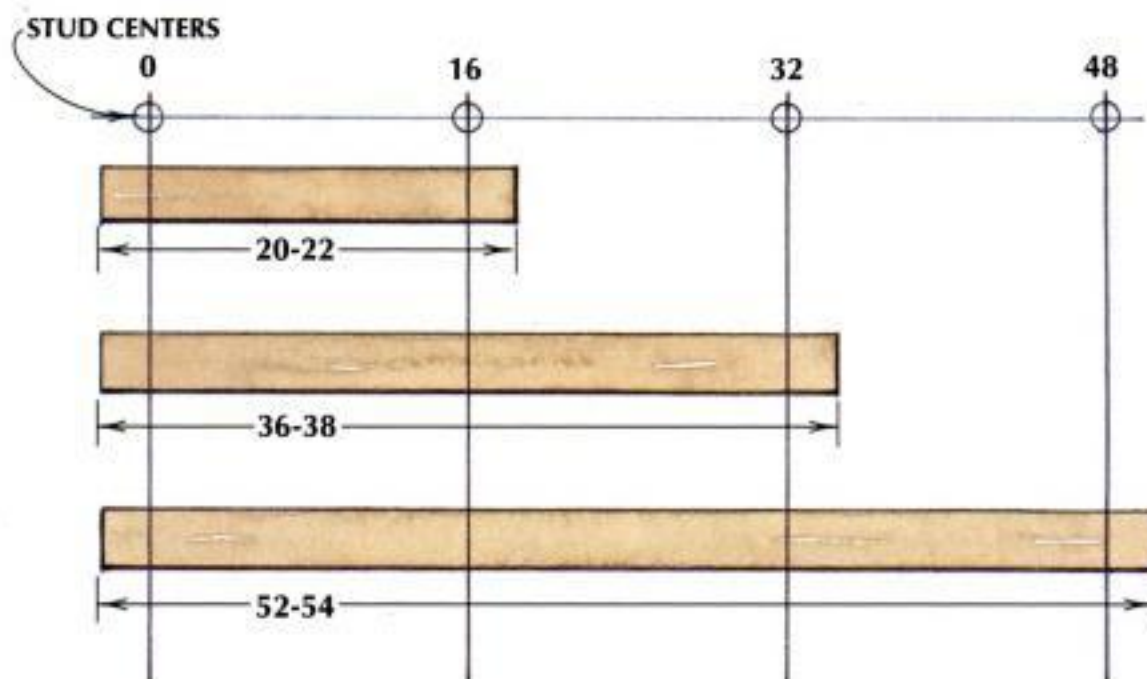
STEP 5: DESIGN THE CORE LAYOUT

Draw a plan view of your core. Remember to include the ledger pocket. Organize the core pieces to get the fewest different lengths of wood. For example, it's usually possible to make all the long core pieces the same length. To complete the grid design, work from both ends toward the middle, where a single unequal space is no problem. Don't worry about end grain because it will be concealed by the solid wood edging.

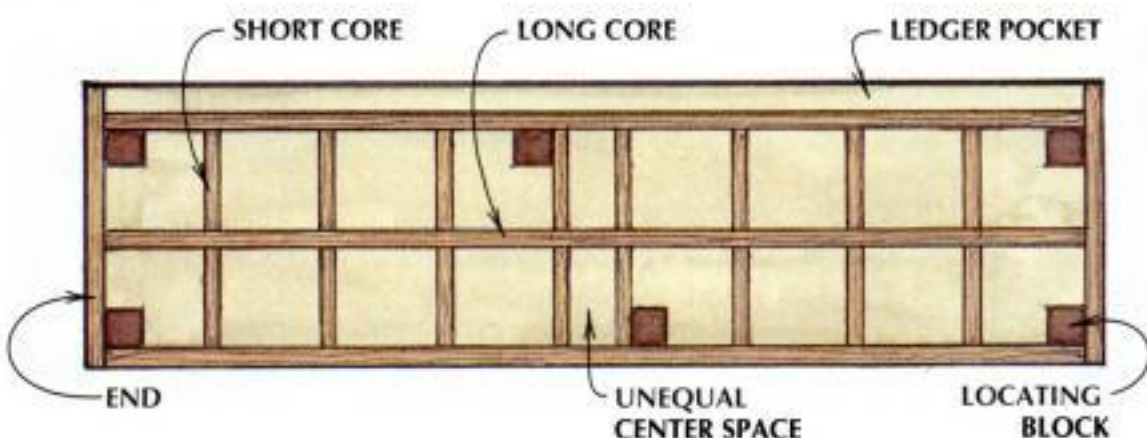
STEP 6: MAKE A CUTTING LIST

Torsion-box projects demand many pieces of wood, so it's essential to make a cutting list. Saw several extra-short pieces to use as spacers during assembly. With your cutting list done, it's time to make your parts.

SHELF LENGTH & WALL STUD SPACING



CORE LAYOUT PLAN VIEW



the skins so that you can reposition them correctly for glue-up.

Now it's time to "skin" the box. Use a roller applicator to spread yellow or white glue on one side of the core. (See top right photo, page 69.) Place the skin on the core—the locating blocks take the worry out of positioning the skin. Flip the assembly and glue on the opposite skin, then clamp up.

This is an ideal gluing project for a veneer press or a vacuum bag press, but

you can get it done with cauls and clamps atop a flat workbench. (See bottom photo, page 69.) The amount of gluing area is surprising: more than 300 square in. for the box shown here.

Lipping and Ledger

The outside pieces of the core become the visible edges of the torsion box. Although the core itself could be shaped and detailed according to the design of the project, it is usually better to glue

on some sort of edge treatment. (See Fig. 3 for different options.)

If you are building a shelf similar to the one shown here, your completed torsion box will have a built-in pocket to fit over a ledger board that is lag-screwed to the wall. The pocket-and-ledger strategy is also used for joining one T-box to another to form larger assemblies. The ledger should be thick enough to extend between 1 and 2 in. into the pocket.

INSTALLING THE SHELF



Lagging the ledger. Pockets chiseled in the ledger increase screw penetration into wall studs. Washers help to distribute the screws' holding power.



Gluing the shelf. Use a pair of long clamping cauls to clamp the pocket tightly against the top and bottom edges of the ledger.

FIG. 3: EDGE TREATMENTS

For furniture applications, torsion boxes usually need some sort of edge treatment to cover the core material and skins. Several options are shown below.

SIMPLE LIPPING



HALF-ROUND



RABBETED



MOLDED



SPLINED LIPPING WRAPPED WITH LEATHER



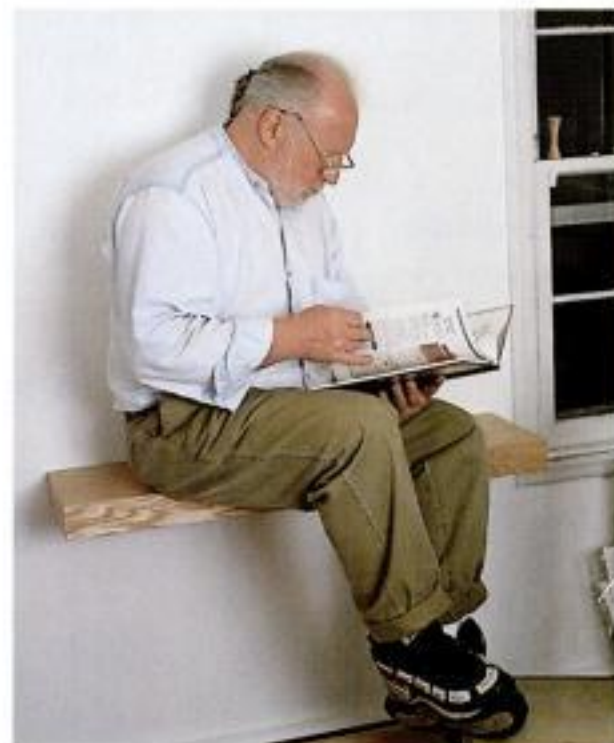
When a torsion box shelf fails, it is most often because the screws that hold the ledger onto the wall have bent. To avoid this, it's best to use stout ($\frac{3}{8}$ -in.-dia. or $\frac{1}{2}$ -in.-dia) lag screws and washers, and to make certain that at least two-thirds of the screw shank will be anchored in the wall framing. You can counterbore the screws or cut pockets for them to get deeper purchase for the threads. (See left photo, above.)

If you anticipate removing a T-box shelf at some point, you can attach it to the ledger by driving screws through the top and bottom skins. But if you want maximum strength, you will have to glue the ledger into its pocket. Use long clamping cauls on the top and bottom edges of the ledger, as shown in the right photo, above.

A few layers of veneer under the center of each caul will help to apply clamping pressure there, as you tighten the clamps at each end. Clamp a temporary vertical strut to the front edge of your shelf, as shown in the above right photo, to keep the shelf level while the glue sets.

When the time comes to remove the clamps, there's a standard method for

testing and enjoying the strength of your completed shelf. (See photo, right.) Once you've made one torsion box project, you'll want to apply the same techniques and design possibilities to other projects as well. ▲



Testing your work. Kirby enjoys the fruits of his labor. Nothing short of a Sawzall® or bomb blast will cause this torsion box shelf to deflect or depart from the wall.



IAN KIRBY

is a furniture designer and teacher with studios in Connecticut.



JOHN KELSEY

is a writer and occasional woodworker in Connecticut.

AMERICAN WOODWORKER 1997 Excellence in Craftsmanship® Awards

It's difficult to describe the excitement that surrounds AMERICAN WOODWORKER's annual Excellence in Craftsmanship® competition. Imagine being able to view some of the best work done by student, amateur and professional woodworkers today. This year, the entries in all three categories poured in right up until our June deadline—from as far away as Argentina and Russia.

One inspiring aspect of the competition is its diversity. Aside from a wide range of furniture, we received plenty of clocks, carvings, turnings, musical instruments and toys—ranging from miniature locomotives to full-size wooden automobiles.

Don't forget to enter your best work next year! The deadline for the 1998 competition is June 5, 1998. Entry blanks will be provided in our next issue (AW #64, February 1998).

AMATEUR

FIRST PRIZE

Tool chest

James Moon
Concord, NC

Ever get tired of trying to fit your woodworking into odd moments—the half-hour segments between mowing the lawn and taking the kids to soccer games? James Moon has found the perfect solution: The North Carolina obstetrician squeezes his woodworking in

between delivering babies. "It works out really well," he notes, "especially with long labors. I live close to the hospital, so after a patient is situated, if things are going slowly I'll pop over to the shop and fiddle around for a few hours."

You may remember Moon's Boston bombe secretary from our 1995 competition. This year's winning walnut and cherry chest houses his 200-plus handmade and antique

tools—all concealed inside carefully dovetailed drawers. The upper lid opens to a wide, shallow top compartment; the lower lid gives access to several tills, trays and wells on the bottom.

Moon resawed all the figured walnut veneer himself. He made the satinwood and ebony banding and the crescent moons. After carving his name and date into the inside upper lid, he wiped on a coat of Danish oil and sprayed the lacquer finish.

SECOND PRIZE

Blockfront secretary
David Hollingsworth
Wilmington, DE

The wealth of exceptional period furniture at the Hollingsworth house isn't hard to explain. David Hollingsworth has been studying and building period pieces since 1955. And he lives just down the road from the famous Winterthur Museum, which houses one of the finest collections of antique furniture in the country.

He pursued his furniture-making passion while raising a family and forging a career in chemical engineering. He retired as CEO of Hercules, Inc., in 1991.

"There are only 10 surviving antique examples of this Rhode Island-style secretary," he explains. "The one I chose to reproduce is owned by the Rhode Island Historical Society. It's the only nine-shell version that is known to exist."

Hollingsworth scaled down his mahogany secretary slightly to suit the proportions of his living room. He also made the carvings more delicate than





And the winners are... First-prize winners in the three award categories—amateur, student and professional—each receive an engraved Bridge City try square and \$1,000 cash. Second-prize winners receive \$300, and third-prize winners receive \$200.

those on the original, and created a more ornate interior. "Even in a period piece, there's still room for plenty of design," he offers. "For this piece, it was a tremendous challenge just selecting the wood for different parts."



THIRD PRIZE CD cabinet on stand Rick Broemel Morton, PA

The very first power tool that I ever owned was a Craftsman router," remarks Rick Broemel. "I bought it about 13 years ago, just after I got married."

Today Broemel works as an art director for a large Philadelphia advertising agency. In his spare time, he's filling his home with furniture—period pieces as well as contemporary projects. "I like both types of furniture," Broemel admits, "but contemporary pieces give me more of a design challenge."

Broemel's CD cabinet holds 99 CDs in three rows. The curved door is coopered from staves of tiger maple; the case corners join with through dovetails. Broemel finished both the case and the walnut base with Danish oil and gel varnish.



STUDENT

FIRST PRIZE Chinese-style table Yeung Chan Millbrae, CA

Yeung Chan has come a long way since 1973, when he barely escaped a Maoist "relocation" farm. He brought plenty of wood-working knowledge with him to America—as a child, he



made his own chisels and planes—and he established a successful career as a designer, patternmaker and prototyper in the commercial furniture industry before enrolling at the College of the Redwoods. Now, at 50, he's finally setting up his own custom furniture shop.

Chan's 18-in. by 36-in. Ming-influenced table is far more complex than it looks, with hidden mortises and tenons throughout. It's made of doussié—"very close to the Chinese wood *huanghuali*, a form of rosewood which we can't get anymore." The little coves and curves are another Ming device; they reflect light in a way that is pleasing to the eye.

Chan made custom scraper planes, a molding plane and a spokeshave for the detail work. "Using my own hand tools gives me great satisfaction in this plugged-in, mass-produced world."

SECOND PRIZE Tambour nightstand Tony Smith Cambridge, MA

Every student at Boston's North Bennet Street School must complete a tool chest and three pieces of furniture. So, for his final piece, Tony Smith took inspiration from the work of two Boston Federal furniture makers: John and Thomas Seymour.

Smith combined aspects of several different Seymour pieces in his table. Several night tables and basin stands contributed to the overall form. The inlaid tambour front recalls a Seymour desk at Israel Sack in New York.

