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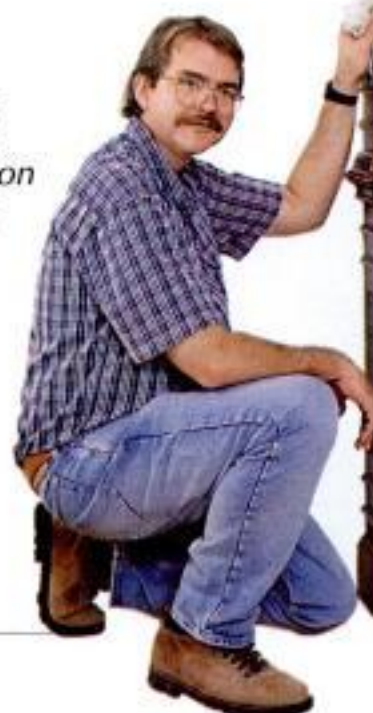
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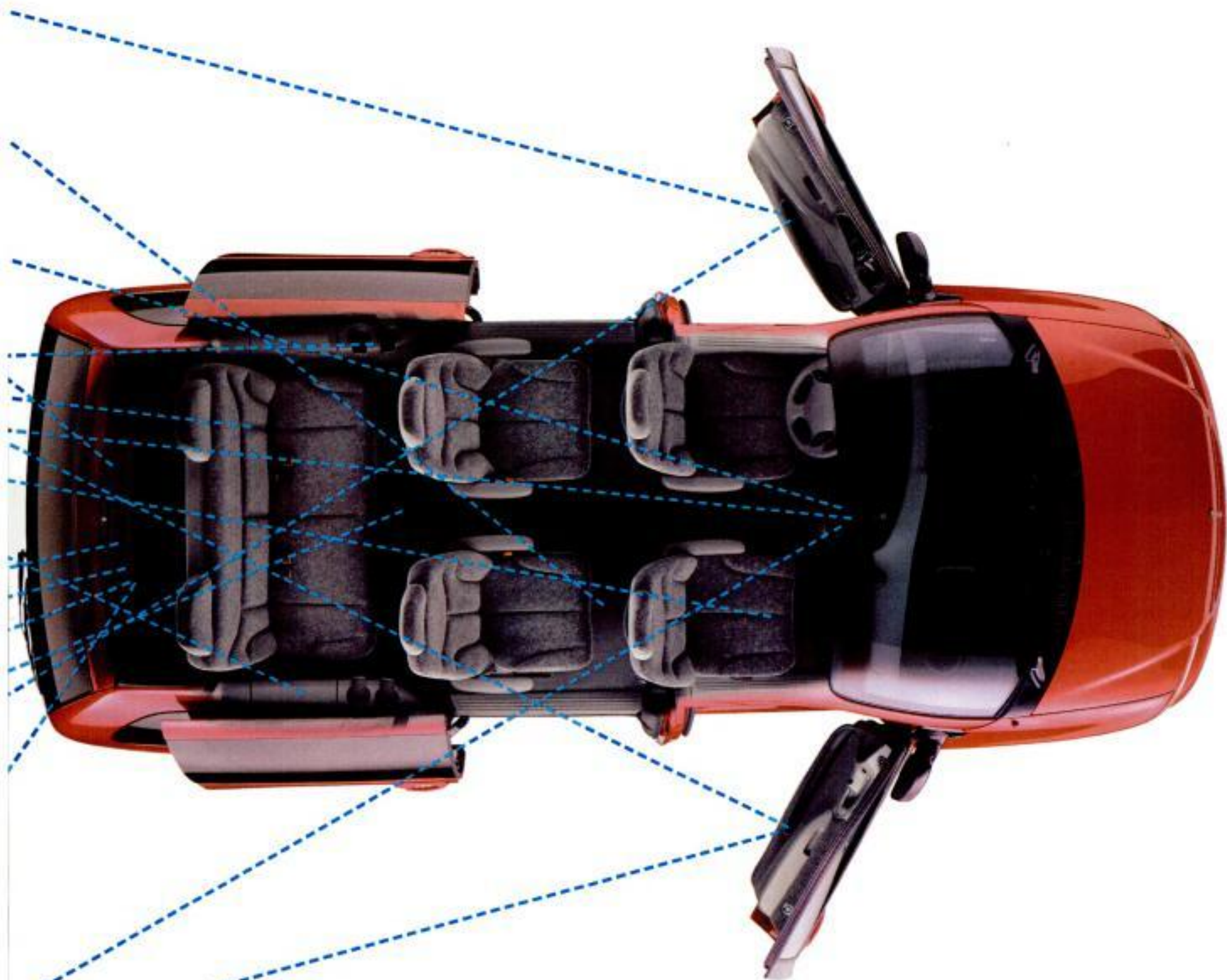
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Sculptural furniture

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Your needs as a woodworker are unique. At Freud, we understand your needs and can provide the quality and dependability you have come to expect. We also feel that safety is essential. Anyone who has been involved with woodworking has experienced saw blade kickbacks from overfeeding. These can be very dangerous and can happen so quickly that it is impossible to react before injury occurs. Freud's thin kerf series of saw blades have an anti-kickback design which reduces the effects of these kickbacks. Each tooth is preceded by a limiter which restricts tooth bite to the maximum safe amount. By incorporating all these features into one series of blades, Freud can offer a superior line of blades that will answer the needs of all woodworkers. Give our thin kerf series a try and see why "Thin Is In".

("Information courtesy of DuPont Teflon® Industrial Coatings")

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Go Ahead— Push the Envelope!

*Expand your woodworking repertoire
by trying something new*

Golfers want to drive the ball an extra 15 yards. Runners push to beat their fastest times. Mountain climbers are always looking for higher peaks.

What about woodworkers? We push the envelope too, and the envelope is big. There's always something new to try.

Consider "Coopering a Door," for example. (See page 48.) We were skeptical when Albuquerque-based Sven Hanson first described his low-tech method for making curved panels, but he responded in standard woodworker fashion: "Come down and visit and I'll show you how to do it." Sure enough, his technique proved to be sound as well as simple. And he showed me some beautiful furniture made with curved panels.

If you prefer pushing more traditional envelopes, check out Lonnie Bird's corner cupboard. (See page 62.) Its proportions and molding profiles are straight out of the 18th century, and

they're just as beautiful today as they were 200 years ago. If there's a better way to fill a living room corner, I haven't seen it yet.

We're overdue for a definition. *The American Heritage Dictionary of Idioms* says that to push the envelope is to "exceed the limits of what is normally done" and to "be innovative." That's what we want to do here at AMERICAN WOODWORKER. And we're fortunate to have readers who share our passion for improving the magazine. Our shop test of midsize plunge routers came about because we kept getting the same query over and over again: "If I can only have one router, what's the best model to buy?" For the answer, see the shop test that begins on page 34.

I hope you enjoy this issue and all of its ideas. Let me know how we can keep pushing the envelope for you. ▲

Tim Snyder
Executive editor



*The best rout.
We had to
make plenty
of sawdust to
evaluate the over-
all performances
of five midsize
plunge routers.
(See page 34.)*

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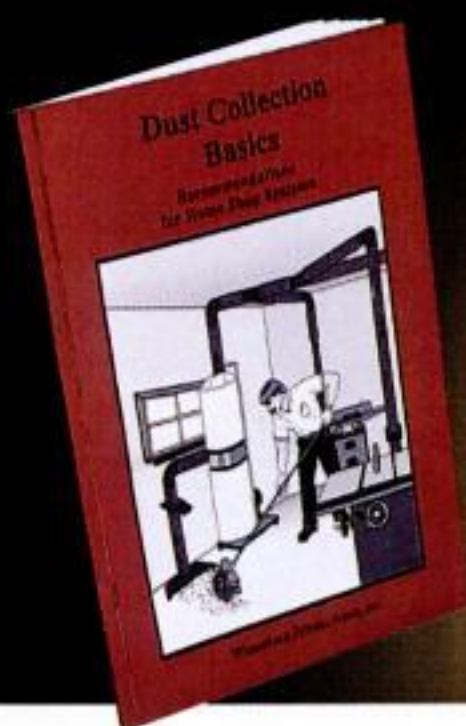
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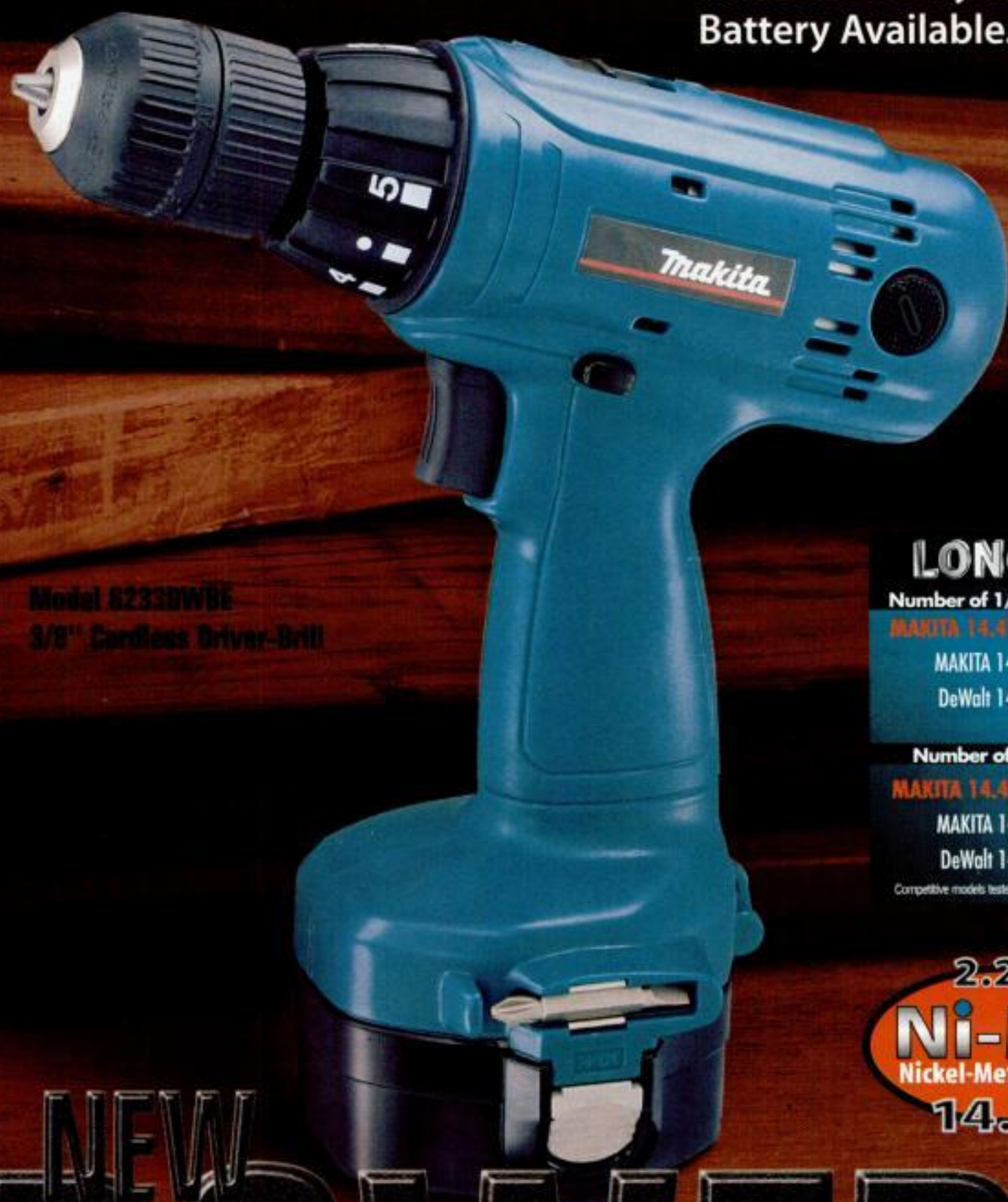
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Makita

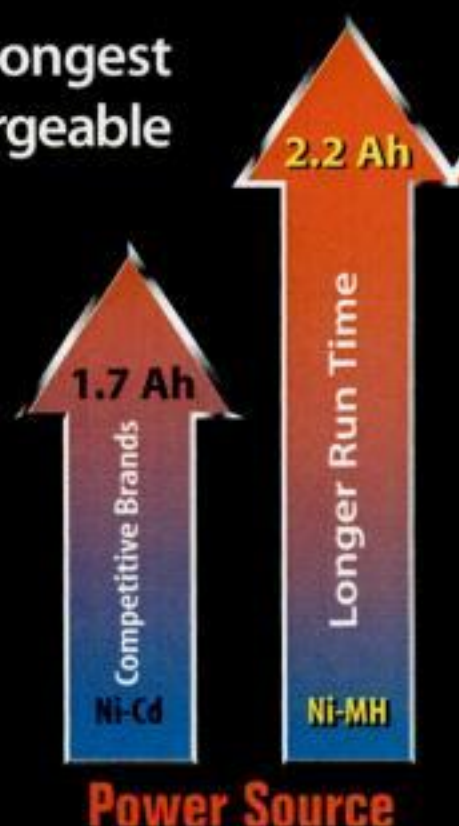
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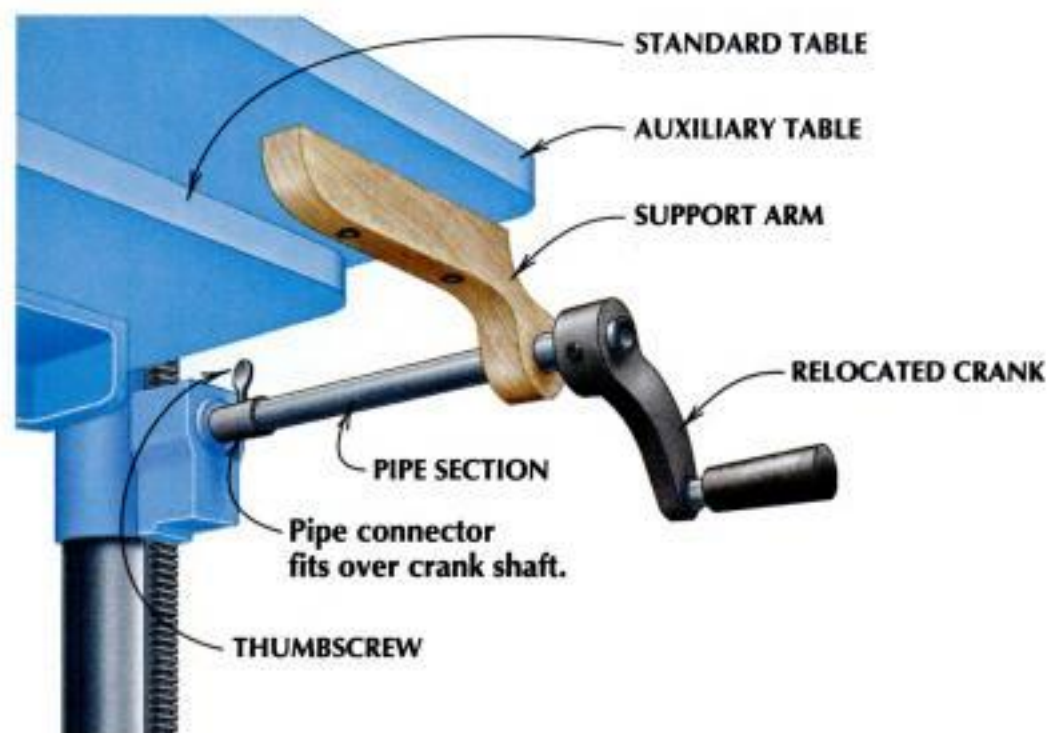
Upgrade for Drill Press Table

I recently built Craig Bentzley's drill press table. (See AW #61.) When I completed the table and attached it to my drill press, I found that there wasn't enough clearance for cranking the rack-and-pinion mechanism to raise and lower the table. If other readers have encountered this problem, they might find my solution helpful.

I cut out a hardwood support arm and screwed it to the underside of the table as shown in the drawing. A hole drilled in the arm supports a length of iron pipe that's large enough to fit over the crank shaft. A pipe connector fitting, tapped for a thumbscrew, enabled me to secure the pipe to the crank shaft. I attached the original crank handle to the end of the pipe. Drill the support arm's hole $\frac{1}{16}$ in. larger than the diameter of the pipe, and "line" the hole with a piece of adhesive-backed drawer guide tape, available from The Woodworker's Store (800-279-4441). This friction-fighting sleeve will make your modified crank work smoothly.

Hugh Springfield
Carrollton, TX

CRANK EXTENSION



Steamed or Sawn Curves?



I plan to make the sleigh bed featured in AW #64, but I'd like to try steam bending the curved slats instead of bandsawing them. Can you recommend steam bending in this kind of project? Why did the author bandsaw them?

Steve McCallum

Randy Sorenson replies: I tried steam bending the slats when I first started making the sleigh bed. I found that each slat wants to bend into its own slightly different shape after being unclamped from its form. It's almost impossible to get the curves uniform. When I lined my steam-bent slats up close together in the headboard and footboard, I could see the discrepancies right away. It's much easier to make the slats uniform by bandsawing them to their final shape.

More on Veneer Repair

Sal Marino nearly got it right in his article on veneer repair in AW #64 when he said that a diamond-shaped patch is best and that it should be oriented at 45° to the grain. It is the best shape, but you will find your repairs much less noticeable if you orient the patch with

two sides parallel to the grain. With careful choice of repair materials and a good fit, these two joints disappear, leaving only two visible angled cuts across the grain, not four.

Mark Shoalts
Fenwick, Ontario

Webbed Feat!

Terrific! I'm glad you finally got on the World Wide Web! This helps enhance the value of my magazine subscription.

Gary Huff
Amarillo, Texas

I currently subscribe to your wonderful magazine. But this is the first time I've found AW online. I'm VERY impressed. I've been surfing the other online woodworking sites and I find yours superior. I have only one complaint: What took so long? I'll be a frequent visitor. Thanks, and keep up the good work.

Pete Kaup
Bixby, OK

Topping Whitley's Workbench



I liked the master's workbench featured in your April issue, and am planning to build one. I have easy access to the oak and poplar men-

tioned in the article. But the hard maple Whitley suggests using for the top is going to cost me a mint. Do you have suggestions for other types of wood?

Tony McKimmy

Robert Whitley replies: In terms of domestic hardwoods, you won't find a comparable substitute for hard maple when it comes to workbench tops. My second choice would probably be birch. Cherry and walnut are too soft. I don't like oak benchtops either. With heavy use, oak's open grain tends to generate splinters. If you must use oak for economic reasons, I'd suggest giving your benchtop several coats of varnish for abrasion resistance.

Your article on Robert Whitley's workbench is illustrated beautifully, and it contained some really great ideas for me. But where did he get those tools? Spectacular! And that bank of drawers. And that workmanship. And that knife press in his pants and shined shoes. Impressive! Thank goodness for those few pieces of wood on the floor in his wood shed. He's not perfect; I feel better.

Tom Wendell
Afton, MN

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Stop Abusing Hand Tools!



As a member of that small fraternity of hand-tool aficionados, I was heartened to receive the latest issue of AW (April 1998). Between the covers I found articles on hide glue and marking gauges, plans for a nice "traditional" bench (with a wall full of beautiful tools behind it), and even plans for a Shaker clock showing mostly traditional techniques!

Unfortunately, my joy was tempered by the Tech Tip offered by Mr. Ray Hannula suggesting that a perfectly good hand plane could be improved by drilling holes in its cast-iron body. Mr. Hannula should be told about jointer fences like the Stanley 386. Or at least he should design a fence that can be clamped to the plane, instead of subjecting it to the abuse he suggests.

A few months ago you published a tip that suggested sawing off the ends of auger bits, and now this. I know that most woodworkers consider the use and care of hand tools to be too archaic for them, but they should at least allow these tools some dignity and/or pass them to those who will. And as for me, if you continue to print suggestions that cause the destruction or mutilation of good, old tools, I will have to either cancel my subscription or start submitting a few "tips" of my own (starting with "Tablesaws Make Excellent Boat Anchors"). I can then use the \$50 you pay me to rescue another hand tool from these habitual abusers.

Dennis Heyza

Are you seriously suggesting that I drill holes in my plane to mount a fence? Very, very bad idea. Decent planes are becoming rare and valuable, and to deface one in such a manner would be irresponsible at best. Your grandchild will someday find that plane and say "Awww, Pops! Why'd you do THAT?"

Better to write an article on how to make a truing plane and leave the old-timers in one piece.

Jim Lemon
Panorama City, CA



As an old-tool user, I would like to register my complaint with your magazine for publishing the "tip" about drilling holes in woodworking tools so that one can plane a true edge. First of all, readers should practice their technique so that they can use the tools the correct way. If that's too difficult, perhaps a "shooting board" would be useful; it works perfectly for me! Secondly, most plane manufacturers produced fences to use when jointing boards. These fences are readily available through old-tool dealers around the country.

Older hand tools are in most cases better made and better at doing their intended job than their modern equivalents. Please try to teach your readers to preserve these tools for future generations rather than abuse them and lessen their value as usable artifacts. Those of us who enjoy woodworking with these tools will thank you many times over.

Wesley Groot

The Virtue of Working by Hand

After reading Yeung Chan's article on making a bowsaw (AW #63), I decided to make one with hand tools only. I cut down my stock with a hand rip saw and used a pushknife to get it close to final size. Then I planed the wood flat. I love it! My chisels are a joy to use. I get to know my wood. It's almost as if I'm gaining a friend. The tools and wood become very close to you, without the impersonal roar of electric tools. Please give Yeung Chan my heartfelt thanks for his article.

David Quinton
San Diego, CA

Don't Neglect Safety

I almost never see a safety article in a wood magazine. Your "Preventing Tablesaw Accidents" (AW #64) was really great. I wish I had read it five years ago, before I cut into my thumb and index finger. Yes, it was kickback, and yes, it was my fault.

W.R. Jordan
Beeville, TX

I am a new subscriber and wish to commend you for the excellent article on tablesaw safety. I would be willing to bet that some people will complain that you have no business reporting such gruesome accident details in a woodworking magazine. But I'm happy to know that I am subscribing to a magazine whose staff is willing to tell it like it is.

Nelson McAfee
Summerfield, FL

Encores, Not Offcuts

A comment on your editorial in issue #64: I also accumulate a lot of "scrap" wood, and I don't care for the name "offcuts" either. I call them "encores"—good enough and pleasing to use again. I encourage my customers to use this word. Pieces made from encores are by no means second class.

Nora Ann R. Drogi
Alden, NY

Mysterious Reversed Numbers

There is a wonderful lead-off picture of Lonnie Bird using a cutting list in your last issue (AW #66). But the numbers on his chisel rack are backward. It looks like you reversed the picture to improve the layout. I enjoy your magazine; please keep up your good work.

Steve Furchak
Eagle, ID

We're guilty as charged.—Eds.

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A Rough Ride on the Lathe

Q I've tried several times to rough some lodgepole pine on my 12-in. floor-model lathe, and each time the lathe has nearly flipped over from vibration. The logs are always smaller than 8 in., and my lowest speed setting is 500 rpm. How can I stop the vibration?

James St. Clair
Colorado Springs, CO

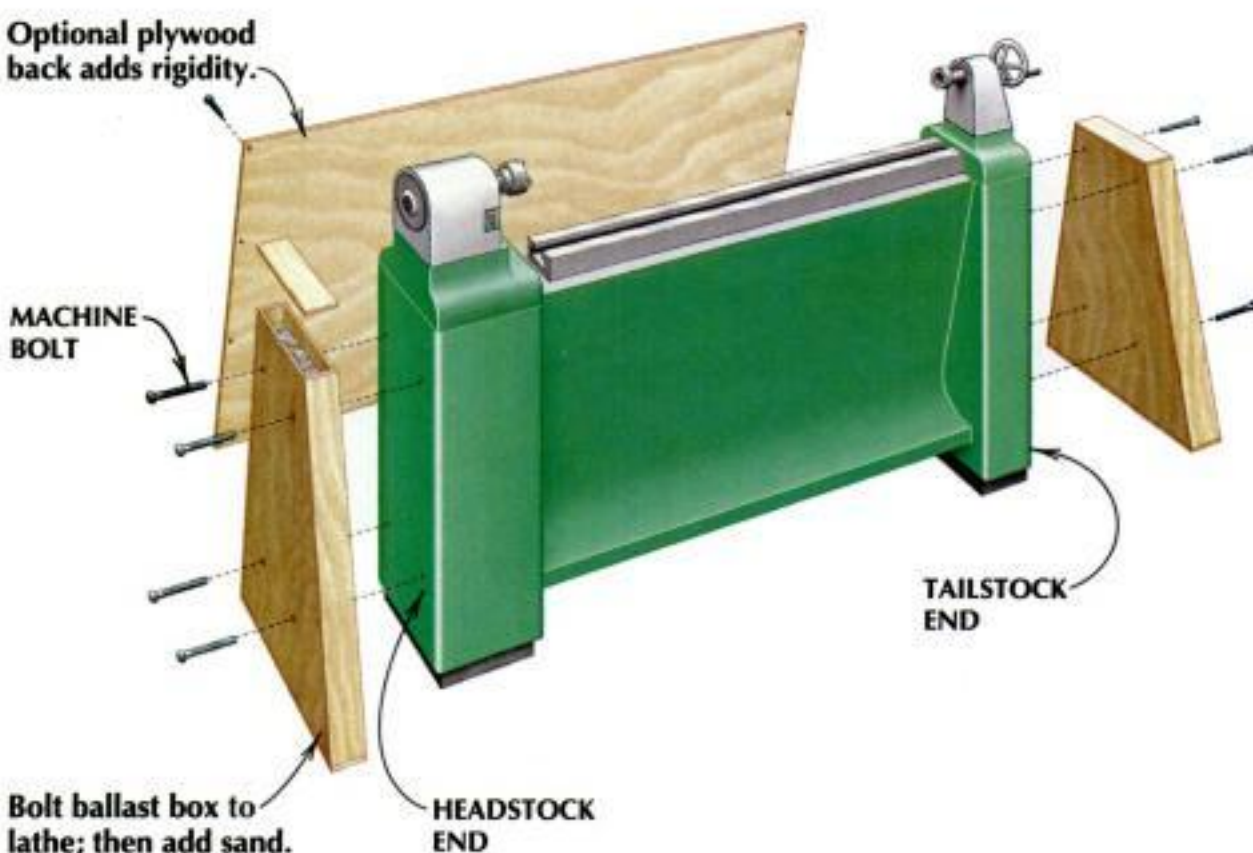
A There are generally three culprits contributing to lathe vibration: the design of the lathe cabinet, a high starting speed, and the material being turned. Look at your lathe from each end. On most lathes, there is little width in contact with the floor—the footprint is small. But there's lots of weight near the top of the lathe. Because of this, even a small, slightly unbalanced log will cause serious vibration.

To improve the design, add some "ballast" boxes on the headstock and tailstock ends of the cabinet. (See drawing.) Bolt one box to the headstock end of the cabinet, the other to the tailstock end, and if you need it, connect the two with a sheet of plywood on the back side of the lathe. To further reduce vibration, you can add vertical structural ribbing to the plywood back, or even make it into an enclosed box and fill it with sand.

As for speed, turning logs is exciting and challenging, but not at a blistering 500 rpm! 150 to 200 rpm is more like it, especially during the initial roughing cuts when the stock is unbalanced. To

ADD HEFT TO YOUR LATHE

Make each ballast box from $\frac{3}{4}$ -in. plywood. The top of each box should be as wide as the existing cabinet, and the sides should flare out to form a base that's 24 to 26 in. wide. A 3- to 4-in. thickness leaves plenty of room inside for sand.



reduce the minimum speed, you can install a "jack shaft" between the headstock and motor pulleys. Or for infinite variable speed, you can buy a $1\frac{1}{2}$ -HP motor with a direct-current (DC) controller (available from Woodco Products, 5507 55th Ave. S., Seattle, WA 98118, 206-723-8487).

A last caution: Resist the temptation to bolt the lathe to the floor. While this

will stabilize the machine, it can also put unnecessary stress on the headstock bearings and could eventually crack the cast-iron bed casting. But if you must bolt it down, level with shims as you tighten bolts to be sure the bed is not under stress.

David Ellsworth
Woodturner
Quakertown, PA

Using Router Bits in a Shaper...

Q Can I run my $\frac{1}{2}$ -in.-shank router bits in my $\frac{1}{2}$ -in.-arbor shaper?

Michael Sorina
Oakland, CA

A It depends on the shaper. Some shaper manufacturers offer a router-bit collet as an accessory for their shapers. If your shaper has an arbor that allows you to change spindles, you can check with the manufacturer to see if they make this accessory.

It's important to note that a router typically runs at two to three times the rpm

of a shaper. To achieve a smooth cut when running a router bit in your shaper, you'll have to reduce the feed rate.

Lonnie Bird
Woodworking instructor and
AW contributor

...And Vice Versa

Q I want to run $\frac{1}{2}$ -in.-bore shaper cutters in my table-mounted, 3-HP router with a $\frac{1}{2}$ -in. arbor. My router has variable speed from 8,000 to 22,000 rpm. Is there any reason why I shouldn't do this?

Jesse Miller
Nepp, IN

A There are two good reasons why I wouldn't run shaper cutters on a router table: performance and safety.

You mention that your router has a 3-HP motor. But the mass of the motor matters too. A shaper, with its hefty motor, gives a very smooth cut in the 7,000 to 10,000 rpm range. To muster comparable moxie with its lighter-weight motor, a router would have to run at 20,000 to 25,000 rpm.

This speed difference raises a serious safety concern, especially as the diameter of the bit or cutter increases. Just as you should never run large router bits at high speeds, you should never run large

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shaper cutters at top router speeds. A shaper cutter's runout may be well within tolerances at 10,000 rpm, but when you double that speed, wobble increases, wreaking havoc with the router's tiny bearings. This can lead to cutter failure and a serious injury.

Even if you ran the router at 8,000 rpm, you wouldn't get the same performance as on an 8,000-rpm shaper. Shaper bits exert too much load on a router motor. I've occasionally mounted a small shaper cutter in the router table at our school's shop, and I can tell from the sound and feel of the router that it doesn't belong there. A shaper cutter is also hard on your router's collet and on its electrical circuitry.

If you're still determined to use a small shaper cutter in your router table, I highly recommend that you contact the router manufacturer first. They can give you more specific advice.

Bernie Maas
Professor of art
Edinboro University of Pennsylvania

What to Do with Worn-Out Batteries

Q My NiCad cordless drill batteries have finally given up the ghost. I know you're not supposed to throw them away with the regular trash, but what am I supposed to do to get rid of them now?

Scott Hughes
Madison, WI

A You're right that nickel-cadmium (NiCad) batteries shouldn't be put out in the regular trash. Whether they're incinerated or simply dumped at a landfill, the toxic cadmium they contain can be released into the air or can leach into the soil. Some retailers will accept NiCad batteries for recycling. To find a retailer near you, call the Rechargeable Battery Recycling Corp. at (800) 822-8837. Another option is to get in touch with your local hazardous-waste collection center.

Paul Anthony
AW Shop manager

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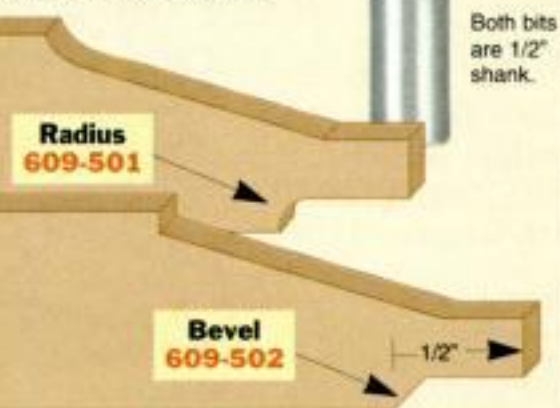
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When Wood and Dye Won't Mix

Q I wanted to improve the color of some bland-looking mahogany, so I bought some water-based dye stain. I prepared the stain exactly according to the manufacturer's directions, and applied it to some samples. Application went well, but when the dye dried I noticed tiny, light-colored lines running along the grain. Closer inspection revealed that the "lines" were large pores that had not been colored by the dye! Other than this, the dye job came out fine. What's wrong, and what can I do to prevent it next time?

Chris Hubner
Roanoke, VA

A Water-soluble dyes color with deep, even, fade-resistant clarity, but their weak spot is their high surface tension. Water's high surface tension can cause the dye to bridge over large pores in woods such as oak, ash, and mahogany, keeping the dye from hitting its mark.

Adding a wetting agent or surface-tension reducer to the dye helps. The best, most easy to find is propylene glycol, sold in cigar stores mixed 50/50 with water. (Cigar buffs use it to recharge humidors humidifiers.) Add about 1 ounce for each pint of dye solution.

Michael Dresdner
Industrial finishing consultant
and AW contributor

Rustic Spindles

Q We'd like to make rustic porch-rail spindles out of sticks with the bark still on. Do you know if there is any kind of wood that we can use, or any finish we can apply, to ensure that the bark doesn't come off, even when it's outdoors?

Noah D. Raber
Conewango Valley, NY

A The main reason bark falls off a log or stick is decay. The only way to preserve the bark on rustic work—indoor or outdoor—is to get the wood fresh cut and then dry it, before the decaying pro-

cess begins. Spindle-size wood will air-dry in a dry, ventilated place in three or four months. Solar and dehumidification kilns also do a good job of drying rustic wood and preventing the onset of decay.

After the wood dries, inspect it to see how tight the bark dried to the wood. If it looks good, install the spindles and finish them with a good sealer like outdoor urethane. Seal extra well areas where the bark is cut and the wood is exposed.

This process should take care of any wood you choose. The best wood for this is hickory. It has a very thick bark—actually an outer bark and an inner bark.

