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Truths About Water-Based Finishes
TURN A WALL CLOSET INTO A WAREHOUSE

January 2000 #112

Popular Woodworking

The Skill-Building Project Magazine for Practical Woodworkers

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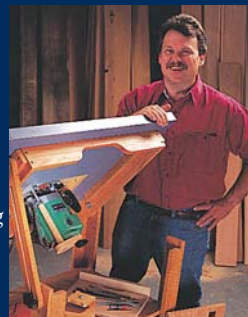
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Cover photo by Al Parrish



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Audit Bureau of Circulation membership applied for.

Welcome Aboard

If you're a regular reader of *Popular Woodworking*, you've probably noticed some new faces in the magazine. In this issue, we introduce yet another so I thought it's time you met these guys. After all, shouldn't you know something about the source of information and advice you're getting?

We welcome **Nick Engler** as a new contributing editor in this issue (that's him on the cover). Nick is a very well-known author. He's published 52 books that have sold more than 5 million copies, including his best-selling "The Workshop Companion" series.

Nick's woodworking career started in the early 1970s making traditional American musical instruments — one was exhibited at the Smithsonian Institution as part of the American Bicentennial. A few years later he founded Shopsmith's *Hands On* magazines. Later, his books covered nearly every facet of woodworking. We think Nick's strongest suit is ingenious jigs. It's an area where his affinity for problem-solving runs free. You'll find one of Nick's "must make for my shop" jigs in every issue.

There's probably no better source for finishing information than **Bob Flexner**. Chances are you already know Bob's work. His "Understanding Wood Finishing" book is the textbook for anyone who wants to *understand* the finishing process. I'm certain there's no one more dedicated and passionate when it comes to unraveling the "mysteries" of finishing.

Bob was a finisher for 15 years when his curious mind led him where few finishers had gone before — the chemistry section of the library. Thus began a six-year quest for understanding why things work, or don't work, in finishing. We should be grateful to Bob. Because of his work, we don't have to learn chemistry. The best part is, Bob teaches finishing without mentioning molecules or chemical reactions.

Troy Sexton and **Glen Huey**, whose work you've seen lately, never gave much thought to being in a magazine. Both have been busy these past 20 years making beautiful furniture for a living.

For many of those years, Troy built antique reproductions. His work was sold through specialty shops all over the eastern United States. When I first saw his work six years ago, I was immediately impressed with the quality of the craftsmanship and the amazing efficiency he applied to construction. From Troy, you'll get wonderful furniture projects and you'll learn how to build them better and faster.

Like Troy, Glen builds antique reproductions. His work exhibits a nice blend of traditional woodworking with inventive ways to produce quality work in a timely fashion. You'll see what I mean when you read about his tenoning jig in this issue. With Troy and Glen, it's nice to have some help from guys who have built more drawers than they can count and who hang more cabinet doors every year than many of us will in a lifetime. All done with an eye toward quality and the good sense of a successful commercial woodworker.

For all their experience, which is formidable, I would be remiss if I didn't mention our long-time contributing editor, **R.J. DeCristoforo**. Working with him can only be called a privilege. No one can take a complex process and explain it more clearly, more simply than "Cris." Just how big a warehouse of woodworking wisdom is he? In the introduction to his 1972 book, "DeCristoforo's Complete Book of Power Tools," his editor at *Popular Science* magazine wrote that he first met DeCristoforo in 1952, the start of a 20-year relationship. He concluded by saying, "Universities often reward achievement with honorary degrees, I believe DeCris is worthy of one — and I hereby offer the idea to any institution that wishes to honor both itself and a leader in the world of tools. Make it officially R.J. DeCristoforo, *Master of Tools*." *Popular Woodworking* is honored to have the *Master's* regular articles.

We're proud to share with you the knowledge of these exceptional men. **PW**

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SAFETY NOTE

Safety is your responsibility.

Manufacturers place safety devices on their equipment for a reason. In many photos you see in *Popular Woodworking*, these have been removed to provide clarity. In some cases we'll use an awkward body position so you can better see what's being demonstrated. Don't copy us. Think about each procedure you're going to perform beforehand. **Safety First!**

Power to the powerless woodworker

One Reader Who Traded His Power Tools for Hand Tools

Thanks for your thoughts in the "One-handed editor" column in the September 1999 issue. I'm glad your one hand is open to the possibility of writing articles about some "impractical" ways of working wood with traditional joints and hand tools. I love to create things of wood using no power but my own, with tools refined by time, not technology. I know I'm in the minority of today's woodworkers, but I wanted you to know that there is at least one of us out here that enjoys doing things the "impractical" way.

I turn chair legs on a pole lathe that I made. I make other chair parts on a shave horse I made from a tree I chopped down. When I made cabinet doors for our entertainment center, I thickness planed the stock with hand planes and created the mortises, tenons and raised panels with hand saws, chisels and planes. You see, I make my living in a high-tech world, but I work in my shop with a passion for these low-tech traditions.

Every day at work I deal with learning tomorrow's technologies, but every trip to my shop I learn a little more of the techniques of the past. But enough about me.

The reason I'm writing is to say that I think there are a lot of amateur woodworkers who would love to work wood this way, but assume the only way to do anything is at the end of a high-voltage cord. When I started my hobby a few years ago I did what all new woodworkers do, I planned my high-powered shop. I drooled over all the high-powered tools, believing they were the only path to quality and pleasure.

Then I bought and restored my first old plane. I was hooked. My table saw has since become a table and the only thing that plugs into my 20-amp circuit is a coffee maker. Like most budding woodworkers, I believed that the non-power hand tool ways of working wood could only be learned by growing up learning from grandpa, and since I hadn't done that, I'd best get powered up. Well, that just isn't so. I've learned the ways of old in virtual isolation from any grandpa types and others can, too.

WE WANT TO HEAR FROM YOU

Popular Woodworking welcomes letters from readers with questions or comments about the magazine or woodworking in general. We try to respond to all correspondence. Published letters may be edited for length or style. All letters become the property of *Popular Woodworking*.

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Magazine Cover Now Truly a Work of Art

I wish to thank you for allowing me to paint the Garden Arbor Bench photo from the cover of your July 1998 issue. I had a great time painting it. I hope you like it.

Bob Schafer
Palm Harbor, Florida

Bob wasn't the only reader spellbound by the cover. Several other readers called us to comment on the model's toe rings (some liked them, some didn't), or to ask if she's Lauren Hutton (she's not). If you want to see more of the model (and the great furniture she's sitting on) check out Danny Proulx's book "How to Build Classic Garden Furniture" from *Popular Woodworking Books*.

—Christopher Schwarz
managing editor

I'm betting others would like it as well. I'm the first to admit that this is not for everyone, but I hasten to add that I think it's for more people than the high-powered advertisers of most wood magazines would lead us to believe. Having rambled on long enough (but not nearly as long as I could!), I'll just say again, thanks for the possibility of some traditional articles, and I cast my hearty vote for them.

Dale Lucas
Cedar Rapids, Iowa

Free E-Mail Newsletter Can Save You Money

Many thanks for your new e-mail newsletter. In the short period of its existence, I've

saved some money tool shopping and learned a few new things from web sites you've identified. What a great idea!

To put things in perspective; I am a 60-year-old hobbyist with a small but well-equipped shop, a graduate school education, a small software design business and the need for a constant infusion of woodworking knowledge. For your effort and dedication, I thank you.

Joel Shapiro
Sparta, New Jersey

Editor's note: Every two weeks we send out a brief but information-packed free e-mail newsletter filled with tool-buying information

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you won't find anyplace else, including special deals we find on tools and comparisons of prices in the major tool catalogs. Plus you'll get previews of things coming up in the magazine and links to some really interesting woodworking web sites we've stumbled on. To sign up for this free e-mail newsletter, visit our web site at www.popwood.com and click on the button labeled "E-mail Newsletter."

Another Vote on the Wood Grain. Is it Jesus or a Woman?

Regarding the "Eye of the Beholder" picture on page 13 of your September 1999 issue. Can anyone look at that picture and not see a big rabbit? Complete with buck teeth? The knot is his nose.

*Jay Kacena
Marion, Iowa*

Article Saved Him \$300

If someone could forward this to Troy Sexton, the author of "\$19.99 Dovetail Jig" (September 1999 # 110). He just saved me

\$300. Give him my thanks and appreciation. The article was great. Keep up the good work.

I also liked the "Borrowing a Design" article. I have never come across any woodworking magazine that has paid any attention to design. I hope there will be more in the future. If I may make a suggestion. Start at a low level. Maybe a list of do's and don'ts. Don't vary table height, for example. Explain why chairs are made to certain heights. Things like that. Keep up the great work.

*Jim Gogue
Ava, Illinois*

Thoughts on the Shaker Tall Clock and the Magazine

This weekend I purchased my first ever copy of *Popular Woodworking*. I have to say that I don't look at the magazine primarily because it doesn't cover my needs, and I do gravitate towards *Woodsmith* and *Fine Woodworking*. But this issue is different, and your Tall Clock (#110) caught my eye. I have just finished a curly maple mantle clock

from an issue of *Woodsmith* and applied a finish process recommended to me by Jeff Jewitt. It came out close to yours using two water-based dyes (one dark and one light) plus two applications of linseed oil and then about four coats of garnet shellac.

Having said all that, I now am inspired to build the Shaker clock you made. You have made a wonderful looking clock and I appreciated the chance you offer your readership to contact you.

In the future I will pick up your magazine and may purchase it on an issue-by-issue basis, but I am going to say the "cover look" of the magazine doesn't attract me to want to pick it up. It's too busy and needs a hint of "Not giving it all away" on the cover.

*Jim Shaver
Oakville, Ontario*

Editor's note: Thanks for your note about the Shaker clock. As to the look of the cover, all I can say is, "You can't always tell a book by its

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cover." Hope you do try us again in the future.

— Steve Shanesy, editor & publisher

Like the Clock, But the Romans Might Take You to Task

I enjoy your magazine very much. I especially liked the article in the September 1999 issue about building a "Tall Clock." But I wonder if Mr. Shanesy took some artistic license with his Roman numeral "IIII" on the hand-done clock face?

Tim Neveldine
Fayetteville, New York

Editor's note: In school I learned to write "4" as IV, probably as did you. The use of "IIII" on the clock face matches the face of the original Shaker clock. Because you stirred my curiosity, I contacted clock historian Jim Laing of S. LaRose, the clock works supplier. He did not have a definitive answer except to say that many clock faces of this era had the "4" represented by "IIII."

— Steve Shanesy, editor & publisher

Hunting for Lumber Saved Him Hundreds of Dollars

I am Mr. garage woodworker, no doubt about it. I once purchased my wood from the local lumber yard, which has been here for almost 100 years. After reading the article "Why you're paying too much for lumber" (July 1999 #109) I decided to do some research.

I was surprised and truly saved myself a bundle. I purchase a couple of 1" x 8" x 8' pieces of maple at \$3.99 per linear foot (\$90) at my local store. Sure it was already surfaced to 3/4" and ready for my inspection, but I did feel that the price was a bit much even before I had read the article.

After reading the article I found a saw mill in New Hampshire called "Tuckaway Timber." They practically bent over backwards to answer my questions and even mailed me a sample. I purchased rough lumber because I already own a planer and jointer.

Before they shipped it to my house they called and asked if they could plane one

side to ensure that I would have one clean side for my project at no extra cost. The final results:

- Local lumber yard cost of approximately 112 board feet: \$670.32 + tax of \$33.52 for a total of \$703.84.
- Tuckaway Timber cost of 112 board feet is \$291.20 + \$85 shipping (New Hampshire has no state tax) for a total of \$376.20.