Smith enjoys the challenge of traditional furniture. "I admire some contemporary work, but 18th-century furniture offers me the greatest discipline—turning, carving, inlay and joinery." All these



methods figure in Smith's night table. The mahogany legs—Smith's first attempt at turning—each have 12 reeds and six carved acanthus leaves. Bookmatched curly maple panels, sand-shaded holly veneer, and black-and-white string inlay also grace the piece.

Smith now makes his living restoring 18th- and 19th-century furniture. In his spare time, he's looking for a permanent place to establish his own furniture shop.

PROFESSIONAL

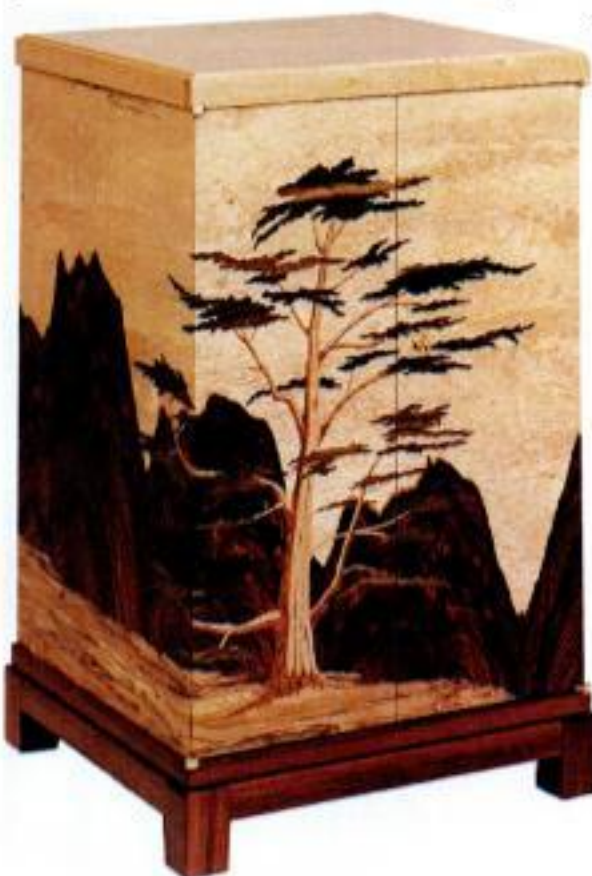
FIRST PRIZE Jewelry case on stand Brian Condran Martinez, CA

Brian Condran didn't intend to specialize in marquetry, but he's developing quite a reputation for it. Last year he won first prize in our student category with a marquetry-embellished cabinet; this year he's done it again as a professional.

"I designed this piece around a small cutoff of cocobolo—just 2 ft. long and 6 in. wide. It had cathedrals that looked just like mountains—I've never seen another one like it. It was a real stretch to resaw the five veneers I

needed," Condran recalls.

He cut out the marquetry pieces on his homemade



scrollsaw. The cloud formations required more than 150 pieces made from granadillo sapwood. Condran also used spalted English walnut, quilted maple, European beech, olive, sucupira, bay laurel, lignum vitae and ebony. After the piece was sold, he added drawers sized to fit the customer's jewelry collection.

He finished the interior with shellac and began to shellac the exterior, but the alcohol made the cocobolo bleed, so he switched to Bartley's gel and finished up with paste wax.

SECOND PRIZE Dining set Roger Heitzman Scotts Valley, CA

This dining set is the wildest we've seen in a long time—but for former architect Roger Heitzman, it's just another day in the shop. He defines his style as "combination Art Nouveau, Art Deco and Detroit."

For this set, Heitzman drew on the 1940s work of Finnish architect Eliel Saarinen. "The tabletop required a lot of vacuum-veneered marquetry and inlay work. I used at least 20 different kinds of wood—including fiddleback anigre,

THIRD PRIZE (tie)
Demilune cabinet
 Nick Clark
 Berkeley, CA

Nick Clark got his woodworking start 16 years ago in England, where he did a four-year formal apprenticeship in joinery. Six years ago he moved to the United States, and now he studies with James Krenov



at the College of the Redwoods.

Surprisingly, Clark's cabinet bears only a slight resemblance to the Krenov style. "We were given a certain set of parameters for this project—no glass, no bent lamination, no veneers—and within those guidelines I tried to keep the cabinet uniquely my own," he notes. "For instance, to achieve the slight curve in the doors without bent lamination, I decided to cooper them. They have six edge joints apiece."

The finish is a simple shellac polish and wax—a Krenov favorite that retains the bright natural hues of the satinwood and canary-wood stock.

THIRD PRIZE (tie)
Chest of drawers
 Mark Edmundson
 Lake Fork, ID

Mark Edmundson's relationship with wood began with trees: He fought fires for the Forest Service on a helicopter crew in central Idaho. "Then, during my winters off, my wife and I were building a house. I had a dull old block plane, so I went to the library to read up on sharpening, and I discovered a whole world of information about woodworking. One thing led to another, and three years later I got accepted to the College of the Redwoods."

Edmundson's chest of drawers is influenced by the English Arts and Crafts designs of Edward and Sidney Barnsley. "I cut and shaped my brass pulls to recall a bronze drop pull that the Barnsleys used.

And I learned from their use of inlay to break up large surfaces, using maple to punctuate my bowed mahogany drawer fronts." The drawers are dovetailed, with modified French bottoms made from Spanish cedar.

Edmundson plans to set up a furniture shop when his wife finishes her graduate work. "In the meantime, I'm building a log house. I still get to practice my woodworking skills—just on giant mortises and tenons."



ebony, wenge and maple. All the woods are their natural colors." The finish is a hand-rubbed semigloss polyurethane on top of a Watco primer.

Magenta leather upholstery and wenge edge bandings give Heitzman's chairs a pop art

feel. "That was a surprise!" he recalls. "The client bought the leather to match the dining room's existing decor. When we delivered the dining set, everything just fell into place."

THIRD PRIZE
Game table
 Ejler Hjorth-Westh
 Elk, CA

Ejler Hjorth-Westh prefers contemporary design—as a native-born Dane, it's probably in his blood. But he's not averse to meeting a traditionally minded client halfway. This table, born of such a commission, has earned him his third Excellence in Craftsmanship® Award. (The first was for a bed in 1992.)

"My client bought a chessboard and asked me to build a table around it, with a backgammon set underneath. He requested a 'Queen Anne flavor.' But since I don't much



care for exaggerated curves, I concentrated on proportions, crisp detail and symmetry."

Hjorth-West used only a few carefully chosen, tight-radius curves, such as where the legs meet the skirt. He oriented the mahogany vertically on the skirt, so it joins the legs seamlessly and turns each corner uninterrupted. And instead of formal hardware, he made ebony drawer pulls with burl inlay. The resulting piece looks equally elegant in modern and traditional settings.





Wooden menagerie. Bandsawn animal figures stow away inside this sturdy ship. Each drawer holds a matched pair of animals, and slides open to either side. The roof lifts off the house to hold Noah, his wife and the dove.

Noah's Ark

bandsaw a boatful of fun

by **steve baldwin**

I'm a professional toy artist, and one of my biggest sellers is this Noah's Ark. It's as much fun to make as it is to play with. And the only tools required are a bandsaw and tablesaw, a disc sander and eight quick clamps.

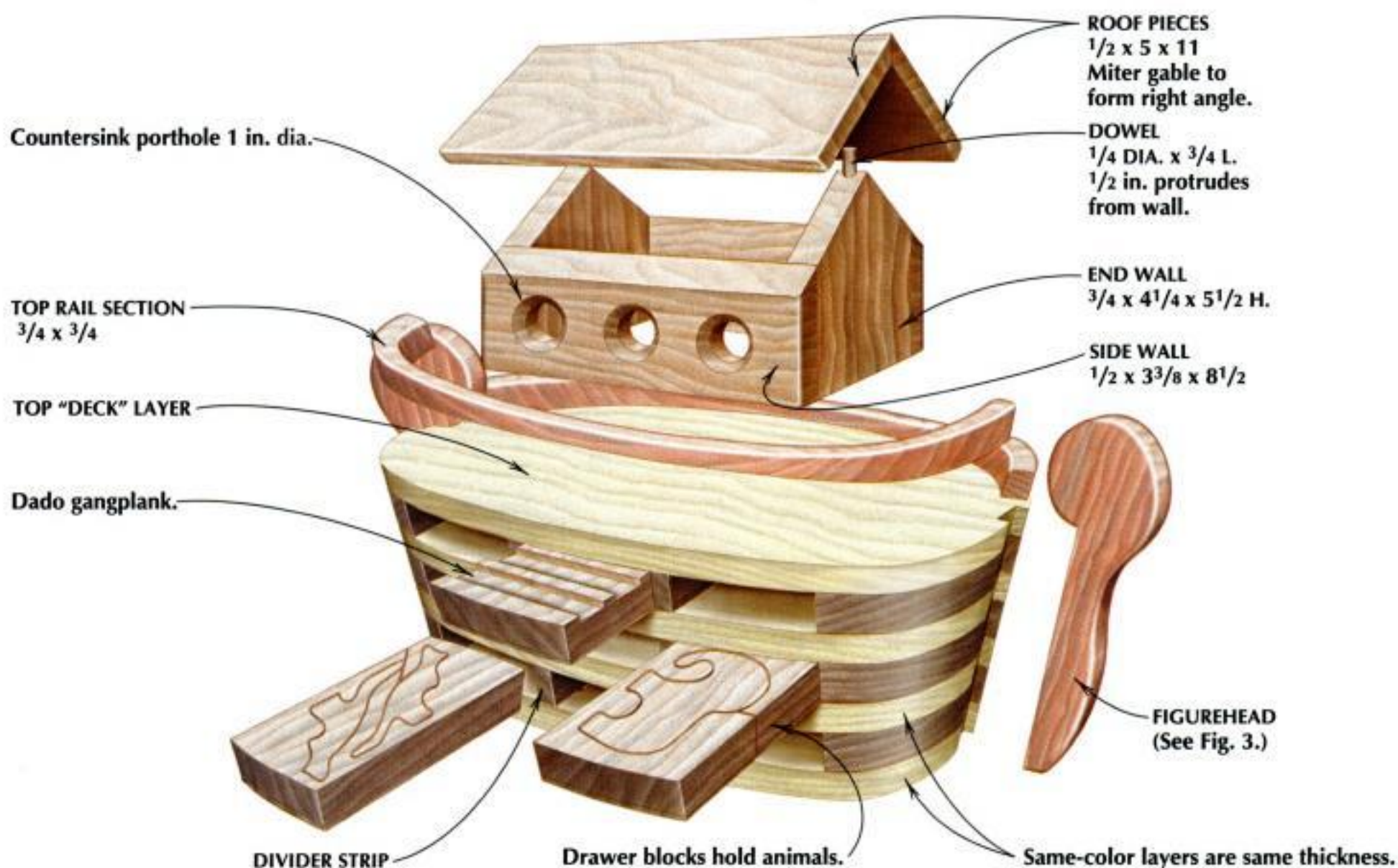
My ark's unique design gives you a lot of creative freedom. You can bandsaw any animal shape you like, and cut a wooden "drawer" block to hold it. The blocks slide into the hull of the ark for easy storage when playtime is over. (See Fig. 1.)

Making the Hull

The hull of the ark is made of contrasting layers of wood. The grain direction of the light layers runs from bow to stern, while the grain of the dark layers runs from side to side. This won't present wood movement problems as long as your stock is well-seasoned and you protect the ark from the elements.

FIG. 1: ARK CONSTRUCTION

The light-colored layers of the hull run from bow to stern. The dark layers—sliding drawers, narrow divider strips and solid end pieces—are oriented with the grain running side to side. All the pieces of the body are bandsawn at a 12° angle, forming a gradual taper. (See Fig. 2.) Disc-sanding refines the contours.



GLUING UP THE HULL

Glue up the hull in three stages. For each glue-up, locate the end pieces and divider strips by placing 1/2-in.-thick by 3 1/2-in.-wide spacer blocks between them. Use the figureheads to align the notches in the ends of the layers before you tighten the clamps. After you clamp, you can remove the spacer blocks.

1 Place the top "deck" layer face down and build the next two layers on top of it.

2 Once the first sandwich dries, add the next two layers in the same way.

3 Add the last two layers. When the glue dries, clean up the outer surface with a disc sander.



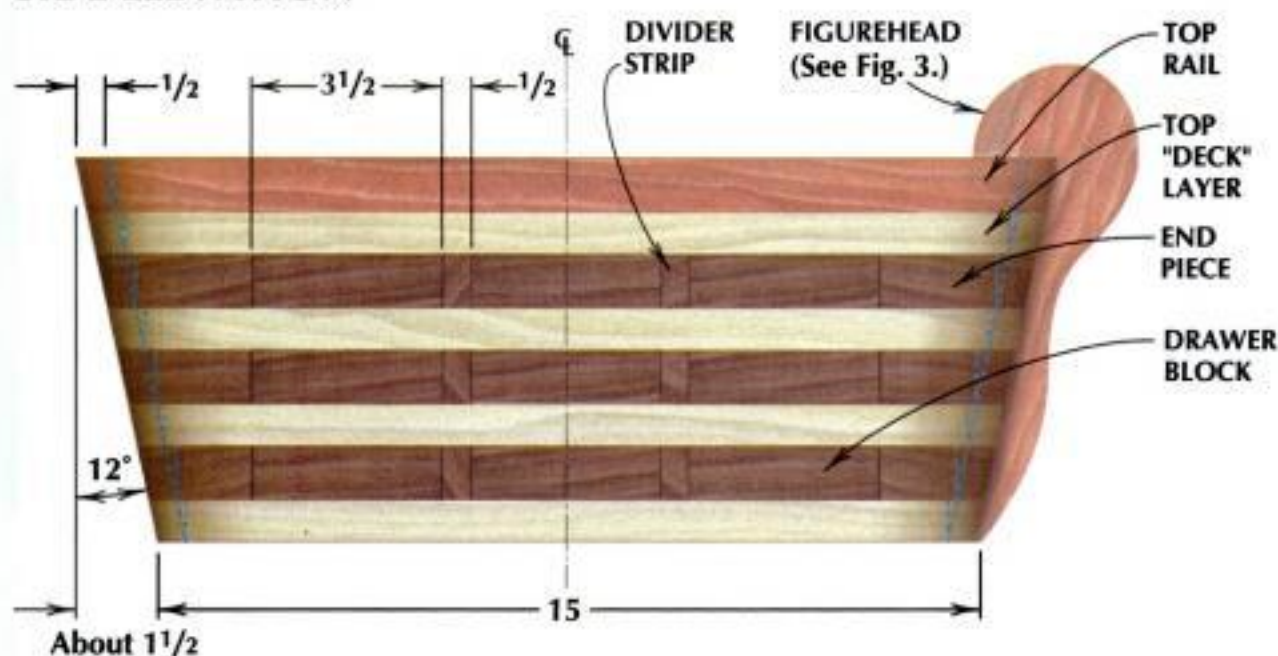
BANDSAWN ANIMALS

Wooden figures fit inside sliding drawers in the hull of the ark. You can enlarge the shapes shown here, or draw your own.