Dan Mack
Rustic furniture maker
Warwick, NY

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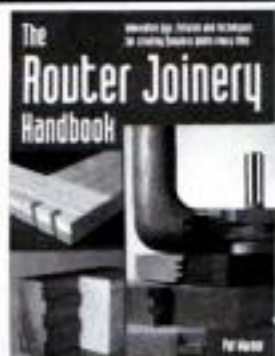
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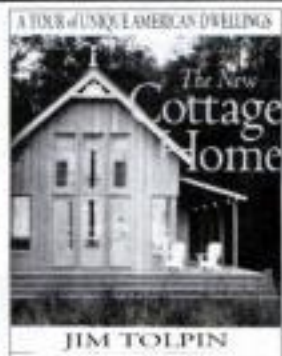
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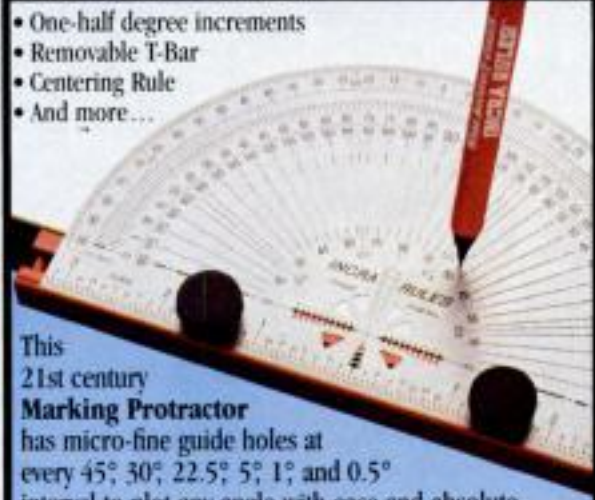
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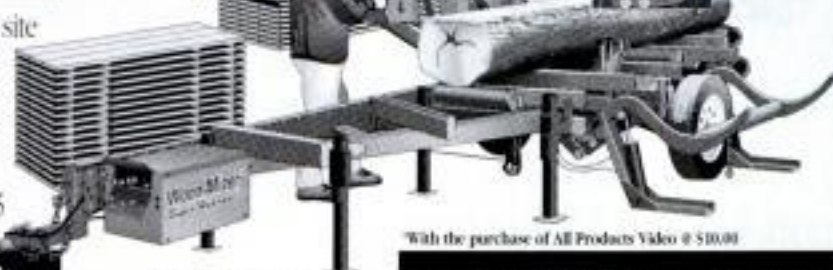
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—Edward Zych (TN)

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CIRCLE NO. 52 ON PRODUCT INFORMATION FORM

offcuts

Bits and pieces of woodworking news

Born-Again Jewelry Boxes

Buff Brown's one-of-a-kind jewelry boxes come with their own written history. He makes them out of salvaged wood and other discarded materials, documenting the "heritage" of each piece. For example, the description of his Ridge Avenue Box goes like this:

"Body made primarily of wood salvaged from the 1875 Ridge Avenue Farmers' Market food hall, located in North Philadelphia, with detailing taken from a Victorian screen door and a garden gate. Drawer made from pieces of a springhouse door, a picture frame, lamp parts, a garden gate, and material stripped off a junked chair. Lining taken from an old prom dress."

Brown preserves the salvaged wood's original finish, however worn. "Old paint, when it's wet-sanded with linseed oil and 600 grit and then burnished with fine steel wool, takes on an ivory or ceramic glaze-like quality," he says.



Box with a history. Buff Brown brings salvaged junk back to life as jewelry boxes. This one measures 9 x 9 x 10½ in.



On his feet again. CERF helped Bauermeister, shown here with his carved vessel, revive his woodworking business after a disaster.

CERF HELPS WHEN CRISIS HITS

Since it began in 1985, the Craft Emergency Relief Fund (CERF) has helped more than 200 craftspeople overcome natural disasters, serious illness, and other threats to their livelihood.

Michael Bauermeister, a custom woodworker near St. Louis, is one of CERF's grateful beneficiaries. He was recovering from an injury in 1993, when the Missouri River flooded and left 3½ ft. of water in his workshop. CERF gave him a no-interest, long-term loan to help him clean up and retool, and paid his booth fee at a national craft show.

September is CERF's fund-raising month. To learn more about CERF, call (802) 229-2306 or write to Cornelia Carey, CERF Director, Box 838, Montpelier, VT 05601, CERF@plainfield.bypass.com.

ARTS AND CRAFTS "BIBLE" ON CD

The most influential document of the Arts and Crafts movement in America was *The Craftsman* magazine, which was published each month between 1901 and 1916 by furniture maker Gustav Stickley. Now all 183 issues of *The Craftsman* are available as a 5-disc CD-ROM, for viewing on a PC or Macintosh computer.

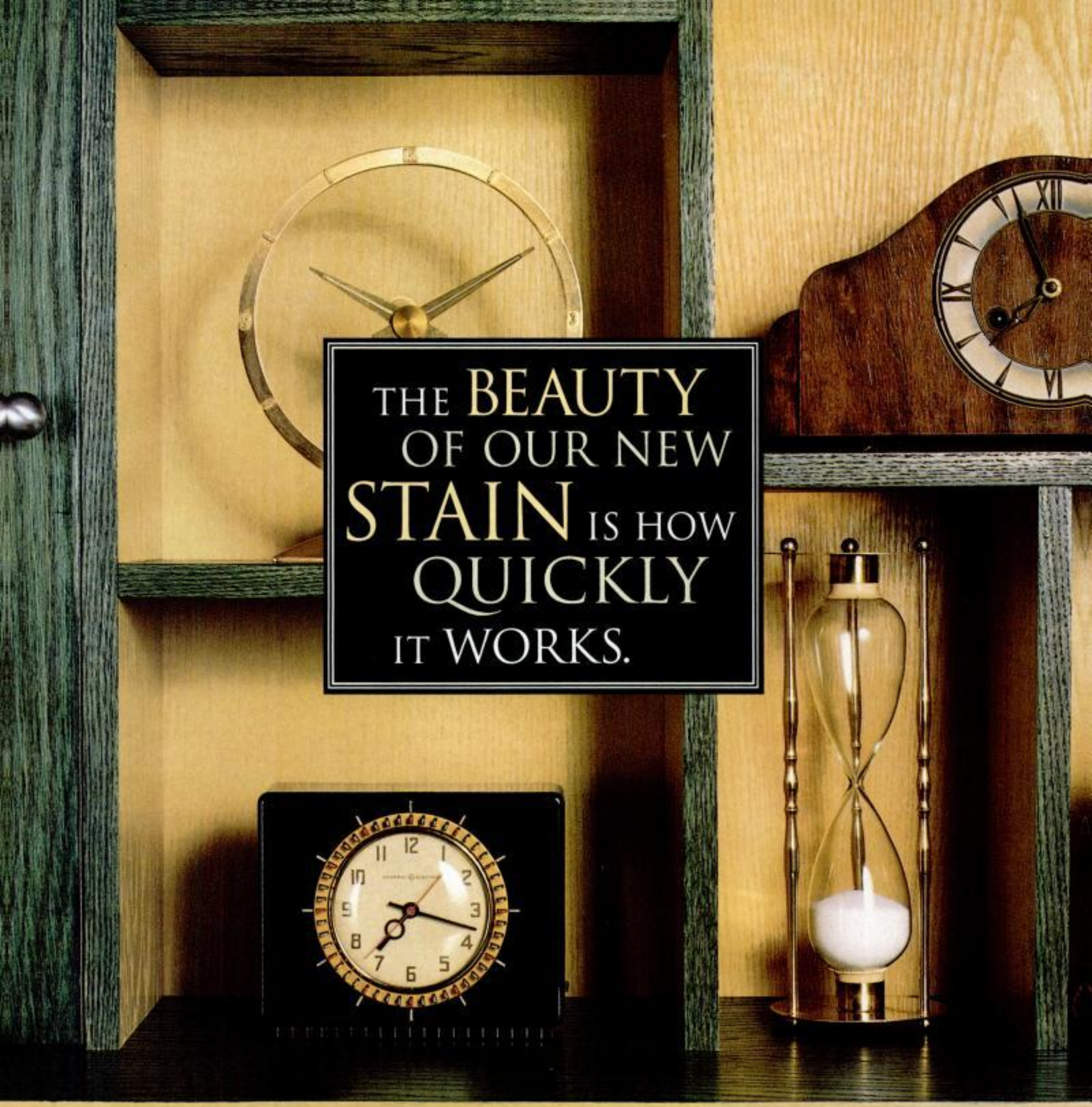
The Craftsman's essays, drawings, and photos strongly influenced furniture design, crafts, interior decoration, architecture, and landscape design of the day.

Along with the complete issue selection, you get a searchable text and a new index. The price is high—\$995—but originals are rare and expensive. A single issue recently sold for \$225. For more information contact Interactive Bureau (IAB), 251 Park Ave. South, 10th Floor, New York, NY 10010, (212) 292-1900. Or visit IAB's Web site: www.iab.com/news/craftsman.



Stickley goes digital.

All 183 monthly issues of *The Craftsman* are now available on CD-ROM. This cover is from May 1904.

A wooden cabinet with various clocks and an hourglass. The cabinet has a light-colored wood interior and a dark green wood exterior. There are three clocks: a round clock with a gold frame on the top left, a round clock with a dark wood frame on the top right, and a square clock with a black frame on the bottom left. An hourglass with a gold frame and a white candle inside is on the bottom right.

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offcuts

SOLAR-POWERED TURNER

In Australia's rugged outback, you won't find many electrical outlets, but there's plenty of sunshine. So Max Walburn, a 63-year-old retired electrical engineer, designed and built himself a sun-powered lathe. The solar spinner folds up and stores in Walburn's trailer home, allowing him to roam the outback, gathering wood billets and old fenceposts otherwise destined to be used for campfires. He turns them into bowls, needle

cases, and vases that he sells to supplement his retirement income.

Walburn uses two silicon solar panels to charge a heavy-duty, deep-cycle battery, which drives a 1/3-HP motor on the lathe. "I can work all day with this setup," says Walburn, "if I stay in the shade." His sharpening wheel is mounted atop the lathe. He doesn't need dust collection—the wind takes care of that.

—Eugene Dimitriadis

Going solar. Max Walburn can take his portable lathe anywhere the sun shines. It's powered by two 48-watt solar panels.

FACTOID

Uncle Sam's Land

About one third of all forestland in the United States is owned by the federal government.



RUNNING AUTOCAD 14 ON A MAC

Macintosh computer users can now run the latest version of AutoCAD, thanks to the availability of a powerful new PC expansion board for the Mac. The board costs about \$1,000, takes about ten minutes to install, and is available from Orange Micro (714-779-2772, www.orangemicro.com). The PC expansion board includes Windows 95, a 166-MHz processor, and 16 MB of RAM—and it's user-upgradable.

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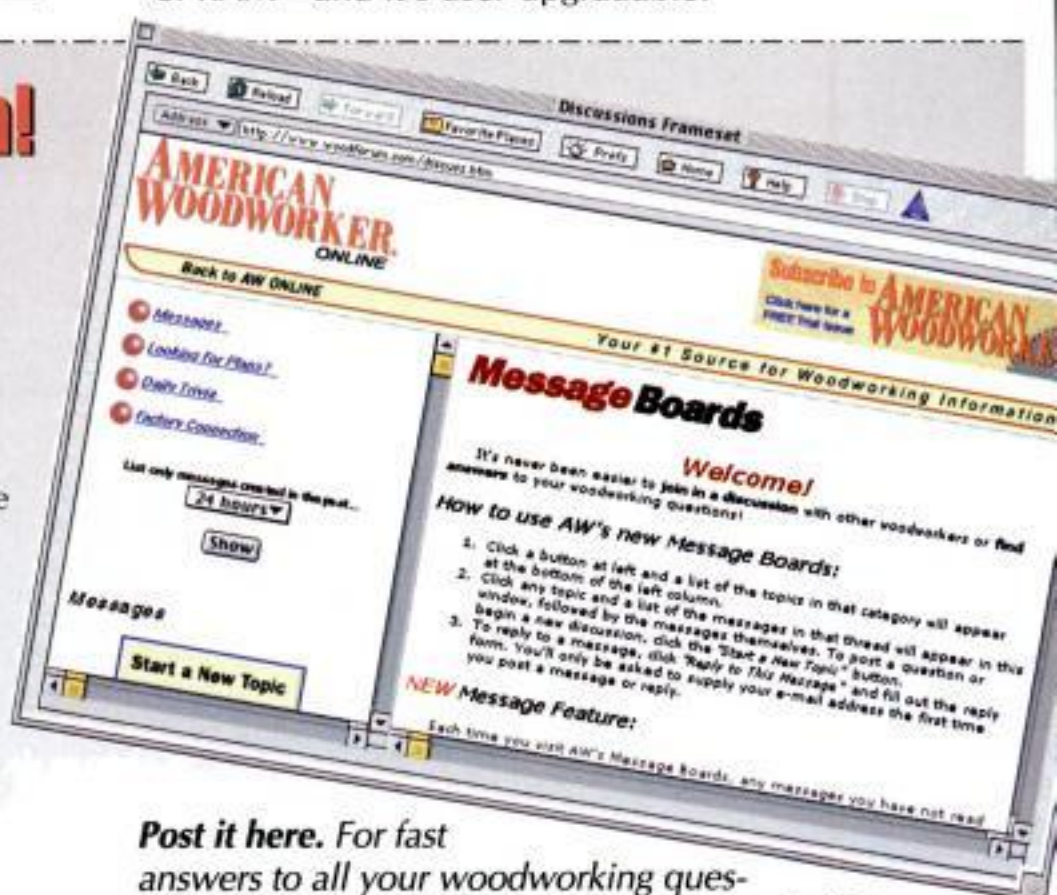
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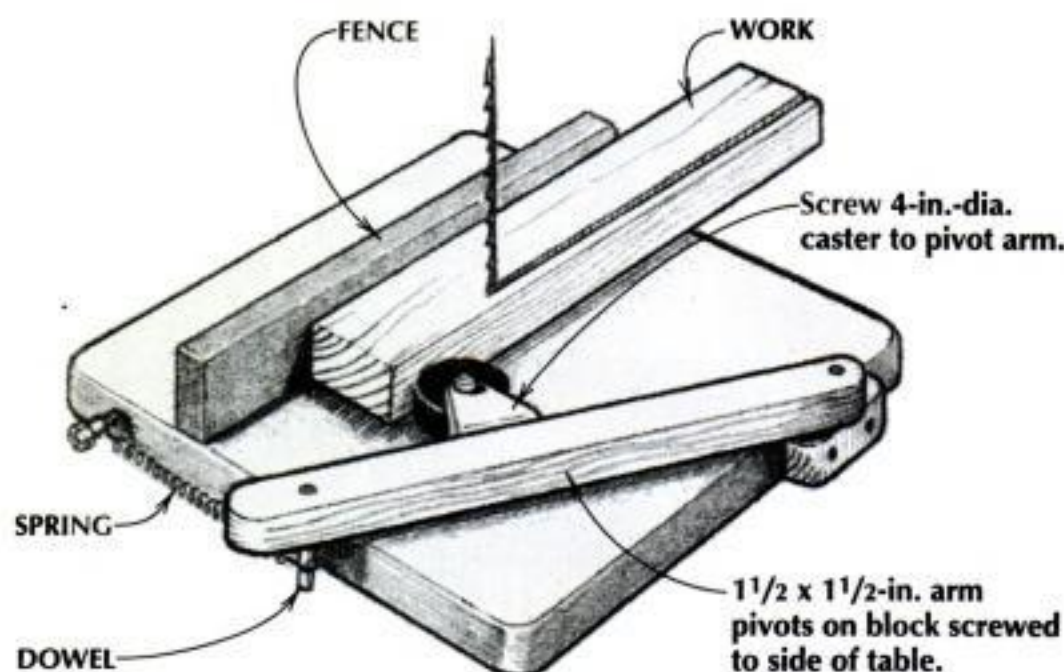


Resaw Feeder

Best tip of the issue

This simple, spring-loaded feeder is as good as a third hand when resawing stock on the bandsaw. Make the wooden arm and attach it to the bandsaw table with a spring as shown. If you can't get the right spring, substitute an appropriate length of bungee cord. Rigid casters with rubber wheels are available from MSC, (800) 645-7270.

Alan Bradstreet
Powell, ME



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.

Adjusting Plunge Routers

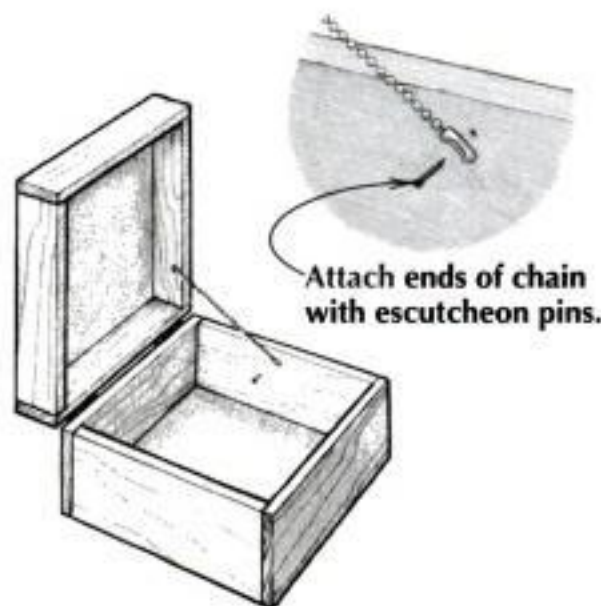
Adjusting the height of the bit with a table-mounted plunge router can be awkward if there's no adjusting post. My solution is simple: Remove the return springs and the beast is tamed! The springs are located in the base columns and it is a five-minute job to remove—or replace—them.

Charles Hont
Burnsville, MN

Lid Supports

I make a lot of small boxes with hinged lids and needed a simple, inexpensive lid support. My answer was the beaded brass chain sold at hardware and plumbing stores. I secure each end with a small brass escutcheon pin.

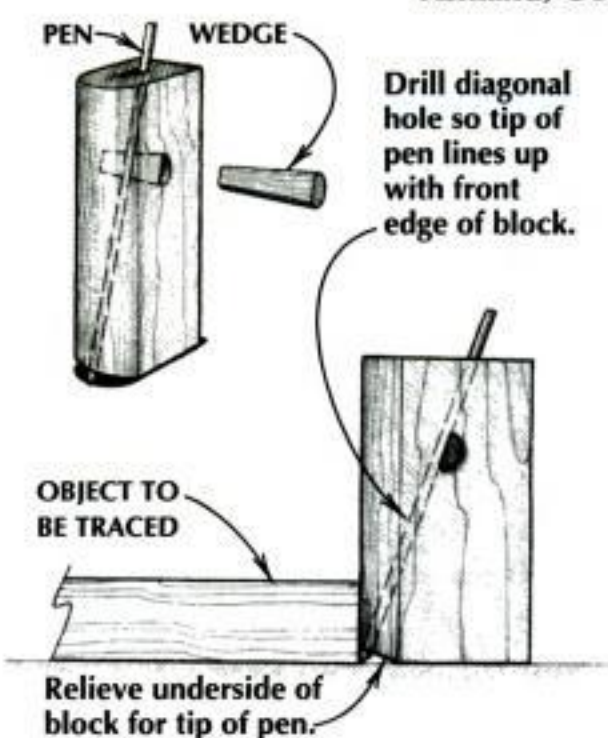
Alex Chalmers
Myrtle Beach, SC



Tracing Tool

I came up with this device for tracing around irregular objects—making a fitted case for a handgun, for example. If you need more clearance, build up the contact edge with a few layers of masking tape.

Jay Wallace
Ashland, OR



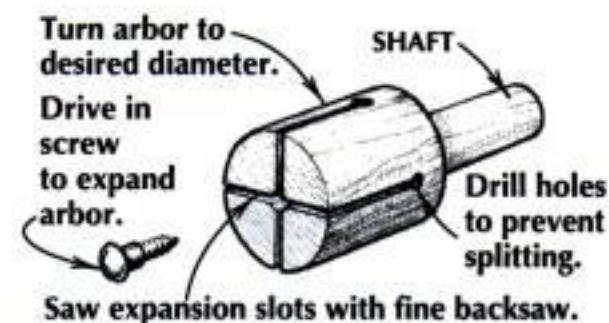
Leveling Chairs

A chair, table, or cabinet often wobbles because one leg is a fraction shorter than the others. I put the piece on the tablesaw or other flat surface, measure the exact distance the leg is short, and then trim half that amount from the two adjacent legs.

Yeung Chan
Millbrae, CA

Expanding Arbor

This simple, expanding arbor is ideal for turning small items such as napkin rings. You can either make an arbor for

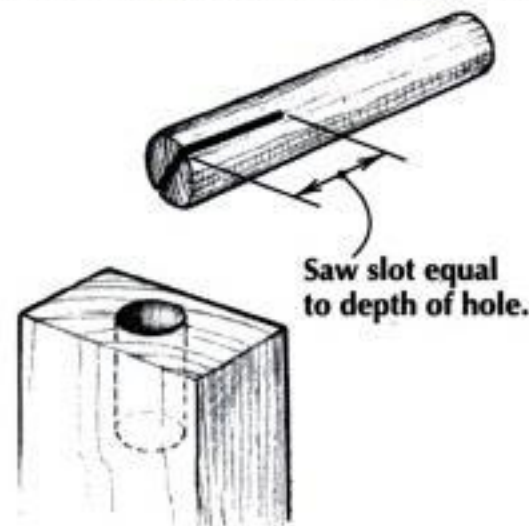


a specific job or turn a set of arbors with varying diameters. I prefer to use maple, but any hardwood resistant to splitting would do.

Robert Steele
Allegan, MI

Dowel Glue Spreader

To coat a dowel hole evenly with glue, cut a piece of dowel rod the same diameter as the hole. Sand it slightly under-



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size, then cut a slot in one end. Shoot glue in the hole, insert the slotted dowel, and twist.

Kelly Mehler
Berea, KY

Keyless Chucks Revisited

I admired Steve Laval's ingenuity (AW #61) in converting his standard drill to the keyless variety by wrapping tape around the chuck. Tape tends to unravel, so I used a donut-shaped rubber



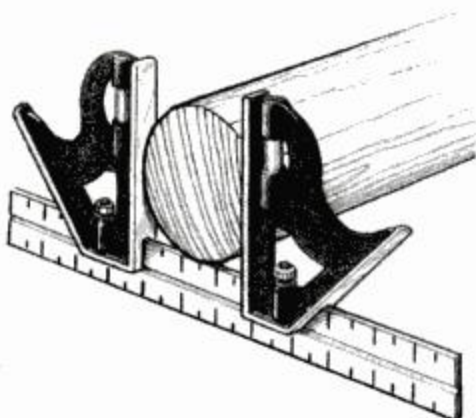
exhaust hanger available at auto supply stores for a couple of bucks. Choose a hanger with an internal diameter slightly smaller than your drill chuck and you're in business.

Clyde Carlson
New Orleans, LA

Head-to-Head Diameters

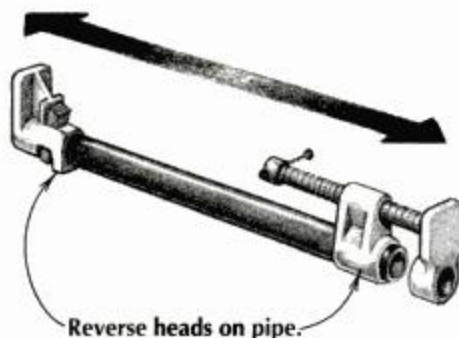
A quick, accurate method of measuring diameters is to use two sliding combination squares with both heads mounted on the same rule. Set one head exactly on an inch mark and read the diameter from the other head.

Mike Renner
Springfield, SD



Pipe Clamp Spreader

To disassemble a large project prior to gluing, I needed a clamp that worked in reverse. It struck me that some pipe



clamps can be made to spread joints apart as well as pull them together. This will only work with the type of clamp that has a sliding bar in the handle.

Patrick Daley
Tucson, AZ

Fold-Down Workbench

I prefer to garage my car during the New England winter, which leaves no room for a fixed workbench. My solution is a plywood work table, supported on legs, that folds down against the wall. I stiffened the edges with 2x4s, as shown, and attached another 2x4 to the



wall with lag bolts. The legs fold up under the bench and latch with hooks and screw eyes. I leave my tools on the wall and have only to dismount my Swiss Zyliss vise.

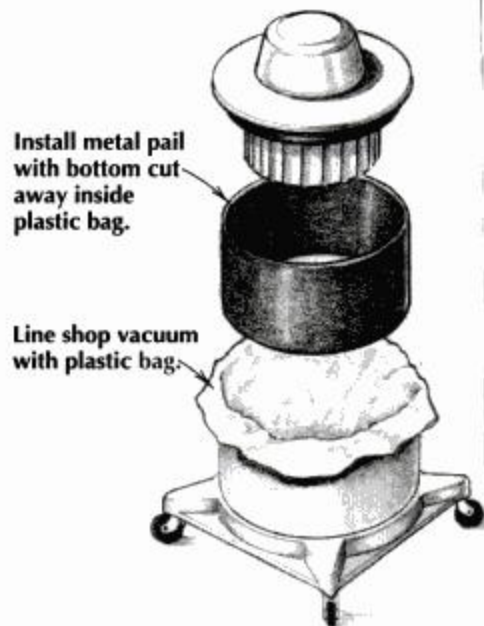
Francis Cozza
Marshfield, MA

Dust Fighter

Emptying my shop vacuum used to be a dusty business sure to aggravate my emphysema. I tried plastic bags, but

they just got sucked into the filter. Finally, I cut away the bottom from a metal pail and slipped the pail inside the bag. When the bag is full, I simply slide out the pail, then dump the bag—along with the dust—without it all becoming airborne.

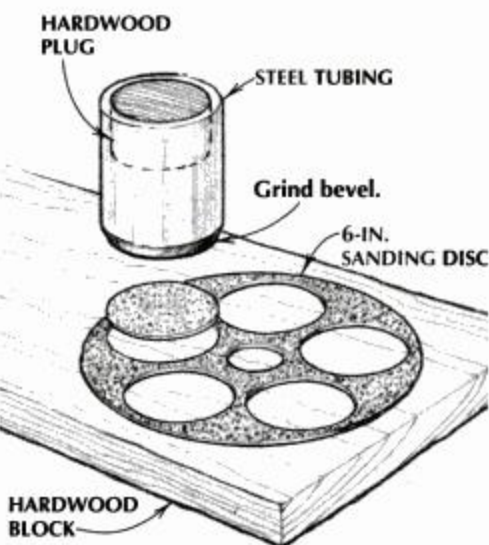
Arthur Duffin
Kalamazoo, MI



Cheapskate Sanding Discs

I use a lot of small-dia. Velcro-backed sanding discs, which are convenient but expensive—you only get two or three for a dollar. To reduce cost I now buy 6-in.-dia. discs and then use a hammer and short lengths of seamless steel tubing to punch out 1-, 2-, or 3-in.-dia. discs as needed.

Douglas Newlove
Islington, Ontario



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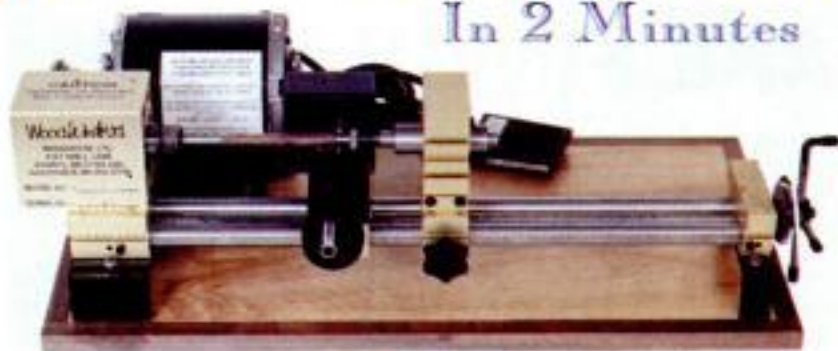


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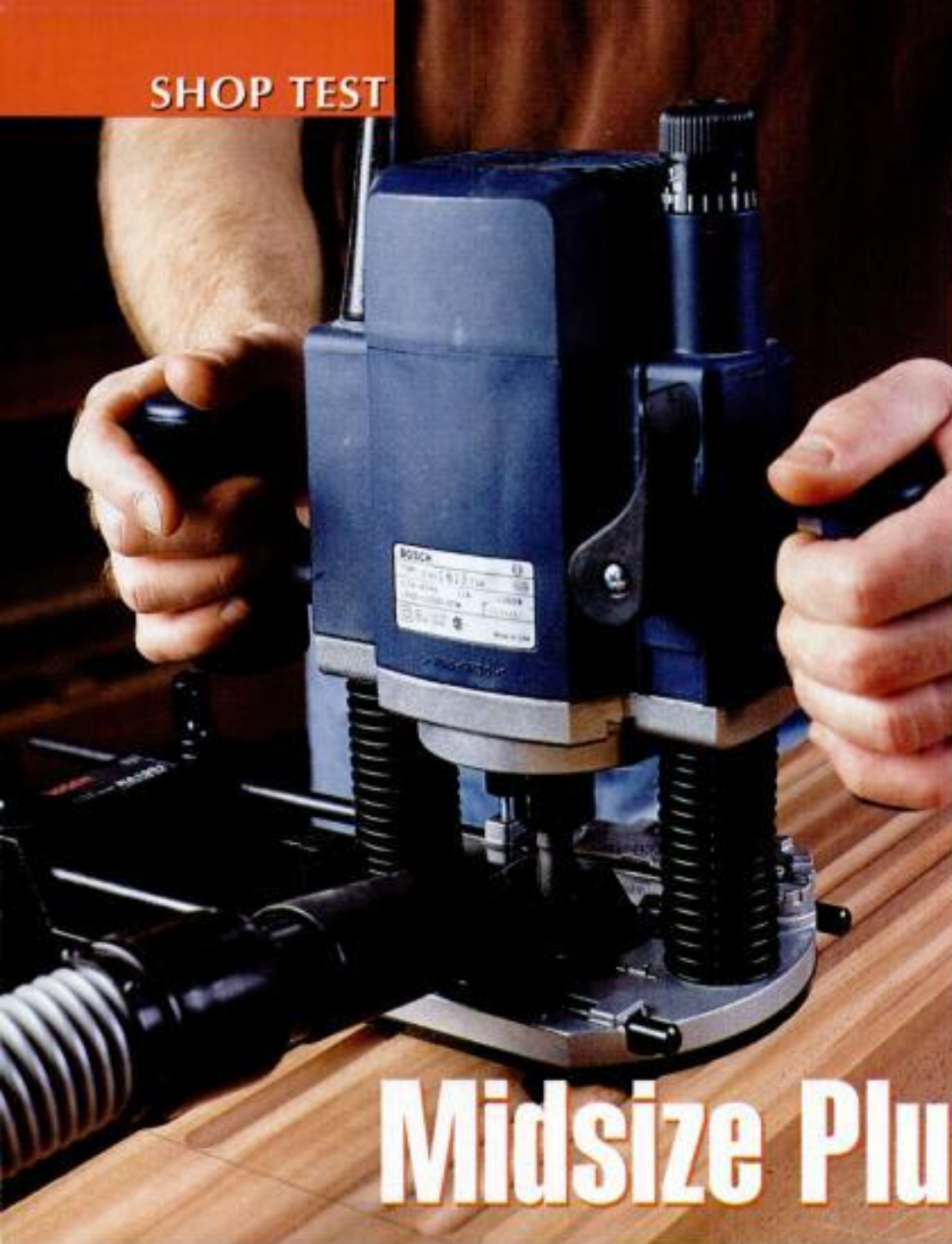
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CIRCLE NO. 55 ON PRODUCT INFORMATION FORM



AWW
July/August 98

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Midsize Plunge Routers

We rate 5 versatile performers

The best of both worlds. Midsize plunge routers are compact enough to perform a wide variety of handheld operations, but powerful enough to take on major shaping work when mounted in a router table.

Think for a moment about the staggering variety of routers you can buy today, from compact laminate trimmers you can hold in one hand right on up to 3½-HP monsters that really belong in a router table. Then of course there are plunge routers and fixed-base models to consider. It's no wonder that many woodworkers have several routers in their shops.

But if you could only have a single router, which model would you pick? This question became the premise for this Shop Test. We went in search of routers that could handle the widest possible range of cutting and shaping assignments and came up with a short list of five models: the Bosch 1613EVS, Craftsman 27510, DeWalt 621, Hitachi TR-12, and Porter-Cable 693PK.

All of these routers are plunge models, which means you can make all kinds of stopped cuts, such as mortises and stopped dados. The Porter-Cable is unique in our test group because it comes in a kit that includes both plunge and fixed bases. It's easy to move the motor housing from one base to another.

In size, weight, and power, all five models qualify as midsize machines. The DeWalt gets the nod as the lightest (8.9 lb.) and most compact machine. Hitachi is the heaviest (12 lb.) and most powerful (12.2 amp) router in our test group. The price

range is tight: between \$179 and \$209 for base models. Add accessories like depth-adjustment posts (necessary on some models for router table use), edge guides, and dust-collection shrouds and the range climbs between \$204 and \$283.

Versatility is the quality that really distinguishes this group of routers. They can make plunge cuts or work like fixed-base models. They're powerful enough to spin all but the biggest bits. Yet they're light and compact enough for all kinds of handheld operations. And all of our test machines can work in a router table. In short, these five models are about as close as you can get to all-purpose routers.

Testing and Rating the Routers

There are quite a few factors that determine how well a router performs in a wide variety of applications. We tested and rated each model in all of the categories described below. You'll find these ratings, along with other important test results, in the write-ups for individual routers. (See pages 37-41.)

Power. Using bits supplied by Jesada, our testers made a consistent series of cuts in different types of wood. All models came out with good or better scores. The Hitachi and Craftsman routers had the most power.

IMPORTANT FEATURES



Easy bit changing. With a spindle lock and a self-ejecting collet, bit changing is a breeze on the Bosch. A clear guard folds down for easy access.



Variable speed. Reducing or increasing rpm on the DeWalt is easy with its built-in speed dial. Speed choices range from 8,000 to 24,000.



Built-in dust collection. DeWalt's unique dust extraction design lets your shop vacuum pull chips up through an oversize plunge post.



Upside-down adjustments. The Craftsman's built-in post adjuster makes it easier to adjust the height of the bit, even in a router table.