Wow! What a savings. Thanks again
Popular Woodworking.

Pete Commerford
Walpole, Massachusetts

Clarification on the Modern Wardrobe Project

A couple of the supplies listed in the Modern Wardrobe article (September 1999 #110) had the wrong item numbers listed for ordering from Rockler.

The drawer slides should be #34843, the hinges should be #40782 and the drawer face levelers should be #28936. **PW**

IN THE FEBRUARY ISSUE

On sale in December



TOOL REPORT

Every year we take a close look at several types of tools to arm you with the information you need to make wise buying decisions in the store. We tell you what features are critical (such as the amperage and RPMs in a router) and which aren't (such as the amperage in jigsaws). Then we give you a complete list of the tools that are on the market today, their street prices and their features. It's the only smart way to buy a tool. This year we examine cabinet saws, biscuit joiners, dust collectors, cordless drills and 14" band saws.

PENNSYLVANIA STEPBACK

This Colonial classic will put your cabinetmaking skills to the test. Contributing editor Glen Huey shows you how to build this traditional cupboard using traditional joints and modern tools.

LIMBERT WASTE BOX

Arts & Crafts enthusiasts will appreciate this authentic replica of Limbert's #255 waste paper box—it's the perfect complement to a modern Craftsman home.

FOUR WAYS TO BUILD A TAVERN TABLE

Learn to build this well-proportioned piece using several types of joints, everything from traditional mortise and tenon to corner brackets. You'll also get the skinny on some of the basic design principles you absolutely must follow when building any kind of table.

PRO TOOLS vs. DIY TOOLS

Have you ever been shopping for a new tool and wondered why you can buy one jigsaw for \$39 and another for \$159 that are made by the same manufacturer? What's the difference between the two tools? We go inside the tool to show you how bushings, bearings and other technical stuff increases the price of a tool, and its accuracy and reliability.

HANDMADE HARDWARE

Visit a traditional blacksmith's shop where cabinet hardware is made using the same methods used in Colonial America. **PW**

ENDURANCE TEST

Marples *Blue Chip* Bevel Edge Chisels

POPULAR WOODWORKING
POPCORN
JANUARY 2000
TESTED

There are a few hand tools that woodworkers must have, no matter how high-tech they are. A hammer, a block plane, screwdrivers and a set of chisels. Depending on your woodworking habits you might use chisels once a month, or every time you're in your shop. We've come to appreciate not only the workmanship and quality of Marples Blue Chip chisels, but also the very real dollar value of these tools. We've been using them in the *Popular Woodworking* shop (and in our homes) for years.

While some chisel snobs might quote metal hardness statistics when they talk about chisels, we take the practical approach. These chisels feel good in your hand, take and hold an edge well for most woodworking tasks, can be hit with a hammer or mallet repeatedly, and—with a little bit of shopping—a set of five can be purchased for about \$35. That's our definition of a good tool.

The polypropylene handles are square-shaped with rounded edges and feel comfortable in your hand, though they don't feel as warm as a wooden-handled chisel. The square shape of the handle gives you an instinctive way to orient the blade by feel as well as sight. Another benefit to the shape is that Blue Chips don't roll off your bench, destroying your sharpened edge.

The blades are quality Sheffield steel, hardened and tempered to perform well without frequent sharpening. Our biggest complaint with these chisels (and some other brands) is that the factory grinding

on the blades is seldom perfectly square, and the backs need flattening before use. Thank goodness you don't need to do this often.

RECOMMENDATION: You can buy more expensive chisels that look nicer, and hold an edge longer than Marples Blue Chips, but you also will pay two or three times as much. We recommend shopping around for the best price on a four- ($\frac{1}{4}$ ", $\frac{1}{2}$ ", $\frac{3}{4}$ " & 1") or five-piece set (add a $\frac{3}{8}$ "). While Marples' boxed sets are a nice touch, the boxes aren't that well made. So if you find a deal on a set without a box, buy 'em, sharpen 'em up, and then don't sweat the details. They'll be ready to use and always reliable. **PW**



RESULTS

MARPLES BLUE CHIP CHISELS

NICE FEATURES

- Affordable
- Sturdy and comfortable handle
- Quality hardened steel edge

RECOMMENDED MODIFICATIONS

- Blades require some prep-work when first out of the box
- Better boxes for the boxed sets

Marples chisels are sold in many woodworking stores and catalogs. Check www.marples.com for more information.

ABOUT OUR ENDURANCE TESTS

When a new tool hits the market we do our best to tell you what the benefits and pitfalls are with that tool. While this is good information, we know that the question you really want answered is, "How long will the tool last?" That's what this column is for. We regularly pick a tool we've used in our shop for at least a year that has stood up to our regular use. We make sure the tools we've tested here are virtually unchanged from the versions in the store today. So when you see a tool written up in here, it has passed the *Popular Woodworking* Endurance Test. —David Thiel, senior editor

Why Water-Based Finishes Aren't Catching On

Many woodworkers are frustrated by water-based finishes. Learn to use them properly and you'll reach for them more often.

Water-based finishing products get a lot of attention in magazines and at trade shows, but these products still don't sell all that well. Most woodworkers seem reluctant to give up their familiar oil, varnish, shellac and lacquer finishes.

I think the reason for the poor sales, especially to amateur woodworkers, is the excessive hype that has raised expectations beyond what water-based products can produce. When you've been led to believe that a stain or finish "doesn't raise the grain," is "equivalent to lacquer," or is "as durable as oil-based polyurethane," and then discover otherwise when you use it, you become skeptical of the product and retreat to what you feel comfortable with.

Water-based finishing products have plenty going for them, especially for amateur woodworkers, so they should sell quite well without all the hype.

Two qualities are critical: water-based products don't stink and make you feel bad; and water-based products are easy to clean from brushes (not so easy from spray guns, however). The proof of the significance of these two qualities is demonstrated by the overwhelming popularity of latex paint, which is a water-based finish with pigment added, vs. oil paint. It's likely that almost every reader of this magazine uses latex paint on interior trim, kitchen and bathroom cabinets, and outdoor furniture when there is no question that oil paint would perform better. Reduced smell and easy cleanup rule with people working at home!

Other advantages you might find attractive are a reduced level of polluting solvents, reduced fire hazard and absolutely no yellowing. For the amount of finishing material you probably use, the first two are



Water-based finishes have the unique advantage over oil-based finishes of easy water cleanup.

minor issues. But the non-yellowing quality can be a real benefit when you're finishing light or pickled woods. Water-based finishes are the only finishes that are totally non-yellowing.

For all their good qualities, however, water-based stains and finishes are still a relatively new technology. In contrast to other stains and finishes, improvements are still being made in the raw materials used, and some manufacturers are faster at picking up on them than others. So, if you're unhappy with the results you get from one brand, try another before giving up on the entire class of products.

Disadvantages

The rarely mentioned disadvantages are the problem, of course, because you have to know what they are or you can't overcome them. The first problem is in the naming of the products. Manufacturers often give water-based finishes the same names as totally different products that have been around for years — polyurethane, lacquer and varnish. The intent is to make you feel comfortable with the product, but the effect is the opposite. The misleading naming sets expectations that can't be fulfilled and causes confusion because you are led to believe there are sig-

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FLEXNER ON FINISHING

Continued from page 22

nificant differences (water-based varnish vs. water-based lacquer, for example) when there aren't. The names are chosen for the market being targeted.

All water-based products should be labeled as "water-based," "waterborne," "aqua," or some other obvious water-indicating name so you don't have to read the fine print to determine what the product is.

Other significant problems common to all water-based products are grain raising, fast drying, and poor bonding over oil-based products. Let's take each in turn.

Grain Raising

Despite some manufacturers' claims to the contrary, all water-based products raise the grain of wood. How could it be otherwise? They contain a lot of water.

There are two ways to reduce the grain raising of a stain or finish. The first is to pre-wet the wood with water, let the wood dry for several hours or overnight, then sand it with fine grit sandpaper just enough

to make it feel smooth. Don't sand any deeper than necessary or you may cut into new wood that will raise again when you apply the stain or finish. In practice you can't eliminate grain raising totally because you can't sand evenly enough, but you can reduce it significantly.

The second is to reduce the depth the stain or finish penetrates. There are several ways to do this. Use a thicker stain or finish, one that has been slightly gelled; dry the wood very quickly with heat lamps and air movement; or spray the stain or finish in a light mist coat, so it flashes dry quickly. These won't eliminate grain raising totally, and each is less effective when the humidity is high.

Without a way to totally eliminate grain raising, you have to deal with it. If you aren't staining the wood, the easiest way is to simply sand off the raised grain after the first coat of finish — the same procedure you use with other finishes. Try to apply enough finish so you don't sand through, but sanding through seldom caus-



es a problem as long as there isn't any stain. If you are staining the wood, you can bury the grain raising. Apply enough finish so you're sure not to sand through, then sand the surface level and apply another coat or two. To learn how much sanding it takes to sand through, practice on scrap wood by sanding through intentionally.

Fast Drying

Fast drying is an advantage when applying a finish because it reduces dust nibs,

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3. To enter without ordering *Popular Woodworking*, DO NOT USE THE ADJACENT CARD. Print your name and address on a 3"x5" postcard and mail to POPULAR WOODWORKING'S \$33,000 Ford Pickup and Power Tool Paradise Giveaway, P.O. Box 5460, Harlan, IA 51593-4960.
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5. Giveaway open only to residents of the 50 United States and the District of Columbia who are 18 years of age or older. Employees of F&W Publications and Marden-Kane, Inc. and their immediate families are not eligible.
6. For complete sweepstakes rules, send a stamped, self-addressed envelope to POPULAR WOODWORKING'S SWEEPSTAKES GIVEAWAY RULES, ATTN: MF, 1507 Dana Avenue, Cincinnati, OH 45207. Residents of VT and WA omit return postage.

Continued from page 24

but it's a disadvantage when applying a stain. Most water-based stains are difficult to apply evenly on large surfaces because they dry too fast to get the excess wiped off.

There are several tricks you can use to get an even color on a large surface. Spray the stain evenly and leave it. Spray the stain and wipe it off quickly. Wipe on the stain with a large soaked rag, and quickly wipe off the excess. Stain small sections at a time. Have one person apply the stain and another wipe off right behind. Add a manufacturer's solvent, usually propylene glycol, to the stain to slow the drying. (Unfortunately, very few manufacturers supply this solvent.)

If you do get an uneven coloring due to some of the stain drying before you get it wiped off, here's what you do: Quickly wipe over the entire area with a wet cloth to redissolve and respread the stain. However, you should be aware that this might lighten the color.

Bonding to Oil Stains

To avoid both the grain-raising and fast-drying problems of water-based stains, you can use an oil-based stain, but then you have to worry about the water-based finish not bonding well. To ensure a good bond, let the oil-based stain cure totally before applying the water-based finish. Curing time depends on the stain itself, the weather and the size of the wood's pores. For example, stain on oak will take longer to cure than on maple.

Some water-based finishes bond well over some oil-based stains before the stain has cured, but there's no way of knowing for sure without trying it. The variables are the resins and solvents used in the finish and how much oil is in the stain.

To test the bonding, apply the stain and finish to scrap wood. After drying for a couple of days, score the finish with a razor in a cross-hatch pattern. Make the cuts about $\frac{1}{16}$ " apart and 1" long. Then press some masking or Scotch tape over the cuts and pull it up quickly. If the finish has bonded

well, the scored lines will remain clean and little or no finish will come off on the tape.