FIG. 2: HULL ELEVATIONS

SIDE ELEVATION



I use soft maple for the four light layers, but any light-colored hardwood will work. Glue up your stock for the light laminates to 11 in. wide, and plane each of them until they're flat and a uniform thickness—around $\frac{3}{4}$ in. Cut the laminates to about 20 in. long.

I use walnut for the dark layers, which consist of end pieces, divider strips and drawer blocks. All these pieces should be about 1 in. thick. I make the figurehead pieces from walnut of the same thickness. Rip all the walnut parts to the widths shown in Fig. 2, and cut them off at 11 in. long.

Rip an extra set of spacer blocks from $\frac{1}{2}$ -in. scrap. You'll use these to locate the layers and divider strips for glue-up. These blocks are only half the thickness of the real drawer blocks, and you remove them before the glue sets, so they won't accidentally get glued into place. (See bottom left photo, page 77.)

Angled bandsawing—It's easy to cut out the hull parts if you follow this method. When you set your bandsaw table at 12° to the blade, each layer you cut will already be tapered to the desired angle, forming a gently sloping hull. You bandsaw the bottom layer first, then use it to lay out the next layer, working your way up the hull.

Use the footprint in Fig. 2 to lay out the very bottom layer, but don't cut the notch yet—just bandsaw to the curved line. Make sure to mark the centerline from side to side.

Now, use the larger face of the bottom layer to lay out the layer just above it. This is a dark layer, which consists of

several pieces. Mark a centerline down the middle drawer block, then gang all the pieces together as they will appear in the finished ark. Line up the centerlines on the light layer and the middle drawer block to ensure that the drawers are centered. Now trace the larger face of the light layer onto the ganged dark pieces, and bandsaw them to shape, once again without the notches.

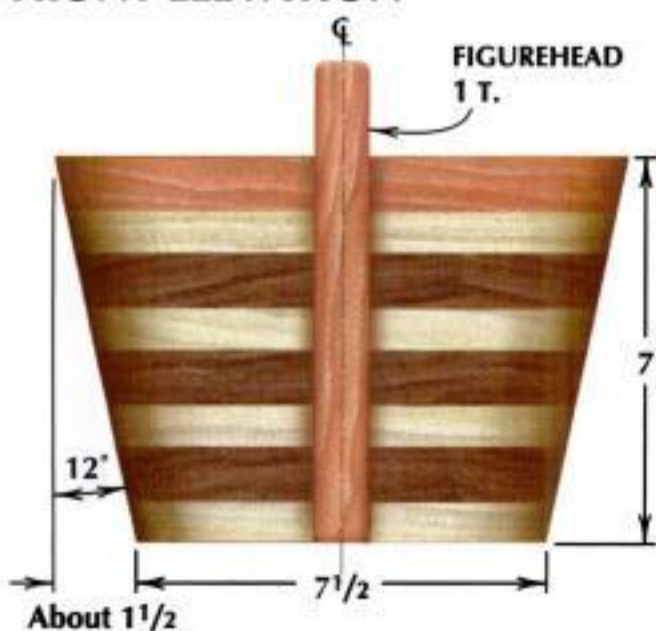
Notching for the figurehead—When you've cut all your layers, cut the figurehead notches in the light layers and the dark end pieces. I do this on the bandsaw, with the table square to the blade. Each notch should be as wide as the figurehead is thick, and $\frac{1}{2}$ in. deep when measured off the smallest face of the layer. (See Figs. 2 and 3.) Since the figurehead is angled, it will contact the back of each notch at only one point. The sides of the notches provide enough gluing surface.

Make the Animals

Before you cut out the animal shapes in the drawer blocks, resaw the bottom $\frac{3}{16}$ in. off each block. You'll glue this back onto the block later, to keep the animal shapes from falling out the bottom. Mark one end of each drawer before resawing so you can glue the resawn pieces back together in the right orientation.

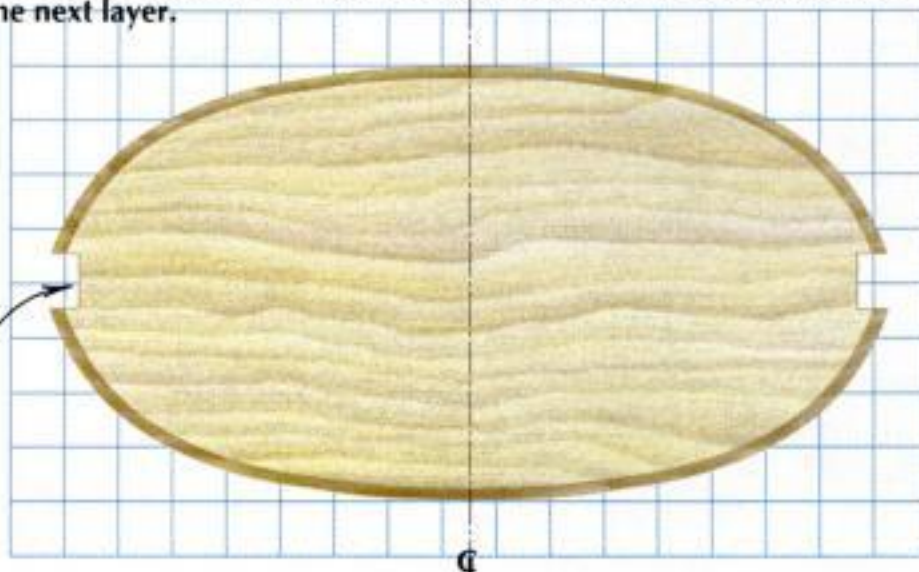
Now draw the animal shapes on the thick pieces. You can enlarge the photos at left and use them as patterns; but it's just as easy—and more fun—to create your own collection of ark inhabitants. For speed reasons, I cut out the patterns with the bandsaw, using a $\frac{1}{8}$ -in. blade

FRONT ELEVATION



BOTTOM VIEW

Cut out the bottom layer at a 12° angle; notch at 90°, then use the larger face to lay out the next layer.



Notch at 90°, 1 in. w. x 1/2 in. d., from smaller face of each layer.

1 square = 1 in.

and cutting in from the edge of the block. But you could make a pierced cut instead, using a scrollsaw. When you've made the animal cutouts, glue the thin bottom piece back onto each drawer block.

I cut the real animals out of woods that evoke their character—zebrawood for zebras, etc.—using the walnut cutouts as templates. Sand the edges of each animal, making sure it fits comfortably in its assigned drawer block.

Assemble the Hull

I assemble the hull of the ark upside down. The photos on page 77 will guide you through the gluing sequence. Glue the top three layers together first—light, dark, light—saving the deck rail layer for later. To align the grooves fore and aft, fit the figurehead pieces into place without glue. Use your 1/2-in.-thick spacer blocks to align the divider strips.

When this first “sandwich” has dried, add another two layers, aligning the grooves and divider strips in the same way. Repeat this process for the final two layers.

Now slide your real drawer blocks into place. They should fit easily but not too loosely. Hold each drawer block in place with a small wedge on one side, and disc-sand the entire hull until you get a smooth taper that's pleasing to the eye.

Next, lay out the top rail sections, using the completed hull to trace the outline. Cut them out and glue them to the top layers. Finally, install the figureheads as shown in Fig. 3.

Final Details

I make Noah's house from walnut. You can build it and check the fit at any point, but don't glue it to the top layer of the hull until you have completed the final sanding.

Careful sanding is the key to a good finish. I sand the whole project using several progressively finer grits, stopping at 150 grit.

I wipe on several light coats of Watco Danish oil. Then I apply two coats of General “Royal Finish” (available from Woodworker's Supply, 1108 N. Glenn Rd., Casper, WY 82601, 800-645-9292) and rub them out with 0000 steel wool.

Finally, I apply a coat of soft wax (available from Craftsman's Products, Box 419, Wyantskill, NY 12198) to each of the animal pieces. This gives them the super-smooth feel that kids just love. ▲



STEVE BALDWIN

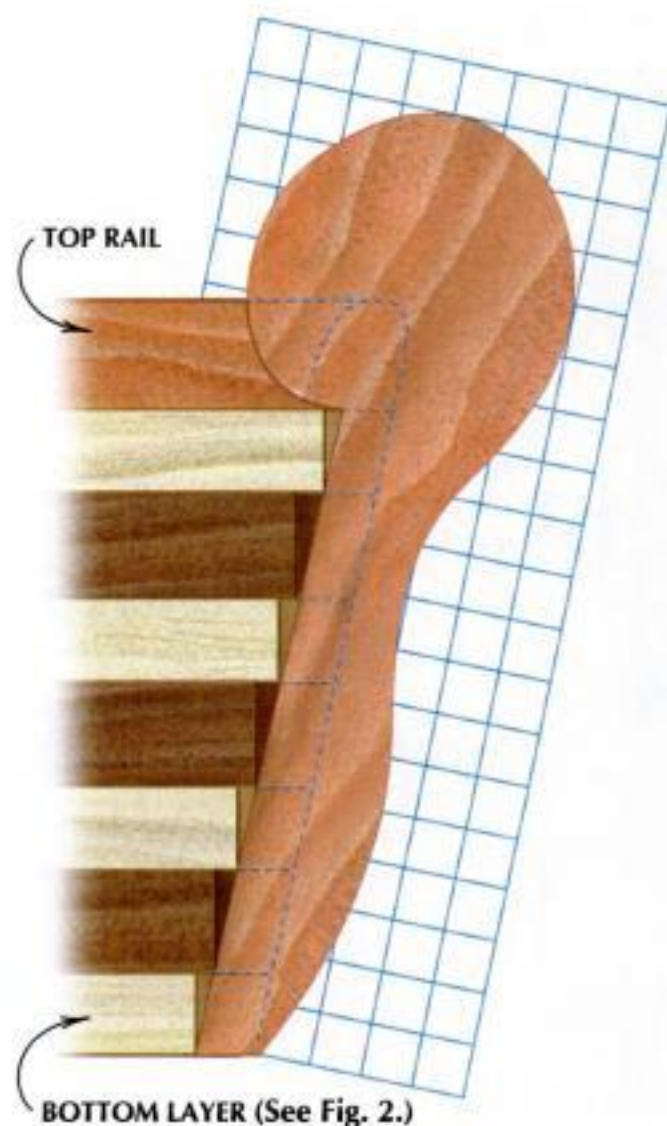
is the founder of Baldwin Toy Company. He displays his toys at art shows around the country.

PLANS & KITS

Full-size plans and kits for this Noah's Ark and many other toys are available from the Baldwin Toy Co., Box 390484, Omaha, NE 68139. Send \$3 for a current catalog.

FIG. 3: SECTION THROUGH FIGUREHEAD

The 1-in.-thick figurehead contacts each layer at one point of the notch. The sides of the notches provide gluing surface. All dark layers are 1 in. thick; all light layers are 3/4 in. thick.



1 square = 1/2 in.



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Downdraft Sanding and Routing Table

by Ed Sheriff

I have two compelling reasons to control the fine dust that results from sanding and routing with handheld power tools: My shop is in my house, next to my home office and on the same floor as two bedrooms; and I've developed an allergy to wood dust.

Commercially available downdraft sanding tables control that kind of dust well, but they're too big for my small shop, not to mention expensive. My solution was to build my own downdraft table. It's basically a piece of casework with a furnace blower mounted inside that sucks dust and chips down through the grille that forms the top of the table. Three layers of furnace filters trap the dust and chips, letting clean air exit through the blower's outlet.

I put casters on the table to make it portable. It stands the same height as my bench, so that I can use the bench to help support long workpieces. (See photo, right).

Dimensions and Materials

The length and width of the table are based on the size of the filters. The 20-in. by 25-in. filters (nominal size) in my table are about twice the width of the blower. This lets air flow freely into both sides of the blower, without taxing the motor or hurting the filter efficiency.

The power plant for my sanding table is a used, 1/3-HP furnace blower, which provides just the right amount of power for a table this size. Heating contractors are good sources for used blowers; or you can buy a new one (average cost: \$200) from a heating, ventilation and air-conditioning (HVAC) supplier.

If you need a larger working surface on top than mine offers, you'll have to start with a larger furnace filter—they come in a wide range of sizes—and calculate your case dimensions from there. Then you may need to use a 1/2-HP blower (which can cost up to \$300 new). If in doubt, ask your HVAC dealer for guidance in matching up an appropriate blower with whatever filter size you choose.

The kind of switch you need and the wiring scheme depend on the type of

motor in your blower. You can get advice on switches and wiring from the same HVAC dealer or from an electrical-supply house.

Construction Details

As shown in Fig. 1, the base for my table is just a case made from 3/4-in. plywood. I joined the sides and bottom with rabbet joints.

I positioned the blower outlet in the interior of the cabinet so that the air can expand, and therefore decrease velocity, before it exits. The outlet wall and its "shelf" fit into stopped dadoes cut in the sides. The size of the outlet wall depends on the dimensions and mounting details required for your blower.

The baffle redirects the airstream coming from the blower, to avoid stirring up dust on the floor of your shop.

Lining the case interior with acoustical tile helps to deaden the noise of the blower. And a layer of felt, glued to the top edge of the case, fights any tendency the top might have to rattle when you're using the table.