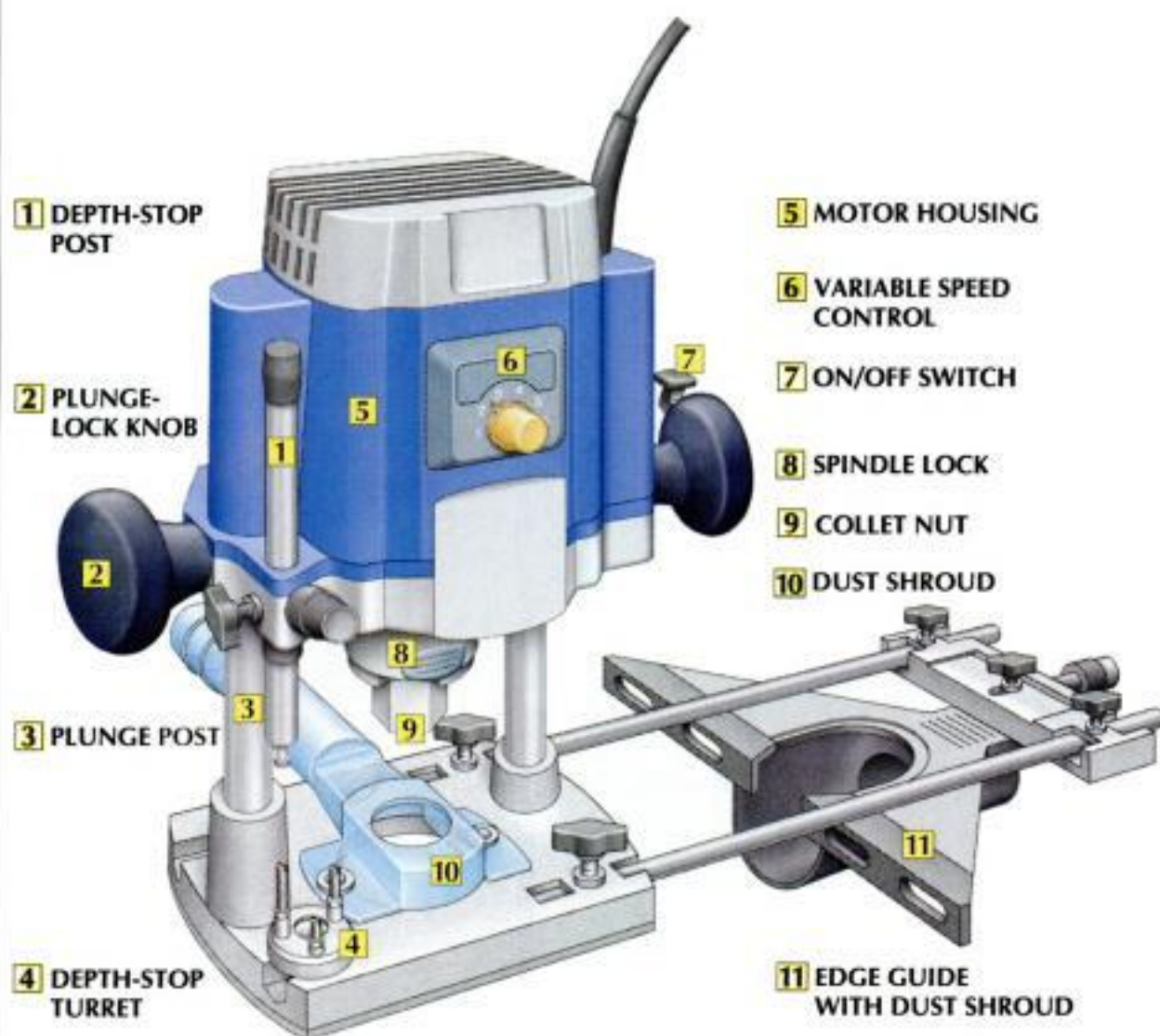
Plunge action. Smooth, controllable plunge action will give you greater precision when routing mortises and making stopped cuts. The DeWalt delivered the best performance in this category.

Balance and feel. Comfortable handles, light weight, and a low center of gravity all play a part in the balance and feel equation. We also factored the router's baseplate into this rating, looking for a flat, smooth surface. The DeWalt came out on top with an "excellent" feel rating, while the Bosch and Porter-Cable routers were rated "very good."

Controls. This rating is based on several important factors. We looked for on/off switches and plunge locks that were accessible and easy to use. We also considered bit height adjustment and the operation of plunge stops and plunge depth adjustments. The "Controls" rating is a good indication of how convenient the router is to use, day in and day out. The DeWalt, Porter-Cable, and Bosch earned "very good" ratings for controls.

Bit changing. Two features contribute to bit-changing ease: spindle locks and self-ejecting collets. Spindle locks enable you

PLUNGE ROUTER ANATOMY



TOP PERFORMERS

Best for handheld routing
DeWalt

Best in router table
Porter-Cable & Hitachi

Best plunge action
DeWalt

Flattest baseplate
Porter-Cable, DeWalt, & Hitachi

Best micro-adjustment for bit height
Bosch

Best dust collection
DeWalt

to loosen the collet with only one wrench. Self-ejecting collets do just what their name implies—they spit out the bit once the collet is loosened. Our testers like bit changing best on the Bosch and DeWalt routers.

Edge guide. Grooves, dados, and all kinds of edge-shaping work call for an edge guide. The Hitachi is the only model to offer an edge guide as standard equipment. We ordered the optional edge guides for the rest of the routers, and tested them for convenience and precision. DeWalt's edge guide worked the best. Our favorite aftermarket edge guide is the one made by Micro Fence Systems (\$98; 800-480-6427).

Speed control. While speed control is a specification and not a rating, it's an important factor to consider. With electronic variable speed (EVS) control, you can lower your rpm to spin large bits (over 1½ in. dia.) more safely. You're more likely to need lower rpm for router table work than for handheld operations. But reducing speed can also help to avoid burning or tearout when routing wild-grain woods. You can buy aftermarket EVS control for any router (\$40; available from Woodcraft Supply, 800-225-1153), but two models in our test come with onboard EVS control: the DeWalt and the Bosch.

Dust collection. All our test models except for the Craftsman can be hooked up to a shop vacuum to collect dust during handheld routing. The plastic shrouds designed to promote dust collection varied in effectiveness and in the degree to which they obscured your view of the bit. The DeWalt's "through-the-post" dust extraction design is a true breakthrough in convenience and effectiveness, earning this model the only "excellent" rating in this category.

Router table use. Features that make a router great for handheld operations aren't necessarily assets when the machine gets turned upside down to work in a router table. We had to buy aftermarket depth adjustment posts for the Hitachi (\$15; available from Woodhaven, 800-344-6657) and DeWalt (\$25; available from Eagle America, 800-872-2511) routers to make router table cutting-depth adjustments more convenient. We mounted all our test machines on Woodhaven baseplates (\$21) and tested each router's effectiveness and ease of use in our router table. The Porter-Cable and Hitachi routers turned out to be our favorites for router table use.

Recommendations

In this group of versatile routers, we gave our Editors' Choice award—best performance regardless of price—to two models: the DeWalt and the Porter-Cable. The DeWalt excelled in just about every handheld category, and it performed well in the router table too.

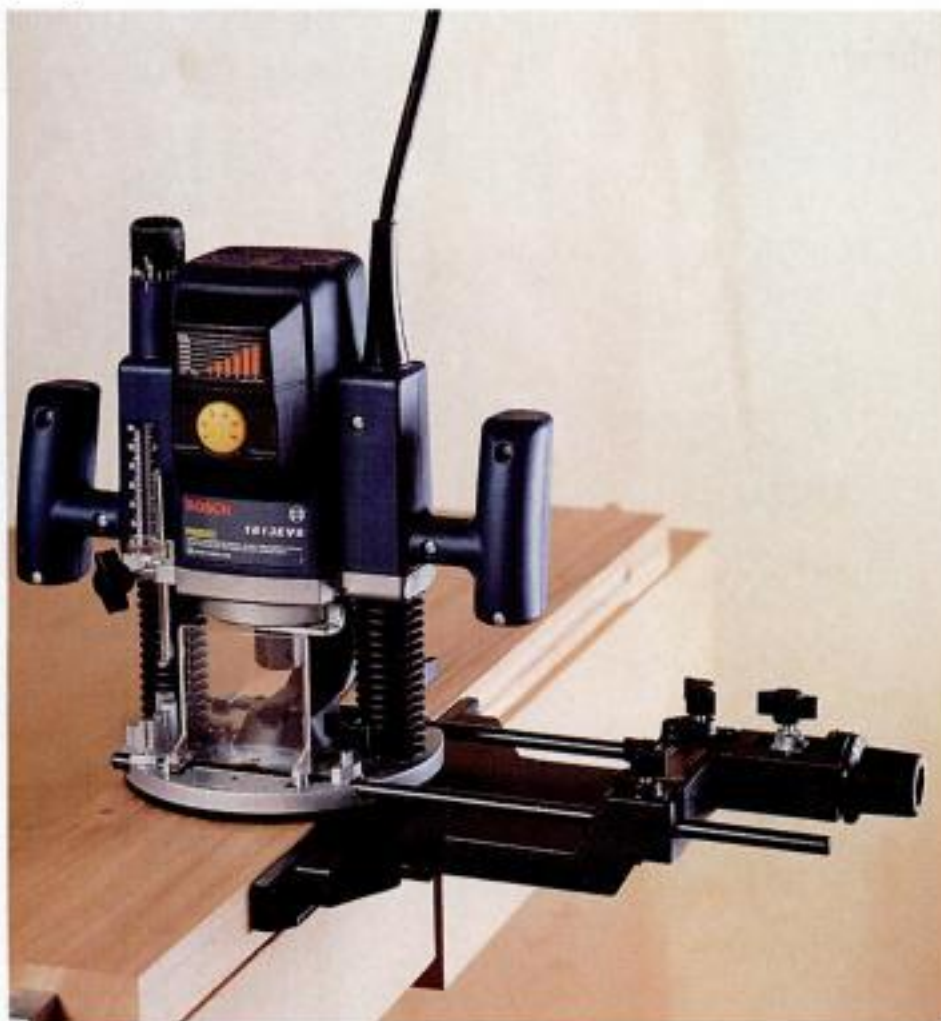
The Porter-Cable won us over with its two bases. You could leave the fixed base mounted in your router table, and simply transfer the motor housing to the plunge base for handheld operation. No other router offers this quick-change ability; it's like getting two routers for the price of one. We also like the Porter-Cable's rugged construction and simple, accessible controls—qualities that are important for both router table work and handheld operations.

Best Buy honors (best performance for the money) go to the Hitachi. Our test machine shared top power ratings with the Craftsman and couldn't be bested for router table use. The \$179 base price includes a good edge guide—quite a bargain. ▲

Bosch 1613EVS

Street price: \$205

(800) 815-8665 Circle #601



Micro-adjustment. Super-fine bit depth adjustments are easy to read and to make on the Bosch.

PERFORMANCE SCORECARD

Bosch 1613EVS

	POOR	FAIR	GOOD	VERY GOOD	EXCELLENT
POWER					
PLUNGE					
FEEL					
CONTROLS					
BIT CHANGE					
EDGE GUIDE					
DUST COLLECTION					
ROUTER TABLE					
OVERALL					

PROS AND CONS

PROS: Smooth plunge action; good maneuverability; best micro-adjustment for bit height; easy bit change; good edge guide; variable speed control; electronic brake stops router quickly; bellows protect plunge posts; quick-connect guide-bushing holder in baseplate.

CONS: Out-of-flat baseplate; dust shroud impedes view of cutline; bit-height adjustment limited to 5/8-in. travel; no provision for aftermarket post adjuster.

FINAL CUT: Good feel and easy-to-use controls make this a great handheld router, but adjusting bit height is fussy in the router table.

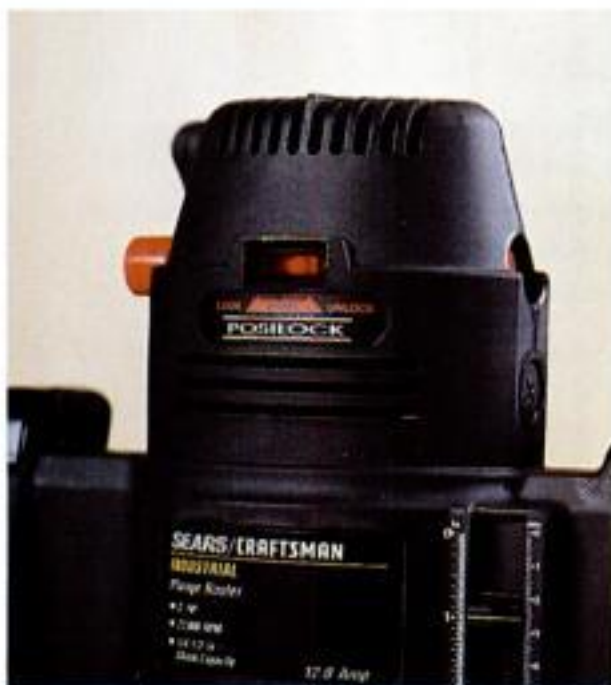
SPECIFICATIONS

Street price as tested (with edge guide and dust-collection shroud)	...	\$257
Amps	...	11
Mfr.'s rated HP	...	2
Collet size (in.) / type	...	1/4 ; 1/2 / 2-pc. self-eject
Speed range (rpm)	...	12,000-22,000 soft start
Max. plunge depth (in.)	...	2
Max. bit length (in.)	...	4 3/16
Max. base opening for bits (in.)	...	1 3/4
Switch type	...	trigger on handle
Plunge lock type	...	push to unlock
Spindle lock	...	yes
Noise (dB)	...	90.6
Weight (lb.)	...	10.2

Craftsman 27510

Street price: \$185

See your local Sears store. Circle #602



Safety conscious. A red light indicates the Craftsman's spindle lock is engaged, while power to the motor is automatically cut to prevent accidental starting.

PERFORMANCE SCORECARD

Craftsman 27510

	POOR	FAIR	GOOD	VERY GOOD	EXCELLENT
POWER					
PLUNGE					
FEEL					
CONTROLS					
BIT CHANGE					
EDGE GUIDE					
DUST COLLECTION					
ROUTER TABLE					
OVERALL					

PROS AND CONS

PROS: Plenty of power for big cuts; good edge guide; safety power shut-off when spindle lock engaged; electronic brake stops router quickly; bellows protect plunge posts; built-in post adjuster means easy bit-height adjustment in router table.

CONS: Plunge posts stick when base overhangs stock; bits stick in collet; base protrusions interfere with fences during cuts; hand position limited to front of router; no dust collection; top-heavy; no graduations on edge guide; no variable speed control; loudest router in test.

FINAL CUT: Good safety features and plenty of power, but changing bits is a hassle.

SPECIFICATIONS

Street price as tested (with edge guide)	\$210
Amps	12
Mfr.'s rated HP	2
Collet size (in.) / type	1/4; 1/2 / 2-pc. self-eject
Speed range (rpm)	22,000
Max. plunge depth (in.)	2 1/2
Max. bit length (in.)	3 3/4
Max. base opening for bits (in.)	2 1/2
Switch type	trigger on handle
Plunge lock type	push to lock
Spindle lock	yes, with power-off safety feature
Noise (dB)	99.2
Weight (lb.)	11.7

DeWalt 621

Street price: \$209
(800) 433-9258 Circle #603



PERFORMANCE SCORECARD

DeWalt 621

	POOR	FAIR	GOOD	VERY GOOD	EXCELLENT
POWER					
PLUNGE					
FEEL					
CONTROLS					
BIT CHANGE					
EDGE GUIDE					
DUST COLLECTION					
ROUTER TABLE					
OVERALL					



Depth adjustment.

The standard rack-and-pinion post adjuster (left) provides quick and accurate depth-stop settings for plunge cutting. An aftermarket post adjuster (shown above) is necessary for easy height adjustment in the router table.

PROS AND CONS

PROS: Best plunge action; good maneuverability; excellent bit-height adjustment in handheld mode; best plunge lock; easy bit change; best edge guide; variable speed control; best dust collection; shortest distance from collet to edge of base for routing into corners; lightest router in test; flat top permits upside-down adjustments on bench.

CONS: Small baseplate can be tippy; aftermarket post adjuster required for convenient depth adjustment in router table; no depth stop available in router table use.

FINAL CUT: For handheld operations, this router has it all: smooth plunge action, light weight, easy-to-use controls, and excellent dust collection. An **Editors' Choice winner**.

SPECIFICATIONS

Street price as tested (with edge guide and post adjuster)	\$269
Amps	10
Mfr.'s rated HP	2
Collet size (in.) / type	1/4; 1/2 / 2-pc. self eject
Speed range (rpm)	8,000-24,000 soft start
Max. plunge depth (in.)	2 1/8
Max. bit length (in.)	3 15/16
Max. base opening for bits (in.)	2 7/16
Switch type	trigger on handle
Plunge lock type	push to lock
Spindle lock	yes
Noise (dB)	93.5
Weight (lb.)	8.9

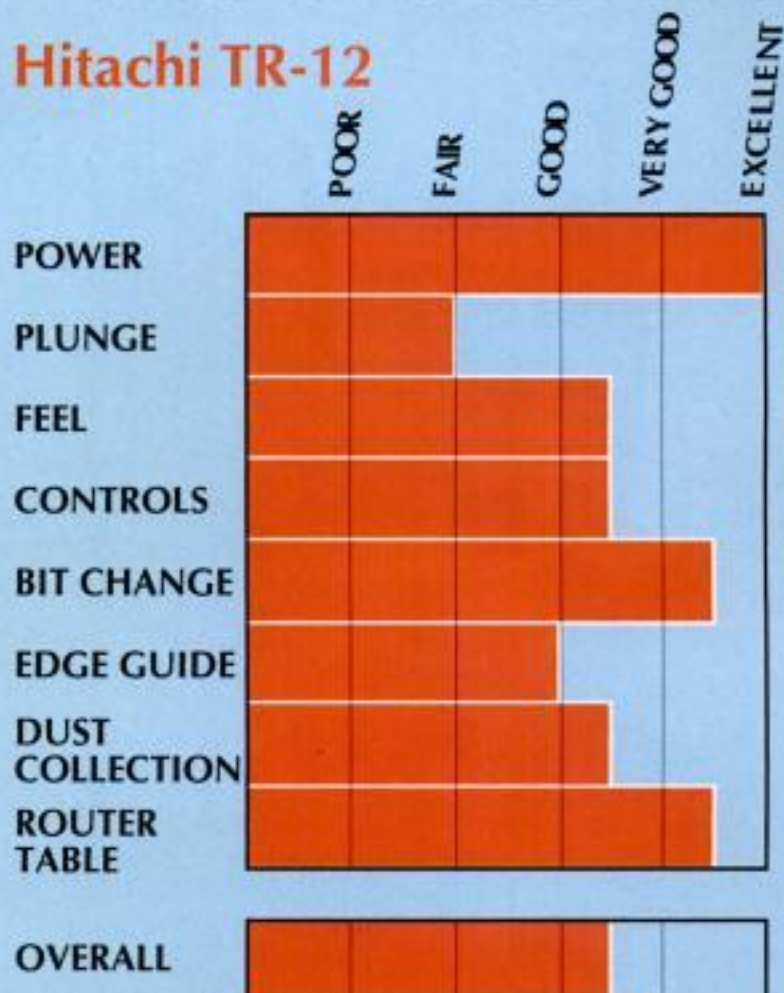
Hitachi TR-12

Street price: \$179
(800) 829-4752 Circle #604



PERFORMANCE SCORECARD

Hitachi TR-12



A switch where you need it.

Turning the Hitachi on or off in router table mode is no problem with its clearly visible, rocker-style switch.

PROS AND CONS

PROS: Plenty of power for big cuts; least expensive model in test; easy bit change; good edge guide; effective dust collection; dust shroud permits clear view of cutline; easy bit-height adjustment in router table; best switch access in router table.

CONS: Plunge posts stick when base overhangs stock; weak plunge springs; heaviest router in test; no graduations on edge guide; no variable speed control; aftermarket post adjuster required for convenient depth adjustment in router table.

FINAL CUT: This powerful performer works great in the router table, and the \$179 price includes a good edge guide. It's an easy pick as a **Best Buy winner**.

SPECIFICATIONS

Street price as tested (with edge guide, dust shroud, post adjuster)	 \$204
Amps	 12.2
Mfr.'s rated HP	 not available
Collet size (in.) / type	 1/4 (sleeve); 1/2 / 1-pc. removable
Speed range (rpm)	 22,000
Max. plunge depth (in.)	 3
Max. bit length (in.)	 4
Max. base opening for bits (in.)	 1 15/16
Switch type	 rocker on motor housing
Plunge lock type	 push to lock
Spindle lock	 no; two wrenches supplied
Noise (dB)	 97.3
Weight (lb.)	 12

Porter-Cable 693PK

Street price: \$209

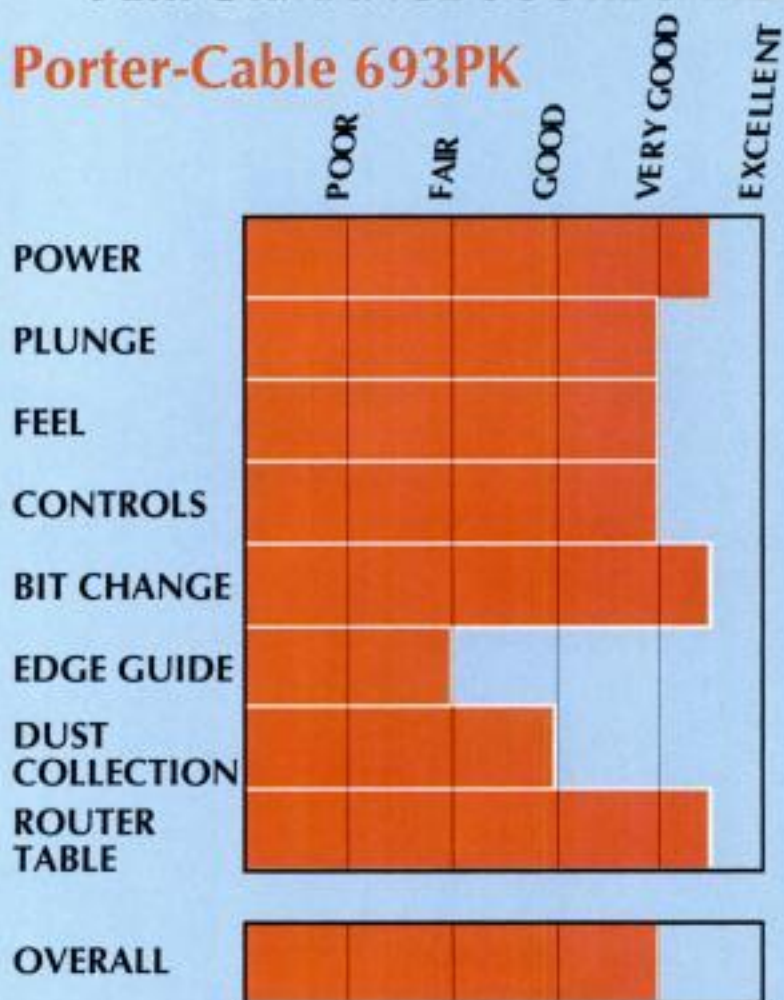
(800) 487-8665 Circle #605



Get a fixed base, too. The Porter-Cable comes with both plunge and fixed bases. It's easy to transfer the motor housing from one base to the other.

PERFORMANCE SCORECARD

Porter-Cable 693PK



PROS AND CONS

PROS: Includes plunge base and fixed base; good maneuverability; excellent plunge lock and depth-stop turret; easy bit change; flat top permits upside-down adjustments on bench; effective dust collection; easy bit-height adjustment and switch access in router table with fixed base.

CONS: Base protrusions interfere with fences during cuts (plunge base only); awkward edge guide; no variable speed control; must install separate baseplate for dust collection; dust shroud impedes view of cutline.

FINAL CUT: Rugged construction, the versatility of two bases and winning router table performance make this router an *Editors' Choice winner*.

SPECIFICATIONS

Street price as tested (with edge guide, dust-collection accessories)	... \$283
Amps:	10
Mfr.'s rated HP:	1 1/2
Collet size (in.) / type:	1/4; 1/2 / 2-pc. self eject
Speed range (rpm):	23,000
Max. plunge depth (in.):	2 1/2
Max. bit length (in.):	4 1/8
Max. base opening for bits (in.):	3 3/4
Switch type:	toggle on motor housing
Plunge lock type:	push to unlock
Spindle lock:	no; two wrenches supplied
Noise (dB):	98.7
Weight (lb.):	11 (plunge); 7.85 (fixed base)

Shave with the best. The author's drawshave is easy to make and a joy to use for shaping and smoothing edges.



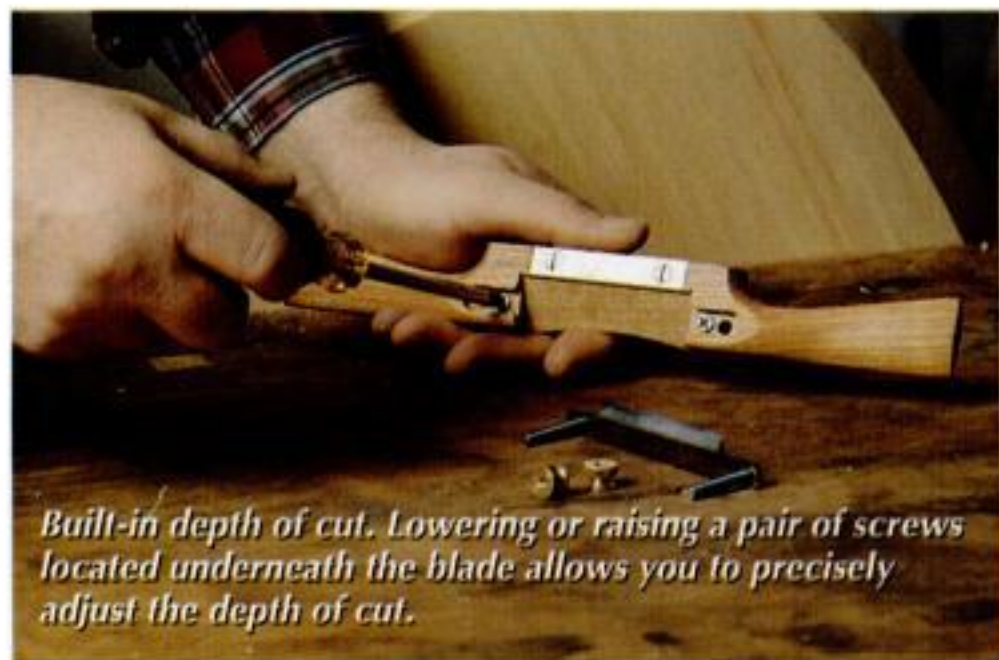
Wooden Spokeshave

Make this improved version of a traditional shaping tool

by David Wachnicki

I think a wooden spokeshave is an important hand tool—for several reasons. First, it's an extremely versatile shaping tool. A wooden shave handles convex or concave edges, edge grain, or end grain with equal aplomb. I use a shave on practically every surface on the chairs that I make. It's great for refining the curve of a seat, rounding spindles, or smoothing crest rails. And I favor a wooden shave over the metal variety for its sensitivity and comfortable feel. In the shavemaking class that I teach, students are always amazed when they see ribbons of end grain shavings spilling from this time-honored tool.

You can buy traditional wooden shaves at flea markets, tool dealers, and antique shops. Woodworking catalogs even offer wooden shaves that look and perform like the antique ones. But I prefer to make my own, since it gives me the chance to customize the tool to my liking.



Built-in depth of cut. Lowering or raising a pair of screws located underneath the blade allows you to precisely adjust the depth of cut.

Shave Parts

Start by selecting a blank of defect-free, close-grain hardwood, preferably with straight grain. Beech and boxwood are traditional species, but hard maple and cherry work just as well. Students even scrounge their firewood piles for blanks.

The next item to acquire is a tanged blade. The old blades you find at antique shops usually have square, tapered tangs, which require careful fitting into tapered, square holes in the body of the shave. I recommend buying commercial blades with round, threaded tangs, available from Woodcraft Supply (\$15; 800-225-1153). The tangs fit through round holes in the shave, and are secured by a pair of brass nuts. (See Fig. 1.)

Another place where my shave differs from tradition is the method of setting the depth of cut. Instead of tapping on the tangs as you would with an old shave, you simply adjust the height of a pair of screws that contact the underside of the blade. (See bottom photo, opposite.) I recommend you use steel sheet-metal screws here, and for securing the brass plate. Sheet-metal screws have deep, sharp threads that run the entire length of the shank, providing more grip than ordinary wood screws.

The last item is the optional brass plate I mortise into the bottom of the shave, which I cut from 1/16-in.-thick brass sheet stock sold at hobby stores.

Fitting the Blade to the Blank

Prepare the blank to the dimensions shown in Fig. 2, making sure the stock is flat and all six faces are square. At this point, it's a good idea to draw the finished contours of the shave onto the blank. In my class, I encourage students to make templates of the bottom and back of the shave's contours, then use the templates to transfer the outlines onto the stock. (See Fig. 3.)

The next step is to locate the holes for the tangs. First, check the tangs for squareness to the blade with a small square. To correct an out-of-square tang, position the blade over a small block of wood or against the edge of your bench and gently tap the bottom, or back, of the blade with a small hammer, in line with the tang. With the tangs square, determine their center-to-center distance by measuring from the inside of one tang to the outside of the opposite tang.

Transfer your tang measurement onto the blank, and drill the holes for the tangs. I start with a 3/16-in. brad-point

FIG. 1: SPOKESHAVE ANATOMY

Use a close-grain hardwood such as maple for the body of this shave. A commercial blade is held in the body by a pair of brass nuts. Two sheet-metal screws located under the blade allow you to fine-tune the depth of cut.

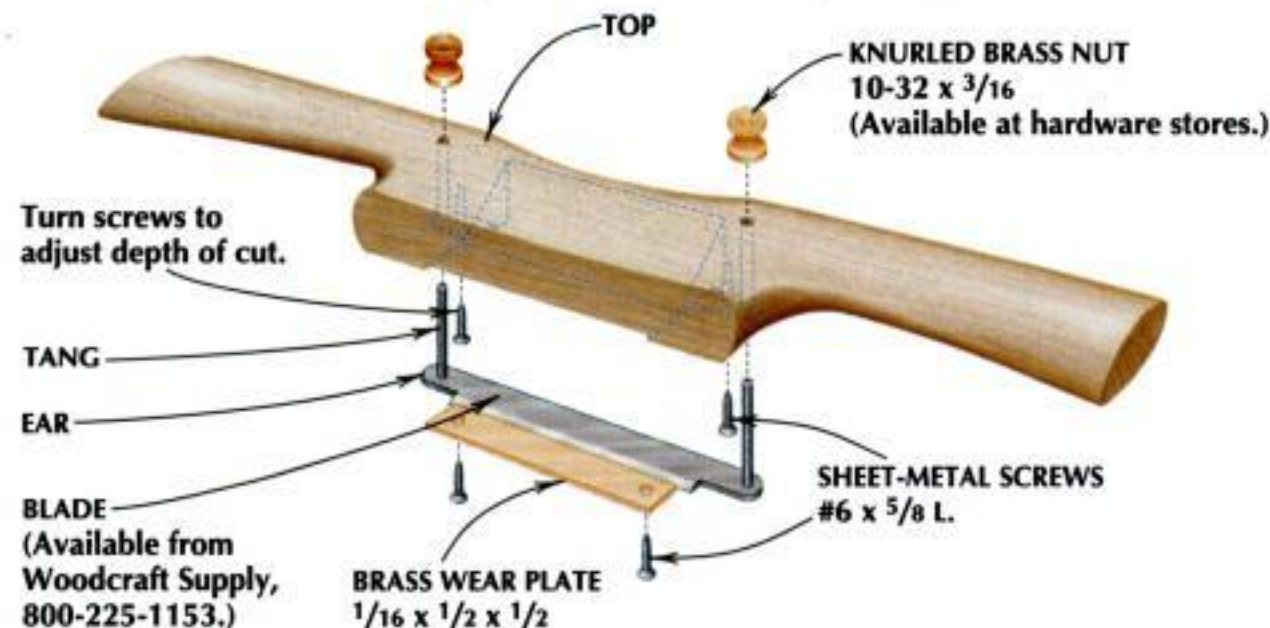


FIG. 2: FITTING THE BLADE

First, mark centerlines on the blank. Then measure the center-to-center distance of the blade's tangs and drill holes for the tangs. Insert the blade and trace its contours onto the blank. Gauge lines to establish the bottom and back edges of the throat. Saw and chisel out the throat, then chisel the mortises for the ears.

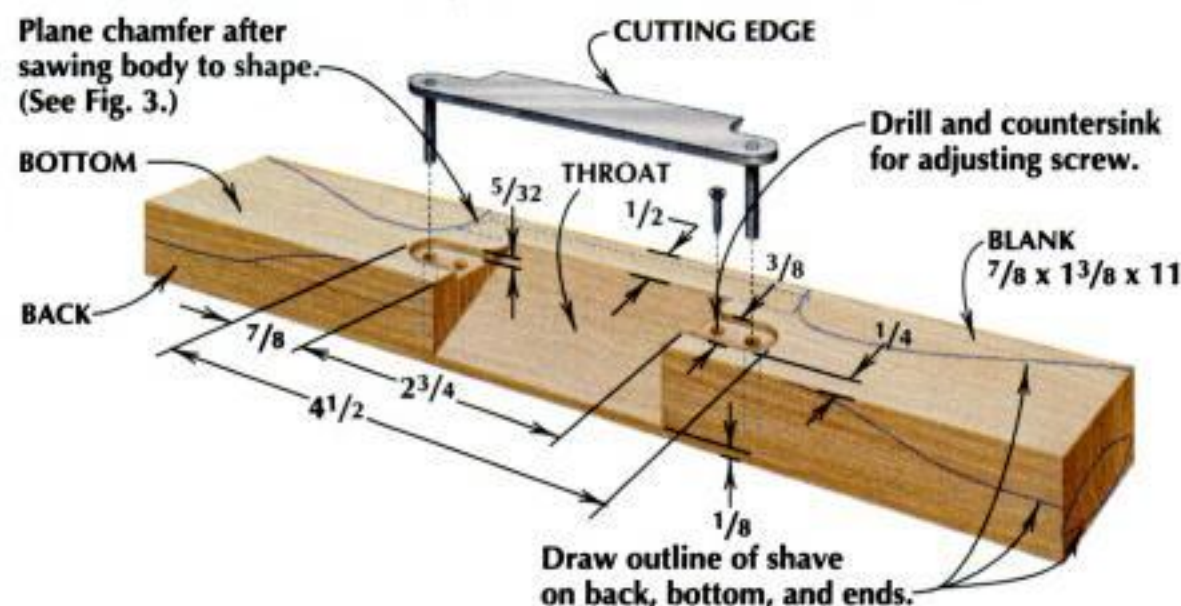
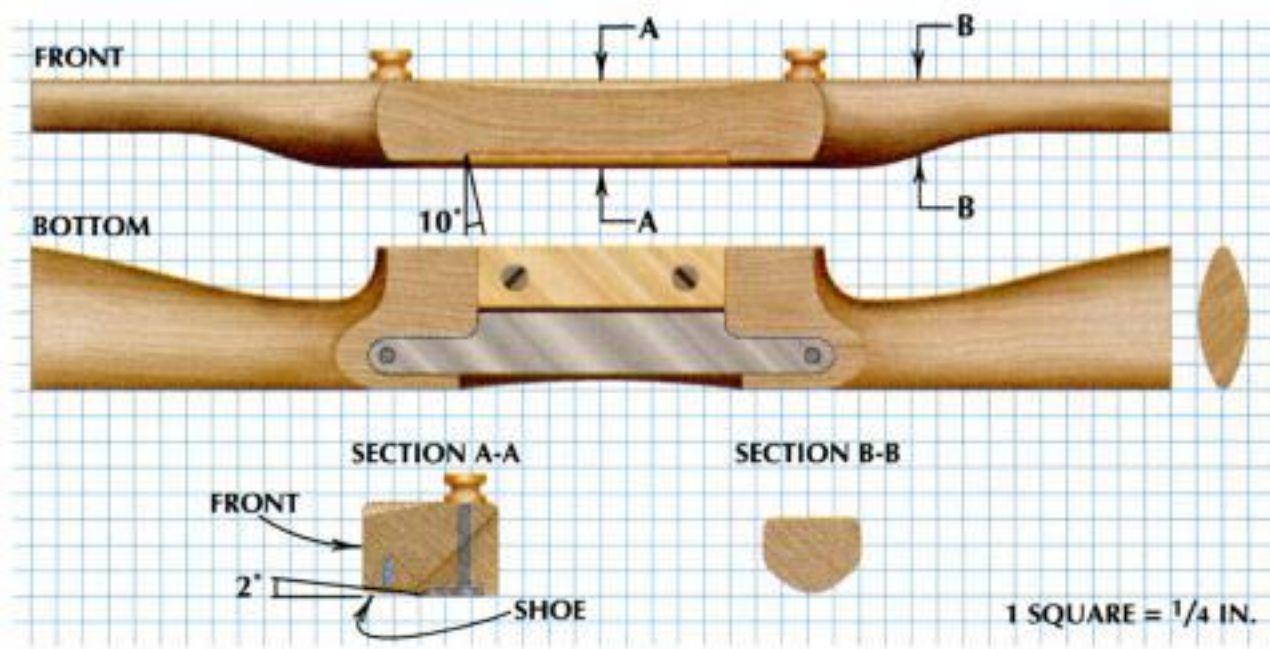


FIG. 3: ELEVATIONS

You can make half-templates of the bottom and back of the shave from the drawings below. Then transfer the templates' outlines onto the shave blank.