Other Problems

Water-based finishes have other problems as well, but they aren't serious enough to make you change to another finish except in special situations. These problems include the following: sensitivity to weather conditions (all finishes are sensitive in high heat, cold and high humidity); less durability than varnish or polyurethane (but more durability than shellac or lacquer); and greater difficulty repairing or stripping than shellac or lacquer.

The problems using water-based finishing products aren't insurmountable. But they're made more formidable by manufacturers who claim too much, mislabel their products and provide inadequate instructions for dealing with the special problems created by water. **PW**

Bob Flexner is a nationally known finishing expert in Norman, Oklahoma, and the author of "Understanding Wood Finishing."

The Deltagram

A nostalgic look back at plans published by Delta Machinery shortly after World War II.

From Volume 18,
Issue No. 5, 1948



BILL OF MATERIALS

For one table section:

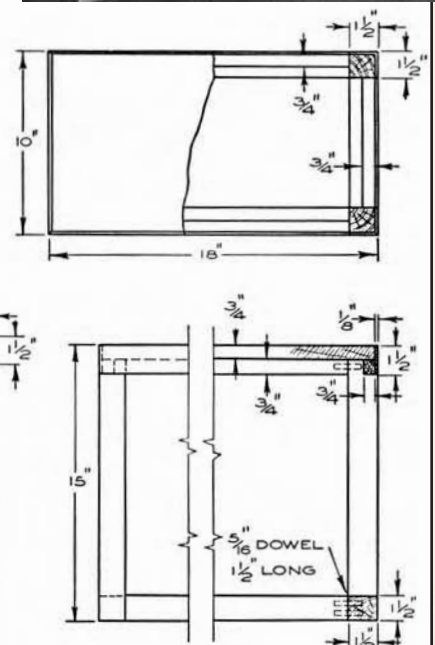
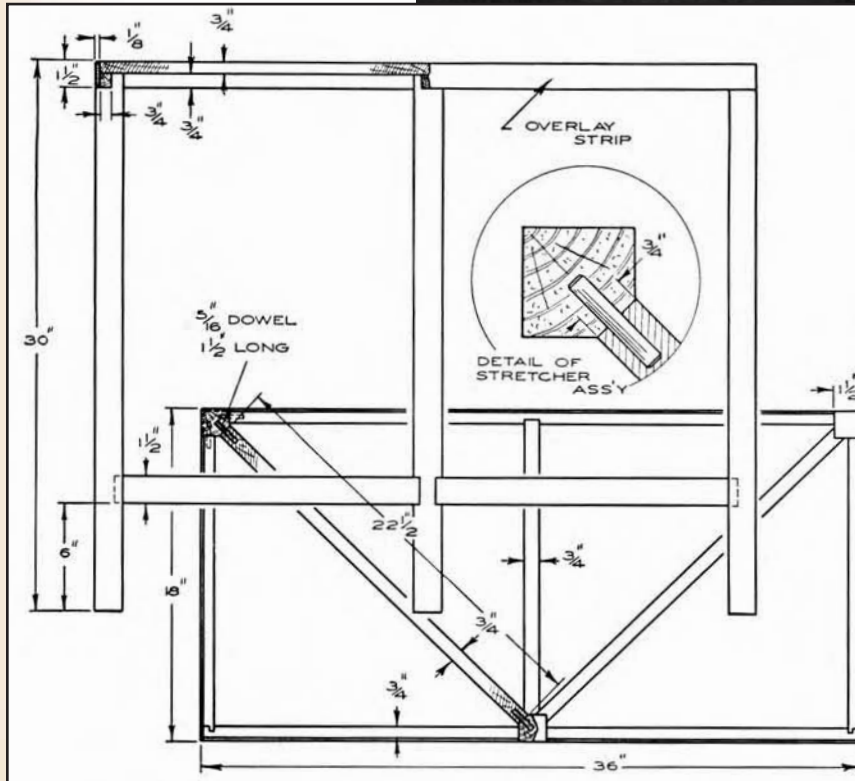
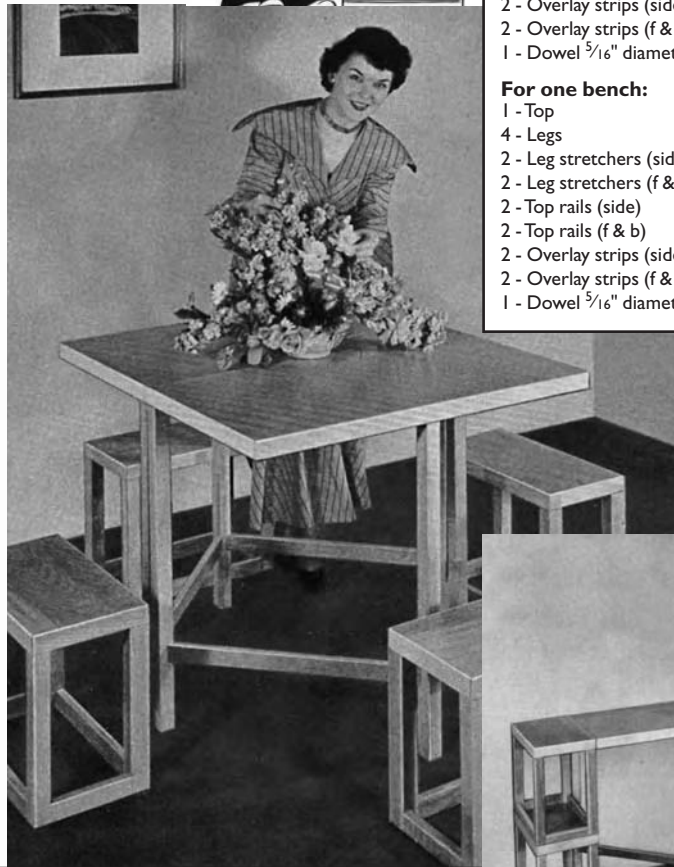
- | | |
|--|--|
| 1 - Top | $\frac{3}{4}" \times 17\frac{3}{4}" \times 35\frac{3}{4}"$ |
| 3 - Legs | $1\frac{1}{2}" \times 1\frac{1}{2}" \times 29\frac{1}{4}"$ |
| 2 - Leg stretchers | $\frac{3}{4}" \times 1\frac{1}{2}" \times 22\frac{1}{2}"$ |
| 3 - Top rails | $\frac{3}{4}" \times 3\frac{3}{4}" \times 15\frac{7}{8}"$ |
| 2 - Top rails (front) | $\frac{3}{4}" \times 3\frac{3}{4}" \times 17\frac{1}{8}"$ |
| 1 - Top rail (back) | $\frac{3}{4}" \times 3\frac{3}{4}" \times 33"$ |
| 2 - Overlay strips (side) | $\frac{1}{8}" \times 1\frac{1}{2}" \times 18"$ |
| 2 - Overlay strips (f & b) | $\frac{1}{8}" \times 1\frac{1}{2}" \times 36"$ |
| 1 - Dowel $\frac{5}{16}"$ diameter x 24" | |

For one bench:

- | | |
|--|--|
| 1 - Top | $\frac{3}{4}" \times 9\frac{3}{4}" \times 17\frac{3}{4}"$ |
| 4 - Legs | $1\frac{1}{2}" \times 1\frac{1}{2}" \times 14\frac{1}{4}"$ |
| 2 - Leg stretchers (side) | $1\frac{1}{2}" \times 1\frac{1}{2}" \times 7"$ |
| 2 - Leg stretchers (f & b) | $1\frac{1}{2}" \times 1\frac{1}{2}" \times 15"$ |
| 2 - Top rails (side) | $\frac{3}{4}" \times 3\frac{3}{4}" \times 7"$ |
| 2 - Top rails (f & b) | $\frac{3}{4}" \times 3\frac{3}{4}" \times 15"$ |
| 2 - Overlay strips (side) | $\frac{1}{8}" \times 1\frac{1}{2}" \times 10"$ |
| 2 - Overlay strips (f & b) | $\frac{1}{2}" \times 1\frac{1}{2}" \times 18"$ |
| 1 - Dowel $\frac{5}{16}"$ diameter x 40" | |

Modular Table and Chairs

The table set shown in the photographs consists of two table sections and four bench sections. The design of the set makes it possible for an almost unlimited number of arrangements. The small units may be used as benches or individual coffee tables, or even magazine racks. You will notice that the two benches, when placed one on top of the other are exactly the same height as the table section. This set lends itself well to the lighter woods such as birch, oak or bleached mahogany. **PW**



TOOL TEST

HOW WE RATE TOOLS

We test a lot of tools at *Popular Woodworking*, and while we don't often test tools until they fall apart, we do give them an honest, real-world workout. Each issue we share the results of our hands-on experience with you and offer insights to help guide your shopping decisions. The ratings reflect the opinion of the magazine's editorial staff.

Here's how our rating system works. **Performance:** A rating of "five" indicates we think this tool is a leader in its category — for now. (You won't likely see performance ratings of "one" or "two" in these reviews because we wouldn't publicize an inferior tool.) **Value:** "Five" is a great tool for the money; "one" isn't the mark of a value. However, a low "value" rating shouldn't prevent you from buying that tool. Some tools might be worth a little more because they're one-of-a-kind or just a really great tool.

If you have a question about a tool — whether it's been reviewed or not — you can contact me at (513) 531-2690, ext. 255, or by e-mail at DavidT@FWPubs.com.

And by the way, many of our past tool reviews appear on our website at www.popwood.com, including data on entire categories of tools (such as table saws). Check it out.

—David Thiel, senior editor

Porter-Cable Redesigns its Brad Nailers With More Power and Features

Porter-Cable has upgraded its 18-gauge brad nailers (BN125 and BN200) by adding features and benefits, without increasing the price. The new models (BN125A and BN200A) have been re-engineered to offer an adjustable depth-of-drive, 360-degree directional air deflection and a bigger cylinder that lets you sink longer nails into harder wood. Other changes include moving the nose safety behind the driver guide (which allows you to more accurately place your brad) and the no-tool jam-release mechanism is on the side of the tool to make it easier to work in corners and other hard-to-reach areas. The anodized aluminum magazine now offers a visual reload indicator to let you know when you're almost out of bullets. The BN125A has a brad length range of $\frac{5}{8}$ " to $1\frac{1}{4}$ " and will still sell for around \$90, while the BN200A has a brad length range of $\frac{3}{4}$ " to 2", selling for around \$140.

In testing, we found the depth-of-drive adjustment easy to use and sensitive enough to adjust to any requirement or wood density. In driving into 2" white oak, the brads could be fully recessed beneath the surface, and the tool didn't hesitate at all with the task. These are quality brad nailers that fill all the needs of the pro or serious home woodworker. If you haven't entered the air powered world yet, P-C informs us the BN125A will also replace the BN125 in its compressor/nailer kit, which lets you get started economically.

For more information, circle #182 on the Resource Directory Coupon.



Performance: ●●●●●
Value: ●●●●●

Porter-Cable: 888-848-5175, or
www.porter-cable.com

Dremel's New 16" Scroll Saw Loaded With Features and Priced Well

Dremel's new 1680 16" scroll saw fits comfortably between many of the entry-level scroll saws (with limited features) and the pricier high-end scroll saws, which are often out of the hobbyist user's range. Selling for \$200, the 1680 offers a number of nice features: variable speed control (with top-mounted controls for easy access) ranging from 500 to 1,600 strokes per minute, with electronic feedback to maintain speeds at low to mid ranges; a 12" x 16" table that tilts 45 degrees to the right or left, with locking detents at 15-degree intervals on the table; an adjustable light; a multidirectional blower; and a toolless blade-changing system for both pin-end or plain-end blades. The blade tension is adjusted at the rear of the tool. When using the saw we noticed some vibration, but it was negligible — unless you were expecting a Hegner or an RBI. The blade changing system worked well on pin-end blades, but the machine screw "clamps" tended to push the plain-end blades out of perpendicular to the table when tightening. In general this is a saw with good features for a decent price. While this isn't a saw for full-time scrollers, an entry-level user won't outgrow it anytime soon.