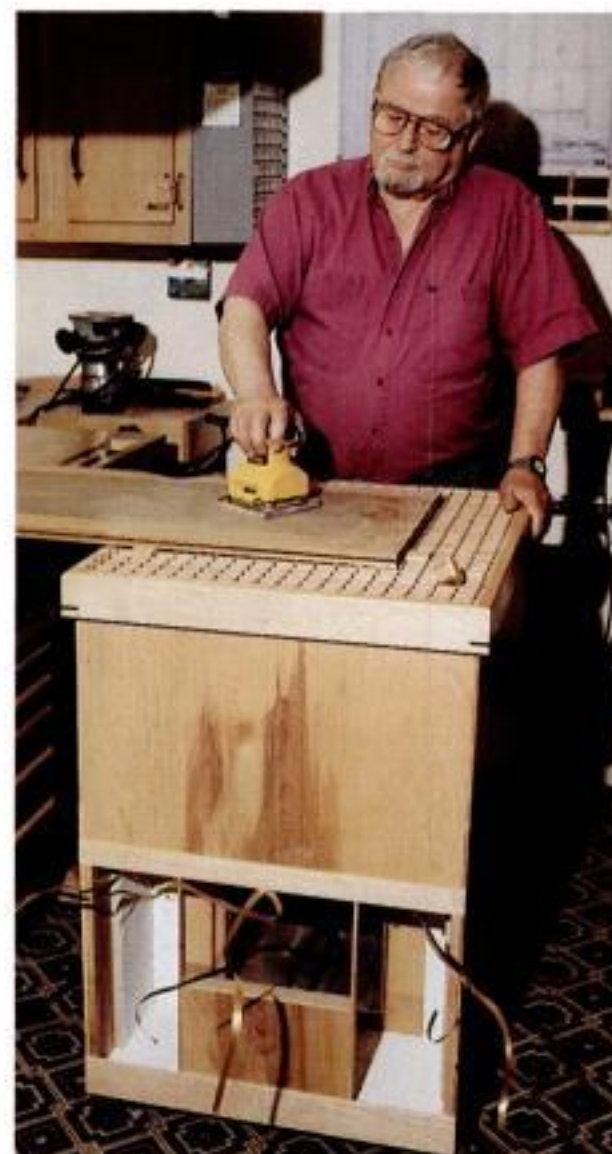
My system for mounting the filters is simple. A ledger is screwed to the case interior to support a stack of three filters and the two spacer frames that separate them. Each spacer frame consists of four pieces of 3/4-in. by 2-in. hardwood, joined with miters at the corners. I glued a layer of 3/8-in. polyurethane foam (available at fabric stores and upholstery shops) around the case interior above the ledger to create a seal around the edges of the filters. The foam compresses just slightly when I lay the filters in place.

To change or clean the filters, you simply lift off the top and then lift the filters and spacers out.

Grille Details

With its 1-in.-square openings, the grille takes time to make, but it's worth the effort. The ample air spaces allow much greater air flow than pegboard.

I made the grille out of 1/8-in.-thick oak strips. But if I were to do it again, I'd use maple or poplar, which are less



Deluxe grille. Chips and sawdust get sucked through the hardwood grid that forms the top. Shop-made plugs help hold the workpiece.



Three-stage filtration. The top filter (left) collects most of the dust, and the other two catch the rest.

likely to crush when you hammer the parts together.

The shorter grille strips are 5/8 in. wide; the longer strips are 1 in. wide. I simply ganged the longer strips together and cut 1/8-in.-wide, 5/8-in.-deep slots on the

tablesaw, into which I glued the longer strips. Being a stickler for detail, I also cut dadoes in the frame pieces, using the slotted grille strips for patterns, to join the grille to the frame. An easier approach, shown in Fig. 1, "Grillework and Frame Detail," would be to cut a groove in the inside face of the frame, notch the ends of the strips, and glue the completed grille into the groove.

I cut several capped plugs that fit into the grille openings. The plugs act like stops on a workbench, helping to keep workpieces stationary when I use an orbital sander. (See top photo, opposite.)

Clearing the Air

I use pleated paper furnace filters, which come from a number of manufacturers in a range of sizes including 20 by 25 in., and are available at hardware stores and home-improvement centers. If you're interested in maximum efficiency, 3M's furnace filters collect particles as small as 0.3 microns, and they're available from the same sources. (Note that some filters are actually as much as 5/8 in. smaller in each dimension than their nominal sizes, in which case you'll have to use thicker polyurethane foam around them or scale the cabinet's dimensions down.)

I check the top filter fairly often. When it's full of dust, I just take off the cover, remove all three filters, and clean them by knocking the dust off in my driveway and vacuuming them thoroughly. ▲



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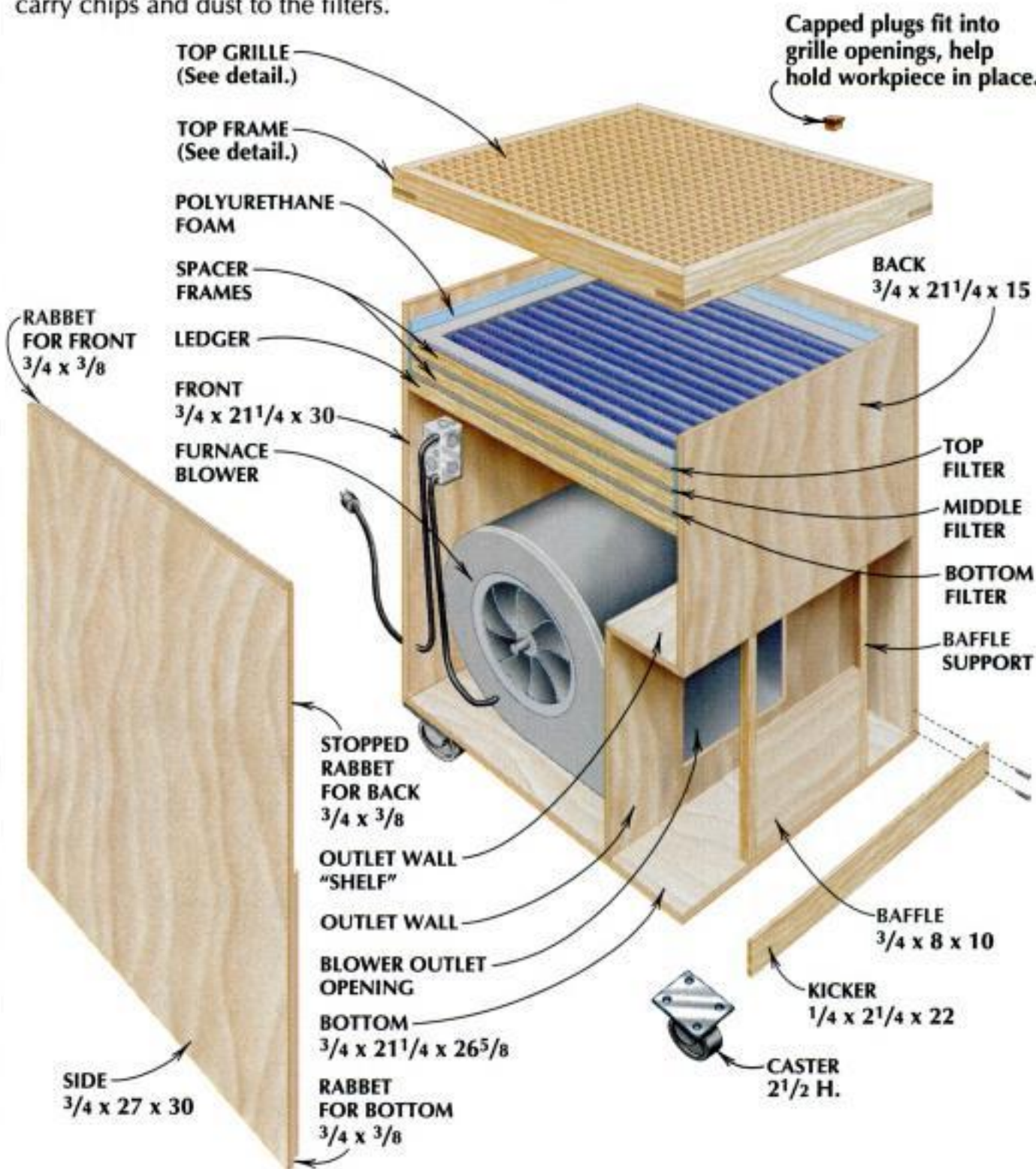
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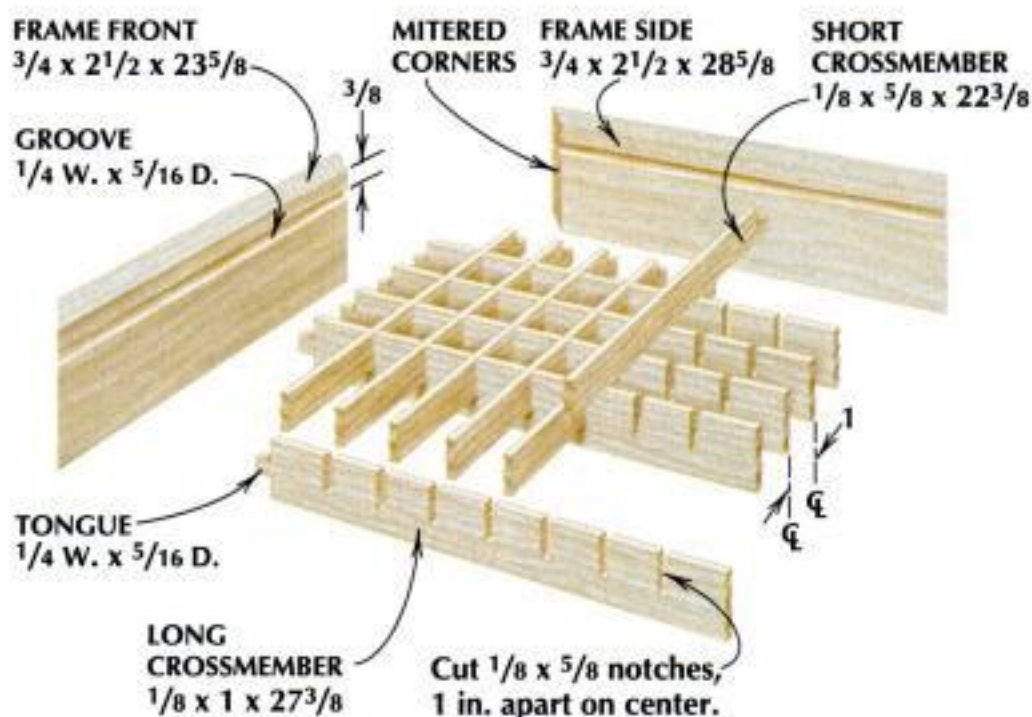
FIG. 1: SANDING AND ROUTING TABLE

Sheriff's table is basically a case that holds a furnace blower and three furnace filters. A lift-off grillework top supports the workpiece and lets the downdraft airflow carry chips and dust to the filters.



GRILLEWORK AND FRAME DETAIL

To make the grille, gang the long crossmembers together and cut 1/8 by 5/8 notches 1 in. apart on center. Glue the short crossmembers into the notches. As you glue up the frame, insert the crossmembers' 1/4 by 1/4 tongues into the grooves in the frames.



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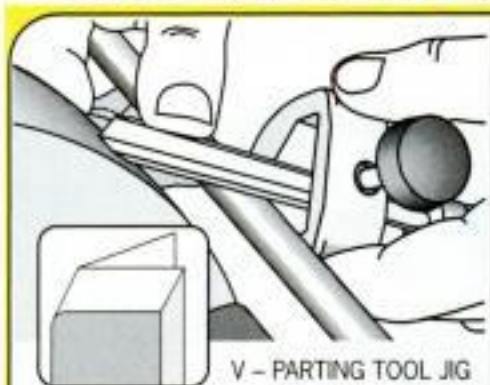
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CIRCLE NO. 43 ON PRODUCT INFORMATION FORM

Sugar Pine

by Paul L. McClure



I'm building a reproduction 17th-century cradle for an expected grandchild (my first). I have been sawing, planing and carving sugar pine in my shop for the past few weeks. The scent is so sweet that bees from my neighbor's hives have been buzzing around the wood, trying to find the pollen that surely accompanies such a wonderful aroma.

Sugar pine gets its name from the sweet globules of white resin that ooze from the bark when the tree is cut. These sugarlike crystals glisten on the surface of sugar pine lumber.

Sugar pine trees can grow up to 270 ft. high and 12 ft. in diameter. The straight trunk of a mature tree has no branches for the first 50 to 80 ft. The branches bear cones up to 24 in. long. Sugar pines begin bearing cones at 100 years old and can live up to 600 years.

Appearance

Sugar pine heartwood is a light yellowish white to buff tan; the sapwood is creamy white. The wood changes color very little on exposure to light and air. It has an even texture; the growth rings are not pronounced. Resin ducts are very visible and easy to avoid in machining.

Workability

Sugar pine works well with hand and power tools. The soft wood has very little blunting effect on cutters, and it dents very easily—so keep your bench clear of tools, stray screws and debris.

Sugar pine joints and planes to a very satiny surface and glues exceptionally well. Pad any clamps with large glue blocks, to avoid marring the wood. Sugar pine holds screws and nails well, without preboring. Use sharp bits and slow feed rates for drilling.

Next to a sharp plane, a sharp, well-burred hand scraper yields the best surface. Sand by hand with 120- to 180-grit garnet paper to avoid scratches.

Sugar pine takes stains well, but the smallest dent or scratch will blotch—hence the prevalence of “distressed pine” furniture. To prevent this, apply a shellac wash coat or wood conditioner before any type of stain. (See AW #42.) Paint and clear finishes adhere very well.

Uses

Sugar pine is used in furniture, cabinets, millwork, construction, carvings and toys. ▲

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SPECIES AND COMMON NAMES: *Pinus lambertiana*—sugar pine, purple-coned sugar pine

GROWING RANGE: From the mountains of southern Oregon along the western slopes of the Sierra Nevada, to the coastline of northern Baja California

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DENSITY: 22 lbs. per cubic ft.

WOOD MOVEMENT¹: Tangential (flatsawn): small (less than 9/64 in. per ft.)
Radial (quartersawn): very small (less than 5/64 in. per ft.)