Pare the wear. Use a sharp chisel to pare away the sawn kerfs to define the throat, or wear. A small gouge takes care of the mortises for the cutter's ears.



Saw out the rough shape. After roughing out the front of the shave, the author saws the bottom face on the bandsaw using a $\frac{3}{16}$ -in. blade.

bit, using the drill press to ensure that the holes are square to the body. The goal is to achieve a sliding fit between the tangs and the body. If the holes are too large, the cutter will chatter in use. If the tangs are too tight, enlarge the holes with a $\frac{13}{64}$ -in. bit or with a small round file.

After fitting the tangs, install the cutter and trace around the blade with a knife or a sharp pencil. The blade's cutting edge defines the front edge, or mouth, of the throat. (See Fig. 2.) Square your marks down the back of the blank and use a marking gauge to incise a line defining the back edge of the throat.

You're ready to shape the throat. Start by sawing the two cheeks with a fine-tooth backsaw. Follow your layout lines, tilting the blade so you cut down just shy of the mouth and back edge. Next, make a series of kerf cuts between the cheeks, again staying just shy of the full depth. Remove the kerfed waste between the cheeks with a chisel, then pare the surface of the throat, called the wear, flat and smooth. (See photo, above.) Make sure the wear meets the mouth and back of the shave evenly.

Once you've shaped the wear, the next step is to cut the mortises for the blade's ears. (See Fig. 2.) Here it's important to cut just inside the lines so the ears will fit closely to the blank. I use a $\frac{3}{8}$ -in. straight chisel for the straight cuts. A $\frac{3}{8}$ -in. incannel gouge or a #8, 7-mm. gouge works best for chiseling the rounded ends of the mortises. Cut each mortise about $\frac{5}{32}$ in. deep so the blade sits just below the sur-

face of the blank. Take light cuts to avoid breaking out the back edge.

With the blade fitted, install the two screws that regulate the depth of cut. Locate each screw at the midway point in the ear mortise between the tang hole and the cheek. (See Fig. 2.)

Sawing Out the Body

At this point, you're ready to rough out the body of the shave; you'll refine its shape later. Saw along the front and bottom faces of the blank, following your previous template marks either with a coping saw or on the bandsaw. I use a $\frac{3}{16}$ -in. bandsaw blade to help me negotiate the tight curves. (See right photo, above.)

Chamfering the Shoe

There's a critical step that can make or break a shave, and that's to chamfer the shoe—the surface directly in front of the cutter. The entire surface on the bottom of the shave is called the *sole*. Just as you'll find on antique spokeshaves, the cutting edge of the blade meets the shoe at a slight angle, creating a sole that isn't entirely flat. (See Fig. 3.) This feature is important because it reduces tearout and provides a more controlled cut.

With the cutter removed, scribe a line about $\frac{1}{32}$ in. below the shoe on the front of the body. Use a sharp plane to chamfer the shoe, planing at an angle of about 2° and to the depth of the scribed line. Be careful not to remove any material at the mouth.

Brassing the Shoe

Installing a brass plate is an option; many old shaves don't have plates and they perform fine without them. But adding a plate accomplishes two things: It promotes even wear of the sole and it allows you to fine-tune the mouth opening of the shave. Cut the brass plate to the dimensions shown in Fig. 1, then drill and countersink the plate for the screws. Countersink to a depth that leaves the screw heads slightly proud. You'll dress the screws flush later.

With a mill file, dress both ends of the plate to a slight bevel. The exact angle isn't critical, but I find that the beveled end of a 2x4 helps my students file evenly. (See left photo, opposite.) Now center the plate on the shoe and mark the ends, remembering to mark the smaller bevel dimension. Scribe a line on the front of the blank equal to the thickness of the plate.

Cutting the mortise for the plate is similar to sawing out the throat, except you'll need to bevel the ends, or cheeks, of the mortise to fit the beveled plate. Eyeball the cheek cuts by holding the saw at the same bevel angle that you filed on the ends of the plate, and saw to the depth of the scribed line. Next, saw a series of shallow kerfs between the cheeks and pare the waste with a chisel. Slide the plate into the mortise and check that it fits snugly and doesn't rock.

Before you install the screws that secure the plate, you'll want to adjust the opening of the mouth, or the distance between the cutting edge and the plate.



Bevel the brass. The beveled end of a 2x4 guides your file as you bevel the ends of the brass plate. A shallow mortise in the scrap holds the brass securely.



Close your mouth. Determine the correct mouth opening by holding a business card against the blade's cutting edge, then slide the brass plate up to the card.

The goal is to create a $\frac{1}{64}$ -in. opening, about the thickness of a business card.

Install the blade and turn the adjusting screws to set the blade flush with the plate. Hold a business card against the blade's cutting edge and slide the plate forward until it rests evenly against the card. Clamp the plate as shown in the above right photo, and secure it with the two screws. One note: If you discover a small ledge in the mouth just behind the brass plate, pare it away to prevent shavings from jamming the mouth.

Finish the brassing work by removing the blade and dressing the screw heads flush with a mill file. Then dress the entire sole by moving the shave back and forth across sandpaper on a flat surface. Sand up to 320 grit, and finish up by burnishing the brass with 000 steel wool.

Final Shaping and Smoothing

The goal when shaping the body is to remove any hard corners and make the tool comfortable to use. There's no "perfect" shape for any one shave. It's more important that the shave fit your own hands. Still, my students find that after refining the shape, their shaves look surprisingly similar to the antique models.

Start from the handle ends and work in toward the center, using rough and smooth rasps for the initial shaping. As you proceed, check the shape by holding the shave as you would use it. Round over any transition lines where adjacent surfaces meet. Complete the process by sanding the surface up through 220 grit,

then give the shave a couple coats of your favorite finish. Oil and shellac are two of my personal favorites.

Sharpening the Cutter

The cutting angle that comes with the blade is satisfactory, but there are a couple of necessary steps for a sharp edge that'll make great shavings.

First, lap the bottom, or face, flat. Use a coarse-grit diamond stone or 80-grit sandpaper on a glass plate. Once it's flat, polish it on a waterstone or use sandpaper in grits from 120 through 400 for an edge suitable for general shaping. For fine work or for shaving hardwood, keep polishing up to 1,000 grit. (For more on sharpening with sandpaper, see AW #66.)

Once the face is polished, move on to the bezel, commonly called the bevel. Clamp one of the tang ears in a wooden-jawed vise so the cutter is horizontal and the bezel faces up. Rub a square stick of wood wrapped with sandpaper back and forth along the bezel, maintaining the cutting angle. Again, sand with grits up through 400 for general work and up through 1,000 for fine work.

Mastering Your New Shave

Now the fun begins. Adjust the cutter for a shallow cut. You may want to cock the blade to make thick or thin shavings, setting one side deeper and alternating the side of the blade offered to the work.

The shave works best after you learn to hold it properly. You can push it or pull it, depending on the operation. In most cases a push cut affords the most control.

But the trick is mastering your grip. Don't grab the shave like bike handlebars. Instead, hold it with your thumbs and the tips of your middle fingers.

To hold the shave for a push cut, place your thumbs on the back of the body (not the handles) and in line with the brass nuts, with your middle fingers on the handles on the front side, almost directly in front of your thumbs. Your index fingers float freely just in front of the nuts, ready to exert downward pressure. The remaining fingers ride on the handles, giving "English" to your shaving strokes. (See lead photo.) To drawshave, hold and operate the shave in reverse as described above and pull toward you.

It's best to practice shaving on a mild wood such as pine. Push with your thumbs while exerting downward pressure over the shoe with your index fingers. Once you get a feel for the cut, try "climbing" toward the end of a cut by easing up on the downward pressure and rolling the shave up in the front. To shave end grain, set the cutter for a very light cut, and push the shave. To reduce chatter, skew the shave at an angle to the direction of the cut, using firm downward pressure on the shoe. ▲



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Colonial Silver Tray

Scrollsaw this traditional centerpiece in an afternoon

by John Nelson

I like to browse antique shops for Early American treasures to reproduce. One piece that's always fascinated me is the silver tray. These open scrollwork boxes held flatware and linens on many a colonial sideboard, but they mysteriously fell out of favor in the 1800s. Goodness knows why—they're very handy. My wife loves hers, and so do our daughters, and our friends, and *their* friends...

Here I'll show you how to make your own reproduction silver tray, circa 1760. It's a simple project that takes just a couple of hours.

Materials

Any interesting hardwood is a lovely choice for this tray. The original is made of cherry and has developed a beautiful patina over its 200-year lifespan. I used bird's-eye maple for the tray shown here.

Square-cut nails and glue hold the original tray together. For an authentic look, you can purchase $\frac{7}{8}$ -in. square-cut brads by the pound from Tremont Nail Co. (8 Elm St., Wareham, MA 02571, 508-295-0038). You'll need 20 nails for each tray you make; a pound contains about 1,500.

Construction Notes

Surfacing—After you've dimensioned the parts but before you start scrollsawing, plane, scrape, or sand them up to 120 grit. If scrollsawing leaves behind any rough edges, you can clean them up with sandpaper later. Sanding will round the edges too, mimicking years of handling.

Scrollsawing—You can scale up the side view of the handle and use it as a template. Any local quick printer can enlarge the drawing for you. Have them enlarge it in red—it's easiest to follow with a scrollsaw blade. Be sure to check the enlargement against a bench rule before you leave the printer; photocopy machines aren't always 100% accurate.

A #5 skip-tooth scrollsaw blade will yield the nicest cuts for this tray. Before you scrollsaw the handle, check it for a nice tight fit to the end pieces. You can make the tray sides shorter if you need to get a tighter handle-to-end fit.

It's most efficient to "sandwich" the two tray sides and cut them together. A piece of paper with a light misting of removable spray adhesive (available at art supply stores) on both sides will hold the sides firmly enough for scrollsawing. Spray only the paper—never the wood. The paper should peel off easily after scrollsawing; if not, heat the wood with a hairdryer or apply mineral spirits.

When scrollsawing the tray sides, set your scrollsaw table to a 15° angle, so the decorative cutouts will be parallel to the angled top and bottom edges of the tray.

Assembly—Prebore the sides, ends, and handle for the cut nails, then glue and nail just the sides and ends together to form the basic box. I've never had a problem assembling the tray—I just hold the assembled portion in a vise as I attach pieces to it.

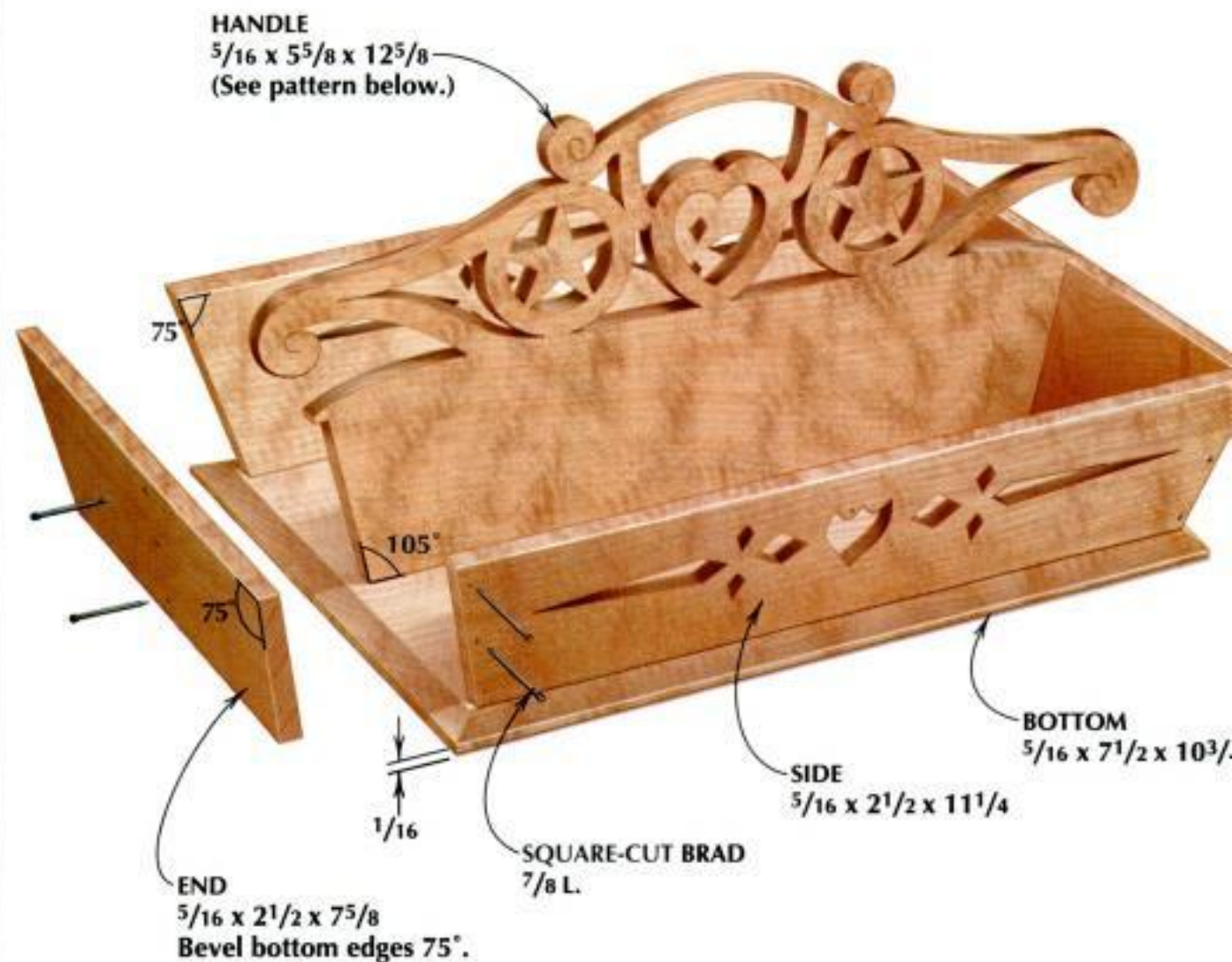
Finishing—I finished this tray with several wiped-on coats of tung oil. It's easy and foolproof to apply, and I like the slight darkening effect that "ages" the piece without hiding the figure. I wouldn't use a glossy finish—it would ruin the antique effect. I rubbed the tray down with 0000 steel wool, then finally applied a coat of paste wax. ▲



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*writes and teaches
scrollsawing in
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SILVER TRAY

This graceful box is a reproduction of an original design from the mid-1700s. It's also an excellent opportunity to show off your skill at making pierced cuts on the scrollsaw. Build your version from any clear hardwood.



HANDLE PATTERN

1 square = 1 sq. in.



BASIC SCROLLSAWING TIPS

- Choose the coarsest blade that gives a smooth enough cut. Finer blades make smoother cuts but require slower speeds and thinner material.
- Before you cut, check the blade for square by placing an engineer's square or drafting triangle on the saw table.
- For longer blade life, loosen the blade when you're done for the day.
- Take extra care when you lay out the pattern on the wood. You want the best grain direction to avoid short-grain breakage.
- A properly tightened blade gives a clear, high-pitched tone when you pluck it.
- To cut duplicates, tape several thicknesses of wood together.

Coopering a Door

*An easy way to make curved panels
from strips of solid wood*

by Sven Hanson



Coopering began as a method for making containers to hold wine, grain, and other goods. Assembling a barrel from a series of narrow staves was far more efficient than hollowing out a solid block of wood, and it produced a container that was light and strong.

For centuries, furniture makers have adapted coopering techniques to make curved panels for lids and doors. A coopered door creates an interior space of varying depths that offers many possibilities for storage or display. (See photo, left.) And coopering isn't at all difficult if you have a good selection of clamps and a way to plane accurate bevels. In this article, I'll explain how to transform straight, square-edged wood into a curved panel that can be used on its own as a cabinet door, or held in a stile-and-rail frame. ([See sidebar, page 51.](#))

Before I delve into the step-by-step specifics of coopering a door, there are several important details to mention. If you're building a cabinet with a coopered door, make the door first. It's easier to build the cabinet to fit the curve than it is to fit the curve to the cabinet. And you'll notice that my method yields a panel with a single continuous curve, not the compound curve found in most barrels.

Wood selection is also important. Because a coopered door will have many glue joints, I prefer coopering with oak, ash, chestnut, wenge, and other woods that have strong grain patterns. In the finished door, you'll notice the grain, not the glue lines.

Calculating the Curve

There are three factors that determine the curve and final size of a coopered panel: the width of the staves, the number of staves, and the bevel angle along the joining edges of the staves. I recommend a stave width of between 1 in. and 1½ in. I don't like running stock narrower than 1 in. through my jointer, and if you use staves wider than 1½ in., the finished panel will require too much scraping and sanding.

The bevel angle on the staves is very slight—just 2.7° for the door shown here. You can bevel both sides of each stave, as I usually do;

Simple technique, beautiful results.

A coopered door adds a graceful curve to cabinetry. Coopered panels can be used alone, or in frame-and-panel constructions, as shown at left.

or you can double the angle, and bevel just a single side of each stave. If you want to cooper a panel with a different curve, follow the four steps shown in the drawing at right.

Make your stave stock several inches longer than the finished height of the panel, and add some extra staves to your cutting list—enough to make the panel about 25% wider than it needs to be. The extra length gives you more flexibility in matching the grain in adjacent staves. The extra staves allow for waste and errors when cutting and beveling. And you can use them to make a curved auxiliary base for the router, which you'll need if you want to detail the edges of the panel. (See left photo, page 51.)

Making the Staves

I don't start with individual staves. Instead, I glue several boards together to make a wide, flat panel from which staves can be cut. A wide panel enables me to create a pleasing grain orientation right from the start. Make sure to draw a large triangular witness mark on the "good" side of the panel.

Ripping the panel into strips comes next. When setting the rip fence on my tablesaw, I add $\frac{1}{16}$ in. to the finished width of the staves. This allows for the stock that will be removed when beveling the edges. As I rip the panel into staves, I place them on a work board, which ensures that they'll stay together as I move from one work station to another. Number the stave ends consecutively, from one side of the panel to the other.

CALCULATING THE BEVEL ANGLE

Step 1: Draw the curve full size, using a compass or trammel points.

Step 2: Divide arc into individual staves (S). Keep stave width uniform and between 1 and 1½ in.

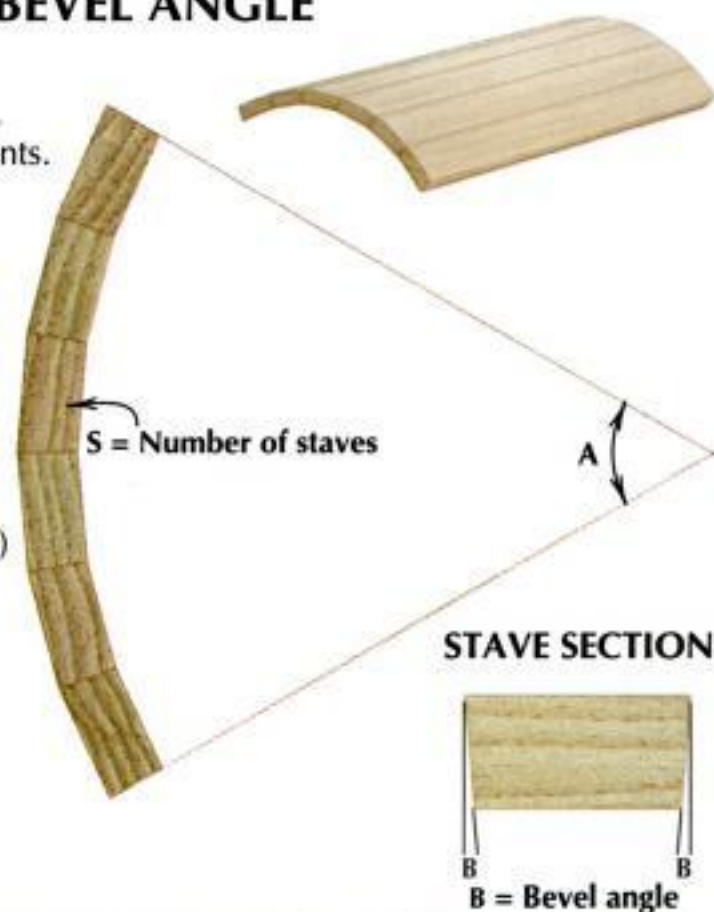
Step 3: Measure the total angle (A) with a protractor.

Step 4: Calculate bevel angle (B) using the formula: $B = \frac{A}{2S}$

Example:

If A = 60° and S = 6, then

$$B = \frac{60}{2 \times 6} = 5^\circ$$



Beveling the Staves

The jointer makes quick work of beveling the stave edges, but you have to pay attention to your witness marks. Bevel each stave so that the good side ends up as the broadest side.

I guide each of the staves against a beveled wooden auxiliary fence that is attached to the jointer's standard fence with double-faced tape. (See right photo, below.) This saves me the trouble of resquaring the standard fence after beveling. Whether or not you use an auxiliary fence, make sure that your fence creates an acute angle (less than 90°) between the fence and the jointer

beds, rather than an obtuse angle (greater than 90°). The acute angle will make it easier and safer to guide the narrow pieces.

After beveling all the staves, including the extras, I test-fit the joints and correct any gaps or unevenness between edges. Then I fine-tune the fit with a block plane, or by making another pass on the jointer.

I lay out the staves on my work board, and shift them as necessary to improve the "flow" of grain across joint lines and throughout the panel. When the alignment is right, I lock it in by making a single pencil line across each joint.

MAKING THE STAVES FOR A COOPERED PANEL



Making stave stock. Rip individual staves from a single flat panel glued up from several boards. Number the staves, so the grain will match when you assemble the coopered panel.



Planing the bevels. Hanson guides each stave against a beveled wood auxiliary fence attached to the jointer's standard fence with double-faced tape. Make sure your fence forms an acute angle with the bed—less than 90°.

GLUING UP THE PANEL



Two by two. A bunch of spring clamps is all you need to glue up adjacent stave pairs—the first stage in gluing up the panel. Hanson's coopering method makes a panel without using forms.



Half the panel. With an assortment of clamps, you can glue up several stave pairs. Look for even beads of squeeze-out—they're a sign of good joint alignment and even clamping pressure.

Gluing Up in Stages

I glue up a curved panel in stages. This approach takes a little longer than doing a single glue-up against a form, but it's easy, foolproof, and less stressful than trying to align 14 to 16 slippery glue lines all at once. Start by gluing up strips in pairs, using spring clamps. (See left photo, above.) Check the numbered ends to make sure you're joining adjacent pieces, and use your register marks to align the grain.

After the glue has set, I remove the clamps and scrape off excess glue. Then I do a "dry run" of the next glue-up stage, which will involve several pairs of staves. Now is the time to correct any gaps in joining edges and fine-tune your clamping strategy.

Joining the stave pairs together forms a small arch that can be clamped with several bar or pipe clamps, C-clamps, or whatever you have handy. (See right photo, above.) The objective is simple:

SQUARING UP THE PANEL



Laminate does the trick. A strip of plastic laminate bends easily to the coopered panel's curve. Clamp one edge of the laminate flush with a panel side, and mark the cutoff line.

Apply moderate pressure and use a balance of horizontal and vertical pressure. Weight placed on top of the arch can take the place of clamps to apply vertical pressure. I look for even beads of glue squeeze-out as indications of even clamping pressure. Use pads to protect stave edges from being marred by clamp feet.

After you glue up two small arches as described above, you can join these arches together, using a similar clamping strategy. Joining a pair of small arches is fairly easy, since you only have a single glue line to worry about.

Smoothing and Squaring

I've tried several methods of smoothing and "fairing" the curved faces of coopered panels. Belt and random-orbit sanders work well on the outer face of a curved panel. On the inner face, I use curved scrapers and a curved sanding block. Wrapping a piece of pine with 1/4-in.-thick packing foam makes a good sanding block.

To get a smooth, uniform surface, I begin by drawing pencil lines across the width of a panel's face, spacing the lines about an inch apart. I scrape, plane, or sand with 80-grit sandpaper until the lines disappear. Then I redraw the lines and sand them off with 150-grit paper. I finish sanding with 220-grit paper.

It's easy to square up a coopered panel. First, I place the panel concave side down on a flat surface. If it wobbles, I mark the high corners and plane the edges until it sits solidly. Then I take a square or rectangular piece of plastic laminate and clamp it so that one edge is flush with one of the panel's two straight edges. Bending the laminate around the outer face of the panel, I mark a right-angled cutoff line. (See photo, left.) Repeat this sequence at the opposite end of the panel, then trim the panel ends square.

Once you've cut your panels to size, your coopering is done. It's time to build the cabinet or chest to fit the curve you've created. Or you can raise the panel edges and make stiles and rails to frame your panel. (See sidebar, opposite.) ▲



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MAKING A CURVED FRAME-AND-PANEL DOOR

A coopered panel can make a fine cabinet door on its own. But I really like the look you get when you surround a curved panel with a stile-and-rail frame. There are two tricky parts in this venture: raising the edges of the curved panel, and making the curved rails.

Raising the Edges

To raise the edges of a curved panel, you need to replace your router's flat plastic sub-base with a curved wooden one made by gluing together several short staves. Make your wooden base oversize so there's plenty of surface area to bear on the panel.

I use two bits to create a raised edge. I start out with a 1/2-in. rabbeting bit. I cut a rabbet all the way around the panel, guiding the router's auxiliary base against the curved surface of the panel and the bit's pilot bearing against the panel edge. Then I replace the rabbeting bit with a core-box bit, which creates a curved transition between the edge and the field. (See left photo, below.) A bowl-cutting bit will also work. You'll need to attach a wooden fence to the underside of the auxiliary base in order to guide the router when making these final cuts. By repositioning the fence and making additional passes, you can get the bit to cut farther from the edge.

Making Curved Rails

While it's possible to bandsaw curved rails, I prefer to laminate my rails on a form. Laminated rails are stronger. They look better, too, since you're not sawing across the grain at an angle. The rails for the door shown in this article are 3/4 in. thick and 1 1/2 in. wide.

I use a simple plywood form for laminating, taking the curve of the form directly from the finished panel. It's impor-

tant to make the form oversize, since you have to allow for rail length, plus the length of the rail tenons and a little waste. I screw short struts to the form sides to keep the laminations straight, and I drill holes for securing clamps. A pair of wooden feet, screwed to the bottom of the form, keep it upright. (See center photo, below.) And to prevent glue squeeze-out from adhering the rail to the form, I cover all "working" surfaces with masking tape.

I rip the rail laminations on my tablesaw. With a premium thin-kerf blade, I can get stock that's ready for laminating without sanding or planing. I cut each laminate strip 3/32 in. thick, 1 3/4 in. wide, and about 4 in. longer than necessary. Eight strips are required to make a 3/4-in.-thick rail. Pre-bending the strips is a good idea. To do this, I dampen the laminations with a wet sponge, clamp them up without glue, and let the setup stand for about 20 minutes before unclamping.

For the actual glue-up, I spread yellow glue evenly over the joining edges, stack the laminations up evenly, and place them on the curved form. I tighten a clamp near the center of the stack, then work my way out toward the ends, as shown below. Once the glue has dried, I unclamp the rail, scrape off the hardened squeeze-out and plane the layers flush. Then I trim the rail to its finished length and cut the tenons on the tablesaw, using a shop-made tenoning jig. (See right photo, below.)

The stiles are straight, so there's nothing unusual about completing their mortises and panel grooves. But to cut the panel grooves in the curved rails, I chuck a 1/4-in.-dia. straight bit in the router and attach a curved fence to the router base. The fence's curve should match the curve of the rail. Position the fence so that the bit is centered on the curved rail.

—S.H.

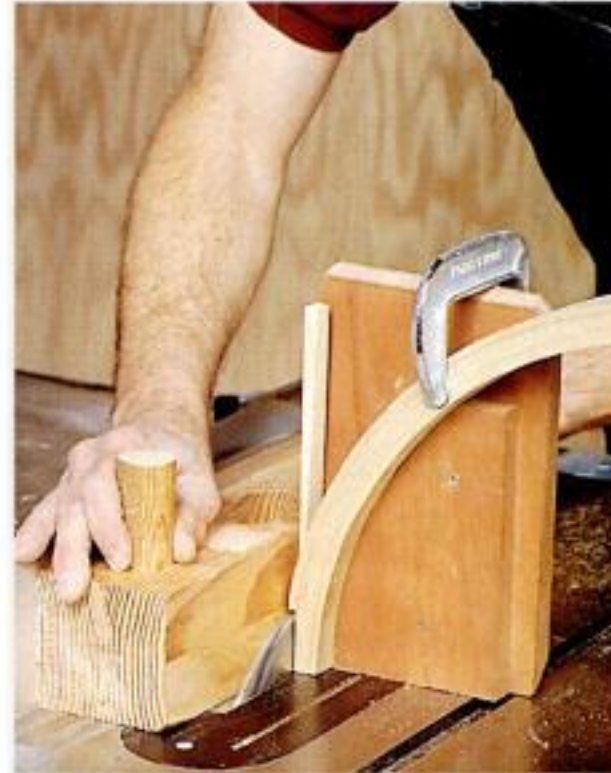
CURVED FRAME-AND-PANEL CONSTRUCTION



Raising the edge. The router needs a curved wooden base to follow the panel's curve. A wooden fence on the underside of the base guides the cut, which is made with a core-box bit.



Laminating a rail. Curved rails for the panel's frame are made by gluing thin strips of wood together in a curved form. Clamps pull the laminations together against the form.



Cutting a rail tenon. With a laminated rail clamped in a shop-made tenoning jig, Hanson cuts half the tenon. The jig's base is guided by the table saw's rip fence.

Make a Rustic Side Chair

*Hand tools split the difference between
free-form and template work*

by Daniel Mack



The shape follows the grain. With just a few simple tools, you can make a green-wood "split grain" side chair that preserves the natural twists and turns of the log.

When I first started woodworking, I did it the "normal" way—a beginners' course at a local college, then a chairmaking course at a local craft center. In the first course, I learned to sharpen a chisel and square up a piece of wood. In the second, all ten of us made identical rocking chairs from a green log. These experiences were formative: I learned that I never wanted to square up another piece of wood, nor did I want to turn another log into anonymous dowel-like posts and rungs.

But I did apply some lessons from these courses to my rustic woodworking. One result is the "split grain" chair. (See photos, above.) The final shape and feel of this chair is influenced by the way the grain runs when you split the wood by hand—hence the name. But the grain isn't the only design factor. By following a gently angled template for the chair's back posts, I keep their shape within a range that's comfortable for your back. The final product is more whimsical than a traditional post-and-rung chair, but less wild than a



SPLITTING AND ROUGH-SHAPING THE POSTS

These photos show how to turn a green 2x4 billet into a chair post.

◀ **Rive the billet to get a post.** Use a hatchet or club and wedge to start the cut; if you have a froe, use it to open the cut.

▼ **Trace the template.** A slightly curved template gives the back posts a comfortable arch. The split grain will tell you which way to align the template.



▼ **Hew to your lines.** Take short, shallow chops with a hatchet so you won't remove too much wood. To remove any milling marks, hew all the way around each post.



stick-style rustic chair. (For more on stick-style chairs, see AW #53.)

In this article I'll give general guidelines for making a split-grain side chair. Your chair doesn't have to look like mine. By varying the construction of the [back panel](#) (see [top right photo, page 55](#)) and the [shapes of the posts](#), you can mimic an earlier style of furniture such as Frank Lloyd Wright, or create something totally new. Or build a table instead—the power is in your hands.

Selecting the Stock

Choose a wood with fairly close grain. I've made split-grain chairs from maple, ash, and pin oak (the smelliest wood I've ever encountered). But cherry is my favorite: When it's green, it splits and shapes very easily with hand tools; the grain is usually visible without being ostentatious; and it ages gracefully to a warm hue, either naturally or with chemical assistance.

I head to the local sawmill and look for clear, green cherry logs at least 6 ft. long. Plan to leave with 150% more

back post billets (2 in. by 4 in. by 6 ft.) than you think you'll need for the number of chairs you plan to make, plus about 50 smaller billets for rungs (1 in. by 1 in. by 4 ft.). A knowledgeable sawyer can give you a rough idea of how much usable lumber a log will yield.

Should you mill the log into billets, or split it by hand from the start? It's your choice. Billets that are initially hand-split or "riven" will exhibit much wilder grain runs than billets that are milled up. If the log is milled, make sure it's sawn as close to the natural grain run as possible. Either way, some new grain will be revealed when you split and shape the billets into posts and rungs.