For more information, circle #183 on the Resource Directory Coupon.



Performance: ●●●●○
Value: ●●●●○

Dremel: 800-4 DREMEL or
www.dremel.com



Skil Beefs Up its Home Shop Drills

Officials at Skil announced this summer they were improving the quality and durability of their tools, and these three drill/drivers are the first evidence of that effort. Skil has added several professional features to these cordless tools but kept the price reasonable. These 12-, 14.4- and 18-volt models sport both high and low speed ranges, a metal gear train and a variable-speed trigger with electronic brake. Each also offers a 16-position torque control clutch, soft-grip handles and each is included in a kit with a one-hour charger, two batteries and a carrying case. The 18-volt model 2892-04 (\$159) delivers 300 inch-pounds of torque and has a $\frac{1}{2}$ " single-sleeve chuck and adjustable side handle. The 14.4-volt model 2592-04 (\$129) offers 200 inch-pounds of torque with a $\frac{3}{8}$ " chuck, and the 12-volt model 2492-04 (\$119) provides 175 inch-pounds of torque, also with a $\frac{3}{8}$ " chuck. While not designed for daily abuse, these drill/drivers are good for any home shop and let you save a few bucks to buy more tools.

For more information, circle #184 on the Resource Directory Coupon.

Performance: ●●●○○
Value: ●●●●○

Skil Power Tools: 877-SKIL 999 or
www.skiltools.com

TOOL SCOOP

JET BUYS POWERMATIC

For the second time in less than a year, JET Equipment and Tools expanded its presence in the woodworking machinery industry by purchasing Powermatic. Earlier in 1999, JET purchased Performax, which makes a line of sanding machinery. JET's purchase in October of Powermatic, which had been caught up in the bankruptcy proceedings of its parent company, DeVlieg-Bullard Inc., greatly expands JET's presence in the high-end market for woodworking machines. JET's immediate plans for Powermatic were to "focus on meeting fall product requirements" and improve the company's line of imported machines, says David Loving, JET's vice president for sales and marketing. There are no plans to close Powermatic's McMinnville, Tenn., plant.

TAIWAN EARTHQUAKE SHOULD NOT SLOW TOOL DELIVERIES

An earthquake registering 7.6 on the Richter scale hit Taiwan on Sept. 21, killing thousands and causing billions of dollars in damage. Though a number of woodworking tool manufacturers have factories in the affected area, none is anticipating significant delays in delivery of prod-

Continued on page 32

Save Money – saw your own lumber



(shown with optional loading ramp)

With a Wood-Mizer!

- + Cut logs up to 28" D. x 11' L.
- + Extended sections permit longer lengths
- + Easily transportable.

Free \$2 Catalog*

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 Independence, MO 64214
www.woodmizer.com

*With purchase of Wood-Mizer LT15

LT15 Personal Sawmill

1-800-553-0219

\$4945

TOOL TEST

Continued from page 31

ucts to stores. While factories survived the quake, delivery of assembly parts from smaller factories may be affected. Company representatives said inventories should be adequate to meet demands.



BOSCH UNVEILS ITS QUIET BENCHTOP TABLE SAW

If you're considering buying a DeWalt benchtop saw, you might want to take a look at Bosch's new Model 4000 Titan Table Saw. The 10" benchtop saw features a 15-amp motor with soft-start and electronic feedback. Other features include a spindle lock for one-wrench blade changing, a 29" x 21 1/2" work surface, full-size blade surround insert and a self-aligning fence. The saw will sell for about \$450 and will be available in December.

Osborne Miter Guide—Stable, Accurate and Easy To Use

If you're a regular reader of this magazine you know that we're strong believers in building your own miter sled. But if you insist on a



commercial product, this is a fine one. Designed to replace your original slot miter gauge, the Osborne guide fits standard 3/8" x 3/4" slots or T-slots in most table saws. The Osborne is a stable cross cut or miter fence with angles from 0 to 45 degrees and auto-locating detents at 45, 30, 22.5 and zero degrees. The guide can be on either side of the blade, and the reversible fence offers two faces: an anti-slip face with a sandpaper-type surface to avoid creeping during a cut, or a smooth aluminum surface.

We found the Osborne Miter Guide to be an accurate, stable and elegant option to the crude miter gauges usually provided with a table saw. And it feels more stable than many of the aftermarket fences you bolt to your existing miter gauge. While it is expensive (\$160), it's a pleasure to use, easy to set up and is well-made. **PW**
For more info., circle #185 on the Resource Directory Coupon.

Performance: ●●●●○
Value: ●●●○○

The Osborne Manufacturing Co., 800-852-9655 or www.osbornemfg.com

The Best New Tools of 1999



Before you spend another dollar on new tools, check out our list of the greatest stuff to hit the stores this year.

Every year we journey to the National Hardware Show in Chicago where tool manufacturers introduce their best and newest products to wholesale buyers and the media. Part of the show is the “New Products Exposition.” This special area is tended by a raft of security guards who prevent over-eager attendees from touching or photographing the thousands of new products on display behind the kind of ropes that separate the stars from the fans at the Academy Awards.

We find all this fuss amusing because in most cases these tools aren’t new to us. In many cases we’ve been using these tools for some time. That’s because we work all year long to find the best new woodworking tools and report on them to you. We visit tool manufacturers’ plants, evaluate tool prototypes, follow up rumors about new tools, and we bring them into our shop here at the magazine and use them to build furniture.

The result is this list: The Best New Tools of 1999. Each of these tools was tested in our shop and is exceptional because of its raw performance or because it is an amazing value. All these tools are highly recommended by our staff.

One final note, there are a handful of new tools that weren’t available to test at press time, such as DeWalt’s new contractor saw. You can look forward to reviews of these tools in upcoming issues as soon as we can get our hands on them. **PW**

by David Thiel, Christopher Schwarz and the PW staff

- BENCH DOG
- VERITAS
- GRIZZLY
- PORTER-CABLE
- ACCUSET
- JET
- RIDGID
- FEIN
- MAKITA
- FRANKLIN



This Router Table is One Tough Bulldog

A couple years ago we built a custom floor-model router table for our shop. Ever since Bench Dog's ProTop benchtop router table entered our shop, the big custom table has become a dumping ground for junk and offcuts. The scrappy and inexpensive ProTop RT100 router table has everything the serious home woodworker needs, including an excellent 22" fence made from a heavy aluminum extrusion, easily adjustable MDF sub-fences for quick zero-clearance settings (or to set up the fence to be used like a jointer) and T-slots

PRO TOP RT100 ROUTER TABLE

from Bench Dog - \$200
800-786-8902
www.benchdog.com

on the front and back of the fence for accessories. There's also an aluminum T-slot and miter gauge track mounted on the front edge of the table for feather boards and other accessories. The price of the whole package is a reasonable \$200. A similar version of the Bench Dog router table is sold by CMT, with slightly different features, so

you might find this product for sale with a different label. If you absolutely must buy a floor model, Bench Dog also makes a larger model with similar features to the benchtop, but with more bells and whistles (and a higher price tag).

The boys at Bench Dog paid nice attention to detail. Everything about it smacks of quality, from the design to the manufacturing — even the packaging. This a great tool at a great price.

For more information, circle #170 on the Resource Directory Coupon.

Veritas Redesigned the Sliding Bevel Gauge, Adding Convenience, Quality and Performance

New tools tend to be power tools, so it's a joy when a manufacturer re-thinks a hand tool. Veritas introduced its new 10" sliding bevel gauge in the early days of 1999, and it has worked its way into our hearts ever since. Inspired

by a turn-of-the-century design, this tool uses a bronze cam-locking mechanism rather than the traditional wing nut. The cam lock recesses flush into the handle with the flick of a finger, allowing it to be used on either side without interference. Accuracy is improved as well because the cam operates on compression, providing a tighter, no-slip setting. The stainless steel blade and resin-impregnated wood body make it entirely waterproof. This tool feels good in your hand, operates accurately and conveniently, and looks good to boot. This is a great heirloom-quality addition to your shop apron or tool cabinet.

For more information, circle #171 on the Resource Directory Coupon.

VERITAS SLIDING BEVEL

from Lee Valley Tools
\$21.95 #05N44.01
800-871-8158
www.leevalley.com



Grizzly's G8027 Dust Collector: Now There's No Excuse for You Not to Have a Dust Collector

Most of our staff has worked in professional cabinet shops where dust collection was a necessity. So we have strong feelings about controlling dust and chips in our shop. However, we know that dust collection can be pricey. That's why we are excited that Grizzly Industrial is offering a 1hp dust collector with 500 cfm (cubic feet per minute) capability for just \$130 plus shipping. Though 500 cfm is less sucking power than the more common 650 cfm found in other dust collectors (priced between \$179 and \$230), we found Grizzly's machine more than capable of handling a home shop's needs. (A benchtop planer requires 400 cfm to adequately collect sawdust.) Grizzly didn't skimp on features to keep the price right, either. The 13-amp induction motor powers a balanced steel radial fin impeller to fill the 14½" x 23", 30-micron rated bag. This is a lot of machine for the money, (even after you include the \$20 shipping charge) and we're pleased that dust collection is becoming even more affordable so your shop can be healthier. Thanks Grizzly.

GRIZZLY MODEL G8027 DUST COLLECTOR

\$129.95 + shipping
800-523-4777
www.grizzlyindustrial.com

For more information, circle #172 on the Resource Directory Coupon.

Porter-Cable's New Plunge Router a Champ in a Router Table or Out

Porter-Cable dove into the fierce competition in the "precision plunge router" market this year with the introduction of its 7529 plunge router. And it looks like P-C has a real winner.

The 2hp, 12-amp precision router offers micro-height adjustment to fine tune the depth of your cut to within $\frac{1}{128}$ ". An integrated dust collection system pulls dust through an opening in the base to keep the work and your vision clear. The ability to fine-tune the router bit's depth while the router is in the "locked" position, and dual power switches (on top of the router for table use and on the handle for free-hand use) make the 7529 an excellent choice for use in either a router table or free-hand. With variable speeds between 10,000 and 23,000 rpm, the router also includes a soft-start feature, an electric brake and a spindle lock for convenient one-wrench bit changing using either the $\frac{1}{4}$ " or $\frac{1}{2}$ " collet. Other marks of quality craftsmanship are the extremely quiet motor and the very low vibration during use.

This router offers both cutting-edge features and versatility making it an easy choice for one of the Best New Tools of 1999. For more information, circle #173 on the Resource Directory Coupon.

PORTER-CABLE MODEL 7529 PLUNGE ROUTER

\$210

\$245 with edge guide
and dust collection kit

800-487-8665 or

www.porter-cable.com



AccuSet's Micro Pinner is for Serious Woodworking, Not Just Crafts

AccuSet's new micro pinner is one of those tools you never knew you needed. When you use it you can put the wood putty away because the holes left by the tool's 23-gauge pins are no bigger than the period at the end of this sentence. The pins (up to 1" in length) are great for attaching mouldings to a project while the glue dries. For holding pieces in place while you screw them together. For installing cock beading on drawers. For pinning drawer runners to the sides of cases while your glue dries. In short, the A100MP is a lot like a clamp that can help hold pieces at any angle. Put one of

ACCUSET MODEL A100MP MICRO PINNER

\$125

888-222-8144

www.accuset.com

these tools in your shop and you'll reach for it at some point during almost every project.