DURABILITY: Heartwood moderately resistant to decay;
sapwood susceptible to decay

SUSTAINABILITY: Sustainable at current harvest levels

AVAILABILITY: Hardwood lumberyards and specialty wood dealers,
mainly west of the Mississippi

SIZE: Thicknesses: 4/4 through 16/4. Widths: 8 in. and wider. Lengths: 8 to 20 ft.

COST: Lumber: 4/4 through 12/4, \$2.50 to \$7 per bd. ft. 16/4, \$7.50 per bd. ft.

Plywood: Clear, 1/4 in. thick, \$40; 3/4 in. thick, \$70

Knotty: 1/4 in. thick, \$36; 3/4 in. thick, \$50

Veneer: Not readily available

¹Indicates wood movement across the grain from 6% to 12% moisture content





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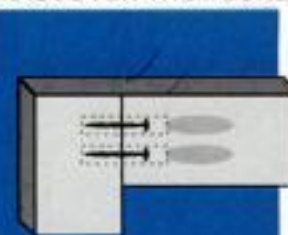
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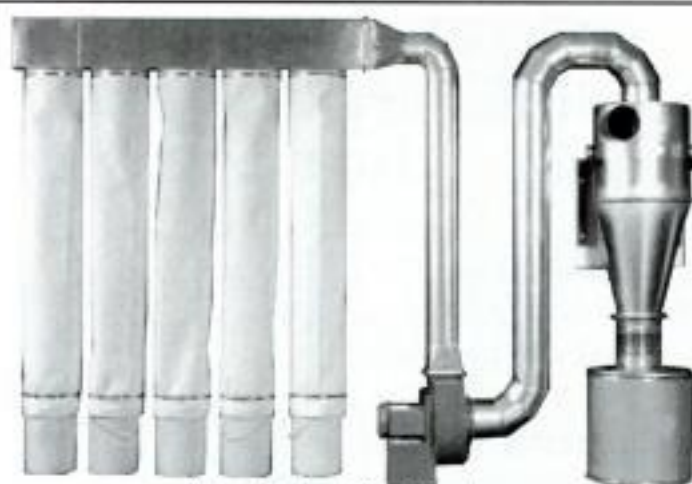
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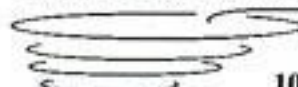


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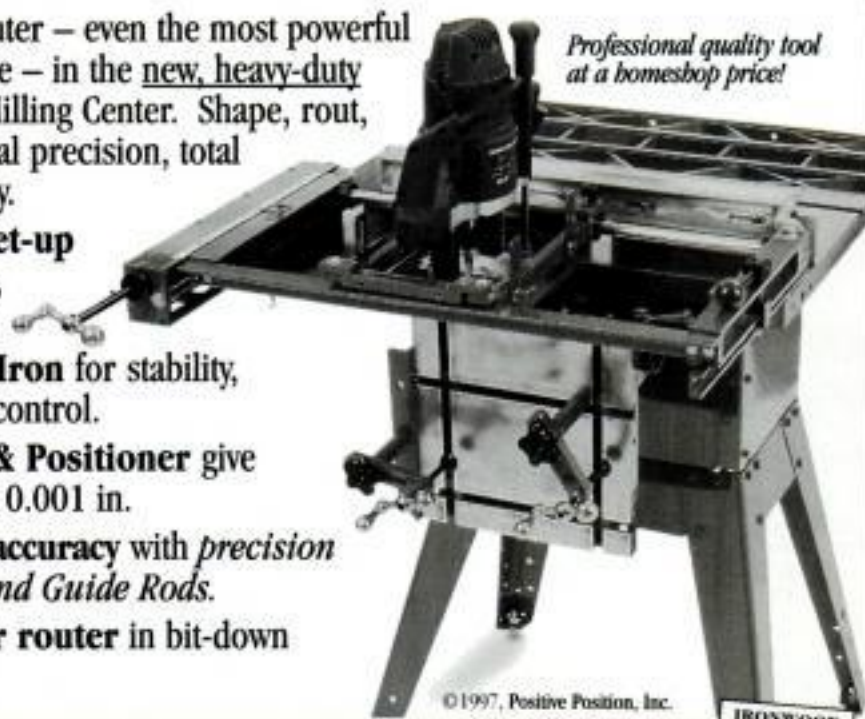
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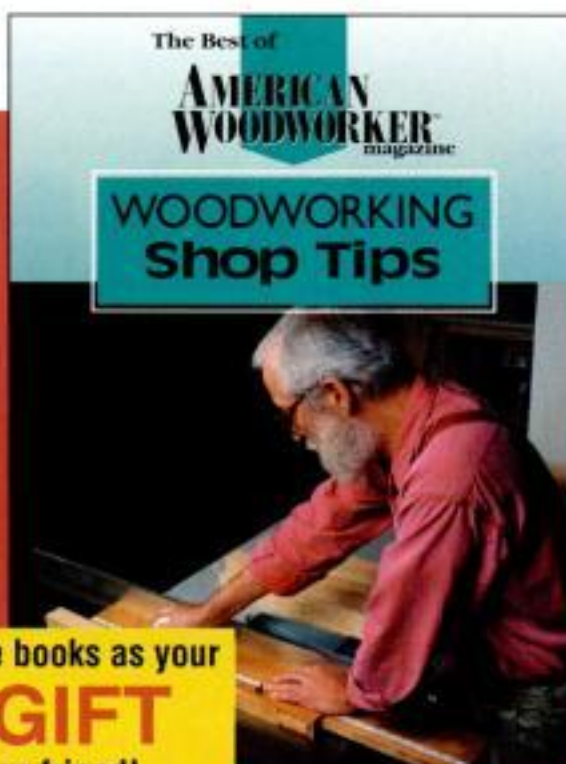
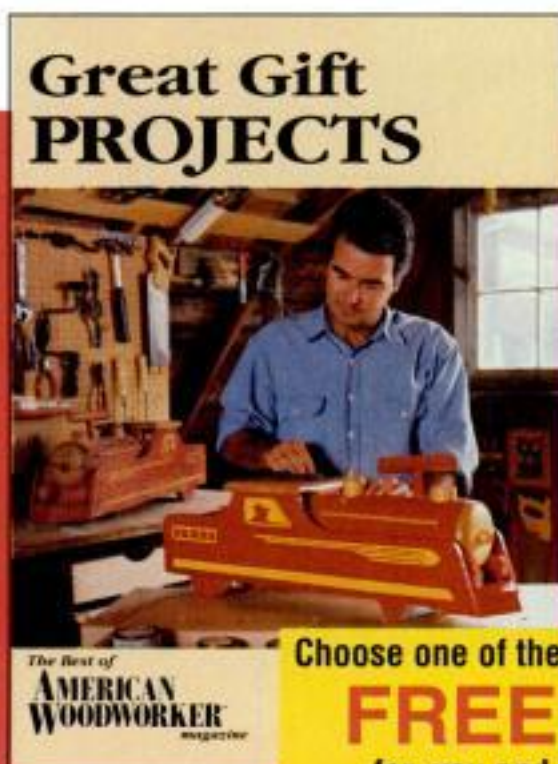
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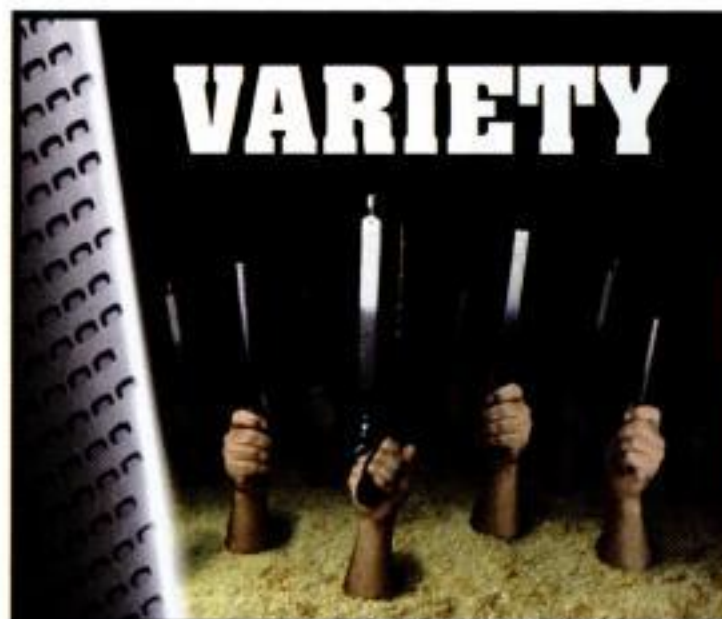
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Grain Enhancement, Part I

How to bring out the best in closed-pore woods

by Michael Dresdner

When it comes to finishing, the nicest thing you can do for wood is emphasize the beauty that nature gave it. A finish does that in a few ways: It can accentuate the grain pattern, create the appearance of greater depth, and add luster. When a finish enhances the grain dramatically, we say it makes the grain “pop.”

The grain-enhancement techniques you choose depend on the type of wood you’re finishing. What works well for woods with fine or closed pore structure can produce poor results with open-pore woods. In this installment I’ll show you a few ways to highlight the grain of closed-pore woods such as figured maple, birch and sycamore. In my next column I’ll deal with large-pore and ring-porous woods like oak, ash, mahogany and lauan.

How Grain Enhancement Works

There are many ways to accentuate wood grain, but all the techniques I’m going to show you involve some sort of stain. The wonderful thing about wood is that it does not absorb stain uniformly. Some areas of the wood suck up more of it than others. Staining therefore increases the contrast between areas of greater and lesser absorption—for example, the contrast between earlywood and latewood, whose different sized pores form the growth rings that define the grain pattern. In woods like curly and quilted maple, figure is created where the end grain veers up toward the surface, and

stain is absorbed quicker in those areas than where the grain is flat and parallel to the surface.

Definitions of “grain” and “figure” are somewhat fuzzy in the woodworking industry; the two terms may mean slightly different things to different people. I use “grain” to mean patterns in the wood that are formed by the grain structure—this would include curly and quilted patterns in maple, cathedral arches in oak, and ordinary straight and parallel grain found in quartersawn boards.

“Figure” refers to grain patterns out of the ordinary (such as curly and quilted), as well as patterns not related to grain structure: color streaks (as in rosewood) and the irregular patterns in spalted woods, for example.

For light, close-grain woods with distinctive figure, I’ll describe three methods of intensifying grain: using linseed oil, dye stain, and transparent “candy apple” colors. (See photos, below.)

Oil It Down

The simplest way to bring out grain is to flood the wood with boiled linseed oil, let it soak in for about ten minutes or so, then wipe off any excess oil. The oil will make the subtle patterns in the wood stand out and make any curl or quilt appear deeper. It also acts as a stain by imparting a warm, amber color.

Let the oil dry for at least two days before finishing with Danish oil, varnish, shellac or lacquer. If you decide to

use a water-borne coating instead, first seal the oiled wood with a coat of 2-lb.-cut shellac.

Staining with Dye

The trick here is to use a weak but dark-colored dye stain to showcase the grain. You can make any color of dye weaker by adding more solvent. This does not change the color, but it makes a weaker, less intense dye stain.

Choose a fairly dark dye stain and dilute it at least 100% with solvent to weaken it. You can use an oil-, water-, or alcohol-soluble dye, or even tea or coffee as your weak, dark stain. Working quickly, flood the dye onto the wood and wipe it all off with a clean rag before it dries.

Let the stain dry completely and continue with your chosen topcoat. Seal the wood with shellac first if you are going to use a water-borne coating. Water and alcohol stains will dry in 20 or 30 minutes, while oil stain may take overnight.

Two-tone staining. A more dramatic dye-stain method is two-step coloring, so called because you stain the wood twice with two different colors of dye. (See photos, page 100.)

Start with a dark, water-soluble dye stain—either dark brown or black—and dilute it at least 100% with water. Flood it on, wipe it all off before it dries, and then let the wood dry completely.

When the wood is dry, sand the surface with 220- or 320-grit self-lubricating sandpaper. This sanding will cut back the raised grain and remove any dye on the “flat” areas, but leave it in the porous, more absorbent areas.

Now for step two. Restain the wood, this time using a weak, light-colored dye stain. Flood it on, wipe it off while it is still wet, then let it dry—but this time we won’t be doing any sanding. Once this second stain is dry, you can apply your first coat of clear finish.

The key to a natural-looking result is choosing the right combination of colors for the two dye steps. One of my favorite combinations is Van Dyke



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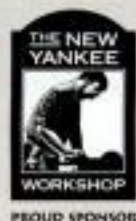
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JUST FINISHING

brown dye first, followed by a light amber dye in step two. This combo nicely mimics rich, aged maple. For a redder, darker treatment, try black followed by antique cherry. Make sure you do a scrap sample first, and find the color pair that suits you best.

Transparent Candy Apple

Candy apple is a term used to describe finishes that are both brightly colored and transparent, so that the wood figure still shows through it. Imagine a film of red plastic sandwich wrap laid over the page of a newspaper. The paper would be red, but you would still be able to read the words. That is how a candy-apple finish works. You see it frequently on highly figured electric guitars.

You'll need spray equipment for candy-apple finishing, and it works best if you use a lacquer topcoat. Here's how to do it.

First, stain the wood with dye. Use black dye if you are going to make the candy-apple finish red, green or blue,



Two-tone coloring. Combine two different dye stains for a more dramatic effect than simple staining. Proper sanding between colors is key.

and brown dye if it is to be yellow or orange. As before, wipe off the dye while it is still wet, and when the wood is dry, sand it with 220-grit paper. This will leave color in the porous areas of the wood only.

Next, seal the wood with several coats of water-clear lacquer. Allow the lacquer to dry and sand it with 320-grit paper. Continue to add more topcoats, alter-

nately spraying and sanding, until the surface is smooth and the pores of the wood are completely filled with lacquer.

Now mix up a colored, translucent topcoat by adding pre-dissolved oil- or alcohol-soluble dye to clear gloss lacquer. Bright, primary colors look best. Spray several coats of this colored lacquer, being careful to apply the color as evenly as possible. When you have sprayed just enough color so that the tint is rich and uniform but the grain still shows through, switch to clear gloss lacquer. Add enough clear gloss so that you can polish the final finish to high gloss without cutting through to the color layer. ▲



Join Michael Dresdner live on America Online Sunday nights from 9:30 pm to 10:30 pm eastern time for answers to your finishing questions. Keyword "wood" takes you to AMERICAN WOODWORKER Magazine Online. Click the "Shop Talk" icon to enter the chat room.