Chair Parts from Billets

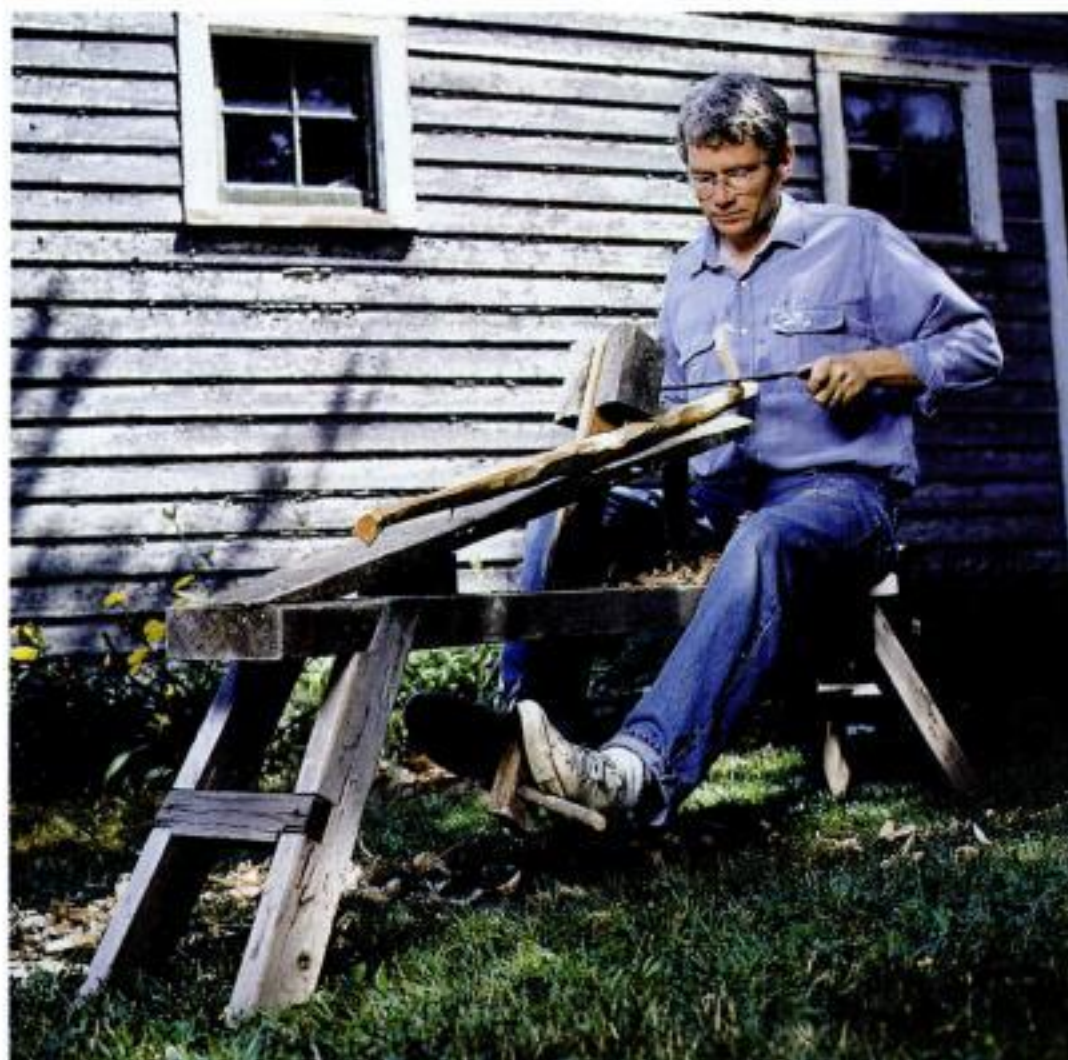
I make chair parts over the course of several weeks, so the green wood can air-dry a little before assembly. Rungs come first—they must dry the longest. Posts come later, since they should be greener at assembly time. That way they'll shrink around the rungs and hold the chair together tighter than glue alone.

Since the rung billets are small to start with, they don't need to be split, just shaped. Take them directly to the shaving horse or bench vise, and refine them with a drawknife and spokeshave. Save any especially knotty or wild-grain pieces for the crown rail. Let the rungs air-dry in a heated area for several weeks.

While the rungs are drying, you can make the posts. The photos above and on page 54 explain this process. Start by riving 2x4 billets. Use a hatchet to start the split and a froe to open it. (For more on riving, see "Q&A," AW #61.) When grain runout yields a piece too short for a back post, save it for the front.

I use a template to help control the angle of the back posts. Most chairs angle slightly backward for comfortable sitting. ([See drawing, page 55.](#)) Bandsaw a full-size template to the desired angle, then use it to evaluate potential back posts. When you find a back post whose grain runs at a similar angle, trace the template on the post and hew to your lines with a hatchet. (See photos, above.) Refine the front and back posts

FINAL SHAPING



Refine the shape.

Take the hewn post to a shaving horse or bench vise, and complete the contours with a drawknife and spokeshave.

Evaluate your work.

Do the posts (left and center) follow the angle of the template (right)? Do you like the way they look?

No two posts are alike, but they match well enough because of the template.



with drawknife and spokeshave as you did for the rungs, and let the posts air-dry in a heated place for a week or so.

While the parts are drying, settle up on dimensions—post height, seat height, where the mortises go in, etc. The drawing opposite provides guidelines, but you can alter these dimensions to fit the sitter.

Joints and Assembly

Before you lay out any joints, match up posts and rungs in symmetrical pairs. Some posts will look better on the right; others on the left. This matching is the heart of your design process: No sleepy woodworking allowed!

I lay out joints with a tape measure, using the dimensions shown in the drawing. Note that just as the back posts angle slightly backward, the seat tilts slightly backward. Lay out the seat joints accordingly—16 in. from the bottoms of the back posts, and 17 in. from the bottoms of the front posts.

Mortising is quick and simple on the drill press. I use a $\frac{5}{8}$ -in. flat-bottom bit, and support the post with notched wooden blocks. (See left photo, opposite page.) To drill the non-square angles for the splayed seat, you can tilt your drill press table or set the notched blocks on an angled ramp. Some chairmakers sight along a bevel gauge while they drill the

compound angles; I just eyeball them. It helps to lay out the parts beforehand as they will be assembled, so you can envision the angles as you drill.

Tenons take a bit more time. To speed up my professional work, I have an electric tenoning machine (available from Bignell Machine Co., 516 7th St. NE, Grand Rapids, MI 49504, 616-458-2233) that works like a pencil sharpener without the taper. You can whittle tenons, shape them with a brace and hollow-auger bit, or try the Veritas tenon cutter. (See "Toolbox," page 84.)

Gluing up subassemblies. Precede your glue-up work with dry runs to make sure all parts fit correctly. I glue up the back panel first, using regular carpenter's glue. Then I tackle the front panel. (See right photo, opposite page.) Band clamps hold each assembly together while the glue is drying. Finally, I put the two subassemblies together with the side rungs.

Finishing

I "age" my cherry chairs with homemade lye solution. This process relies on a chemical reaction between the lye and the tannins in the wood. It's less predictable than staining, but more dramatic and very well suited to rustic woodwork.

Wipe on the lye *before* assembly, so the glue won't keep the lye from penetrating. Put one tablespoon of lye in two quarts

of warm water, in a glass container. A weaker solution yields a lighter color; a stronger lye solution will eat through your final coat of finish. *Caution:* Lye is caustic—it can burn you. Wear safety goggles and chemical-safe gloves. The lye dries in about 20 minutes.

After assembly, I carefully scrape off any squeeze-out and sand very, very lightly with 220-grit paper to remove raised grain. The lye finish is only skin-deep; if it comes off, you can make the error less conspicuous with a closely matching color of magic marker. To complete the finish, I wipe on a coat of polyurethane varnish, sand lightly again, and rub the chair down with paste wax.

The seat cushion comes last. This cushion is a very simple upholstery job—all you need is a piece of plywood, some padding, some covering, and a staple gun. (See "Section Through Cushion," opposite page.) Check your yellow pages for local upholstery and fabric or leather suppliers. ▲



DANIEL MACK
is a professional rustic
woodworker and
author in New York.



Mortising made easy. A pair of notched wooden blocks cradles the post as you drill. Hold the post steady with your free hand. For angled mortises, tilt the table or rest the blocks on a ramp.



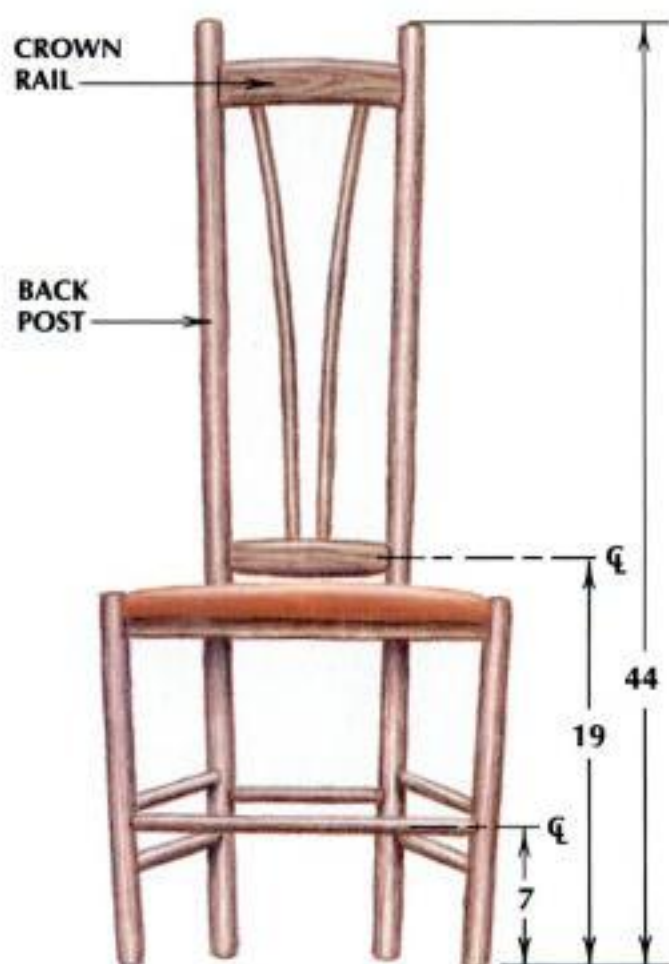
Front and back subassemblies. The back panel is glued up and ready to go. Band clamps hold the front panel in place (foreground) while the glue sets. While you're waiting, you can dry-fit the next chair.

BASIC CHAIR DIMENSIONS

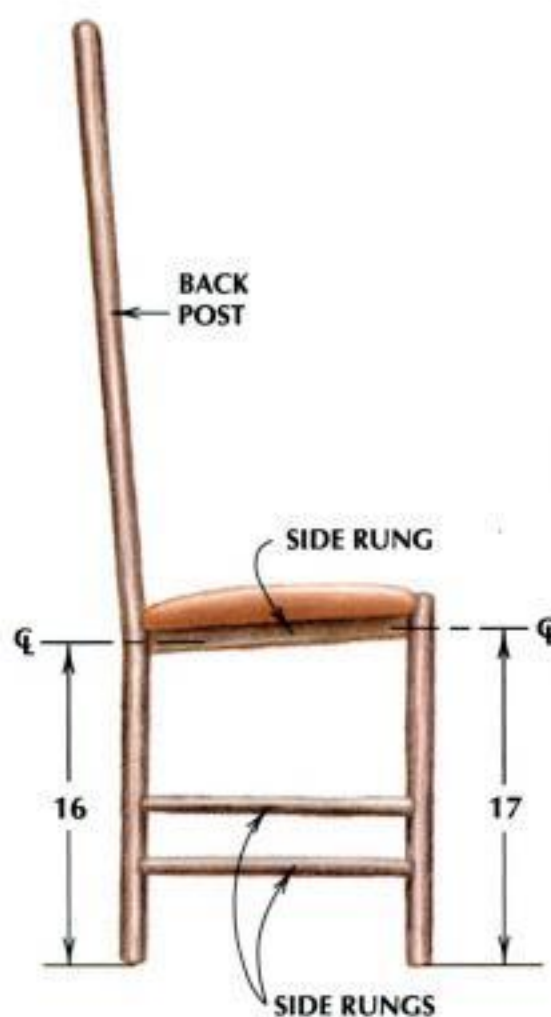
ELEVATION VIEWS

The dimensions below are for a chair like the one in the lead photo. Make all tenons $\frac{5}{8}$ in. dia. by $\frac{3}{4}$ in. long—or up to $\frac{3}{4}$ in. dia. by 1 in. long for larger stock.

FRONT

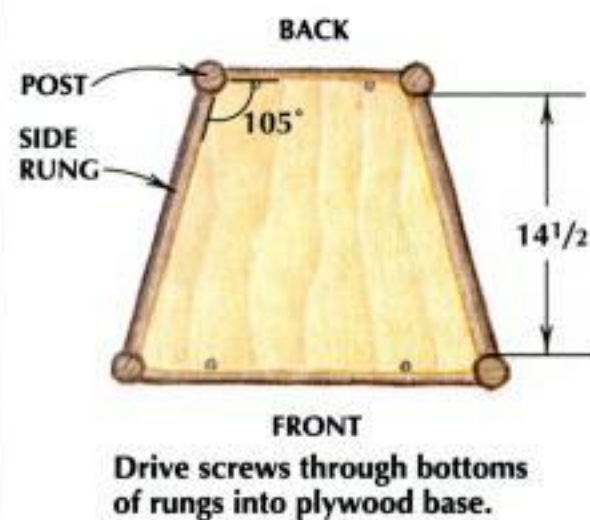


SIDE

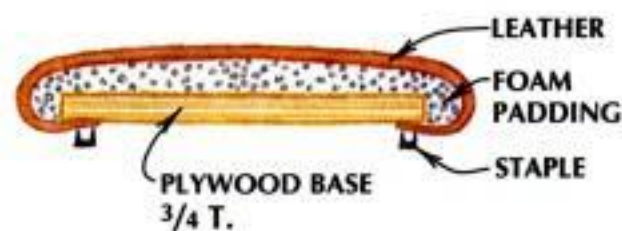


TOP

Seat overlaps chair frame front and back.



SECTION THROUGH CUSHION





Great Scot!

Charles Rennie Mackintosh designed sleek, sexy furniture—in the age of Queen Victoria

by David Kiley

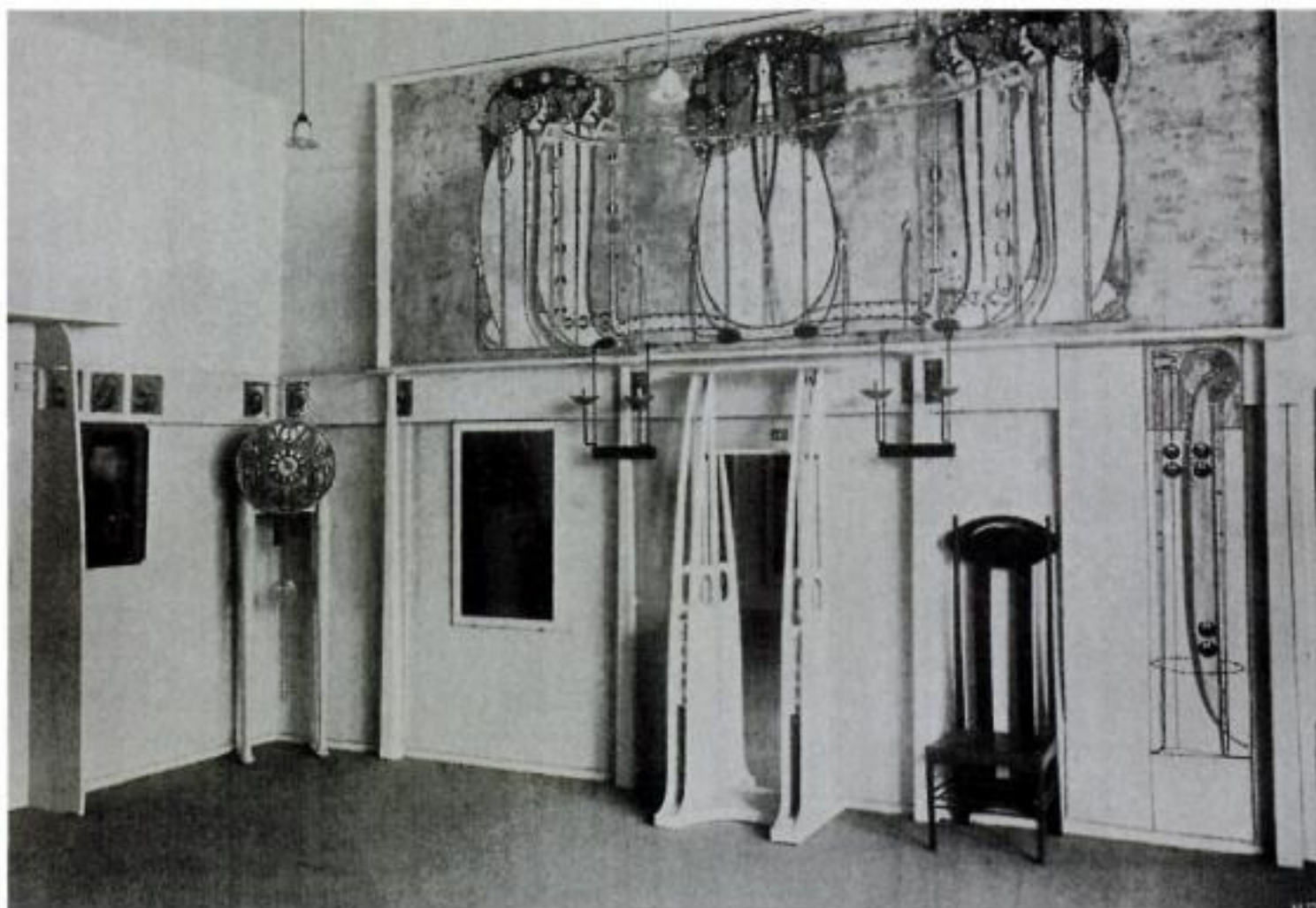
Charles Rennie Mackintosh, 1868-1928. This radical Scot made bold modernist furniture at the dawn of the 20th century.

In the 1890s and early 1900s, most British craftsmen were still making heavy, highly ornate, Victorian-style furniture covered with carvings and intricate turning. Only a few, disillusioned with machine-made products of the late 1800s, were venturing into the rectilinear Arts and Crafts style. But one young Scotsman—Charles Rennie Mackintosh—moved radically beyond them all, into the sleek lines and spare, sinuous curves that we now associate with the Art Deco and modernism of the 1920s, '30s, and '40s. Mackintosh's use of bold, stylized geometric shapes and his passion for making furniture fit its destination have inspired the work of furniture makers ever since.

Mackintosh was born in 1868 to a Glasgow policeman and his wife. Mackintosh was dyslexic and walked with a limp, but even as a child he was a talented artist. By age 15 he was studying architecture, painting, graphic design, and furniture design at the Glasgow School of Art.

Through his first job in an architecture firm, Mackintosh met several other young artists who greatly influenced his style: Herbert McNair, and the sisters Frances and Margaret McDonald. The young group of friends called themselves "The Immortals," and they used geometric shapes to create elegant, flowing designs for paintings, fabric, and furniture. The controversial sexual imagery and ethereal spiritual

The chair fits the room. Mackintosh modified his designs to fit different settings. Here, a similar chair appears with other Mackintosh work at the Eighth Vienna Secession, a modernist exhibit held in 1900.



imagery in some of their work drew scorn from many critics, who called them "The Spook School." But other designs were drawn from less objectionable sources—birds, flowers, and plants were frequent themes.

Furniture Should Fit the Room

As an architect and artist, Mackintosh fervently believed in what he called "the total art form." A building's interior had to be in complete harmony with its exterior—right down to the vases, light fixtures, and fireplace irons. Though Mackintosh wasn't closely associated with Arts and Crafts artisans, he probably borrowed this idea from them.

Few clients had the money or the patience to indulge Mackintosh's "total art form." His best-known work was for Miss Cranston's tearooms, the most exclusive dining rooms in Glasgow. True to his word, he coordinated everything from the furniture to the tableware and even the waitresses' uniforms.

Each piece of Mackintosh's furniture was designed to fit a particular place in the room. He worked mostly in neutral colors—dark-stained, ebonized, or black enameled oak furniture for "masculine" rooms; white or pastel enameled furniture for "feminine" rooms. Inlays of stained and leaded glass, silver, or trendy new plastics provided welcome splashes of color.

Mackintosh carefully considered the type of use that each piece of furniture would receive. Some Mackintosh pieces—including certain highback chairs for tearooms—were intended more for decoration than for regular use. One such ladderback chair has legs that are only $\frac{3}{4}$ in. square! But other pieces, such as dining-room chairs for private houses, were built to withstand daily wear and tear.

Mackintosh has been described as a proto-modernist or as a prophet of Art Deco. Though he achieved tremendous output—more than 400 furniture designs—and considerable success in continental Europe, he quit designing furniture to concentrate on watercolor painting just as the modernist movement took off. But today, 100 years later, his futuristic designs have once again found their place in time: You can see them on the set of TV's *Star Trek: The Next Generation*. ▲

DAVID KILEY is a woodworker and the features editor of *Brandweek* magazine.

The Mackintosh Style

Highback chairs were popular in the late 19th and early 20th centuries. Mackintosh used them as accent pieces in private settings, and as "room dividers" in public settings.

Images of nature or people. Is this a bird cutout in a sun-shaped headrest? Or an eye cutout in a head-shaped headrest?

Headrest is pinned into through mortises on back posts.

Frequent use of simple geometric shapes foreshadows the Art Deco style.

Slender, elongated lines evoke the Art Nouveau and modernist styles.

Simple cushion bears little resemblance to Victorian upholstery.

Outer back posts are rectangular at the floor, taper to square near the seat, then taper to oval and then round at the top of the headrest.



FOR MORE INFORMATION

BOOKS TO READ

Charles Rennie Mackintosh,

by Wendy Kaplan (1996, Abbeville Press, 800-278-2665)

The Mackintosh Style, by Elizabeth Wilhide (1995, Chronicle Books, 800-722-6657)

PLACES TO VISIT

Call ahead for tour information.

Glasgow School of Art, 167 Renfrew St., Glasgow, 011-44-141-353-4500

The Mackintosh House,

Hunterian Art Gallery, University of Glasgow, Hillhead St., Glasgow, 011-44-141-330-5431

Queens Cross Church, home of C.R. Mackintosh Society information center and reference library, 870 Garscube Rd., Glasgow, 011-44-141-946-6699

The Willow Tea Rooms, 217 Sauchiehall St., Glasgow, 011-44-141-332-0521

DOVETAIL PUZZLE BOX

Create a mystery to challenge your friends

by Jim Follette



THE SOLUTION



STEP 1: Tap the face with the small dot—this will knock the base pins away from the magnet.



STEP 2: Spin the box to separate the two base pins, so the locking post can fall between them.

STEP 3: Push the spring-loaded button to release the locking post, and slide the top off. There's your penny!

My day job is medicine, and I strive to help my patients heal and ease their troubled minds. My hobby is making wooden puzzles to drive people nuts. This project is one of my favorites.

The challenge is to separate the box's top from its bottom and find the penny inside. The first task is figuring out how the top and bottom come apart. A close inspection reveals that the dovetails run in three parallel rows—all you have to do is slide the two pieces apart. (See Fig. 1.)

The top won't budge, though, because it's locked in place. So the second task is figuring out how to unlock it. The steps for solving the puzzle are shown in the photos opposite. The secret to the locking mechanism is shown in Fig. 4.

I divided the construction of the puzzle into two phases: building the body and creating the internal locking mechanism.

Build the Body

I like to make the puzzle out of three different species of wood, with as much contrast as possible. You need to use clear hardwood for strength, because the narrowest part of each tail gets pretty thin.

I glue up the two-piece top oversize, and when the glue dries I cut both top and bottom to their final thickness and length; the length has to be precisely 4 in. (See Fig. 2.) The final front-to-back depth will be exactly $3\frac{15}{32}$, but for now I leave it oversize—around $4\frac{1}{4}$ in.

Next I rout the dovetails across the grain, using a 14° dovetail bit on the router table. To make routing easier, I first remove most of the waste by cutting a series of $\frac{7}{16}$ -in.-deep grooves on the tablesaw.

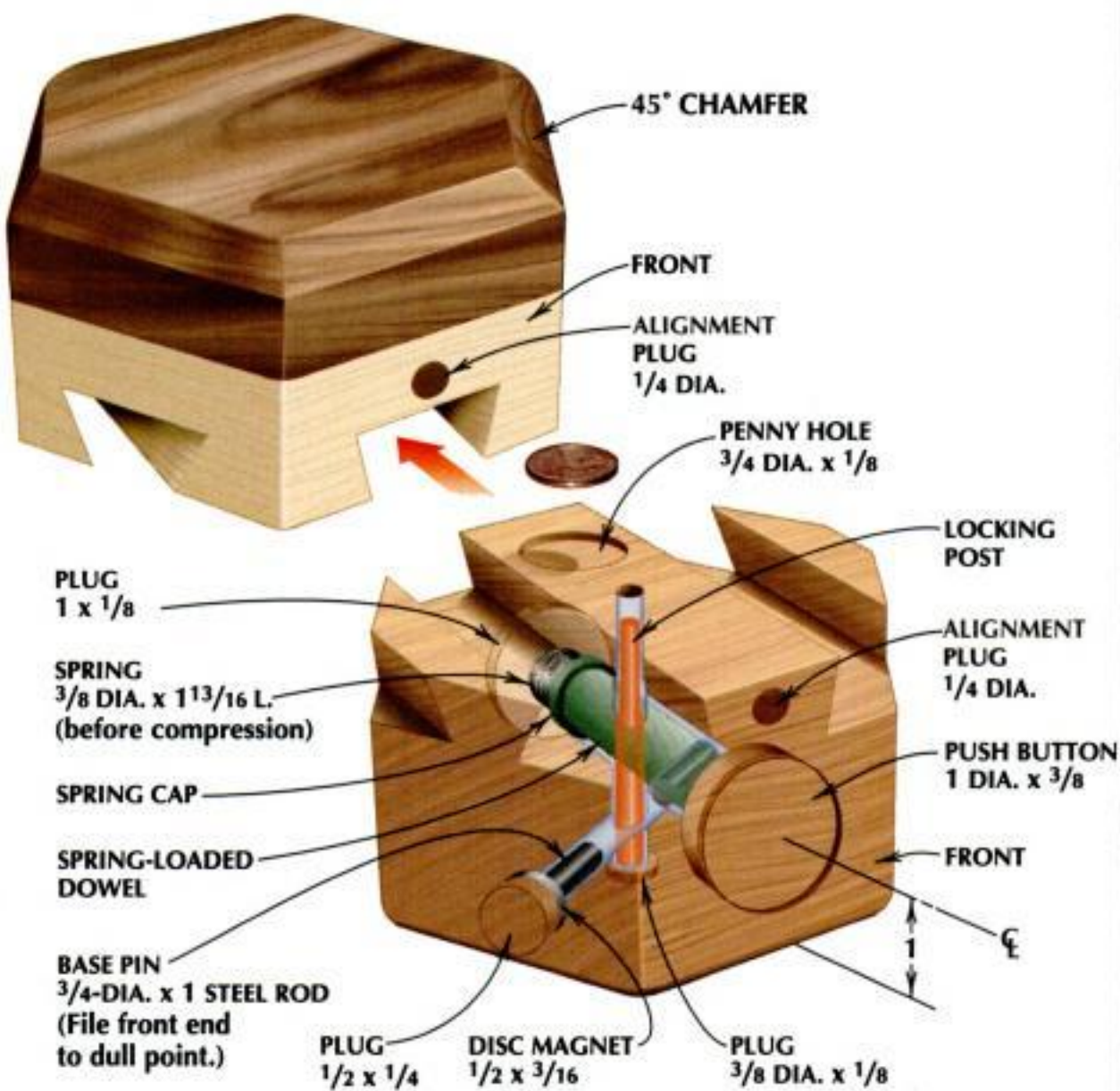
After you rout the dovetails, the top and bottom should slide together with very little friction.

Then tape the top and bottom together at the sides and trim the front-to-back depth to exactly $3\frac{15}{32}$ in., removing any router tearout. While the body is still taped, drill matching $\frac{1}{4}$ -in.-dia. holes in the front of the puzzle, plug them, and sand them flush. (See Fig. 3.) These plugs are your alignment marks for putting the puzzle back together.

Now trim the body's four corners to make the box hexagonal. With the top and bottom taped together on all four sides, mark the puzzle's body as shown in Fig. 3. Trim the corners on a power miter saw, radial-arm saw, or tablesaw. To be safe, clamp the puzzle to the fence or miter gauge. You can also temporarily attach it to a fence with hot-melt glue.

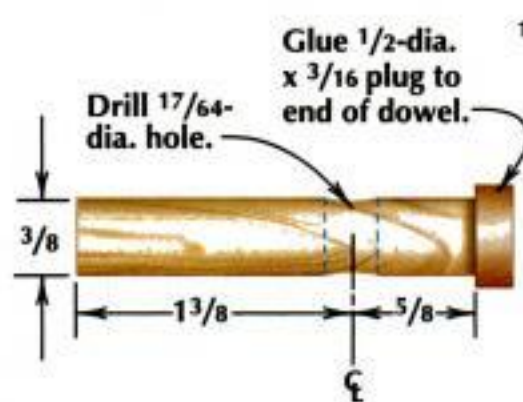
FIG. 1: DOVETAIL PUZZLE

The top is made of two contrasting woods, laminated together. When you unlock the puzzle, the top and bottom slide apart along three parallel sliding dovetails. (See photos, opposite.) This drawing shows the relationship of the internal mechanism when the puzzle is unlocked. Figs. 2, 3, and 4 illustrate the major steps in the puzzlemaking process.



LOCKING MECHANISM DETAIL

SPRING-LOADED DOWEL



LOCKING POST



Set the saw's miter angle to a dead-accurate 30° . Press the front and back against the fence, and cut off the four corners.

The final step in shaping the body is chamfering the top. (See Fig. 1.)

The Locking Mechanism

Keep the box taped together while you drill the three deep, stepped holes for the internal mechanism. (See Fig. 4.) Each hole intersects at least one other hole, so they must be drilled precisely on the drill press. Use twist-drill bits to keep all holes centered.

The first hole is vertical, and it accommodates the retractable locking post. With the body still together, drill through the center of the bottom. (Draw two diagonals to find the center.)

Start with a $\frac{3}{16}$ -in.-dia. bit and drill to a depth of $2\frac{1}{2}$ in. Then enlarge the hole by drilling with a $\frac{17}{64}$ -in.-dia. bit to a depth of $1\frac{3}{4}$ in. Enlarge it once more to a depth of $\frac{1}{8}$ in., this time using a $\frac{3}{8}$ -in.-dia. Forstner bit.

The second hole is horizontal, and it's for the spring-loaded dowel. (See Fig. 4.) I drill it in the front (the face with the two alignment plugs). It must intersect



Precision drilling. Use a fence and a stop block on the drill press to make sure the angled holes will intersect.



Pin reduction. Reduce the base pin's diameter at one end by filing it as it spins in the drill press.

the locking-post hole you just drilled, and it's not difficult to line it up: I chuck a $\frac{25}{64}$ -in.-dia. bit in the drill press, then set the fence $3\frac{1}{2}$ in. from the center of the bit. Place the puzzle on its back with the top against the fence, and center the bit in front of the bottom hole. Clamp a stop to the fence so it touches the side point of the hexagon. Then move the fence $1\frac{1}{4}$ in. forward or insert a $1\frac{1}{4}$ -in. spacer between the fence and puzzle. Drill all the way through the puzzle, and make sure it intersected the vertical hole.

Change to a $\frac{1}{2}$ -in.-dia. bit and enlarge the back end of this hole to a depth of $1\frac{1}{8}$ in. (See Fig. 4.) Then switch to a 1-in.-dia. Forstner bit and enlarge the hole in front to a depth of $\frac{3}{8}$ in. and the hole in back to a depth of $\frac{1}{8}$ in.

Next drill the lower horizontal hole for the two base pins and magnet, using a $\frac{5}{8}$ -in.-thick spacer against your fence. You can drill this hole in any of the four remaining faces of the hexagon, as long as it intersects the locking-post hole. (See photo, above left.) Start by drilling a $\frac{17}{64}$ -in.-dia. hole to a depth of $3\frac{1}{4}$ in. (not all the way through the body) and enlarge it with a $\frac{1}{2}$ -in.-dia. bit to a depth of $\frac{3}{8}$ in.

Post and Pins

Now you're ready to fill the holes with mechanical gizmos. The needed materials—steel rod, spring, and magnet—are available at hardware stores.

I made the locking post out of $\frac{1}{4}$ -in.-dia. steel rod, though a brass rod would be easier to shape with a file. I reduced the diameter of one end so when the puzzle is open, the post can't fall out. (See Fig. 1 detail.) I chuck the post in my drill press and use a metal file to reduce $\frac{5}{8}$ in. of its length to a diameter of $1\frac{1}{64}$ in.

(See photo, above right.) To protect the drill's chuck I cut a ring out of a peanut-can lid and tape it to the bottom of the chuck's jaws with double-stick tape.

I also cut the two base pins from $\frac{1}{4}$ -in. steel rod. File or grind one pin's end to a dull point to weaken its attraction to the magnet, so you'll be able to knock the pin away from the magnet to solve the puzzle. (See top photo, page 58.)

Round over all sharp edges of these three metal pieces so that they won't bind inside the puzzle. I buff and wax them before installing them in their holes (which we'll do later).

Spring Loaded

The spring-loaded dowel in the upper horizontal hole keeps the locking post from falling even after you spin the base pins apart. To make it, I insert a $\frac{3}{8}$ -dia. by 4-in. dowel all the way through its hole, and use the locking-post hole as a guide to drill a $\frac{17}{64}$ -in.-dia. hole through the center of the dowel. Then remove the dowel, smooth the rough edges of the hole with a round file, and cut it to final length. (See Fig. 1 detail.)

I cut a $\frac{3}{16}$ -in. length of $\frac{1}{2}$ -in.-dia. dowel for the spring cap, sand it a little undersize in diameter, and glue it to the "short" end of the $\frac{3}{8}$ -in. dowel, centering it as precisely as possible. When the glue dries, insert the dowel-and-cap assembly in its hole to make sure it slides smoothly—if not, sand some more, then wax it.

Post, Magnet, and Spring

Now the internal pieces start to interact. Insert the $\frac{3}{8}$ -in. dowel in its hole again, turn the puzzle upside down, and drop the post into its hole—thread the post through the hole in the dowel on its way in. To keep the dowel in place while you

thread the post through it, you should be able to grab the protruding "long" end of the dowel with your fingers.

Next glue a 1-in.-dia. plug to the "long" end of the dowel for your button. (See Fig. 4.) I cut the plug from an offcut for a close grain match. Keep glue off the surrounding hole so the button can move in and out. Also plug the bottom of the locking-post hole.

Insert the two base pins in their hole, pointed end facing out. Force a disc magnet (not a strong rare-earth magnet) in behind them and plug that hole too.

When the glue dries, insert a spring behind the spring-loaded dowel and plug the hole. You'll have to clamp the plug in place because the spring will be compressed. After the glue dries, trim the plugs and sand all faces flush. Soften the sharp edges of the dovetails.