AccuSet air tools are made in Taiwan for Senco, and we've found the quality and reliability of the entire line of AccuSet tools to be very high. The micro pinner sells for about \$125 and is available through home center stores and catalogs.

For more information, circle #174 on the Resource Directory Coupon.

Jet Benchtop Mortiser a Steal at \$240

If you've got to cut a lot of mortises (say, for a Morris chair) then chain-drilling using your drill press will not do. You need a dedicated hollow-chisel mortiser. It is, put simply, a drill press that cuts square holes. Jet's new JBM-5 is a real bargain because it comes complete with three sizes of hollow chisel bits ($\frac{1}{4}$ ", $\frac{3}{8}$ " and $\frac{1}{2}$ ") for the same price as competitive mortisers that don't include chisels.

The JBM-5 is powered by a $\frac{1}{2}$ hp induction motor that turns at 1,725rpm. It can mortise to the center of a 7"-wide board that's up to 4" thick. The Jet model offers a longer chuck key and spring-loaded side doors, which are not found on competitors' models. But the best reason to buy the Jet is the included set of chisels. This is a potential savings of \$45 to \$75, and a factor that should make the Jet fly off the shelves. One last thing: Moments before press time, we learned one of Jet's competitors will be offering a similar deal on its mortiser and chisels, which points out what a hot deal this really is.

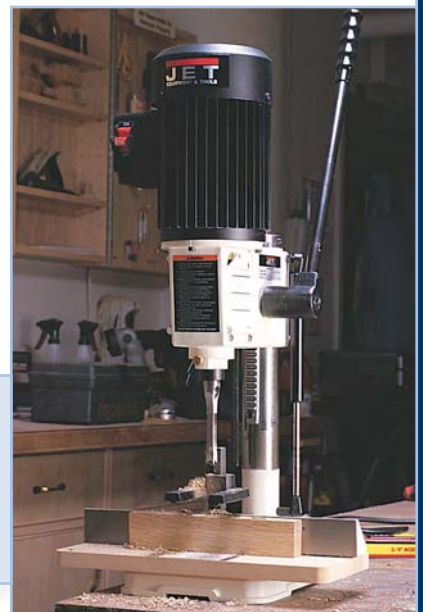
For more information, circle #175 on the Resource Directory Coupon.

JET JBM-5 BENCH TOP MORTISER

\$240

800-274-6848

www.jettools.com



Porter-Cable 690 Wonder Pack

About a year and a half ago, Porter-Cable made us and a lot of other woodworkers happy by offering its venerable 690 router in a package that included both a fixed base and a plunge base for less than \$200. While that package was great, it didn't make last year's list of best new tools. But when the folks at Porter-Cable added the accompanying D-handle base, and threw in the 698 router table all for about \$300, we knew we had a winner.

The 690 router is a 10-amp, 1½hp motor with both ¼" and ½" collets that has provided outstanding performance for home and commercial woodworkers for years. The three bases in this kit offer versatility usually only provided by three separate routers. The fixed base can stay in the router table, the D-handle can be used for hand routing and the plunge base for plunge cuts. The 698 router table offers a separate on/off switch, a hole capable of accepting 3½" diameter bits, a split-fence design and attachments for dust collection. You can't get a much better deal or a more versatile router system, and that's why this package of "old" tools gets our nod as a best new tool.

For more information, circle #176 on the Resource Directory Coupon.

PORTER-CABLE 690 PACKAGE

■
\$300
800-487-8665
www.porter-cable.com



Lots of Features Make Ridgid's 13" Benchtop Planer A Great Buy

We constantly get questions from readers about which 12½" benchtop planer to buy, the Delta or the DeWalt. Both are good machines, and quite honestly it was difficult to recommend one over the other. This year the competition got thicker. Ridgid introduced a 13" benchtop planer that borrowed the best ideas from both competitors and added some of its own, then wrapped it up with an extra ½" of cutting capacity.

RIDGID TP-1300 BENCHTOP PLANER

■
At Home Depot for \$399
800-4-RIDGID
www.ridgidwoodworking.com



Features include: a 15-amp motor providing 66 cuts per inch (better than the competition); a four-post cutterhead locking mechanism for reduced snipe; the Ind-I-Cut™ depth measurement gauge; and an eight-position depth stop that allows you to plane to a particular thickness again and again. There are also two sets of dual-edge re-

placeable knives, on-board tool storage; larger infeed/outfeed tables; and a removable top for easier blade changing. With the suggested retail of \$399 it's priced a little higher than the competition, but with all these features, plus an extra ½" of cut capacity — this is an easy recommendation for one of the Best New Tools of 1999.

For more information, circle #177 on the Resource Directory Coupon.

Fein's Four-Gallon Vacuum is the Strong, Silent Type

Let's clear up a myth about shop vacuums that has plagued woodworkers for years: Your 5hp vacuum has nowhere near 5hp of sucking power. For years many manufacturers have stretched the horsepower rating of their vacuums by calling it "developed horsepower" or something else. So don't be alarmed when you hear that Fein's new shop vacuum is rated for only 8 amps (about 1hp or 1½hp). Fein has refused to go along with the little fiction other manufacturers have been using for so long. Rest assured this new four-gallon vacuum has plenty of power. In fact, the only thing it doesn't have is the mind-numbing roar many other vacs have. This Fein vac is quieter than you think a vacuum could ever be.

The Fein 9.11.20 comes with a nice array of 12 accessories, including an excellent 10-foot hose, extension tubes and brushes. The vac is well made, with details you'll appreciate, such as a switch that's sealed from dust, a hose that locks to the tank, heavy-duty swiveling casters and a 16' cord. Plus at only 20½" high, this little guy can fit just about anywhere in your shop. The price is nice, too — \$150.

For more information, circle #178 on the Resource Directory Coupon.

FEIN MODEL 9.11.20 SHOP VAC

■
\$150
800-441-9878
www.fein.com/en/index.html





Makita's 18-volt Miter Saw Pushes Cordless Technology to Next Level

What can we say? We are very fond of Makita's miter saws. The 18-volt LS711DWBK takes the majority of the features of the corded 7½" model LS0711 sliding compound saw, then

rips the cord off. You may not need this tool in your shop, but you'll want one. The 18-volt Nickel-Metal Hydride batteries (it comes with two) are capable of cutting 100 2x4's on one charge. The dual-pole saw features an electronic brake; it bevels from 0-45 degrees to the left and

**MAKITA
LS711DWBK
CORDLESS SLIDING
MITER SAW**

■

**\$499
800-4-MAKITA**

www.makita.com

miters to 47 degrees to the left and 57 degrees to the right. Cutting capacities are 2⅜" x 5⅞" with bevel and miter set to 0 degrees, and 2⅜" x 3⅓" with the miter set to 45 degrees. Weighing just under 24 pounds, this well-made groundbreaking saw comes with its own carrying case that's capable of holding a matching Makita drill/driver, should you already own one. Priced at \$499 this isn't the most affordable miter saw. But trust us, you'll want one.

For more information, circle #179 on the Resource Directory Coupon.



Titebond's New 'Push-pull' Glue Caps

The cap on your glue bottle is probably the most-used tool in your shop. It's also probably something you don't think much about — until it gets torn or clogged. Thank goodness Franklin International has spent more than \$100,000 during the last five years to try to perfect the glue cap. Franklin, the makers of the Titebond line of wood glues, developed this cap after talking to woodworking clubs and professionals about what they disliked about the cap on their old glue bottle. We've been using these new caps for almost a year, and we're impressed. Here's why.

First, there's no cap to lose in the mountains of sawdust. When you're done spreading a line of glue, you push the cap down and it shuts. Second, when you shut the cap, a little piece of plastic pushes out any glue left in the nozzle. Result: you don't have to extract a hunk of dried glue that looks like a wisdom tooth every time you open your glue bottle. The little bit of glue that dries on top of the cap can easily be flicked off with a fingernail. And third, the nozzle is made from trans-

parent plastic so you can see the glue as it comes out and know when to stop squeezing.

It's now safe to say that the manufacturer of the best yellow glue on the market also has the best cap.

For more information, circle #180 on the Resource Directory Coupon.

The Ridgid RoboHammer: Less Shock, More Precision and Power

When you think about it, it's truly amazing when a manufacturer takes a tool as fundamental as a hammer and revolutionizes its design in a way that greatly improves its performance. Ridgid has improved immensely on the first hammer design (a rock) and all subsequent designs with the new RoboHammer™. With a special shock-absorbing cut made in the center of the head, the hammer works more like a dead-blow hammer than the basic claw. This minimizes recoil, as well as maximizing and focusing the energy from your swing to the point of impact. The 18-ounce hammer also has the head offset from the center to help control your wrist position during the swing. This feature, as well as the contoured right- or left-handed grip provides improved accuracy. Forged with a deep cut claw for pulling nails, and a sporty look, this hammer actual does decrease shock to the user's hand. We found that a three-swing drive on a 16d nail was no problem, and we actually had to pay attention to not anticipate the bounce of the hammer. Comfortable in your hand, efficient, ergonomic and practical, this is a tool we're happy to include on our best of '99 list. **PW**

For more information, circle #181 on the Resource Directory Coupon.



**RIDGID
ROBOHAMMER**

■
**At Home Depot for \$29
800-4-RIDGID**

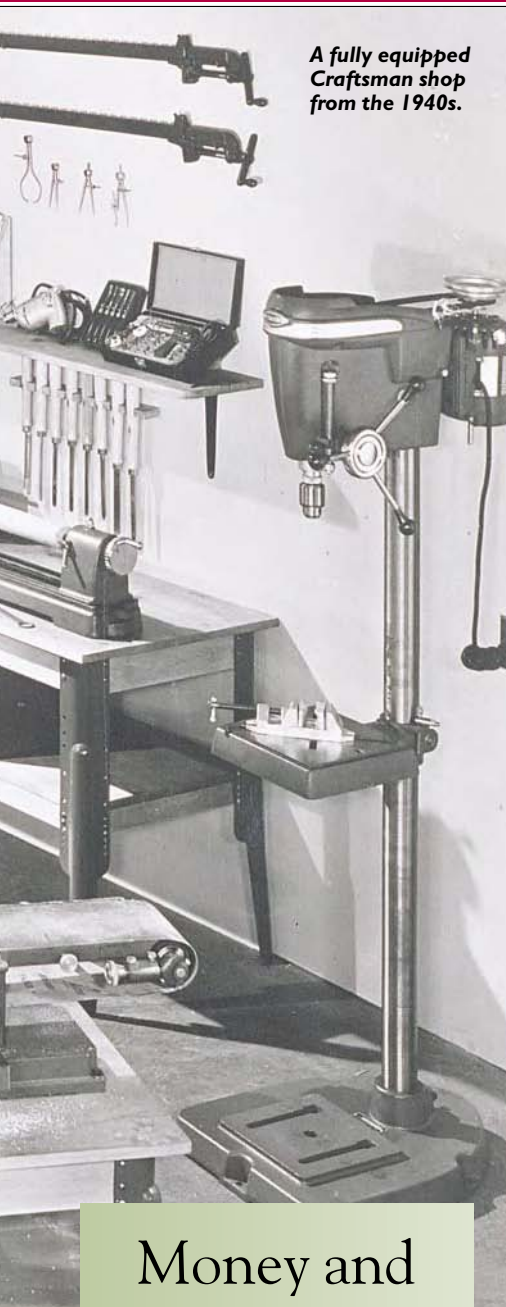
www.ridgidwoodworking.com



The Amazing Rise of **Home Woodworking**

by Roger Holmes

Roger Holmes trained as a furniture maker in England and has been working wood professionally and for fun for 30 years. He lives in Lincoln, Nebraska.