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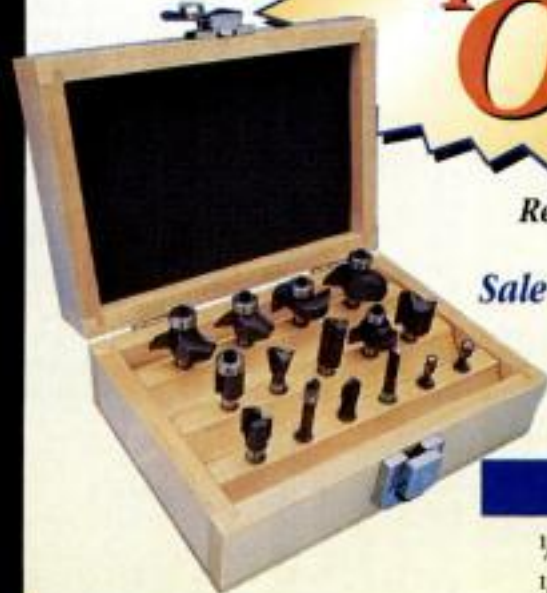
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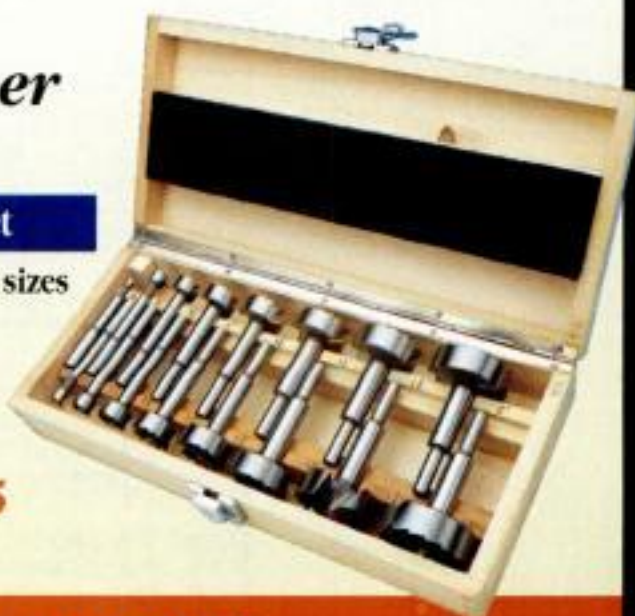
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1194VSR	1/2" VSR, 2 STAGE HAMMER DRILL	148
12740VS	3" X 21" VS DUSTLESS BELT SANDER	168
12750VS	3" X 24" VS DUSTLESS BELT SANDER	213
12760VS	4" X 24" VS DUSTLESS BELT SANDER	228
12950H	5" RANDOM ORBIT SANDER	82
13700EVS	6" VS DSTLS RNDM ORB SNDR	246
1584VS	CLIC BARREL HANDLE JIG SAW, VS	142
1584VSW	1584VS JIG SAW W/CASE & 10 BLADES	159
1587AVS-50	50TH ANNIV. JIG SAW KIT W/13 BLADES	156
1587DVS	DUSTLESS VAR. SPEED JIG SAW	177
1587VS	TOP HANDLE JIG SAW, VAR SP	142
1604	1 3/4 HP ROUTER W/CASE & ROUTER PAD	144
1609AKX	DELUXE INSTALLERS KIT W/4 BASES	229
1613EVS	2 HP VAR SP PLUNGE ROUTER	208
1613EVSX	1613EVS W/RA1051 DELUXE EDGE GUIDE	196
1613EVSXK	1613EVS, EDGE GUIDE, TEMP GUIDE KIT	229
3107DVS	5" RANDOM ORBIT SANDER, VS	96
3107DYSK	6" RANDOM ORBIT SANDER WITH CASE	114
325DVS	5" DUSTLESS VS RANDOM ORBIT SANDER	144
327DVS	6" DUSTLESS VS RANDOM ORBIT SANDER	149
3272AK	3 1/4" PLANNER KIT WITH CASE	118
3296K	3 1/4" PLANNER KIT WITH CASE	178
3310K	12V CRDLS T HANDLE W/2 BATT, CS & CHRG	174
3610K	14.4V CDS DRILL KIT W/2 BATT	194
3915	10" SLIDE COMPOUND MITER SAW	538

BIESEMEYER

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H077M	7 1/4" MAGNESIUM WORM DRIVE SAW	169
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3400	10" TABLE SAW W/CARB BLADE & STAND	198

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SLP20	BRAD NAILER W/CASE 5/8" - 1 5/8" CAP	278
SFN40	FINISH NAILER 1 1/4" - 2 1/2" CAP	389

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CF8B	8 1/2" SLIDE COMPOUND MITER SAW	456
C10FC	10" COMPOUND MITER SAW	194
C10FS	10" SLIDE COMPOUND MITER SAW	738
M12V	3 HP VAR SPEED PLUNGE ROUTER	238
	INCLUDES \$15 FACTORY REBATE	
NR83A	FULL HEAD STRIP NAILER, 2 - 3 1/2" CAP	388
P20S8	3 1/4" PLANNER	79
S875	3" X 21" 2 SPEED BELT SANDER	139
TR12	3 HP PLUNGE ROUTER	158

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60	8" LONG BED JOINTER	1775
61	1 1/2 HP TBL SAW W/ACCU FENCE W/CARB BLD	745
64L	1 1/2 HP TBL SAW W/50" ACCU FNC W/CARB BD	845
66	3 HP, 1 PH 10" T.A. SAW W/50" FENCE	1995
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73	1 1/2 HP DET COLLECTR W/CLOTH LOWR BAG	398
75	3 HP DET COLLECTOR W/LOWR CLOTH BAGS	675
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DS2000K	2 SP. DETAIL SANDR W/CS & ACCYS	62
HT20VSK	MULTI ROTARY TOOL W/CS & ACCYS	45
ML518	18" WOOD MINI LATHE	199
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SC165VS	16" VS SCROLL SAW	164
WDS1600	WIDE DRUM SANDER	564

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Q565T	ANGLE FINISH NAILER 1"-2 1/2"	202
Q625NK	NARROW CROWN 1 1/4" STAPLER 1 1/2"-1" WITH CASE & 5000 STAPLES	103
EZ-1	SHOOTS 1/4", 3/8", 1/2" CRN STAPLES & BRADS, 5/8" CAP, W/CASE & FASTNERS	96
EZ-2	SHOOTS BOTH BRADS & STAPLES	138

Thakita

1912B	4 3/8" PLANER	199
3901	BISCUIT JOINER	204
5007NEK	7 1/4" CRC SAW W/CS & BLADE	124
6095DWE	9.6V CDS DRILL KIT W/2 BATT	124
6019DWE	7.2V CDS DRILL KIT W/2 BATT	96
6213DWE	12V CORDLESS KIT W/2 BATTERIES	169
6233DWE	14.4V CORDLESS KIT W/2 BATTERIES	194
60501	5" RANDOM ORBIT SANDER	67
DA391DW	9.6V ANGLE DRILL KIT	178
LS1011	10" COMPOUND MITER	428
LS1013	10" DUAL COMPOUND MITER SAW	566
LS1211	12" COMPOUND MITER	778
N1900B	3 1/4" PLANER	138

DELTA

11-990	12" DRILL PRESS	183
14-650	HOLLOW CHISEL MORTISER	238
17-900	16 1/2" DRILL PRESS, 3/4" HP, 12 SPD	398
22-540	12" BENCH TOP PLANNER	328
22-560	NEW 12" PORTABLE PLANNER	389
23-710	NEW SHARPENING CENTER	174
28-185	BENCH TOP BAND SAW	167
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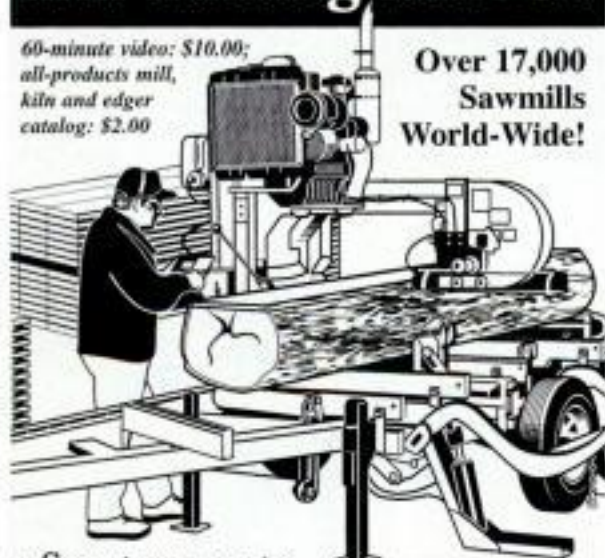
DEWALT

DW321K	TOP HANDLE JIG SAW KIT	162
DW359K	7 1/4" CIRCULAR SAW W/CASE	128
DW411	1/4 SHEET SANDER	57
DW420	5" RANDOM ORBIT SANDER, PSA	68
DW421	5" DSTLS RNDM ORB SANDER, VELCRO	69
DW423	5" VS DSTLS RANDOM ORBIT SANDER	93
DW431	3" X 21" DSTLS BELT SANDER VAR SP	183
DW443	6" ROS SANDER VAR SP, VELCRO	139
DW610	1 1/2 HP ROUTER, 9 AMP	147
DW615	1 1/4 HP PLUNGE ROUTER, VAR SP	162
DW621	2 HP VS DSTLS PLUNGE ROUTER	214
DW625	3 HP HWY DTY PLUNGE RTR, VAR SP	268
DW673K	7/8 HP LAMINATE TRIMMER KIT	185
DW675K	PLANNER KIT, 7 1/2 AMP W/STEELE CASE	159
DW682K	BISCUIT JOINER KIT	192
DW691K2	12" MITER SAW W/CARB BLADE	357
DW708	NEW SLIDING COMP. MITER SAW	667
DW733	NEW 12 1/2" PORTABLE PLANNER	448
DW744	10" PORTABLE TABLE SAW	539
DW788	NEW 20" VAR. SPEED SCROLLSAW	479
DW935K	14.4V CDS CIRCULAR SAW KIT	228
DW936K	18V CORDLESS CIRCULAR SAW KIT	244
DW972K2	12V CRDLS KIT W/2 BATT & CS	178
DW991K2	DW991K WITH TWO BATTERIES	208
DW991K2S	14.4V CDS DRILL & CRC SAW KIT	

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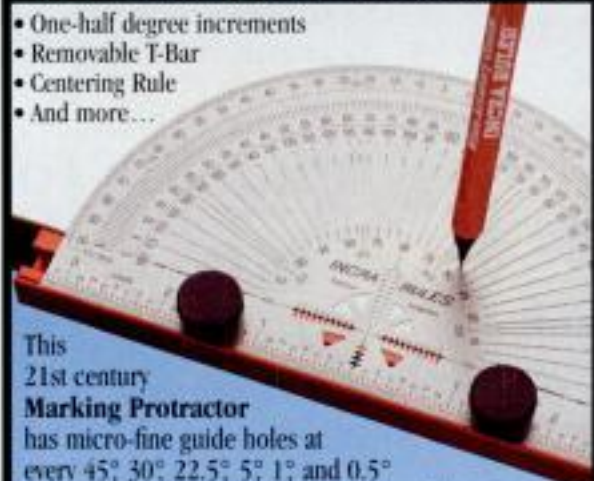
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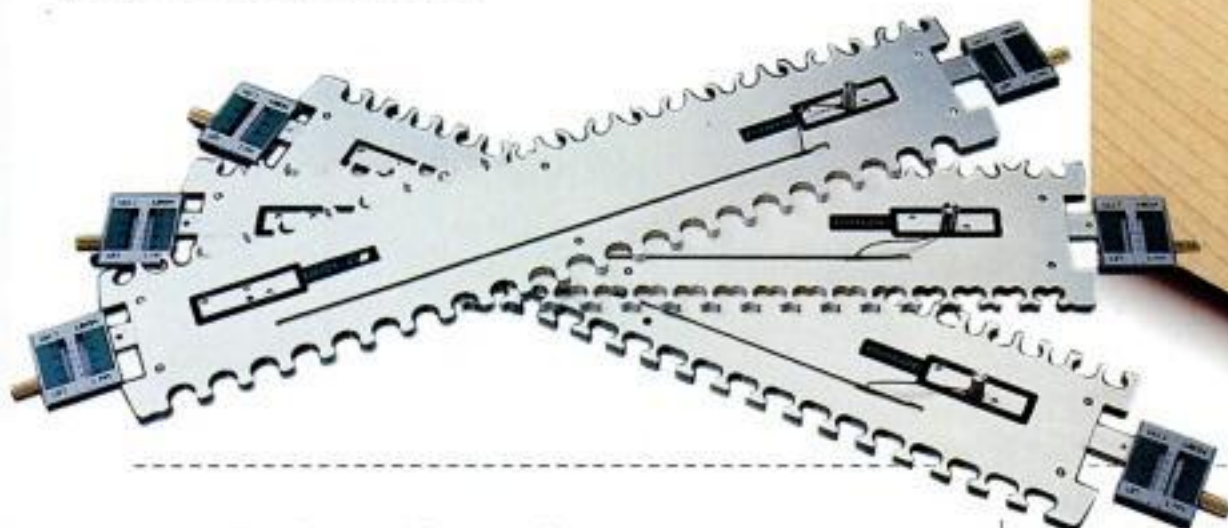
Special Edition!

Have a look at the hottest new tools from two great shows

AERICAN WOODWORKER editors prowled the aisles at two big tool shows recently—The National Hardware Show in Chicago and the Woodworking, Machinery and Furniture Supply Fair in Anaheim. We uncovered great new gear! Here's the scoop on the hottest items we found at the shows.

Amazing Joints!