The last step is to drill the shallow hole for the penny in the center dovetail of the bottom piece. After fine-sanding, I finish the puzzle with beeswax polish, which helps the dovetails slide smoothly.

Lock It Up

Place a shiny penny in its hole. To lock the puzzle, slide the top and bottom together, turn it upside down, and press the spring-loaded button. You'll hear the post fall into locked position. Shake the puzzle so the base pins contact the magnet. Then find a friend to drive crazy. ▲



JIM FOLLETTE is a physician and woodworker in New York. For a free brochure on Jim's puzzle designs, e-mail jwfollette@pol.net.

FIG. 2: CUTTING THE DOVETAILS

Start by cutting the top and bottom pieces to the dimensions shown below. Lay out the sliding dovetails as shown, then cut the dovetails in the bottom piece first. Use a 14° dovetail bit in the router table. Use the bottom dovetails as a guide to lay out the top dovetails.

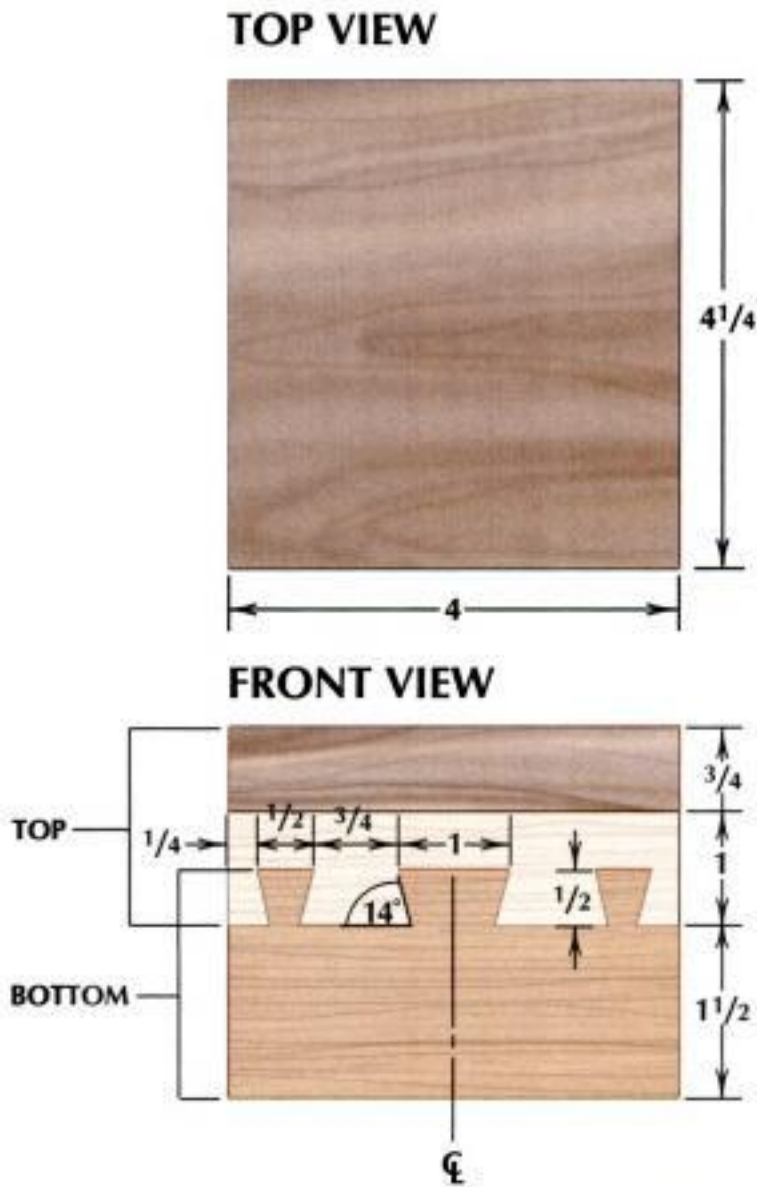


FIG. 3: FROM SQUARE TO HEXAGON

After cutting the dovetails, slide the top and bottom together, tape the ends, and trim the puzzle blank to its final width of $3\frac{15}{32}$ in. Then tape the front and back, and trim the corners as shown.

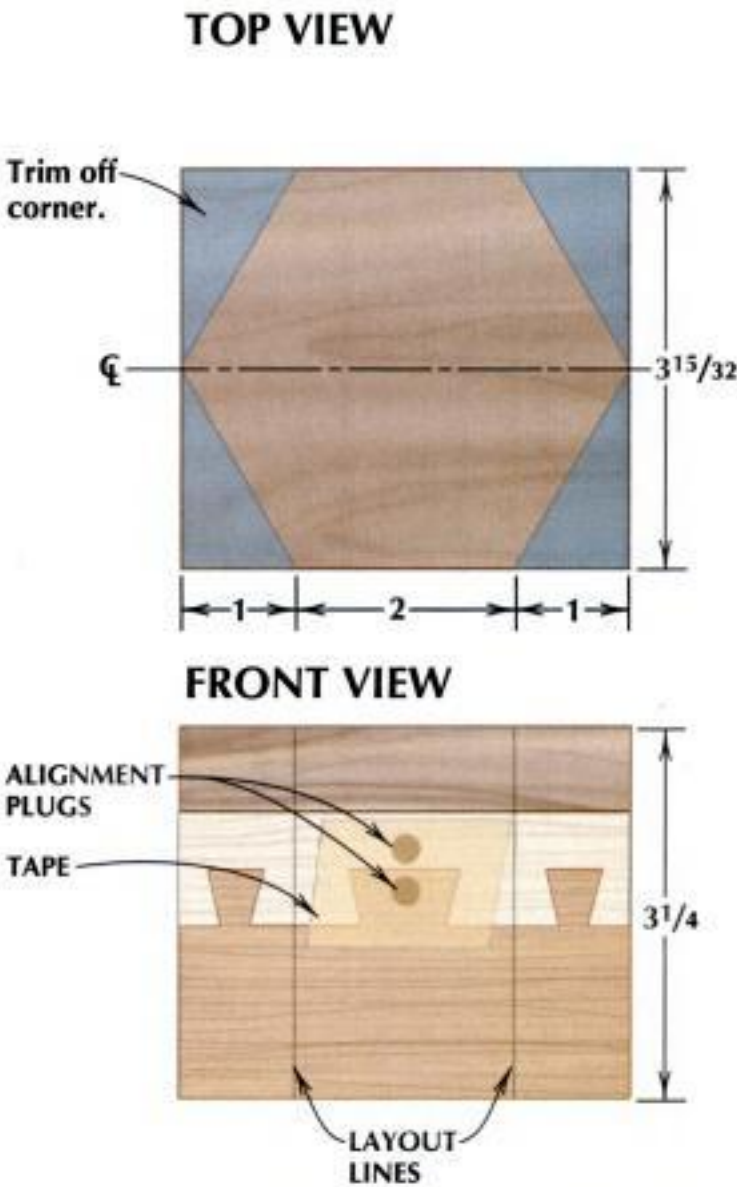
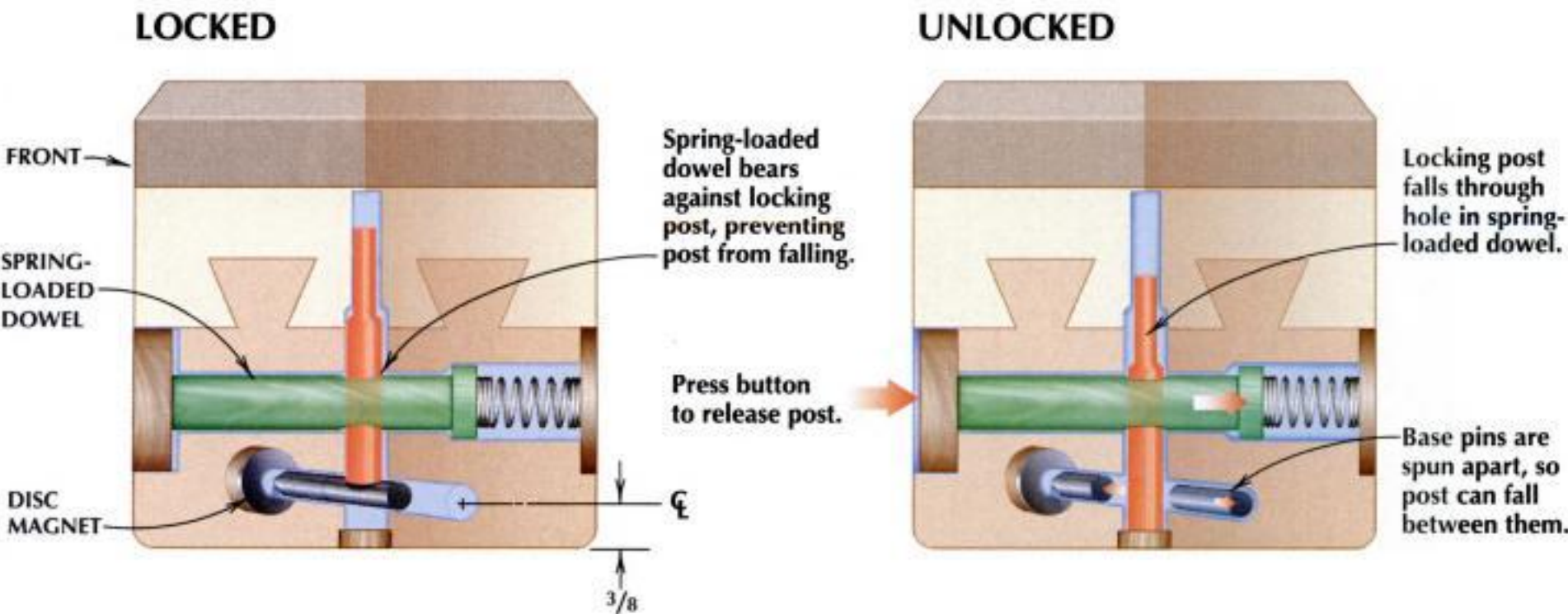


FIG. 4: HOW THE LOCKING MECHANISM WORKS

The locking mechanism fits into a series of three stepped, intersecting holes that need to be bored on the drill press. (See top left photo, opposite.) When the puzzle is locked, the locking post (red) extends into the top so you can't slide the top and bottom apart. The post rests on the two base pins (blue), and is also held in place by contact with the spring-loaded dowel (brown). To unlock the puzzle, you must retract the locking pin by first separating the base pins, and then pressing the 1-in.-dia. button to move the spring-loaded dowel away from the locking pin. (See photos, page 58.)



Colonial Corner Cupboard

The history and construction of an 18th-century classic

by Lonnie Bird

The Colonial craftsmen on Virginia's eastern shore, where many versions of this corner cupboard were built, developed frame-and-panel construction to an especially high level. Frame-and-panel assemblies were joined together to create furniture as well as architectural elements. Chests, cupboards, bookcases, doors, wainscots—even entire walls were fashioned using this construction method.

The antique cupboards that inspired my reproduction were built by house joiners, not cabinetmakers. These 18th-century carpenters typically used simple joinery and plenty of nails to assemble their furniture. Pegged mortise-and-tenon joints were reserved for doors and frame-and-panel assemblies.

Interior architecture. Fluted pilasters and mitered bands of molding create a dramatic presence. This piece is patterned after an antique version built in eastern Virginia during Colonial times.



What this furniture lacked in sophistication of construction, it made up for with elaborate architectural detail. No piece illustrates this principle better than the corner cupboard. Part furniture and part interior architecture, the corner cupboard presented its makers with a triangular shape and tall, narrow proportions that cried out for ornamentation.

To visually reduce such a large mass, builders used a waist molding to divide the cupboard into an upper and lower case. A sash door in the upper case usually had 12 to 15 "lights," or glass panes. The fanciest cupboards (including mine) were built with "tombstone" doors—so named because of the arched top rail. Lower doors were usually made of two rectangular raised panels separated by a narrow rail or muntin.

Fluted pilasters flanked the doors. The pilasters were designed to resemble the ornate columns in classical architecture, with intricately molded bases and capitals. By carefully mitering horizontal bands of molding around the pilasters, builders added a tremendous degree of visual detail. The finishing touch was a complex crown molding made up of two or more joined molding strips.

Many antique corner cupboards from Virginia's eastern shore were made from locally milled yellow pine and painted in bright colors. Green was popular, with highlights of orange and white. Although this may seem unusual to us today, it was a way for colonists to brighten up the dark interiors of their homes.

I've also found a few surviving examples made of black walnut, which is what I used to build my own version. The drawings on the pages ahead will provide the important proportions, molding profiles, and construction details if you want to make a cupboard of your own. And I'll fill you in on the major steps in the construction sequence in the text ahead.

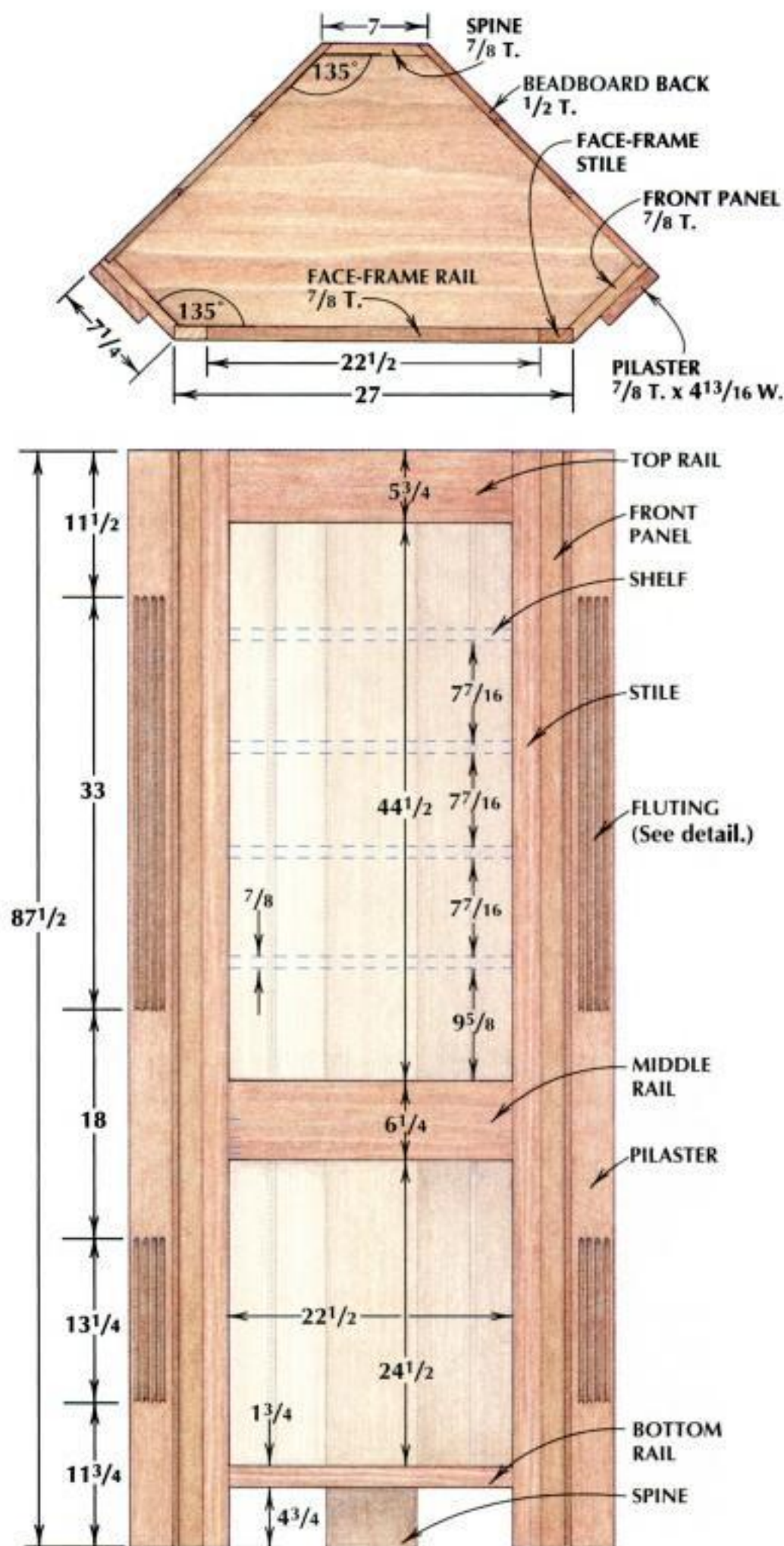
Building the Cupboard

This cupboard looks much more intimidating to build than it actually is. Strip away the ornate moldings and what you have is a very basic case made from solid wood. (See Fig. 1.) And if you're not up to building a "tombstone-style" glass light door, don't worry. Many antique examples of this cupboard have doors made with straight top rails.

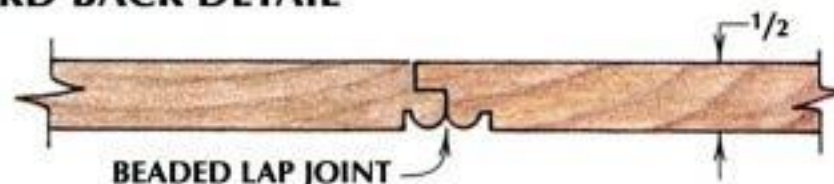
Unlike the craftsmen who built these pieces two centuries ago, I don't assemble my cupboards with hide glue.

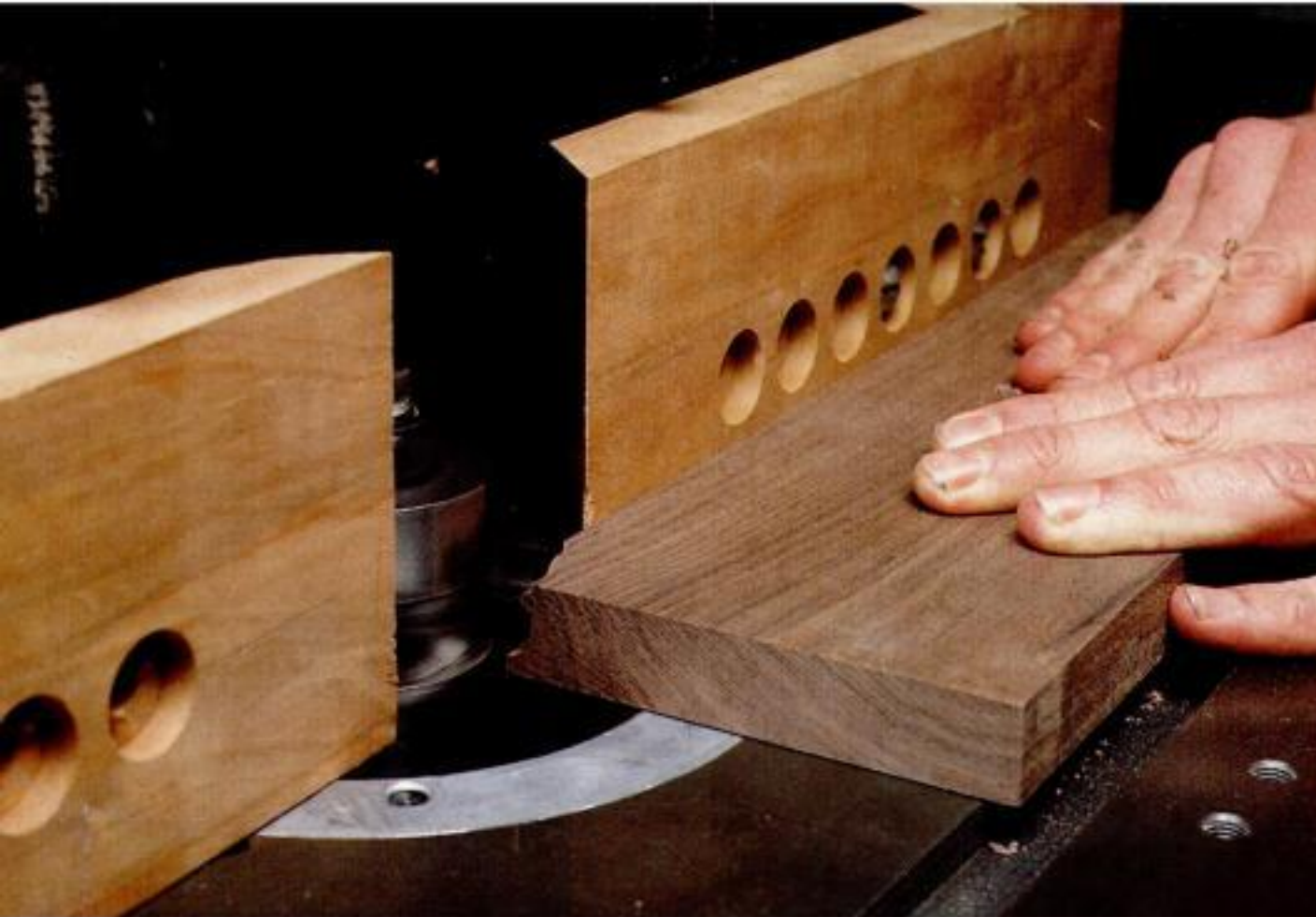
FIG. 1: CASE CONSTRUCTION PLAN AND ELEVATION VIEWS

Strip away the moldings and the core of this cabinet is revealed: a case piece made from solid wood. The plan and elevation views show the key dimensions and construction details. The two pilasters are also shown. These are the first two pieces of molding to apply.



BEADBOARD BACK DETAIL





Custom-made moldings. Authentic molding profiles call for custom-ground shaper knives. It's safer to shape a profile on wide stock, as Bird does here. Then he rips the narrower molding free.

Instead I use yellow wood glue because it's easier to work with and it holds well. I do, however, like to use historically accurate cut nails instead of standard nails and brads. The irregular wrought heads of these nails show on the cupboard's back pieces. I get my nails from Tremont Nail Co. (800-842-0560).

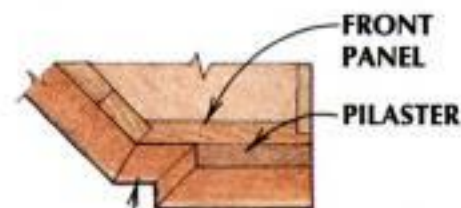
The moldings make the piece. Stock moldings from a lumber dealer won't do for a piece like this. To make my cup-

board, I took careful measurements of the moldings used on genuine antique cupboards. (See Fig. 2.) You can come close to duplicating profiles using a selection of router bits, or a tablesaw molding head fitted with different knives. But it's much easier to create historical accuracy on the shaper, using custom-ground knives. (See photo, above.)

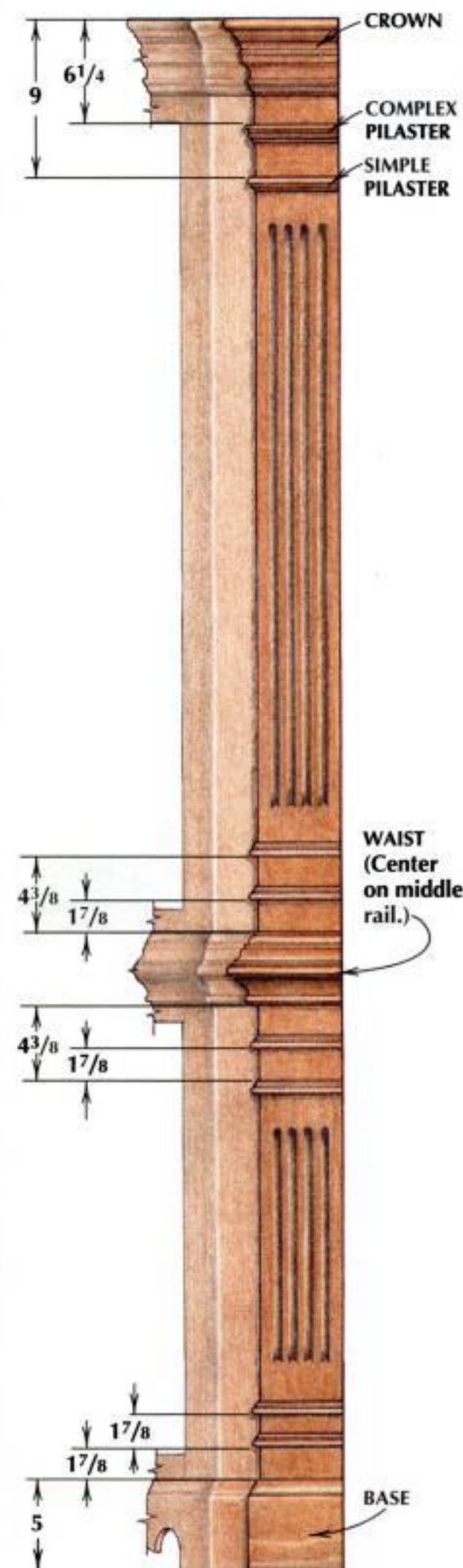
When you set up for a run of molding, always plan to make more than you'll

FIG. 2: APPLIED MOLDING

TOP VIEW



ELEVATION



MASTERFUL MOLDING WORK



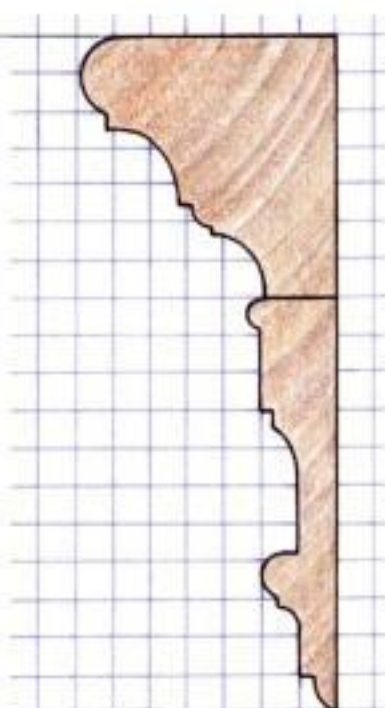
Tight joints to turn corners. Each course of molding runs horizontally, "wrapping" around pilaster and case corners with tight miters.



Working on the waist. Bird's assistant, Jeff Coffman, clamps a length of waist molding to the case to ensure exact marking for the miter cut.

CROWN MOLDING

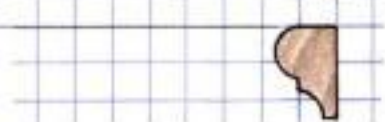
Moldings transform the bare case shown in Fig. 1 into a masterpiece rich in intricate detail. There are two secrets to this transformation: 1) Authentic molding profiles, taken from antique examples, ensure proper proportions and a pleasing combination of shapes. 2) Exact miters effectively "wrap" molding around the pilasters and front corners. This carries the molding lines seamlessly around the case.



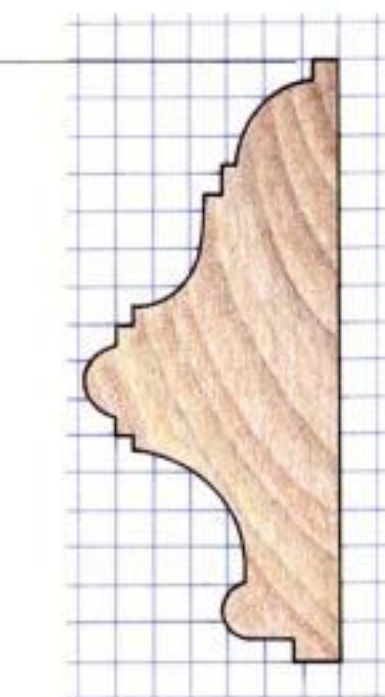
COMPLEX PILASTER MOLDING



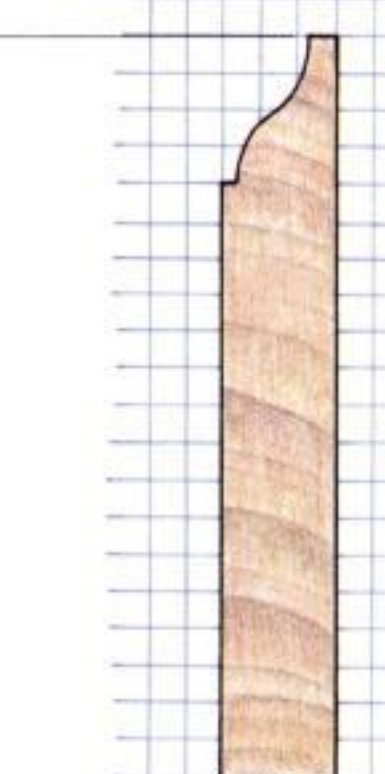
SIMPLE PILASTER MOLDING



WAIST MOLDING



BASE MOLDING

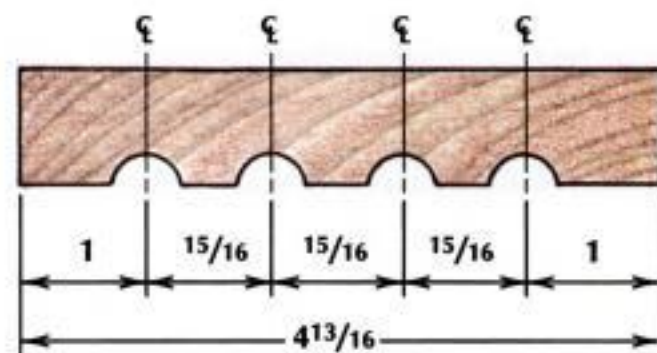


1 square = $\frac{1}{4}$ sq. in.

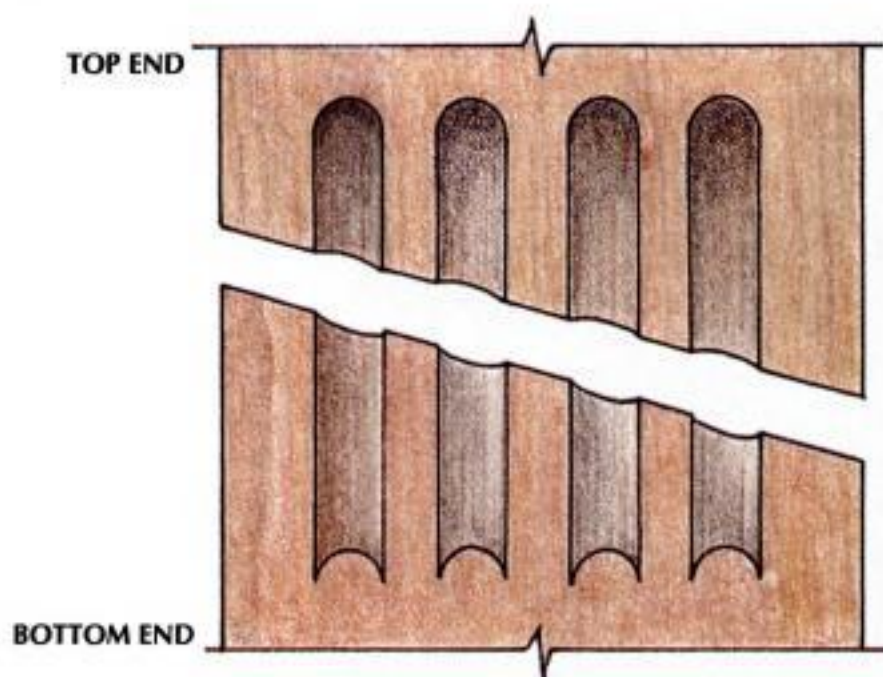
PILASTER FLUTING

Rout flutes with a $\frac{1}{2}$ -in.-dia. round-nose (or core-box) bit, following the spacing shown below.

SECTION VIEW



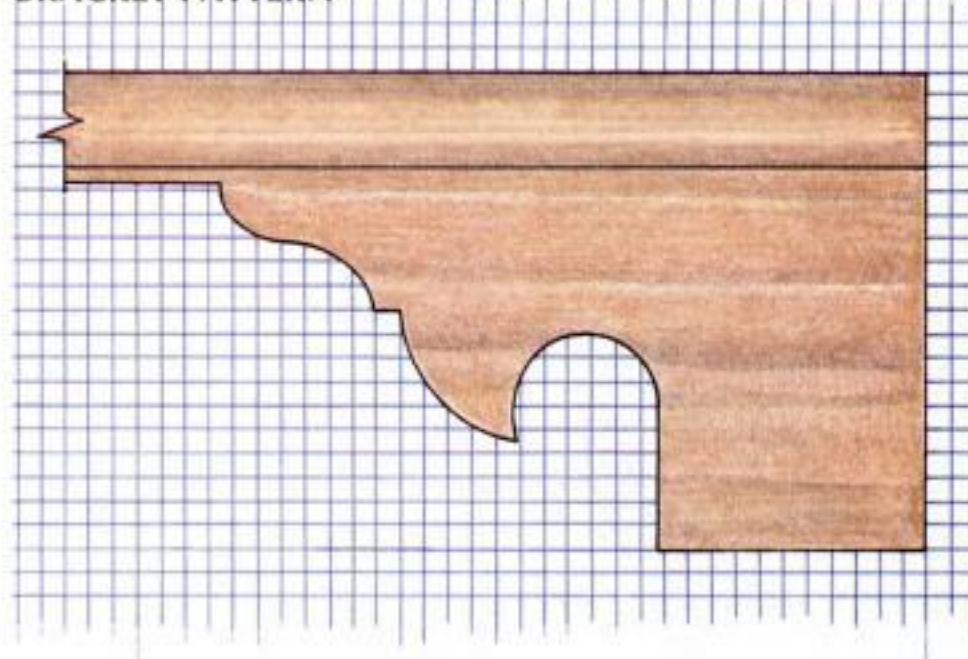
ELEVATION



BRACKET DETAILS

Cut bracket into base molding piece on front of cupboard.

BRACKET PATTERN



DOOR DETAILS



Making the muntins. With sashmaking cutters, you can make mullions as well as stiles and rails for glass light doors. Make sure to use a shop-made push stick, as shown above, when shaping narrow parts.



Building an oversize door. Coffman positions the completed upper door on top of its opening so he can mark it for trimming. Bird recommends building the door to match the opening size, then trimming to fit.

need. This will create a stockpile of extra molding you can draw on later if you miscut a piece.

Making the case. I assemble the face frame first, then make the two front panels. The notched front edge on each panel promotes a precise glue-up. I dado and rabbet the front panels to accept the top, bottom, and shelves.

Join the face frame to the front panels next. This will give you the critical dimensions for the top, bottom, and shelves. I pattern-route the shelves, using a hardboard template and a flush-cutting bit. You can take the hard

edges off the shelf curves using rasps and sandpaper.

Glue the shelves, top, and bottom to the face frame and front panels. It's fine to secure these joints with screws, but locate them where they will be covered by pilasters and molding.