**A fully equipped
Craftsman shop
from the 1940s.**

Photo courtesy of Craftsman

Money and
inexpensive
machines
transformed
woodworking
from a skill for an
elite few into
a passion
for millions.

It had been so long I had nearly forgotten the smell. When I recently pried the lid off a can of orange shellac, the first whiff took me back almost 40 years to my grandfather's workshop. Occupying half of the second-floor apartment where he and my grandmother lived, my grandfather's shop was a mysterious and fascinating place for a child. A rabbit warren of dimly lit rooms housed old furniture awaiting refurbishing. An ancient table saw and battered workbench dominated the main room, lit by a single bare bulb. A rickety wooden landing out back supported a stool and the handsaw-sharpening vise where grandpa perched, filing away a few hours every week.

My grandfather and his workshop are inseparable in my memory. Of course, I saw him in the apartment, usually at meals or resting in his beat up reclining chair. But the tidy apartment was grandma's turf, and grandpa seemed as much a visitor there as I was. The workshop was his true home. Over the years my memories of the place had faded, but the slightly sweet pungency of shellac, an aroma that permeated every room and seemed to seep from the old man's pores, brought my grandfather and his favorite spot vividly to mind.

I grew up in a workshop family. Like his father, my dad had a shop, which he shoehorned into half of the basement of our suburban home. Today, my shop occupies two-thirds of a building that would be a garage if there were any room among the tools for a car. Home workshops like my family's can be found across the country in spare rooms, basements or garages. Some, however, occupy custom-made buildings, while others are squeezed into closets. There are shops devoted entirely to hand tools and shops fitted out with state-of-the-art machinery. Every home workshop, grand or humble, is a special place to its owner. While the actual work undertaken there is frequently humdrum, the time spent in the shop is often valued beyond practical accomplishments. In numerous tangible and intangible ways, our workshops reflect our personalities. Just as I can't think of my father and grandfather without conjuring up images of their workshops, I expect that when my children become middle-aged sentimentalists they'll remember me in the same sawdusty setting.

From Necessity to Hobby

Home workshops reflect their times as well as the quirks of their owners. They've been a feature of domestic life in America since colonial days and have changed as the country has changed. What was a necessity on the frontier and the farm has become a center of leisurely pursuits for millions of Americans. Jack-of-all trades home shops, in which a plow hitch or a broken chair leg could both be readily, if rudimentarily, mended, were joined over the years by do-it-yourself home repair and improvement shops. There, paint cans and rolls of wallpaper mingled with plumbing and electrical fixtures amidst an odd assortment of tools.

All-purpose, jack-of-all trades home shops have become as rare as the farms and homesteads that depended on them. The eclectic do-it-yourself home improvement shop, on the other hand, can be found in some form or another in almost every household. While usually not the kind of setup readers of this magazine would take seriously as a shop, these home-improvement workrooms are often incubators for more serious woodworking interests. The bookcase uncertainly knocked together as part of the family room redecoration project plants the seed that several years later has grown into a full-blown woodworking passion, with a shop to match. To be sure, home woodworking shops continue to facilitate household repairs and improvements. But, if we're honest, most woodworkers will admit that our home shops have much more to do with enjoying life than with providing its necessities.

"The measure of a workshop," Scott Landis writes in *The Workshop Book*, "is greater than the sum of its parts." The workshop, so concrete in its structure and contents, can be surprisingly difficult to pin down in its essence. Unlike many of its parts, the workshop as a whole is always changing. A new tool, a new project, a new shipment of wood, a new passion or whim taken up by its owner, all require rearranging the shop's innards.

Assimilating and reflecting all these changes, the workshop presents a microcosm of the wider world of woodworking. Home workshop evolution can be tracked by examining the evolution of its "parts" — woodworking tools and materials. But the story also flows from currents in society

1900's

1900

Paper clip, tractor, alkaline battery invented

1902

McKinley assassinated; Hormones discovered, disc brakes invented

1903

First flight at Kitty Hawk made by Orville and Wilbur Wright; first World Series

1906

452 killed in San Francisco earthquake; crystal radio apparatus; Porter-Cable founded

1907

Financial panic and depression started March 13, first modern color photography

1912

First diesel locomotive; 100th anniversary of Constantines' cabinet shop, which later became a major cataloger

1914

The first World War begins in Europe; brassiere invented

1915

First phone call made by Alexander Graham Bell & Thomas A. Watson; pistol-grip drill introduced by Black & Decker

1917

U.S. troops sent to Europe; SONAR detection system invented



Early shops, such as this replica at Williamsburg, were not for hobbyists.

at large: The spirit of self-sufficiency that has always driven Americans. And the unprecedented affluence of the country's vast middle class during the last half of this century.

It won't surprise anyone to hear that technological innovation and widespread affluence have shaped woodworking, as they have everything else, during this century. What is remarkable, to me at least, is the way these forces have transformed a demanding and somewhat inaccessible craft into a pastime enjoyed by millions.

My grandfather was a young man the last time a century turned. At the time, his home shop (if he had one) would have presented no surprises to a journeyman woodworker from colonial Philadelphia or medieval London. A drawing in *The Practical Woodworker*, a how-

to woodworking book of the period, shows a home workshop equipped with a sturdy cabinetmaker's workbench, several hand-saws, a hand plane and a treadle grinder. Other than a foot-powered treadle lathe, the shop contains not a single machine tool. Woodworking machinery had been in commercial use for much of the 19th century. Small professional shops or well-to-do amateur woodworkers might have a few manually powered machines. But machines capable of the work routinely done in today's home workshops by com-

pact and powerful table saws, jointers and planers were then massive cast-iron affairs, driven through belted lineshafts.

At the turn of the 20th century and for several decades after that, much woodworking was the province of hand work. The period's tool catalogs offer a marvelous snap-

shot of the times.

Makita's first plunge router — one of the first to hit the market in the United States (courtesy of Makita).



Photo courtesy of Colonial Williamsburg

1916

Early pistol-grip drill



“Every CARPENTER, BLACKSMITH or other mechanic once buying from us ever after is a regular customer,” boasted Sears in its 1897 catalog. Saws, marking gauges, squares, rules, hammers, chisels, spoke-shaves, gouges, braces, bits, clamps, grindstones and more — Sears crammed hundreds of tools into 18 pages of the catalog's “Mechanic's Tools” section. Two treadle scroll saws (called “bracket” saws) and a combination treadle lathe and bracket saw are the only machines offered. Hand planes alone occupy four pages, including three complete lines of bench planes (wood, metal and wood-metal combination). The prices make a modern woodworker weep. A Genuine Bailey Iron Smooth plane sold for \$1.14, or you could get “an imitation of the above plane” for \$1.08. Wooden moulding planes went for 27 to 54 cents each, and the majestic Universal Plane for a budget-busting \$9.30.

Mail-order catalogs revolutionized retail marketing, bringing a vast array of goods within the reach of people on farms and in small towns — the majority of the population at the time. Unlike specialty tool catalogs circulated only among tradesmen, the Sears and Montgomery Ward catalogs were sent to ordinary homes. These catalogs addressed their tool sales pitch to tradesmen, but I suspect they had considerable appeal for others.

Tools and Training

Owning a tool and knowing how to use it are, of course, two very different things. For centuries, even basic woodworking procedures required considerable training. Anyone hoping to produce more than the roughest of shelters and furnishings would need at least rudimentary skill with various handsaws, planes and chisels. Acquiring these skills to earn a living required years

1918

First domestic refrigerator

1919

Sale or consumption of alcoholic beverages banned in America; Delta founded

1921

Germany defeated, World War I ends; hydraulic four wheel brakes, Powermatic founded

1922

Raymond E. DeWalt invents the radial arm saw, DeWalt Products Co. founded in 1924

1924

Skilsaw introduced on July 1; spin dryer invented

1926

Porter-Cable introduces the first portable belt sander; aerosol can, synthetic rubber, television invented

1928

Woodcraft Supply, a major supplier of woodworking accessories, founded in Boston

1929

Stock market crashes; first color television transmission, Porter-Cable introduces the first helical-gear circular saw

1931

Craftsman publishes its first power tool catalog; Fiberglass, electric razor invented

of dedicated training. Acquiring a few of them (sawing, pushing a jack plane, sharpening a chisel) for occasional use around the farm or house was less time consuming and more common. Acquiring specialized skills (cutting joints, running mouldings) for use as a hobby was rarer.

Looking back from our machine-enabled and leisure-enriched age, the difficulties woodworking posed to the would-be amateur some 100 years ago are formidable. Apprenticeship, the traditional means of acquiring skills beyond the rudimentary, wasn't an option for even the most serious hobbyist. Fortunately, as the 19th century drew to a close, an increasing number of Americans were receiving instruction in woodworking skills courtesy of the nation's public schools.

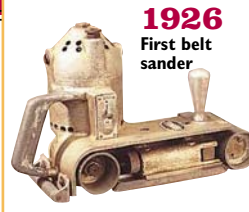
From about 1870, manual arts training was gradually integrated into the mainstream of American education. Starting in technical colleges and working its way down through high schools, grammar schools and finally elementary schools, manual arts were by 1900 accepted as a valuable part of a well-rounded education.

Although debates periodically arose over the nature and goal of manual arts training, generations of Americans have found in it the spark of lifelong interests and a start on the skills with which to pursue them. My grandfather left school sometime before the 8th grade, but he may well have received some manual arts training in the Ohio schools of the 1890s. My father took shop classes in junior and senior high school in the 1930s and 40s. And I still remember how my shop teachers, Mr. Sell and Mr. Gast, attempted to mask their well-founded apprehensions as my buddies and I stepped up to the table saw or jointer in our early 1960s junior-high shop.

Some of the impetus for the spread of manual arts training in the late 19th and early 20th century came from the Arts and Crafts Movement, whose rejection of shoddy or garish machine-made products gathered steam in opposition to the

rise of industrialism. Movement theorists John Ruskin and William Morris were influential in England, on the continent and in the United States, where Gustav Stickley's *Craftsman* magazine, published

furniture that has become emblematic of the "craftsman" style in America. While the Arts and Crafts ethos was influential in educational circles and a certain segment

1924
First Skilsaw**1926**
First belt sander

SHOPSMITH: A CLEVER COMBINATION

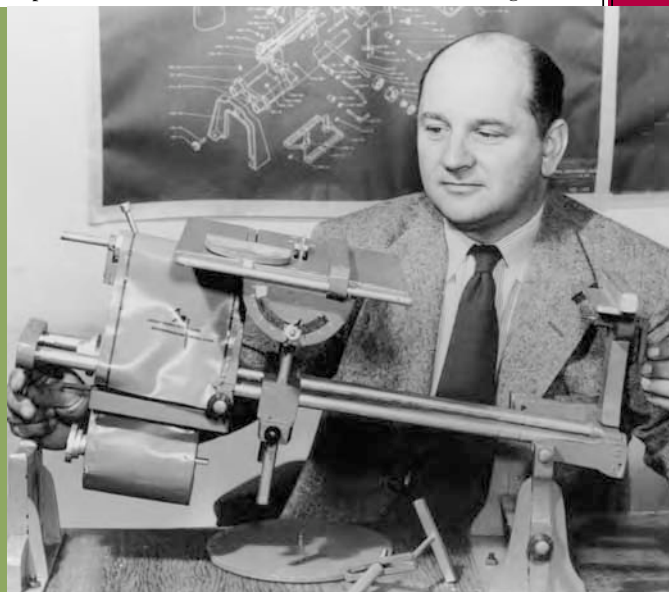
Combination wood-working machines — two or more machines operating off the same motor or sharing the same platform — are ideal for home workshops. They fit from two to five machines into the space any one of the tools on its own would require. And for a price always less (sometimes substantially less) than the cost of comparable machines bought individually. Combination machines are common in Europe and have been available in North America throughout this century, but they have never been very popular here. With one exception — the Shopsmith.