You wouldn't dare cut these corner joints by hand. But they're easy to rout using Leigh's new Isoloc™ Joint Templates, a router and Leigh's 24-in., D-Series Dovetail Jig. Three templates are available with two different shapes on each. You get six new patterns with names like "wave", "clover" and "bear's ears," which describe the joints' appearance. Both half-blind and through joints are possible. (Price: \$240 per template, includes guide bushing and holder to fit most routers) *Leigh Industries Ltd.*, (800) 663-8932. **Circle #601**



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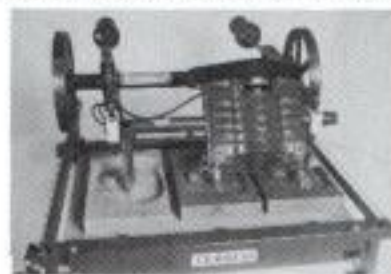
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Model T-110 Dupli-Carver



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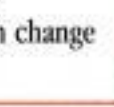
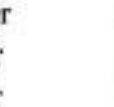
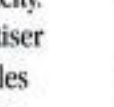
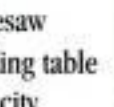
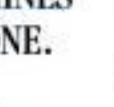
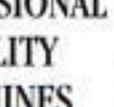
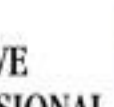
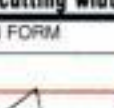
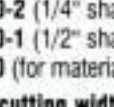
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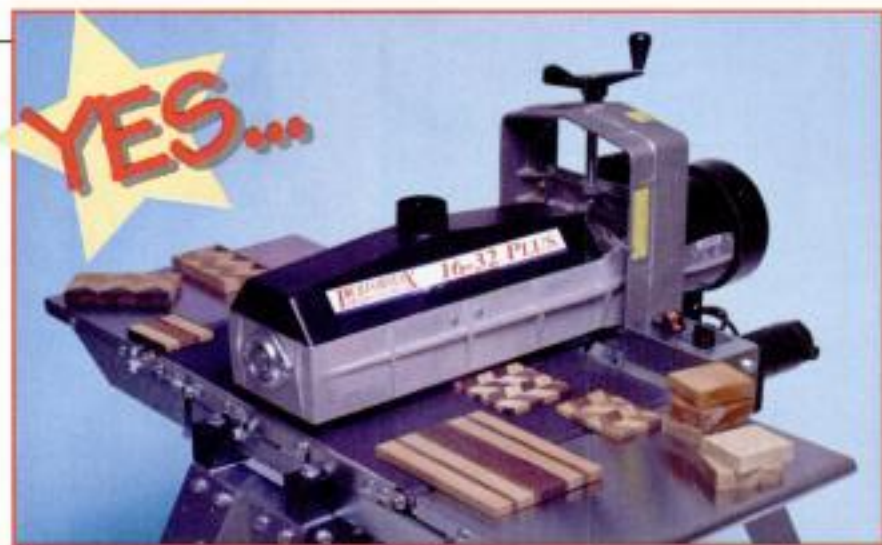
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CIRCLE NO. 52 ON PRODUCT INFORMATION FORM



Performax Drum Sanders continue to make those once-difficult sanding jobs easy.

New, solid, steel In-feed and Out-feed Tables are now available for all 16-32 models at a **Special Introductory Price of \$79.95**. Multiple craft pieces, as short as 2 1/4", and veneers as thin as 1/64th" can be sanded more efficiently with an additional 3 sq. feet of workspace. The in-feed and out-feed support is also a real advantage for easier handling of longer, rough-sawn boards.

Just Get It...FREE! For a limited time the In-feed and Out-feed Tables are yours with the purchase of a 16-32 Plus Drum Sander. So if you're still wrestling with a belt sander, see your Performax Dealer today for a demonstration of how easy sanding can be with a Performax Drum Sander. **Call 1-800-334-4910 for a FREE brochure and the dealer nearest you.**



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CIRCLE NO. 67 ON PRODUCT INFORMATION FORM

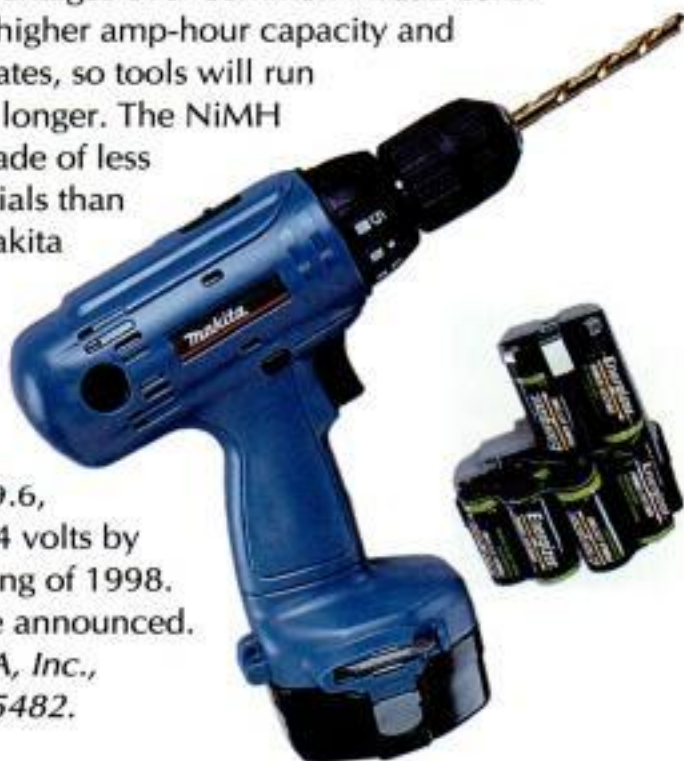


Accurate Arcs

The Veritas Carpenter's Gauge combines the functions of a compass and a marking gauge. But it's easier to use, more accurate and more convenient to carry in an apron or pocket than either of these marking tools alone. You simply set your radius directly on the scale, locate the center using the gauge, then scribe the line with the compass. (Price: \$14.95) Lee Valley Tools, (800) 871-8158. **Circle #604**

New-Generation Batteries

In one of the biggest surprises at the Hardware Show, Makita introduced the first Nickel Metal Hydride (NiMH) batteries for cordless power tools. NiMH cells offer distinct advantages over common NiCad cells: They have higher amp-hour capacity and discharge rates, so tools will run harder and longer. The NiMH cells are made of less toxic materials than NiCads. Makita will offer the new batteries on a line of cordless drills with 9.6, 12 and 14.4 volts by the beginning of 1998. Prices to be announced. Makita USA, Inc., (800) 462-5482. **Circle #605**



Quieter Belt Sander

Belt sanders are notoriously hard on the ears. Porter-Cable's new "Whisper Series" Belt Sanders are a lot quieter thanks to a redesigned cooling fan and a poly V-belt drive. Our shop measurements show that the new sanders rate about 88 decibels (10 dB lower than a previous Porter-Cable model), low enough that you can use the sander without ear protection, according to OSHA guidelines. The sanders are available in 3 by 24-in. and 4 by 24-in. sizes and come configured with or without dust collection and variable speed. Street prices range from \$224 to \$265. Porter-Cable Corp., (800) 487-8665. **Circle #606**

Improved Miter Gauge

The Osborne Miter Guide represents a new approach to aftermarket miter-gauge design. An adjustable extension arm supports the outer end of the fence, forming a large triangle that's more solid and stable than protractor-type guides. You set an angle by adjusting the telescoping arm, while index marks and crisp detents ensure accuracy. An abrasive face on the fence prevents work from shifting, and it's easy to set up the guide for use in either miter slot. (Price: about \$130) The Osborne Manufacturing Co., (717) 368-1493. **Circle #607**



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Clamps From Garrett Wade

These are German made with the expected high quality design and workmanship – and at less than \$4.50 each, they are a phenomenal value.

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Stainless Steel

CIRCLE NO. 82 ON PRODUCT INFORMATION FORM

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- Equipped with a rugged, dependable 1 1/2 HP, single phase, AMERICAN MADE MOTOR.
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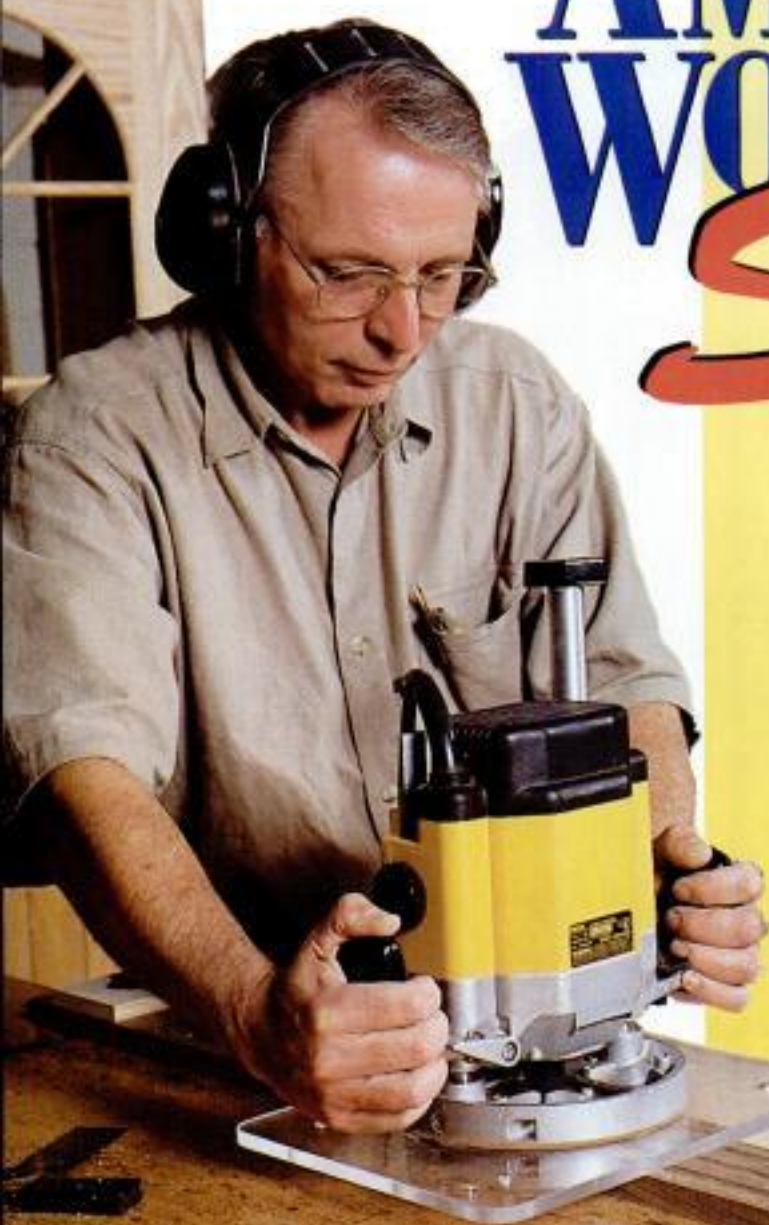
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Saturday 8:30am-10:30am

Ernie Conover

In this seminar, you'll learn how to:

- Select the right router for your needs •Choose and use router bits •Perform router table operations and joinery •Rout safely and efficiently •Work with router fences and dovetail jigs •Use template guide bushings

Who should attend: Beginning to intermediate woodworkers

About the presenter: Ernie Conover has been a woodworking teacher and demonstrator for 20 years. He and his wife Susan run Conover Workshops, a woodworking school in Parkman, OH.

GETTING THE MOST FROM YOUR TABLESAW

Friday 1:00pm-3:00pm
Saturday 4:00pm-6:00pm

Mark Duginske

In this seminar, you'll learn how to:

- Use the tablesaw for joinery—tenons, finger joints, variably-spaced dovetails •Make and use tablesaw jigs and fixtures •Work safely with the tablesaw •Align and troubleshoot your tablesaw for top performance •Choose the right blade for the job •Use dado heads and molding heads

Who should attend: All woodworkers

About the presenter: A fourth-generation Wisconsin woodworker, Mark Duginske is a prolific writer, designer and inventor. His work has appeared in numerous magazines and books, including *Cutting Shapes and Profiles* (Rodale Press, 1997).

SHARPENING SECRETS

Friday 4:00pm-6:00pm
Saturday 8:30am-10:30am

Leonard Lee

In this seminar, you'll learn how to: •Sharpen chisels and plane blades •Sharpen cabinet scrapers •Sharpen carving and turning gouges •Check an edge for sharpness •Choose the right grindstones, bench stones, microabrasives and polishing compounds

Who should attend: All woodworkers

About the presenter: Author of books and magazine articles on planemaking and sharpening, Leonard Lee has been a woodworker for over 35 years. He is president of Veritas Tools Ltd. and Lee Valley Tools.

DESIGN AND BUILD GREAT FURNITURE

Friday 4:00pm-6:00pm
Saturday 1:00pm-3:00pm

Ian Kirby

In this seminar, you'll learn how to: •Design and make joints—butt joints, mortise and tenon, dovetail •Make the best design decisions •Design to accommodate wood movement •Choose adhesives and clamping methods •Design with alternate surface treatments—veneer and leather •Integrate the key design elements—form, space, proportion and function

Who should attend: All woodworkers

About the presenter: Trained in England as a furniture maker, designer and wood technologist, Ian Kirby has taught and written extensively on woodworking in the United States and England for over 30 years.

FEARLESS FINISHING

Friday 8:30am-10:30am
Saturday 4:00pm-6:00pm

Michael Dresdner

In this seminar, you'll learn how to: •Select the best finish for the job •Get a professional-looking finish on your project—from surface preparation to final polish •Choose the right brush •Understand wood stains and use them correctly

Who should attend: All woodworkers

About the presenter: A contributing editor of *AMERICAN WOODWORKER* magazine, Michael Dresdner writes our "Just Finishing" column and hosts our finishing "chat room" on the America Online computer service every Sunday night. He is the author of *The Woodfinishing Book* (Taunton Press, 1993).

SETTING UP SHOP

Friday 8:30am-10:30am
Saturday 1:00pm-3:00pm

Sandor Nagyszalanczy

In this seminar, you'll learn how to:

- Decide which tools to buy, in which order •Buy the right quality tools and equipment •Stretch your tool budget •Lay out your shop for best results •Make the most efficient use of space •Get dust and chips under control

Who should attend: Beginning to intermediate woodworkers

About the presenter: Furniture designer and author of four books, with 18 years of woodworking experience and six years as an editor of *Fine Woodworking* magazine, Sandor Nagyszalanczy writes and lectures frequently on woodworking topics.