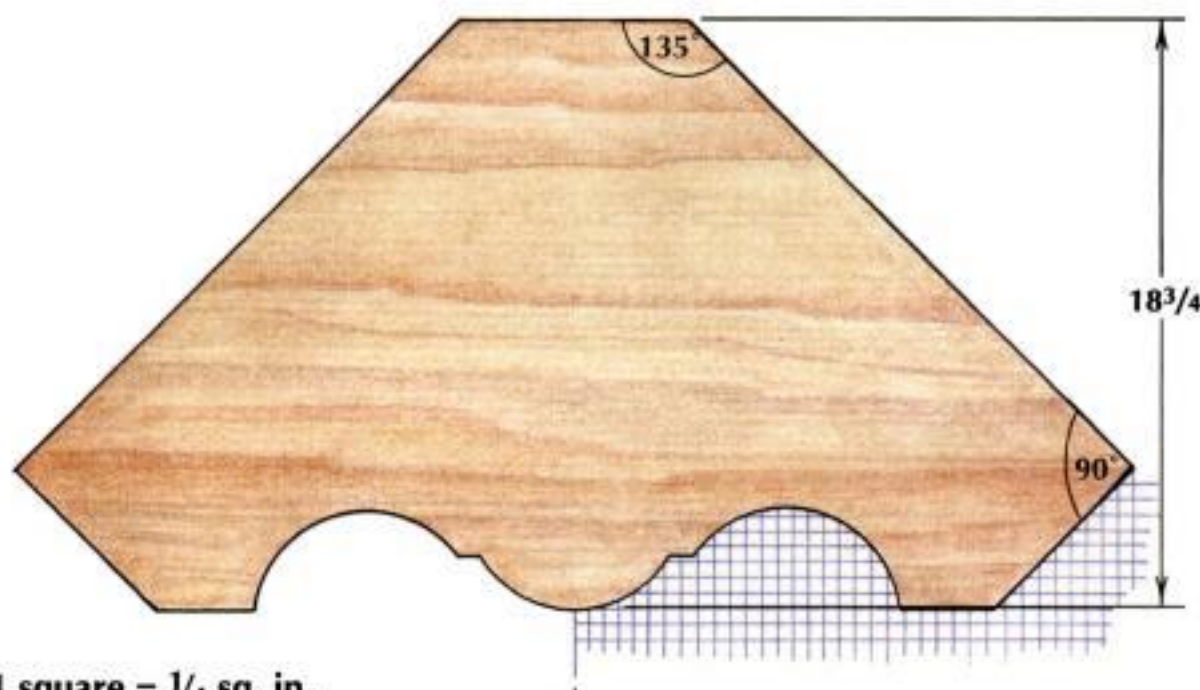
Make the spine, then glue and screw it to the top, bottom, and shelves. Nail the backboards to the rabbets in the front panels, to the edges of the shelves, top, and bottom, and to the spine. I edge-glued 1/2-in.-thick boards together to make up a pair of wide backboards. It's also historically accurate to cut

beaded lap joints in narrower boards and nail these up individually to form each back. (See Fig. 1.) If you plan to paint the inside face of your backboards, you can make them from a secondary wood such as poplar.

Finish up the case by making the pilasters and attaching them to the front panels. The fluting layout for the pilasters is shown in Fig. 2.

Attaching the molding. The cornice, waist, and base moldings wrap all the way around the front of the case. The remaining secondary moldings wrap around the pilasters only.

FIG. 3: SHELF DETAIL



1 square = 1/4 sq. in.

MORE INFORMATION

Try the following book for more information on Colonial corner cupboards from Virginia's eastern shore:

Furniture of Williamsburg and Eastern Virginia, 1710-1790 by Wallace B. Gusler (1993, Colonial Williamsburg Foundation). Available for \$24.99, (800) 446-9240.

PLACES TO VISIT

Museum of Early Southern Decorative Arts, Winston-Salem, NC

Metropolitan Museum of Art, New York, NY

Colonial Williamsburg, Williamsburg, VA

When it comes to cutting precise miters to take each course of molding around the case, we have a tremendous advantage over Colonial builders that can be summarized in just one word: chapsaw. Any decent chapsaw fitted with a premium cutoff blade will give you the precise, super-smooth joints that this project requires. (See bottom photos, page 64.)

I've found that the best way to install a course of molding on a cupboard like this one is to cut the long center piece first, as my assistant is doing in the bottom right photo on page 64. This is true even for the moldings that run around the pilaster only. Tack the first piece in place, driving a couple of finishing nails just deep enough to hold the molding fast. Then cut and tack the moldings in place on both sides. Only when the entire course fits just right is it time to glue up.

Making the doors. Now take a deep breath. With the case complete, you'll need to gather the energy, material, and tools for the door construction work. The important dimensions and details for both of the doors are shown in Fig. 4.

I won't go through the door construction process here, but I can set you on your way. You'll find that it's not difficult to make door stiles, rails, and muntins on your router table, using matched router bits designed for sashmaking. (See left photo, opposite page.) These bits are available through numerous mail-order suppliers. For more on making divided light doors and period moldings, see "Using the Shaper" (AW #35) and "Glass Light Doors" (AW #54).

Finishing

As I mentioned earlier, pine versions of this cupboard were usually painted. Walnut, on the other hand, deserves a clear finish that makes the most of the wood's natural tone and grain patterns. I applied a light coat of varnish to the bare wood to seal it and add depth. This I followed with several coats of orange shellac. Finally, I buffed on a coat of brown paste wax to create a subtle antique patina. ▲

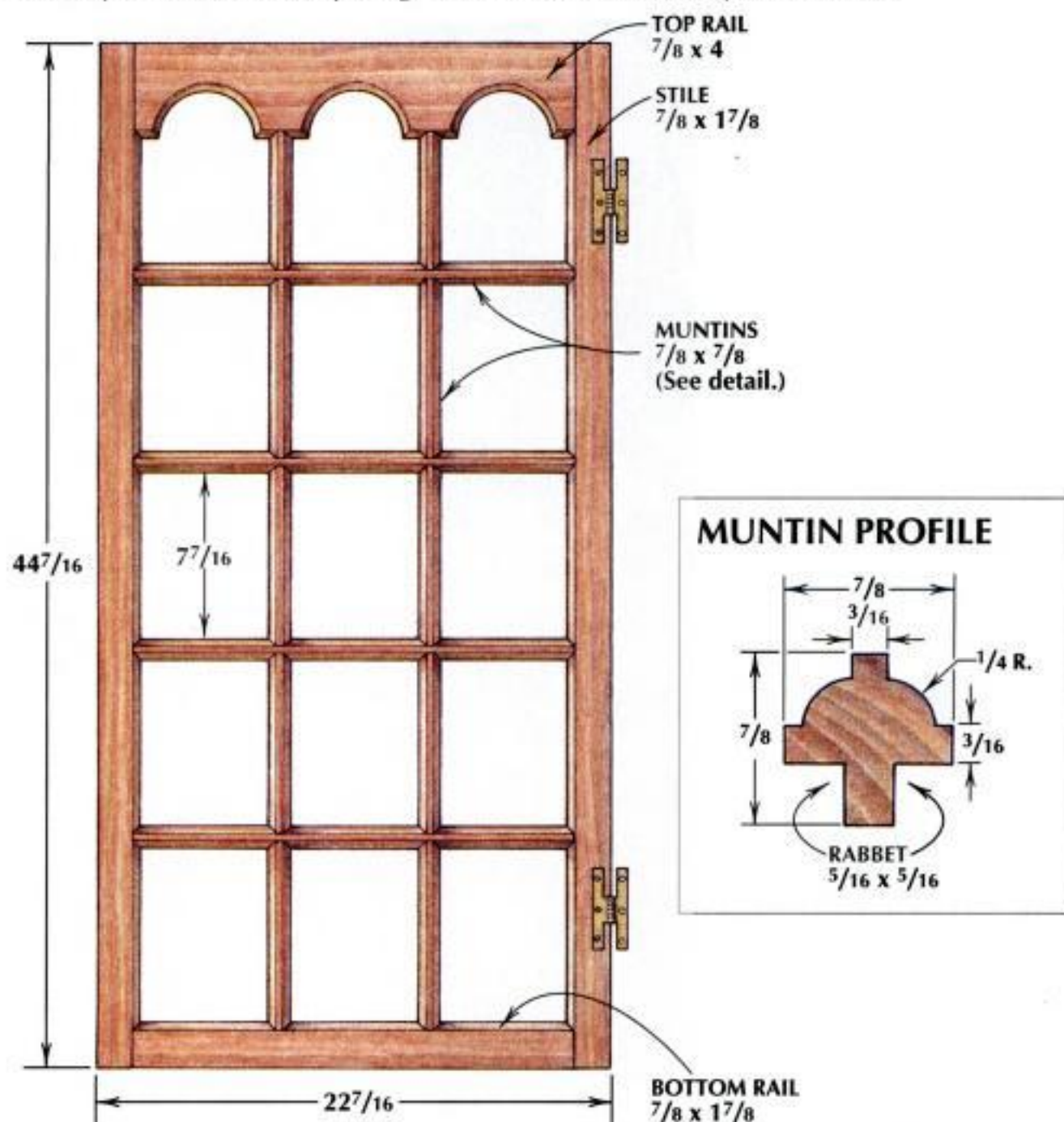


LONNIE BIRD

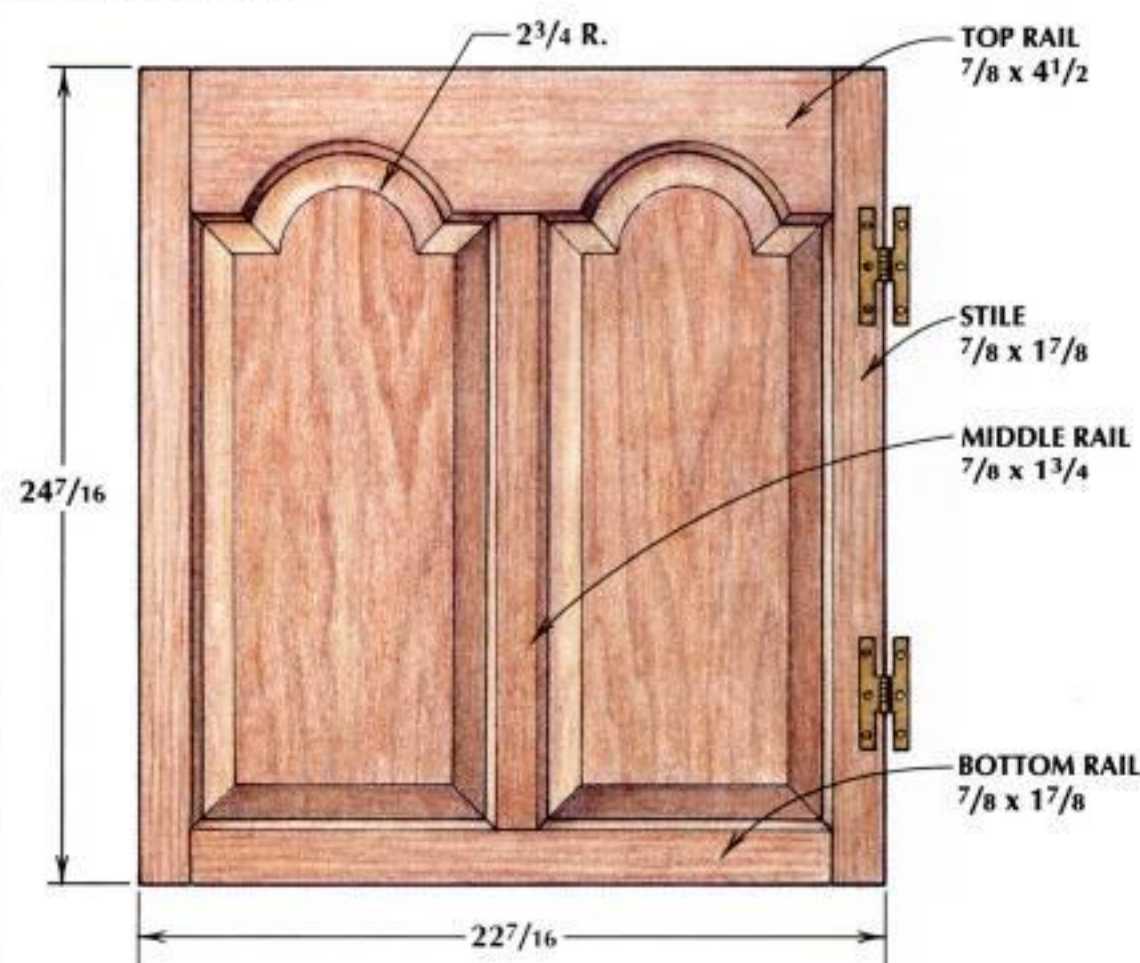
teaches furniture making at Ohio's University of Rio Grande and is a contributing editor to AW.

FIG. 4: DOOR CONSTRUCTION DETAILS

Doors are the final touch in this project. Height and width measurements are for reference only. Size your upper and lower doors to match the actual height and width of your finished door openings. Trim doors to fit after they're assembled.



DOOR DETAIL





No wasted space. Heitzman uses every available inch of shop space. His traditional solid maple benchtop sits on a welded steel base.

Imagination and Innovation

Roger Heitzman creates remarkable furniture in a crowded shop

by Sandor Nagyszalanczy

Roger Heitzman's distinctive work depends on an interesting blend of technology, tradition, practicality, and ingenuity. He often mingles Art Deco and Art Nouveau influences with his own contemporary flair. You'll see this dialogue expressed in the furniture shown in this issue's "Gallery." (See page 90.)

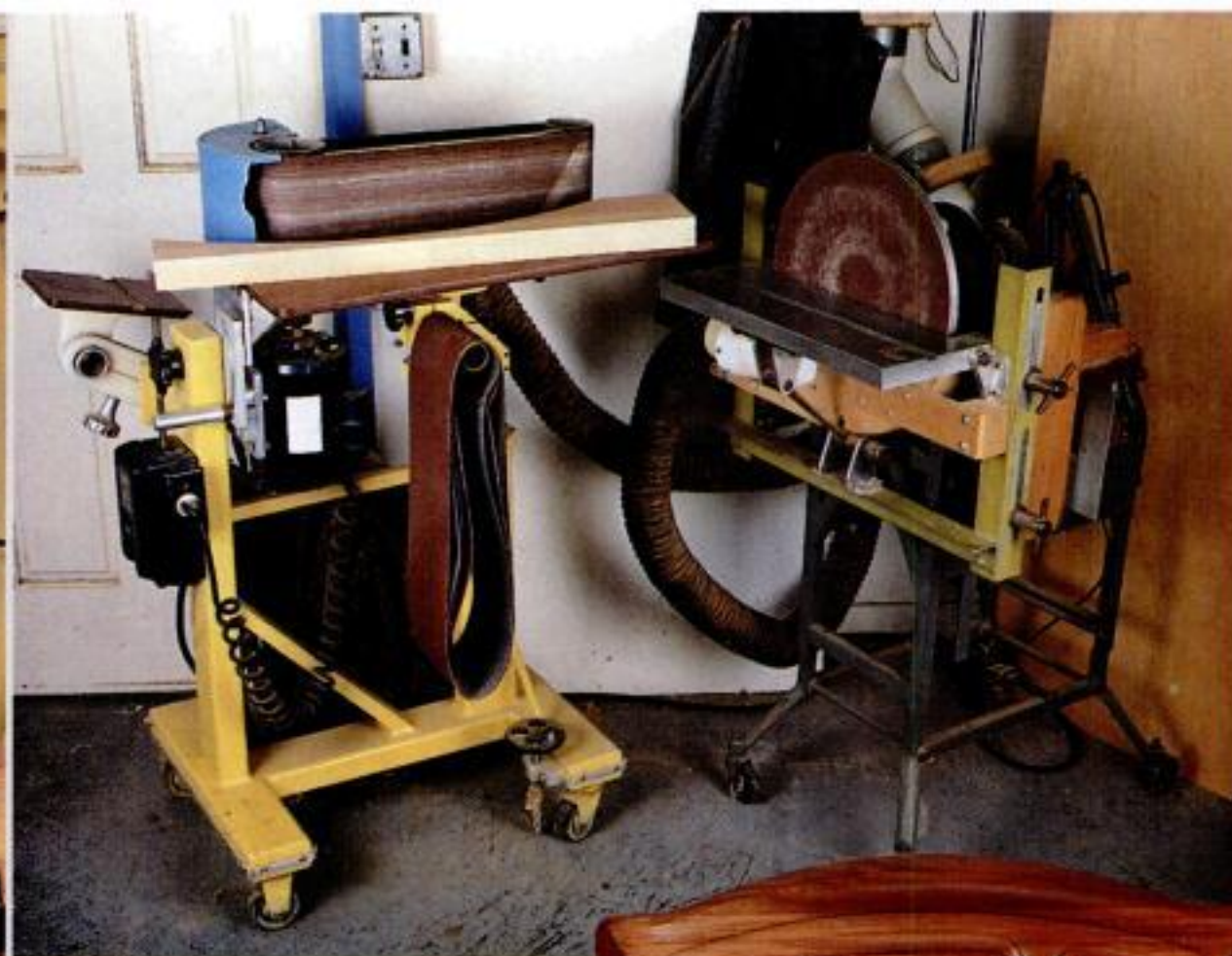
It only took Heitzman a few hours of walking around at an Arts and Crafts exhibit to get hooked on woodworking. That was in 1973. After earning a degree in industrial arts and education at Humboldt State College (located in northern California), he set up a small shop around his only major power tool,

a Sears radial-arm saw. Heitzman started building cabinets and simple furniture on commission. In between jobs, he built speculative pieces for woodworking exhibits and for consignment in the many galleries that flourished in California during the late '70s and the early '80s.

After years of making sawdust in an uninsulated, 600-sq.-ft. building nestled high in California's Santa Cruz mountains, Heitzman got together with another woodworker and bought a shop building in Scotts Valley, CA. His present shop has an L-shaped floor plan that encompasses 1,200 sq. ft.



Mechanical marvel. An ingenious shop-made carving machine plays a big part in many Heitzman pieces.



Shop-made sanders. A 16-in. disc sander and stationary belt sander are among many shop-made machines.

Heitzman found that doubling his shop size only brought momentary relief from space problems. Every inch of wall space is devoted to storage. Cubbyholes and drawers are built in beneath bench-tops. (See photo, opposite.) To maintain open areas for large assembly work, Heitzman has most of his machines on mobile bases; when not in use, they're rolled against the wall. Even his large assembly table is on wheels.

To further conserve space, the shop's industrial-size compressor and dust collector live outside, under a shed-style enclosure. Electrical cord reels and air-hose connections in several overhead locations make it handy to run portable power tools anywhere in the shop.

A salvaged tractor-trailer shipping container sits just outside the shop, handling overflow and finished work that awaits delivery. Behind the sheet-goods storage bins at one end of the shop is an insulated 9-ft. by 3-ft. "gluing room." Its electric baseboard heater helps speed up the drying of veneered panels and laminations bonded with slow-drying urea-formaldehyde glue, which Heitzman often uses on large assemblies.

Heitzman's metalworking skill shows up in the shop and on many custom furniture pieces. He frequently fabricates metal accents and hardware, and—as a sideline—builds brass and copper

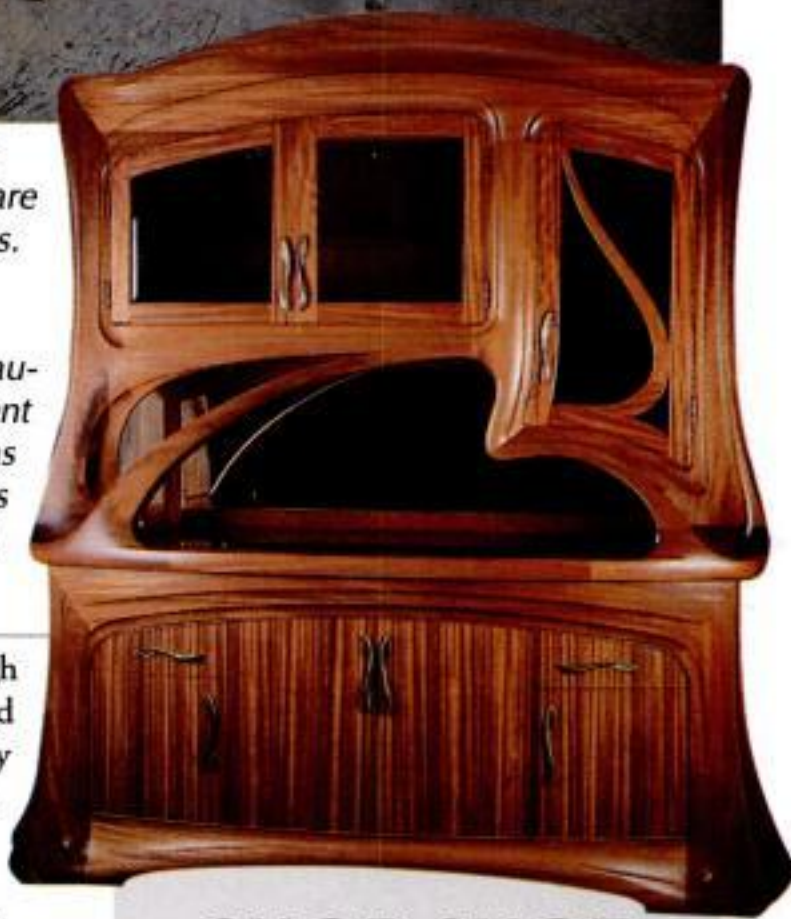
Big buffet. This Art Nouveau-style buffet cabinet is a recent commission, and was designed as a built-in. For more of Heitzman's work, see page 90.

wind sculptures that are sold through a mail-order catalog. Heitzman used a friend's metal shop to built many of his own welded-steel woodworking machines, including a 20-in. three-wheel bandsaw, stationary belt and disc sanders, a shaper, and a horizontal boring machine.

Of all Heitzman's shop-made tools, his pride and joy is a duplicating/carving machine. (See top left photo, above.) This metal monster has two counterbalanced arms linked together with an ingenious mechanism. One arm holds a router; the other holds a tracing stylus. To make a part, he traces the tip of the stylus over a pattern while the whirring router bit carves out the blank. The machine allows Heitzman to quickly and cleanly shape complex parts for his curvy, one-of-a-kind furniture, and for limited production pieces he occasionally builds. ▲

Find out more online.

Roger Heitzman's Web site address is: <http://www.scruz.net/~heitzman/>.



SHOP SHOT

Name: Roger Heitzman

Age: 46

Shop location: Scotts Valley, CA

Shop size: 1,200 sq. ft.

Specialties: Art Nouveau and Art Deco furniture and cabinetry

Most recent project: Built-in buffet, made primarily of Honduras mahogany (see above)

Most unusual commission: Elaborate custom interiors for a 65-ft. yacht

In business since: 1977

Favorite power tools: Makita 3612 plunge router, custom-built carving machine

Next tool purchase: Wide-belt sander

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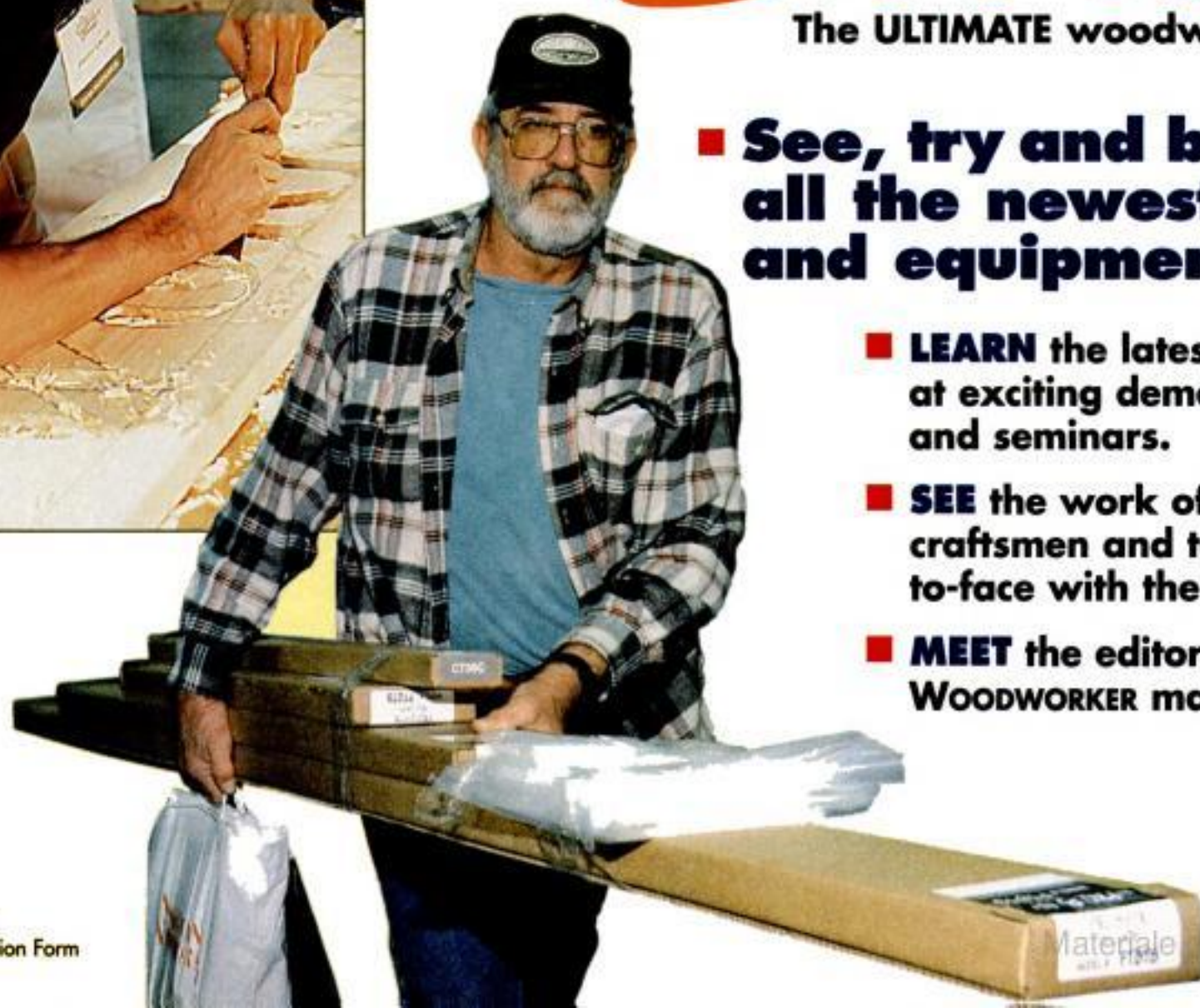
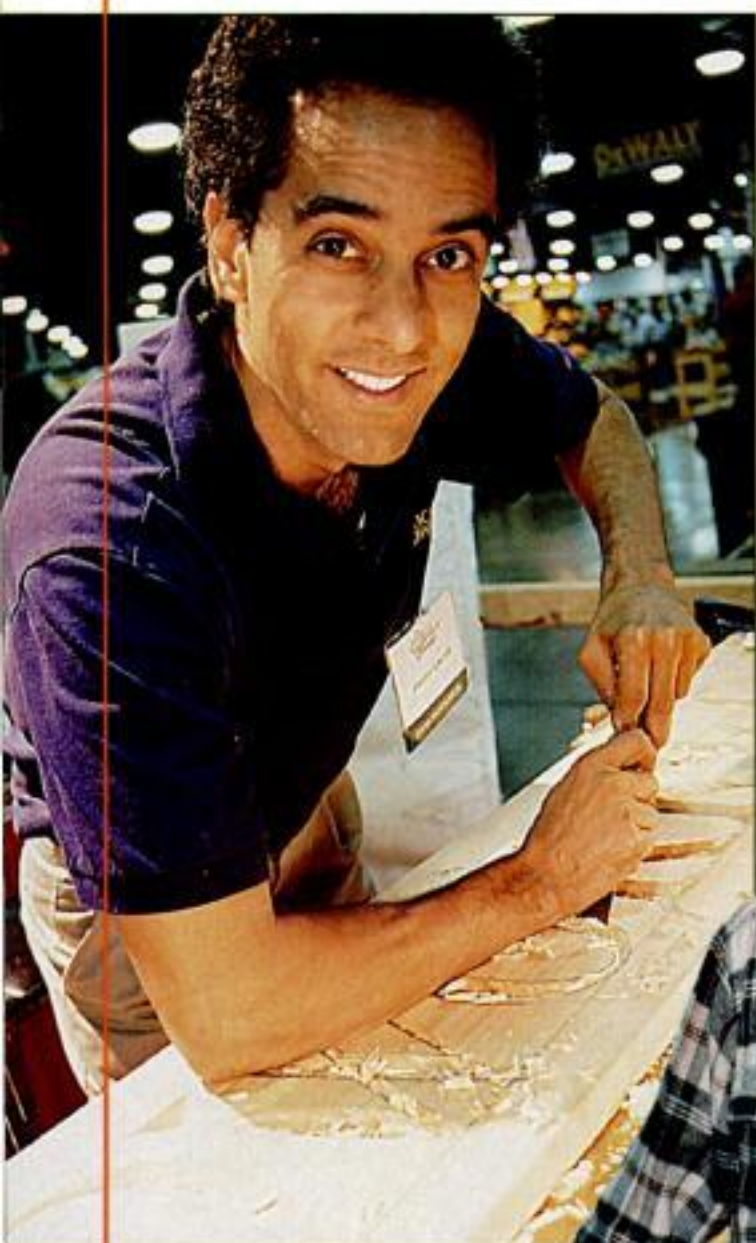
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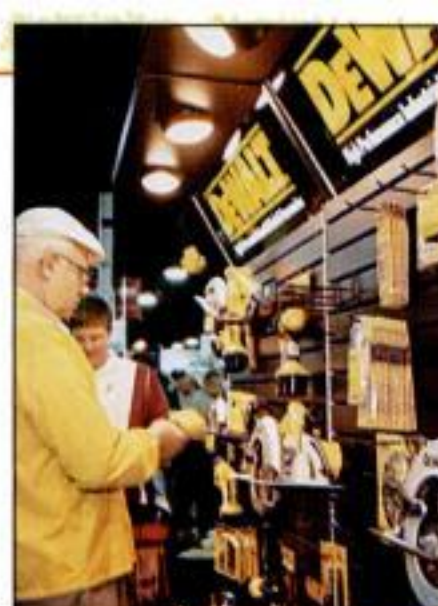
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Select the right router and accessories for your needs • Use a router safely and effectively • Profile edges and make moldings • Cut basic woodworking joints like dados, rabbets, and simple mortises and tenons • Make time-saving router jigs • Use a trammel to cut arcs and circles • Rout with pattern bits

Who should attend: Beginning to intermediate woodworkers.

About the presenter: Bill Hylton is a long-time woodworker and woodworking writer. He is the author of *Woodworking with the Router and Router Magic*, as well as the recently published *Rodale's Illustrated Cabinetmaking*.

ADVANCED ROUTER WORK

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

BILL HYLTON

In this seminar, you'll learn how to:

Make complex moldings • Choose and equip a router table • Joint and surface difficult woods with the router • Cut advanced router joints—cope-and-stick, lock-miters, and finger joints • Make professional-quality router jigs and fixtures • Perform template-guided router operations

Who should attend: Intermediate woodworkers.

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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. He is a frequent contributor to *AMERICAN WOODWORKER* magazine.

DESIGN AND BUILD A WORKBENCH

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Who should attend: All woodworkers.

About the presenter: Frank Klausz is a professional cabinetmaker who learned his craft in his native Hungary. He lectures and gives seminars throughout the U.S. and Canada and is a contributing editor to *AMERICAN WOODWORKER* magazine.

FINISHING SECRETS

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

MICHAEL DRESDNER

In this seminar, you'll learn how to:

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Who should attend: All woodworkers.

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

WOODWORKING FUNDAMENTALS

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

FRANK KLAUSZ

In this seminar, you'll learn how to:

Select and understand tools, machines and materials • Choose projects and joinery you can handle • Allow for wood movement • Use glue and clamps effectively • Apply great-looking finishes

Who should attend: Beginner to intermediate woodworkers.

DESIGN AND BUILD GREAT FURNITURE

Friday 4:00-6:00 pm
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IAN KIRBY

In this seminar, you'll learn how to:

Develop problem-solving strategies • Recognize the elements of good design—form, function, and economics • Design joints and details • Make the best use of materials—solid wood and sheet goods

Who should attend: All woodworkers.

JIGS AND FIXTURES

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Saturday 4:00-6:00 pm

SANDOR NAGYSZALANCZY

In this seminar, you'll learn how to:

Design and build jigs and fixtures for many woodworking operations • Understand jig-making principles • Incorporate safety features and dust collection • Choose appropriate hardware and materials

Who should attend: All woodworkers.

About the presenter: Sandor Nagyszalanczy is a furniture designer and the author of four books, with 18 years of woodworking experience and six years as an editor of *Fine Woodworking* magazine. He is currently a contributing editor to *AMERICAN WOODWORKER* magazine.

SCROLLSAW SAVVY

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STEVE VORNDRA

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About the presenter: Steve Vorndran is a veteran scroll saw instructor who has lectured extensively across the country. He is the author of several articles on scroll sawing techniques.

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2. Limit one entry per person. All entries must be deposited or postmarked by the Sweepstakes ending date of March 19, 1999. Mailed entries must be received no later than March 19, 1999. 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 31, 1999. 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.

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6. For the prize winner's name, available after April 30, 1999, 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, 1999, will not be honored.