Since its invention in 1946 by Hans Goldschmidt, a German expatriate living in California, Americans have bought some 500,000 Shopsmith 5-in-1 combination machines.

The Shopsmith is an odd duck. Most combination machines are built around tools at the core of traditional joinery and furniture making — table saw, jointer, planer, shaper and horizontal boring tools. The Shopsmith, however, combines a lathe, drill press, horizontal borer, and disc sander with an 8" table saw. Not an ideal selection of tools for someone who wants to turn rough lumber into coffee tables. But just right for a hobbyist primarily interested in woodturning and small projects or a homeowner in need of a table saw and drill press for occasional household improvements. The machine has admirers among "serious" amateurs and some professionals, too. They use the machine primarily as a horizontal and vertical borer — it is one of the few drill presses designed specifically for woodworking and it is remarkably versatile.

Sold initially through Montgomery Ward and a network of hardware stores, Shopsmith thrived in the suburban boom of the 1950s, but by 1964 the tool was out of production. In 1971, a Dayton, Ohio, stockbroker and amateur woodworker named John Folkerth bought the rights to the Shopsmith and revived the tool, much to the delight of its devotees. Folkerth's initial attempts to market the tool through the old hardware store outlets faltered. It was only when sales reps began showing potential customers what the tool could do in live shopping mall, state fair, and woodworking show demonstrations that sales perked up. Today's \$3,000 price seems a bit steep compared to the \$199.95 tag on the 1950 model, but the company maintains the cost is still less than you'd pay for individual tools of comparable quality.

Photo courtesy of Shopsmith



1933

Adolph Hitler rises to power in Germany

1936

Jesse Owens wins 4 golds at Berlin Olympics, "Gone With The Wind" published; jet engine and Plexiglas invented

1937

Delta sells its first Unisaw

1939

Germany invades Poland; jet aircraft, DDT invented

1940

Automatic transmission invented

1941

Japan bombs Pearl Harbor; first color television system

1942

Battle of Midway; Nuclear chain reaction produced at University of Chicago

1943

The 100th anniversary of the founding of the Stanley Works

1944

D-Day brings Allies a step closer to Hitler; Lamello, inventor of the biscuit joiner, starts his company

of well-heeled, well-educated society, I suspect that Stickley and his magazine created more furniture customers than furniture makers. But the furniture designs themselves, with their simple joinery and low-key decoration, have proved over the years to be ideal projects for home-shop woodworkers.

As the 20th century progressed, traditional tool manufacturers and suppliers began to notice the growth of do-it-yourself home repair and improvement and hobby woodworking. From its 1843 origins as a manufacturer of bolts and hinges, The

Stanley Rule and Level Company had grown by the 1920s to dominate the North American market for carpenters' tools. As early as 1905, the company produced an inexpensive line of tools aimed in part at the expanding household market. In 1923, Stanley launched the "Four Square" line with what tool historian John Walter calls a "classic of early modern American advertising... a nationwide promotion aimed at the public and hardware dealers, utilizing film strips, street car ads, whimsical storefront display figures and special packaging." (Walter's book, "Antique &

Collectible Stanley Tools," covers Stanley's vast output in fascinating detail.)

Beginning in 1921 and continuing through the 1960s, Stanley sold tools sets for home workshops. Carl Stoutenberg, a longtime Stanley design engineer and unofficial company archivist, described some of them to me. At the top of the line was the Number 850 Tool Cabinet, produced from 1922 to 1942. The 1925 version, which sold for \$95, included a double-doored walnut cabinet and 50 hand tools. At the other end of the line was the Number 907 Tool Assortment, selling for just \$5 in 1929. Included were seven tools in a cardboard box, which doubled as a store display, with plans and hinges for a wooden tool box to build yourself.

Stanley quickly realized that homeowners and hobbyists, unlike tradesmen, might not know how to use the tools or what to build with them. *How to Work with Tools and Wood*, first published in 1927, was among the first of a steady stream of Stanley instructional materials that included booklets, wall charts and film strips on specific tools. It joined a growing body of books and magazines purporting to reveal the secrets of woodworking and other domestic trades to amateurs. *How to Work with Tools and Wood* was in continuous publication (with revisions) into the 1960s, selling about 10,000 copies a year by promising to "open the way to make useful projects, to repair furniture, and to do odd jobs around your home."

Despite Stanley's promise to "take all the mystery out of using tools," hand tools and the time and skill required to use them were still an obstacle to many would-be home shop woodworkers. As I think back to my father's 1950s basement workshop, it seems clear what, more than anything, fueled this century's explosion of amateur woodworking — compact, high performance, low-cost machines. Occupying no more than 300 square feet, my father's shop contained a 10" table saw, 14" bandsaw, 6" jointer, a drill press, a shaper, a combination 6" belt sander

Modern manufacturing made drill presses — once a high-price item — a tool every woodworker could afford.

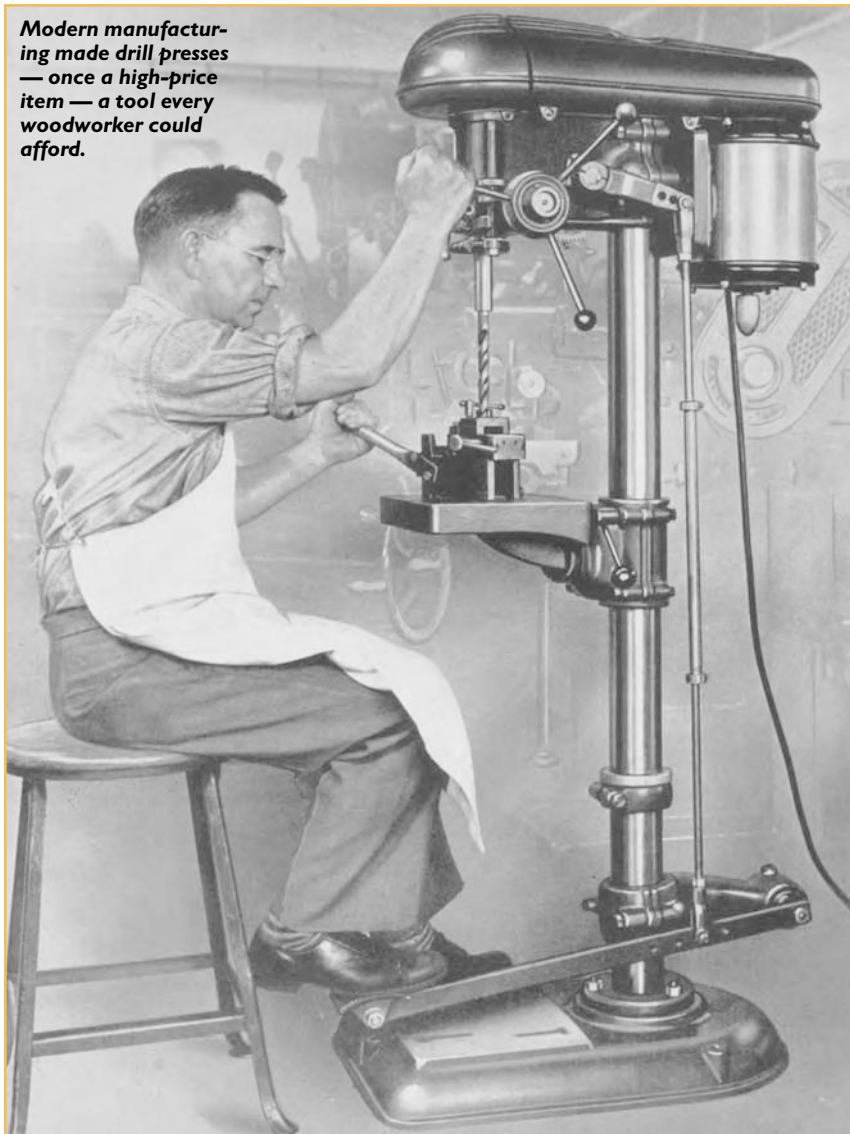


Photo courtesy of Delta

1945

FDR dies, Truman becomes president; atomic bomb dropped on Hiroshima and World War II ends

1946

Lowes, which was later to become a home center superstore, is founded

1947

Bosch introduces the first jigsaw; the transistor is invented; Chuck Yeager makes first supersonic flight

1949

First orbital finishing sander introduced by Porter-Cable

1950

U.S. troops enter Korea; Xerographic copying machine invented

1952

Ike victorious again; transistor radio, artificial heart valve invented

1953

Korean Conflict ends in uneasy truce; "Catcher in the Rye" published; first measles vaccine

1954

Racial segregation ruled unconstitutional in public schools; first regular broadcast of color television

1958

First laser, first communication satellite; Jet Equipment and Tools founded



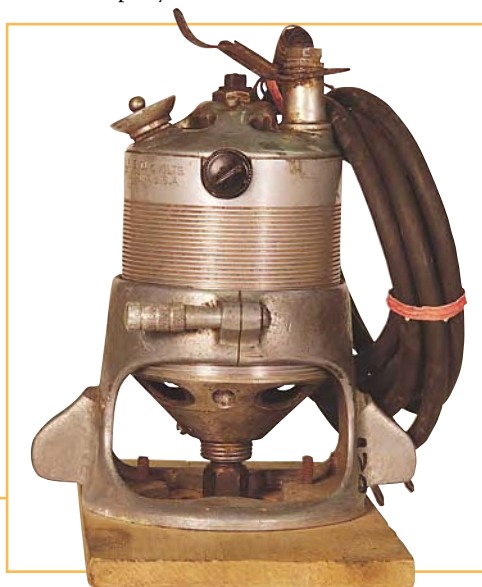
The top-of-the-line Stanley 850 tool cabinet. Price, with tools, \$95.

and 12" disc sander, and even a peculiar little 6" thickness planer with no feed rollers. Stashed on shelves and in cupboards around the shop were an equal complement of portable electric tools. Dad's hand tools gathered dust on the pegboard above the workbench. I don't think I ever saw him use a bench plane.

Machine Age

If home workshops in the first half of the century were the province of hand tools, those of the second half belonged to the machine age. Woodworking machines had the same attraction to homeowners as to industry — they reduced the level of skill and the time required to build things. It can take weeks to learn to flatten a board and square its edges with a hand plane. The same tasks can be mastered on a jointer in about an hour. And in that hour you can flatten and edge-joint all the material for a chest of drawers; the work of a day or two for a skilled hand craftsman. As the electricity-supply grid spread across the country and electric motors became small and cheap, woodworking machines began to appear in home workshops.