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1. To enter, obtain, complete and deposit an official entry form at The American Woodworker Show™ in Novi, MI, Fort Washington, PA or Ontario, CA; or print your full name, address, and daytime telephone number on a 3" x 5" piece of paper, place in a stamped envelope and mail to: The American Woodworker Dodge Truck Giveaway, 33 East Minor Street, Emmaus, PA 18098; or visit us on the internet at www.americanwoodworkershow.com and follow the instructions there.
2. Limit one entry per person. All entries must be deposited or postmarked by the Sweepstakes ending date of March 20, 1998. Mailed entries must be received no later than March 20, 1998. Mechanically reproduced, damaged, lost, late, postage due, misdirected, incomplete, or illegible entries are not eligible. All entrants agree to be bound by the official rules and the decisions of the judges.

3. Winner selected by random drawing from eligible entries on or about March 23, 1998. Odds of winning depend on the number of entries. Winner will be notified by phone and/or mail. Winner will be required to sign and return an Affidavit of Eligibility and Release within 14 days of receipt of notification. Noncompliance or return of any prize notification as undeliverable, will result in the disqualification of the entry and selection of an alternate winner. The winner must consent to the use of his or her name and/or likeness for promotional purposes without additional compensation, except where prohibited by law.

4. Grand Prize: One 1998 Dodge Ram 1500 Laramie SLT 135" WB truck with an estimated MSRP value based on 1997 pricing of \$23,270 (including destination) or less, to be delivered to the authorized Dodge dealer nearest the winner's residence in the United States. (If the winner is from Massachusetts, New York or California, add \$102 to the MSRP for a state-mandated emissions package.) No transfer or substitution of prize is permitted except by sponsor due to prize unavailability. All taxes, insurance, licensing and other associated fees are the responsibility of the winner.

5. Sweepstakes open to legal residents of the 50 United States, only, who, as of March 23, 1998, are 18 years or older. Winners must reside in the United States at time of prize delivery. Employees (and members of their immediate families) of Rodale Press, Inc., the Chrysler Corporation, their subsidiaries and dealers are not eligible. The winner agrees to hold harmless the Chrysler Corporation and Rodale Press, Inc., and each of their respective affiliates, officers, directors, employees, representatives, agents, successors and assigns from any and all loss, liability, damage, cost and expense arising out of the Giveaway, void where prohibited, and subject to all federal, state and local laws.

6. For the prize winner's name, available after April 30, 1998, send a self-addressed, stamped envelope to The American Woodworker Show™, Show Management Division, 33 East Minor Street, Emmaus, PA, 18098. Requests received after May 15, 1998, will not be honored.

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10" x 60 Tooth	\$129	\$116	\$103
12" x 60 Tooth	\$149	\$125	\$111

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12" x 80 T (1" hole, 1/8" K)	\$189		

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10" x 80 T	\$129	\$116	\$103
12" x 80 T	\$139	\$125	\$111

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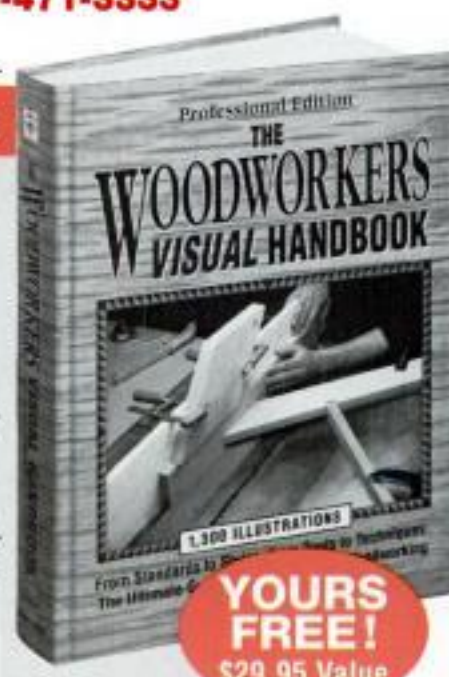
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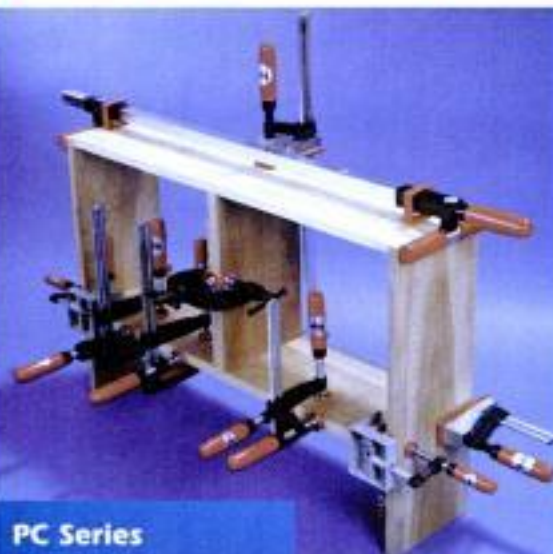
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Excellence Award Finalists

A dazzling variety of woodworking achievement came our way with the sixth annual Excellence in Craftsmanship® competition. Nipping at the heels of the winning entries (see page 72) were dozens of exceptional projects. Here's a sampling from our box of finalists.



▲ **Fifteenth-century cathedral clock** by C.I. Greenwood, Springfield, IL. Amateur. Red oak. 4 W. x 24 D. x 72 H. (including stand).

PHOTO BY STEVE RICHE



▲ **Cherry rocking chair** by Richard C. Miller. Student—Palomar College, San Marcos, CA. 27 W. x 42 D. x 41 H.

PHOTO BY DAVID HARRISON

Cherry highboy ▶ with coopered interior by Valerie Rogers Muise. Student—North Bennet St. School, Boston, MA. Secondary woods: maple, poplar and pine; drawers veneered with madrone burl. 37 W. x 88 H. x 19 D.

PHOTO BY LANCE PATTERSON



Call for entries! The deadline for 1998's Excellence in Craftsmanship® Competition is June 5, 1998. Entry blanks will be provided in our next issue (AW #64, February 1998). Don't miss this opportunity to show off your best work and win an award.



▲ **"Dolphin" custom-made sports car** (120 mph top speed) by Peter Portugal, Eureka, CA. Professional. Redwood strip exterior; oak frame members; trim made from walnut, quilted maple, mahogany, brass and bronze; wicker seats.

PHOTO BY PETER PORTUGAL



◀ **Chippendale card table** by Michael Dolbow. Student—North Bennet St. School, Boston, MA. Primary woods: mahogany and mahogany veneer. Secondary woods: maple, poplar, cedar. 35 W. x 17 D. x 29 H.

PHOTO BY LANCE PATTERSON



◀ **Cedar waxwing cabinet** by Craig Vandall Stevens, Sunbury, OH. Professional. Hickory legs, handsawn maple veneer over birch plywood. Marquetry woods: juniper, poplar, ebony, kwila, Pacific yew, satinwood, bloodwood. 28½ W. x 27 H. x 16 D.

PHOTO BY STEPHEN WEBSTER



◀ **Carved six-string electric guitar** by G. Stewart Lenox, Akron, OH. Amateur. Mahogany body, rosewood fretboard, recycled ivory inlay. 10½ W. x 34 H.

PHOTOS BY JIM MARTIN



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In Favor of the Inch

by J.R. Beall

Not long ago, while at a woodworking show, I overheard a great guru of contemporary woodworking lambasting the English system of measurement. He railed against the idiocy of dealing with fractions, and against the strange and senseless units of measurement this system employs. I held my tongue, as is my custom, but have since thought about his comments and now feel obliged to advance an argument in favor of the much-maligned inch.

Long, long ago, in my wild and reckless youth, I too was a champion of the metric cause. And it still seems reasonable that measures of volume and weight could be simplified by adherence to that system. When it comes to the centimeter, however, I must depart from conventional wisdom and declare the inch to be the superior unit.

To start with, the centimeter is simply too short. It can only be divided into ten easily visible increments, or twenty barely visible ones—and twentieths, or half-millimeters, are as fine as any metric measuring device shows. The inch can be divided into sixteenths, which are quite easily seen, and into thirty-seconds, which are bigger than half-millimeters. I won't even deal with sixty-fourths, which are too fine for my "mature" vision but which do appear on most good measuring devices.

All measuring systems are based on arbitrary standards. The meter is one ten-millionth of the length of a quadrant of the meridian. And the standard, which is nearly that, is kept in Paris. The foot is, as one would imagine, based on the average length of a human

foot and seems to me to be somewhat more user-friendly.

The fact that the metric system is based on 10, or decimals, is what its defenders find most attractive. And they are correct: In most cases, decimals are easy to manipulate. But in the woodworking world, decimals present a big problem.

The most common calculation in woodworking is division by two. We always need to find the center of a rail, a stile or an edge. The common foot with its 12 inches can be divided by two into

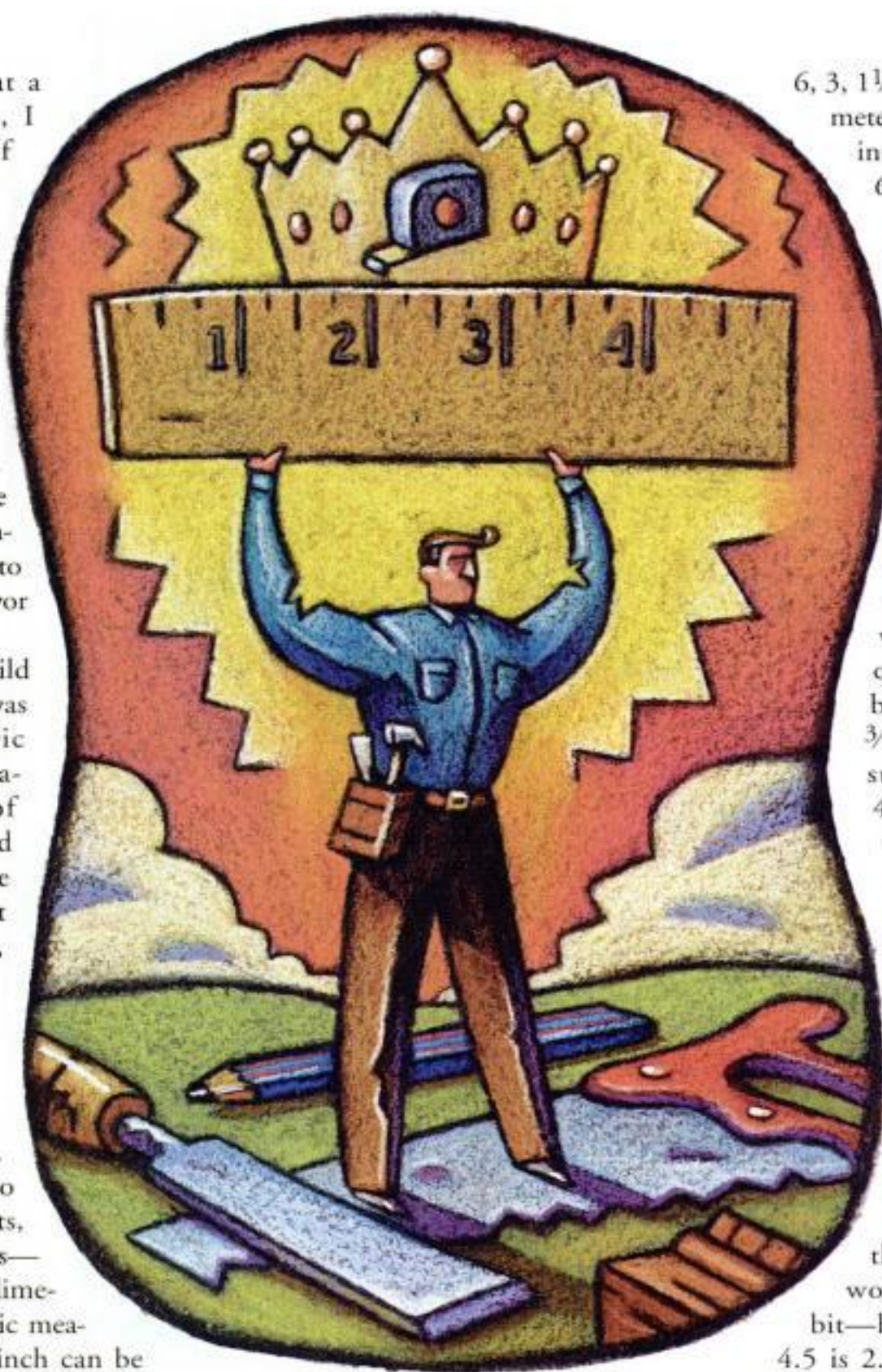
6, 3, $1\frac{1}{2}$, $\frac{3}{4}$, $\frac{3}{8}$, $\frac{3}{16}$, $\frac{3}{32}$, $\frac{3}{64}$. The meter, meanwhile, divides by two into 50 cm, 25 cm, 12.5 cm, 6.25 cm, 3.125 cm—and this is where the metric scale runs out of increments, because there are no marks finer than 0.5 mm. So, the foot can be halved eight times, while the much longer meter can only be halved four times.

Let's suppose you have a $\frac{3}{4}$ -in. board. You want to lay out a tenon whose thickness is half the board's, with each shoulder one-quarter the thickness of the board. Instead of $\frac{3}{16}$ - $\frac{3}{8}$ - $\frac{3}{16}$ in., you'd need to measure 4.75 mm - 9.5 mm - 4.75 mm. Bear in mind that 0.75 mm does not appear on a metric scale—you have to interpolate it. Any metric measurement with an uneven number will quickly pose problems for the woodworker.

If the metric system ruled, there is little doubt that lumber manufacturers would soon reduce standard lumber thickness to 18 mm, which would lessen the problem a bit—half of 9 is 4.5, and half of 4.5 is 2.25—but we would still be faced with those difficult decimals that extend beyond tenths.

Naturally, those who have grown up with the decimal system will be resistant to change—just as English-system users already are. I expect that the metric system will eventually become standard throughout the world. Still, I count my blessings for having learned my fractions. Woodworking would be more difficult without them. ▲

J.R. Beall is a professional woodworker and toolmaker in Ohio.



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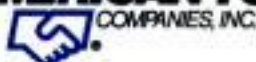
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