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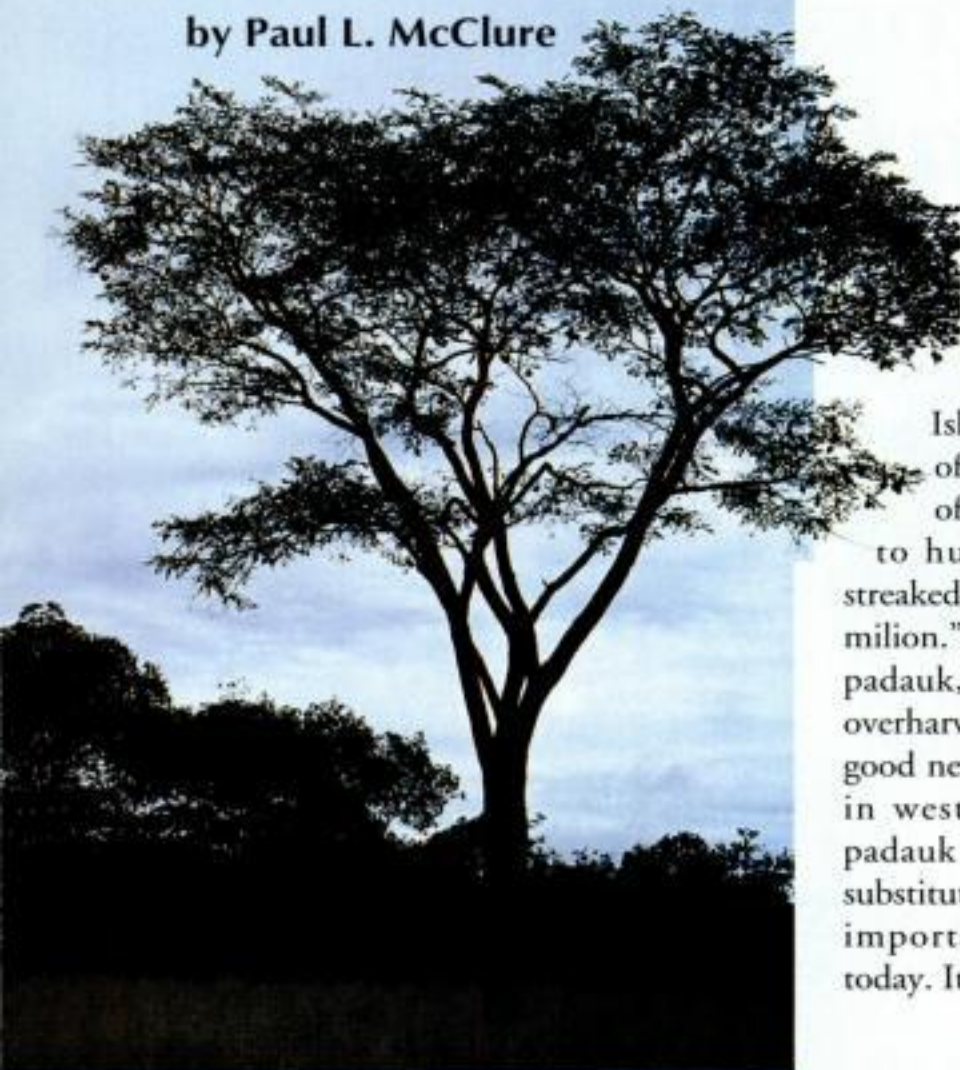
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Padauk

by Paul L. McClure



SPECIES AND COMMON NAMES: *Pterocarpus soyauxii*—padauk, padouk, African padauk, African coralwood, camwood or comwood, and barwood. Sometimes called vermillion, but true vermillion (*P. dalbergioides*) is rare and overharvested.

GROWING RANGE: Gabon, Cameroon, Belgian Congo, Nigeria, and the Gold Coast. Lumber grown in southern parts of the range may exhibit white splotches.

SPECIFIC GRAVITY: 0.67 to 0.78

DENSITY: 42 to 49 lb. per cu. ft.

WOOD MOVEMENT¹: Flatsawn (tangential): small = less than 1/4 in. Quartersawn (radial): very small = less than 1/8 in.

DURABILITY: Heartwood very durable, sapwood moderately susceptible to decay and insect attack.

SUSTAINABILITY: African padauk is sustainable at current harvest levels.

AVAILABILITY: Hardwood and specialty wood dealers, some large home centers.

SIZES: Thicknesses: 4/4 through 10/4. Widths: 6 to 22 in. Lengths: 6 to 16 ft.

COST: Flatsawn or quartersawn lumber 4/4 through 10/4, \$6.50 to \$8.50 per bd. ft. Quartersawn ribbon stripe veneer, 95 cents per sq. ft.

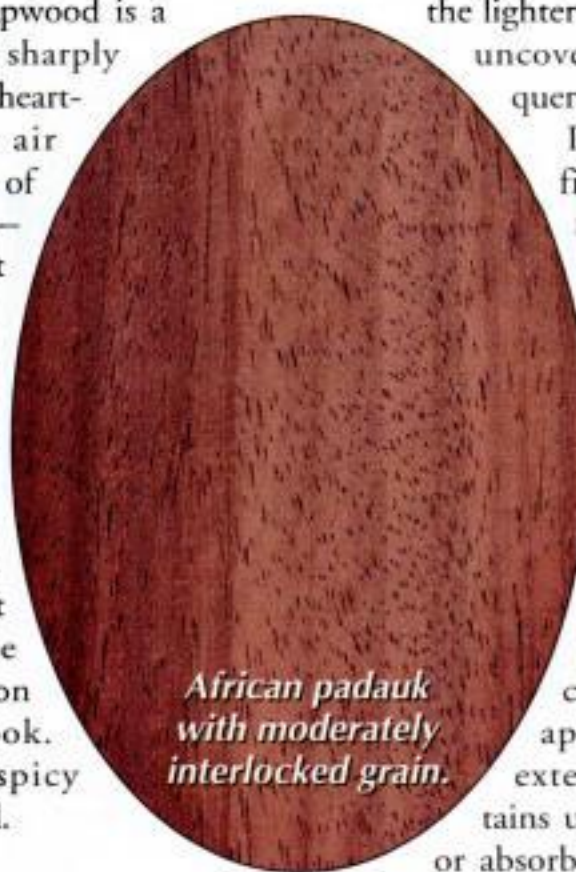
¹Indicates wood movement across the grain from 6% to 12% moisture content.

In the early 1600s, European convicts were banished to penal colonies on the Andaman Islands, in the Bay of Bengal west of India. There they harvested one of the most beautiful woods known to humanity—a brilliant, purple-streaked crimson lumber they called “vermillion.” Today we know it as Andaman padauk, but it’s extremely rare, due to overharvesting for the past 200 years. The good news is, a very similar species grows in west and central Africa. African padauk is the best and most common substitute for vermillion—hence the most important padauk for woodworkers today. It’s the species I’ll discuss here.

Appearance

Padauk heartwood is bright orange when freshly milled. The sapwood is a grayish white and is sharply demarcated from the heartwood. Exposure to air doesn’t alter the color of padauk, but sunlight—specifically ultraviolet rays—turns the heartwood blood red, then very deep maroon black. Sapwood is not affected.

Padauk has an open grain with large pores. Grain can be straight or interlocked—the latter creating a ribbon stripe or mottled look. The wood has a spicy aroma when machined.



African padauk with moderately interlocked grain.

Workability

Padauk is very strong and resilient, and moderately stiff. It’s exceptionally stable in service, with very little movement.

Straight-grain padauk works easily with both hand and power tools, and blunts cutting edges only moderately. It planes, joints, and sands easily to a very smooth surface. It also carves and turns

well. Interlocked padauk grain requires abrasive planing—not knife planing—and calls for very sharp cutting edges. Even so, tearout is a common problem. Carving or turning highly interlocked grain is nearly impossible.

Padauk glues well, but the glue line will normally be very dark because of bleeding from the wood. The wood does accept fasteners, though I would recommend pre-boring.

Padauk’s brilliant color can be a liability during sanding and finishing if you’ve combined it with a lighter-color inlay or accent. The dust will impregnate the pores in the lighter wood—even in a tight-grain wood like maple—giving it a light orange cast. And the wood also bleeds red when you apply a clear finish.

I mask off the padauk portions and seal the lighter wood with shellac, then uncover the padauk and lacquer the entire surface.

Padauk will accept any finish, though hard finishes like lacquer, varnish, and polyurethane require a wood filler or sanding sealer if you want to achieve a glass-smooth finish. Woodworkers who love the brilliant color of fresh-cut padauk have tried all kinds of tricks to keep it from changing color. The best approach is to apply an exterior varnish that contains ultraviolet (UV) blockers or absorbers, as well as hindered amine light stabilizers (HALS). But even these finishes only delay the inevitable color changes.

Uses

Padauk is an excellent choice for furniture and cabinets, architectural woodwork and floors, tool handles, turnings, carvings, and inlays. ▲

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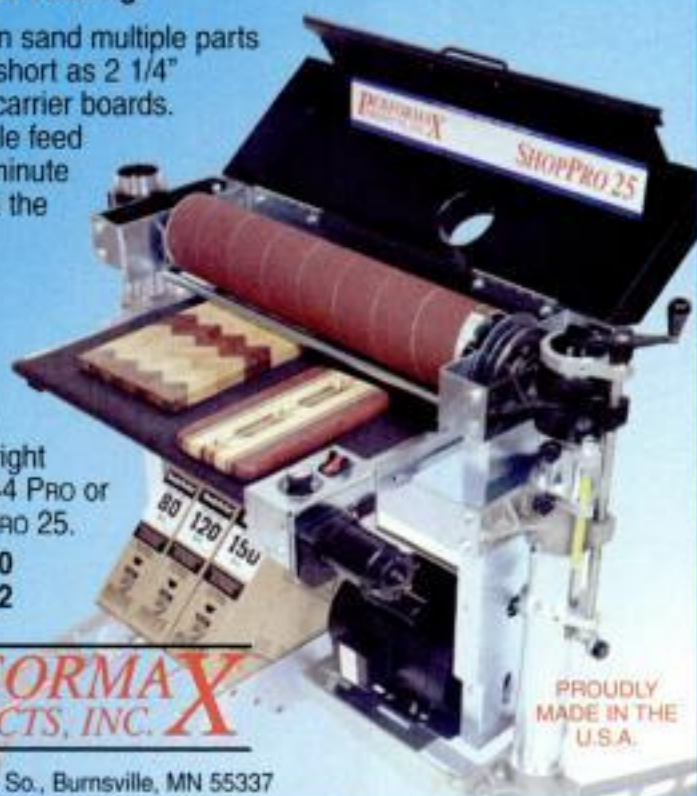
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Polyurethane Finishes

How to choose between oil-based, gel, and waterborne polyurethane

by Michael Dresdner

Polyurethane is one of the most durable and protective of all wood finishes. It's ideal for high-wear surfaces such as dining tables, chairs, kitchen cabinets, and bartops. It builds fast, it's inexpensive, and you can apply it by hand or spray it on wood.

But deciding which polyurethane product to use can be perplexing. A trip to the paint store will reveal a variety of oil-based, gel, and waterborne versions. While they all share some similarities, there are also significant differences. Let's look at the various products called polyurethane and learn the pros and cons of each. (See chart, below.)

What Polyurethane Is

Urethane or polyurethane resin (the terms are interchangeable) is the key ingredient in polyurethane finishes. Resin is the "glue" of a finish—the part that stays behind after the solvent evaporates, to form a film that sticks to the wood. In general, polyurethane resin forms a clear,

tough, water- and heat-resistant film with excellent mar resistance, fair stain resistance, and a slight bluish-gray tint.

In most cases, there are other resins in a polyurethane finish besides polyurethane. Manufacturers add the other resins to increase stain resistance and warm up the color. The finish may also contain solvent or diluent to make it thinner, and pigment or dye to give it color.

Exterior polyurethane has a slightly different chemical structure than interior poly. The main advantage of exterior poly is that it tolerates sunlight better.

That's what the polyurethanes have in common. Now let's discuss the significant differences among the three major polyurethane formulations: oil-based varnish, wipe-on gels, and waterbornes.

Oil-Based Polyurethane Varnish

Oil-based polyurethane varnish is a mixture of polyurethane resin and oil varnish. Since it is made from oil, it picks

up some of the oil's amber color, flexibility, and good stain resistance. It brushes on and flows out just like oil varnish (it takes a bit of practice to get it on uniformly without leaving brush marks), but dries to a more durable film. You can thin oil-based polyurethane with naphtha, mineral spirits, turpentine, or paint thinner. (For more on applying all kinds of varnish, see AW #61.)

Polyurethane varnish also inherits oil's ability to "wet out" wood. That means it will penetrate wood and bring out the color and depth, or *chatoyance*, hidden in it. (See photos, page 80.) The amber color added by the oil may or may not be to your liking.

Wipe-On Polyurethane Gel

The easy-to-apply, wipe-on gel is a more recent addition to the pantheon of polyurethane options. Basically, it is oil-based polyurethane varnish with the solvent left out. As a result, it is too thick to brush, but quite convenient to wipe on

Polyurethanes at a Glance

	Oil-Based Varnish	Wipe-On Gel	Waterborne
Durability	EXCELLENT	EXCELLENT	EXCELLENT
Flammability	FLAMMABLE	NONFLAMMABLE	NONFLAMMABLE
Odor	SOLVENT SMELL	ALMOST NONE	ALMOST NONE
Appearance	EXCELLENT	EXCELLENT	GOOD
Color	AMBER	AMBER	CLEAR
Ease of application	FAIR	VERY EASY	FAIR
Dry/cure time	SLOW	SLOW	FAST



OIL-BASED



GEL



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JUST FINISHING



with a rag and wipe off if there's excess. It doesn't take any practice to achieve good results.

The total cure time of gels is not much different from the cure time of brush-on polyurethanes.

Likewise, these gels have the same toughness and durability as their brushed-on counterparts. However, a thicker finish is more durable than a thin one, and we tend to apply a thinner coat when we wipe it on with a rag than when we brush it on. You just might have to apply two or three coats of gel to get the protection you'd get from one coat of brush-on poly.

Waterborne Polyurethane

Most waterborne polyurethanes are a blend of polyurethane and acrylic resins suspended in a mixture of solvents and water. The resulting film is just as durable as oil-based polyurethane.

Unlike oils, which are usually amber, acrylic resins are almost completely clear. As a result, waterborne polyurethane dries to an almost colorless film with just a slight blue-gray tint, preserving the brightness of maple and other light-colored woods. (See photos, left.)

On the other hand, waterborne mixtures do not "wet out" wood as well as oils. Darker woods, like walnut, will not exhibit the chatoyance they show under oil-based finishes, and may appear pallid.

Like oil-based poly varnish, waterborne can be brushed or sprayed. Waterborne coatings dry much faster than oil-based ones. When it comes to application and drying, waterborne polyurethanes act much more like lacquer than varnish. (For more on applying waterborne coatings, see AW #49.)

Waterbornes are more sensitive to any contamination of the wood surface, like wax, oils, and grease, and usually don't flow out as well as oil-based polyurethane on an unclean surface. They are also likely to redissolve water-soluble dyes, causing them to "bleed" up into the finish. In some cases, they will not adhere well to cured oil-based stains.

All of these problems can be avoided if you apply a thin wash coat of dewaxed shellac under the waterborne polyurethane. Shellac will seal in water-based dye, prevent peeling over oil stain, and wet out dark woods to add back a bit more chatoyance. ▲



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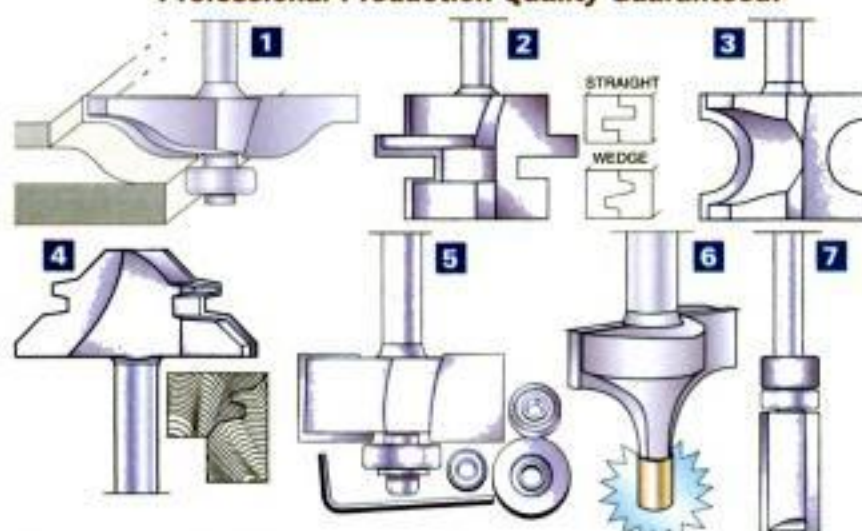
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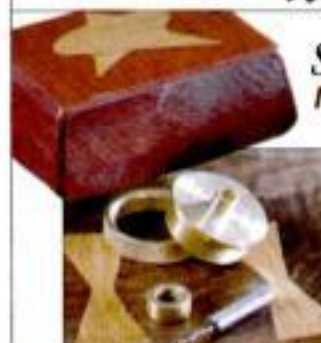


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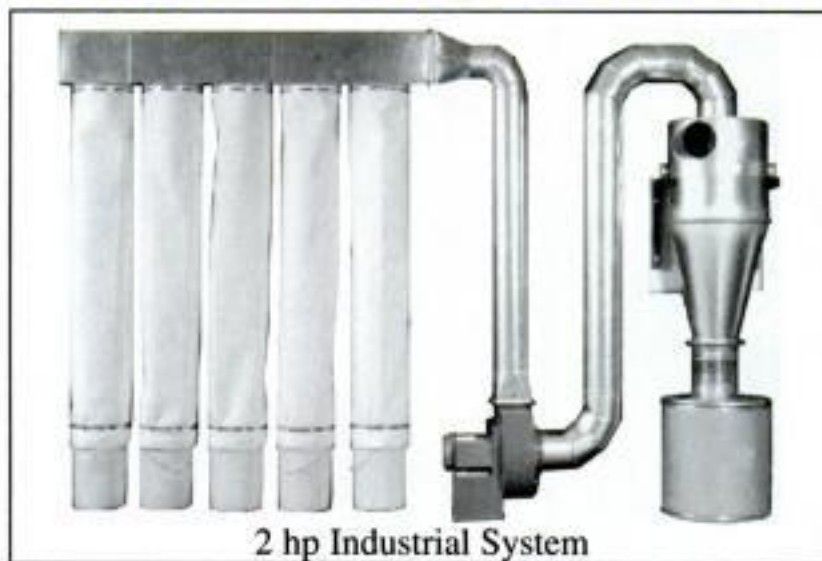
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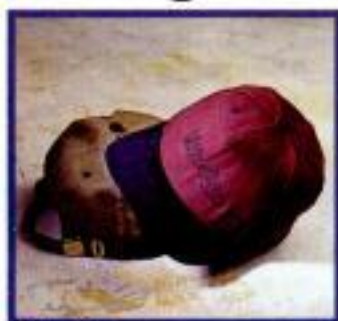
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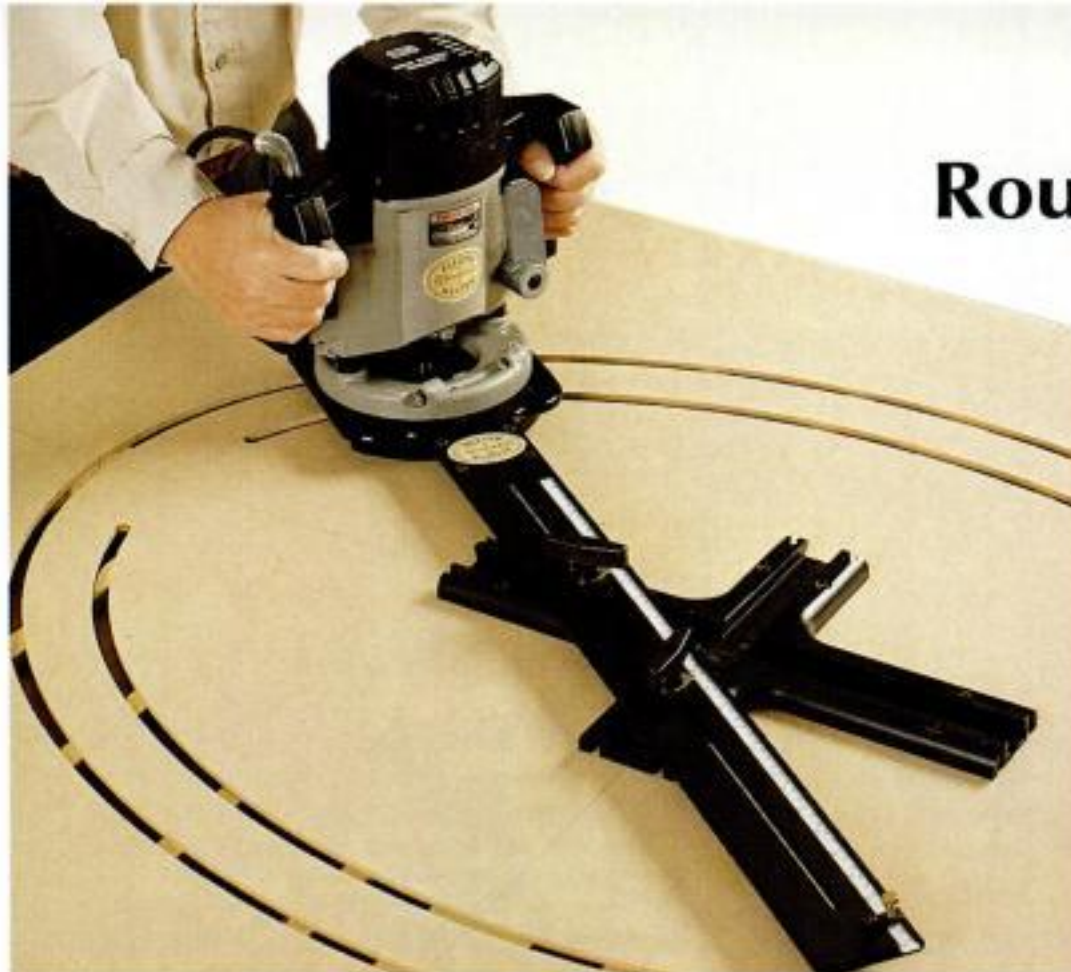
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CIRCLE NO. 1 ON PRODUCT INFORMATION FORM

Porter-Cable "Bammer" Cordless Finish Nailer

by Dave Sellers

Pneumatic finish nailers are great for fastening wooden parts and trim work, but dragging around an air hose can be cumbersome. Porter-Cable overcomes this problem with their new "Bammer," which doesn't need an air hose for power. Instead, the gun uses the explosive force of compressed Mapp gas from an onboard fuel cell to drive nails. It's a totally self-contained tool that you can use anywhere, in any position.

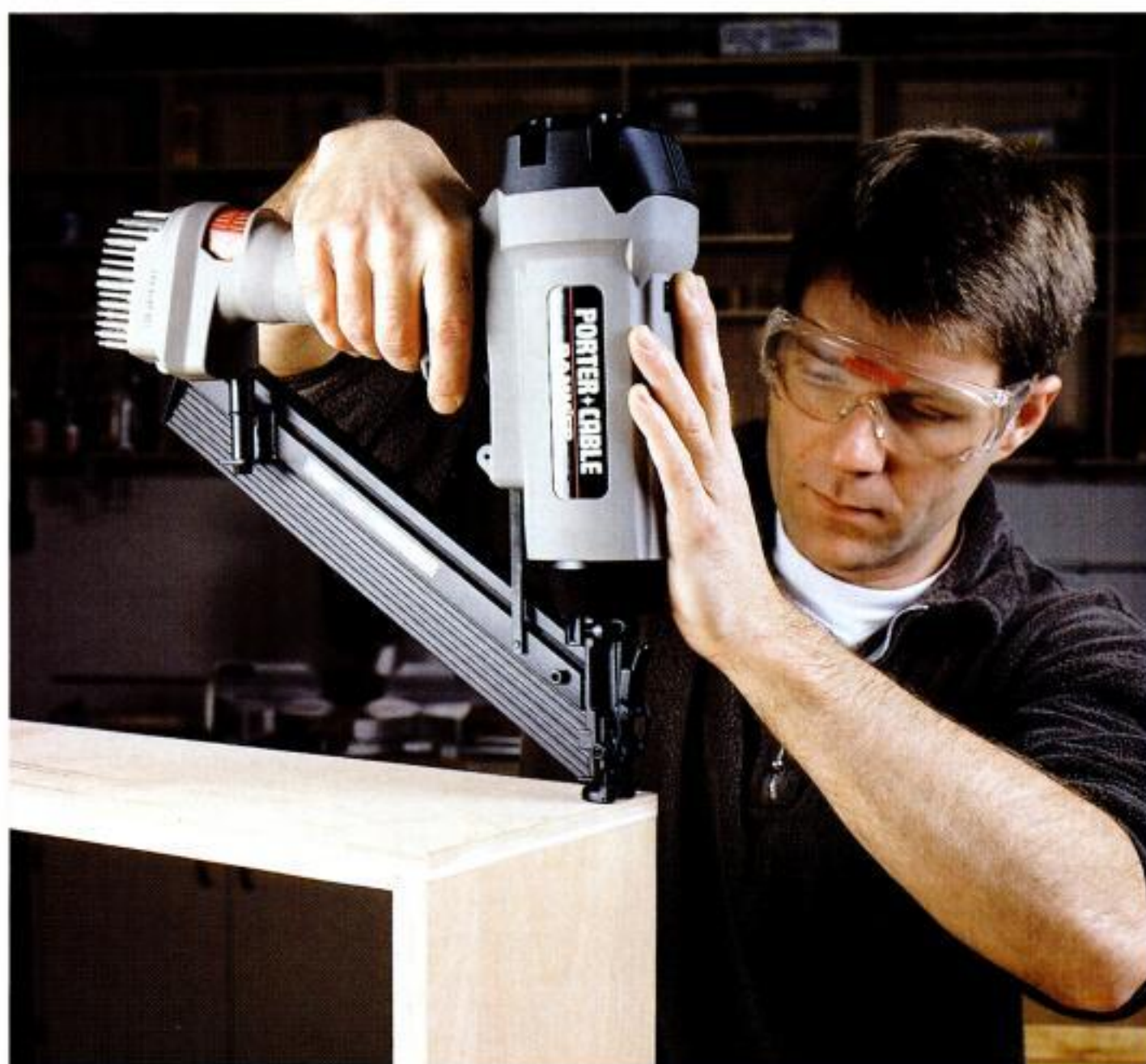
To fire a nail, you simply compress the telescoping nose, which injects a charge of fuel, and pull the trigger. The Bammer recoils and sounds much like a comparable pneumatic nailer. After each firing you have to allow the nosepiece to extend before you can fire another round.

Porter-Cable isn't the first company to make a gas-powered nailer. But they've engineered the Bammer to solve some of

the problems associated with earlier models. For example, there's no oil lubricant to mess with, and the Bammer's piezo electric ignition does away with both batteries and chargers. The result is a simple, rugged, and user-friendly nailer.

We tested the model CDA250 Bammer, which fires 15-gauge D-head finish nails ranging from 1 1/4-in. to 2-in. length. These nails are available from mail-order catalogs and home centers. A box of 4,000 2-in. nails costs about \$30. A 16-gauge finish nailer (model CFN250) and a 16-gauge medium crown stapler (model CMS200) are also available.

Replacing the fuel cell takes less than a minute. According to the manufacturer, one cell is good for approximately 3,000 firings. (Two replacement cells cost about \$12.) You can fire up to two nails per second for short bursts. Porter-Cable recommends no more



No air hose. The Porter-Cable "Bammer" cordless finish nailer drives 15-gauge nails with the power of Mapp gas from a fuel cell. You can fire the Bammer anywhere, in any position.

than 200 nails per 15-minute period to avoid overheating the Bammer.

We liked the angled magazine that lets you get into tight spots and the quick-release nosepiece that lets you clear jams without tools.

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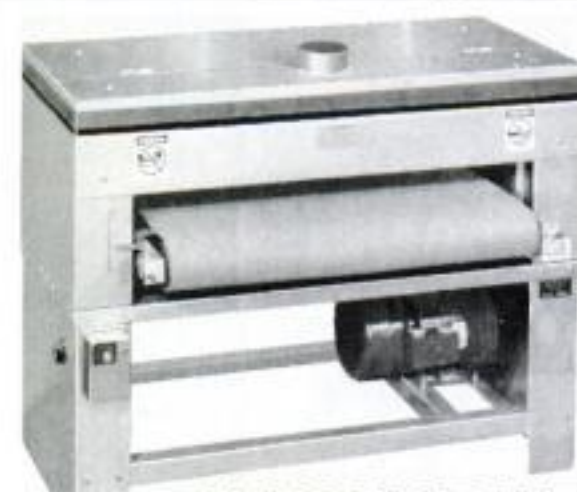
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▲ **Credenza** Claro walnut, makore, wenge, various wood inlays, aluminum, Avonite solid-surface material, hardwood plywood, and bending plywood W: 48 in. D: 22 in. H: 32 in.

WOODWORKING

on a road less traveled

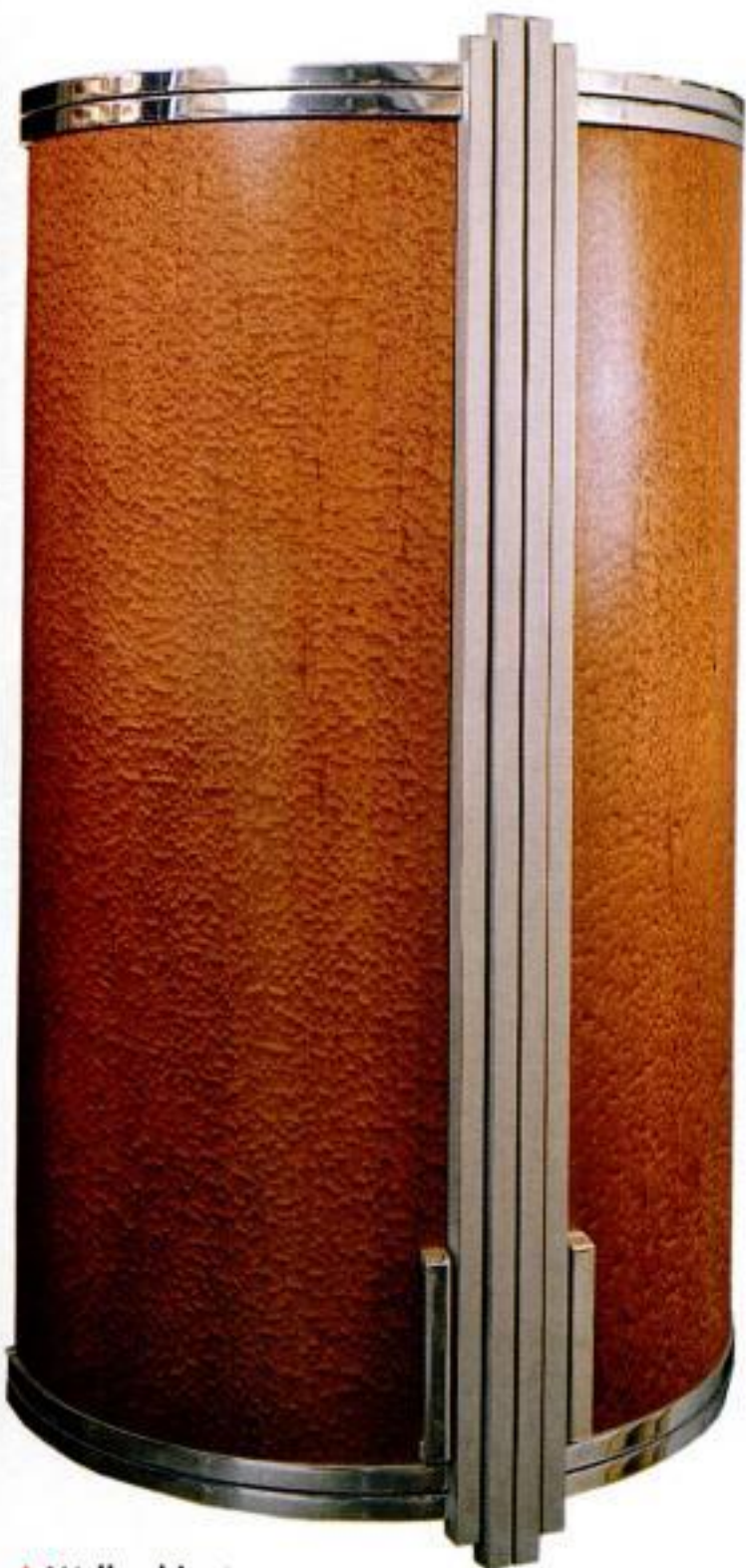


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of chrome fenders and dramatic curves.

Heitzman likes to mix materials as well as styles. Combining his skills as a metalworker and woodworker, he often incorporates polished aluminum and glass with the fine woods and veneers he uses in his pieces. Last year, Heitzman took second-place honors in AW's Excellence in Craftsmanship® Awards. (See AW #63.) No wonder. His work combines engaging design and excellent craftsmanship.

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by Paul Saporito

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After cutting all the dados, replace your dado cutter with a plywood or combination blade, and cut the uprights from the plywood sheet. My uprights are 11 1/2 in. wide. Glue and nail the uprights between top and bottom pieces and you're done with the main frame. Now cut as many shelves as you need, and decide how to mount your cubbyholes. I built a plywood stand for mine, but these shelves could also be attached to wall framing. ▲

PAUL SAPORITO is a professional woodworker in central New Jersey.



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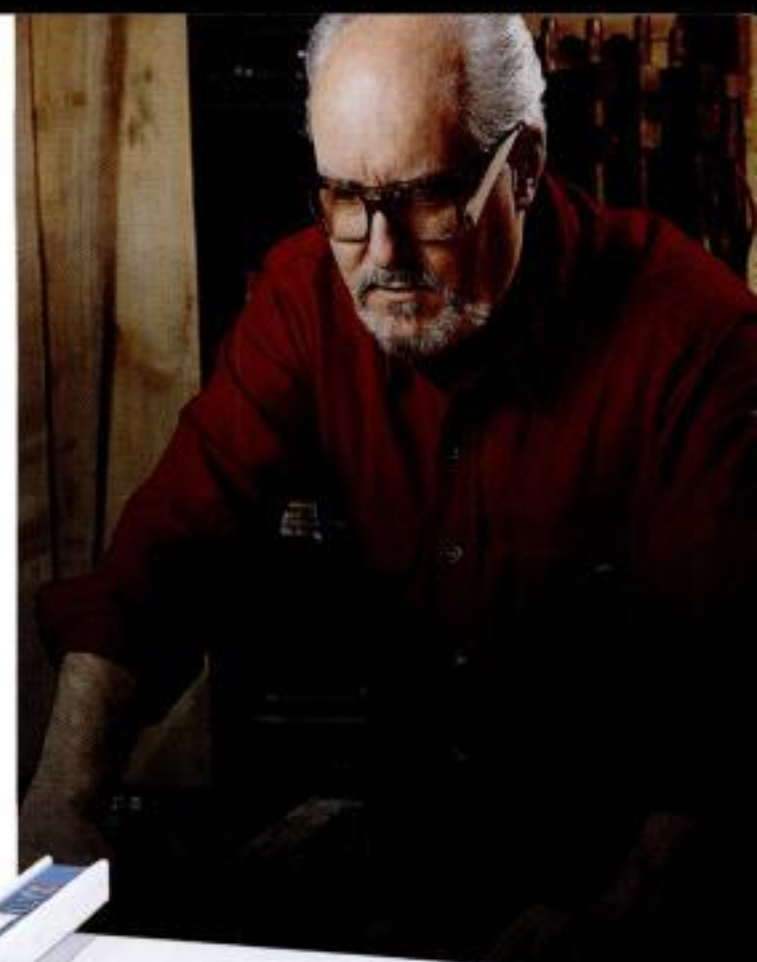
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