The home-shop opportunities that were evident to Stanley for **Early R. L. Carter Co. router** (courtesy of the New Britain Industrial Museum).



sales of hand tools don't seem to have been as clear to traditional machinery manufacturers, though some tested the waters. In 1935, responding to a reduction in sales of industrial machinery during the depression, Yates-American placed an ad in *Popular Homecraft* magazine introducing a line of woodworking machines for the home shop. But Yates, like other established machinery manufacturers, was unable to figure out the market, perhaps because of its distrust of smaller, lighter, less "serious" machines, perhaps because the company didn't understand less "serious"

WOODWORKING IN THE INFORMATION AGE

Of all the changes in the world of home-shop woodworking in the past 100 years, none is more dramatic than the explosion of information for home-shop woodworkers. When I set up my first shop in the early 1970s I searched the local library for instruction into the many mysteries of the craft — how to sharpen a hand plane and cut a dovetail, for instance. The selection was discouraging. Only a few well-thumbed books from the 1940s and earlier concerned themselves with the traditional techniques that interested me. With few exceptions, the how-to texts were woefully incomplete, the drawings and photos were sparse or equally unenlightening. The few contemporary magazines that covered woodworking weren't much better.

Today we are deluged with information, both practical and inspirational. Books, magazines, videos, broadcast television, internet web sites. A simple search of amazon.com's web site yielded 1,028 titles having something to do with woodworking.

In addition to all these books, there are today perhaps a dozen national magazines devoted entirely to amateur and small-shop professional woodworking. In the past 25 years, these magazines have reshaped coverage of woodworking. Instructional articles are more detailed and clearly explained, with a wealth of drawings and photographs. They have expanded their horizons to include almost every woodworking interest, no matter how obscure. Magazines have nurtured the rediscovery of many traditional techniques and even entire crafts once headed for extinction.

Perhaps the most remarkable information innovation has been the instructional video. Now anyone with a VCR and a TV can learn by observation directly from a master craftsman, an experience once only for apprentices.

Video in the form of broadcast television has also brought woodworking to a vast audience. The best known TV woodworkers, Norm Abram and Roy Underhill, don't so much instruct as entertain and, mildly, proselytize. While largely devoted to their respective interests — contemporary machine woodworking and traditional hand woodworking — Norm and Roy introduce viewers to the wider world of woodworking, too. Viewers come away intrigued, perhaps inspired to try something new in the shop, perhaps inspired to set up a shop in the first place. Once they're hooked, they can start working their way through amazon.com's 1,028 titles....

1961

Berlin Wall constructed; Alan Shepard first American in space; first cordless drill introduced by Black & Decker

1962

John Glenn circles Earth in space craft; first minicomputer

1963

JFK assassinated by gunman; cassette tapes invented

1964

Martin Luther King "I have a dream!" speech celebrates passage of Civil Rights Act; BASIC computer language invented

1965

Continuous bombing of North Vietnam ordered by Lyndon B. Johnson; first word processor

1968

Martin Luther King and Robert Kennedy assassinated; TET offensive results in heavy casualties

1970

Makita enters the U.S. market

1971

Black & Decker introduces the first Workmate

1972

Watergate break-in sets off chain reaction; digital watch invented

1961

Cordless drill



amateur users.

Manufacturers with a fresh perspective and fewer preconceived notions did better. In 1919, Harvey Tautz started the Delta Specialty Co. and housed it in the garage of his Milwaukee home. Over the next 30 years, Delta developed a range of small woodworking machines that, in many ways, set the standard for quality in home shop machinery. Though small, these machines were not toys. Like their industrial counterparts, they were accurately machined from generous amounts of cast iron.

Delta's first tool, the hand-crank-powered "American Boy Scroll Saw," appeared in 1923 and was followed in 1928 by the more substantial "Delta Hand-Shop." It comprised a 9" lathe, 8" disc sander and 6" table saw, all driven directly by an electric motor. A 12" American Giant Scroll Saw completed the outfit, which sold for \$99.50. In 1937, the company introduced its most famous machine, a 10" floor model table saw called the "Unisaw." The first saw of its size to have a tilting arbor, rather than a tilting table, the Unisaw sold for \$89.50 in 1939; to date 640,000 have been sold. The photo of the 1937 version looks exactly like the 1960s-vintage machine I owned in my first shop and not much different from the Unisaw sold today. The Unisaw hasn't

changed much because it's been hard to improve on the design — almost every 10" stationary table saw on the market today is a virtual clone.

Delta wasn't the only fledgling manufacturer hoping to capture the home-shop market, but surprisingly few survive today. In a market dominated by inexpensive import machines, Delta still holds its own (in part by selling machines it imports). Today Delta's customers include factories and small commercial shops as well as amateurs at

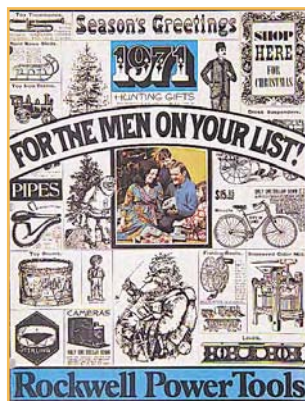
the top end of a vast home-shop market that exceeds, I imagine, even the wildest dreams of Harvey Tautz.

Occupying the middle and lower end of that market, selling to folks perhaps a bit less passionate about woodworking or less able to bankroll their passion, was (and is) Sears. With catalog sales and retail stores reaching into every corner of the country, Sears has long had a finger on the pulse of the American consumer. And as a retailer, rather than a manufacturer, Sears responded to new trends and opportunities better than traditional machinery manufacturers.

Sears Started Small

Sears offered its first power tools for the home market in 1928 — sev-

Tool catalogs and magazines helped generate a desire to build and a lust for tools (courtesy of Dana Batory).



One of the early cordless drills. Cordless drills have banished tangled cords from many shops (courtesy of Makita).

eral table saws, "bench drills" and bench grinders. The same year marked the introduction of the now-familiar Craftsman brand name, which designated the top-of-the-line equipment in the company's good-better-best tiered marketing. As with other goods sold under various Sears brand names, woodworking machines (and hand tools) were manufactured by outside firms according to Sears specifications. Emerson, a St. Louis firm whose rotating fans cooled hot summer evenings in my childhood home, manufactured many of Sears stationary and benchtop tools from the 1950s until recently. Sometimes, manufacturers worked closely with Sears to design tools produced only for Sears. Other tools came from existing lines. Near as I can tell from my well-worn machine, Sears changed only the name plate on the 12" Parks thickness planer sold under the Craftsman label in the 1950s. While Sears' tools weren't always the top-quality machines on the market, they were dependable (the company has long subjected its products to rigorous in-house testing) and a good value for money. In 1930, for instance, Sears sold a 7" bench saw for \$16.75.

Home-shop versions of stationary or benchtop machines — table saws, jointers,

1973

The last U.S. troops leave Vietnam; long gas lines created by OPEC; first CAT scans, microcomputer and space station

1974

Nixon resigns; Patty Hearst kidnapped

1975

World population more than 4 billion; Fine Woodworking begins publication

1977

Carter pardons Vietnam War draft dodgers; New York City blackout; space shuttle, neutron bomb and alkyd paint invented

1978

Home Depot founded in Atlanta

1979

Chrysler bailed out by U.S. government loan; gasoline rationed

1980

American Clamping introduces the K-Body clamp; first solar-powered aircraft

1981

Iran hostages released after 444 days; Reagan survives assassination attempt; Lie-Nielsen Toolworks founded

1982

AT&T splits up; first artificial heart

planers, band saws — are only part of the machine tool revolution that transformed home workshops. Portable power tools are, of course, far more common. Many households without any workshop at all have at least one electric hand drill. Like my dad, woodworkers in the early 1950s might have owned a portable circular saw, jigsaw, belt and pad sanders, and a router in addition to a hand drill. Today you can choose among dozens of different variations on each of these tools as well as a few truly innovative new tools, such as the biscuit joiner.

In the early days, versatility was a big selling point. An author in the March 1954 issue of *Popular Science* called the electric hand drill “a motorized shop you can hold in your hand.” There were attachments to transform a drill into a hole saw, drum or pad sander, a grinder, buffer and even a hedge clipper. My favorite pitch for tool versatility is a 1949 Dremel ad for its electric sander, which shows the tool used for sanding, for polishing and for massaging the back of the homeowner’s neck.

Enter the Router

Versatility was not a hollow claim for one of the most important innovations in 20th century woodworking — the electric router. If I had to choose one feature of the home shop that encapsulates the reasons why woodworking has become such a widespread and popular American pastime it would be the router.

With a router and very little training, an ordinary woodworker can tackle work once the province of only highly skilled craftsmen and their well-stocked tool chests. It

makes obsolete dozens of moulding planes, as well as dado, rabbet, plow, sash and filister planes. Fitted with jigs, a router can produce mortises, tenons, dovetails and a raft of other joints. It can be made to joint edges, thickness boards, even carve. In the hands of a true router fanatic, the tool seems to be able to do almost anything — though I’ve yet to hear of one giving a massage.

A primitive form of the electric router appeared as early as 1905, and today’s versions bear a striking resemblance to their ancestor — a cutter mounted directly on the shaft of a high-speed electric motor that is held above the work by an adjustable base. Over the years, the tool lost some weight and

orders of magnitude higher than those of 1928, woodworkers can buy comparable routers for the same prices.

By the early 1950s, all the familiar components of the home woodworking shop as we know it today had fallen into place. Amateurs had ready access to hand and machine tools designed to fit their houses and pocketbooks, to cater to their interests, and to overcome their technical limitations. Plywood and new synthetic glues developed during World War II were hitting the home market. Such materials further reduced the difficulties of traditional woodwork by eliminating tedious stock preparation and simplifying joint-cutting and assembly. A growing number

The Sensationally NEW Low-Priced

PARKS No. 20 20" PLANER

Here is a modernly designed, rugged, high-speed, low-priced planer that is ideally suited for every shop and industrial plant requiring a quality surfacer. The Parks No. 20 Planer has a four-knife cutterhead with a speed of 3600 R.P.M. and offers two feed speeds — 20 and 40 F.F.M., and 40 and 80 F.F.M. Write for complete descriptive literature.

The PARKS Heavy-Duty 12" x 4" Planer

A compact, sturdy, thickness planer that offers mill planer precision and ruggedness at a sensationally low price. Write for descriptive selling sheet.

The PARKS WOODWORKING MACHINE CO., Dept. 22-MM, 1546 Knowlton St., Cincinnati 23, O.

Sturdy, no-frills Parks planers (above) are still prized by woodworkers.

No, it's not a Unisaw, it's a Duro (right). The Delta Unisaw has always been imitated (courtesy of Dana Batory).

size (in 1928, for instance, the R.L. Carter Company offered an 18,000 rpm, 1/7th hp model that weighed only 3 lbs.), but the only truly significant technical innovation was the introduction, in 1949, of the plunge router by the German firm Elu.

Far more than technical advances, it is the availability of low-cost models that has made the router ubiquitous in home shops. In 1928 Carter sold the lightweight router mentioned above for \$46.50 and a heavy duty model for \$245. Today, with incomes

D-3017 - New Duro 10" Ball Bearing Tilling Arbor Saw, complete as shown (less switch).

\$167.50

There is a complete line of precision engineered Duro Power Tools at NEW ECONOMY PRICES!

New Band Saws in 10", 12" and 15" sizes . . . priced from \$49.95 to \$114.85.

Router-Shaper-Carver . . . multi-purpose power tool that is really 3 tools in one! . . . \$277.50.

Drill Presses in 12" and 14" sizes . . . priced from \$44.65 to \$93.50.

30 Years of building precision tools has given Duro the priceless design and production experience that brings you "today's greatest power tool values."

Makers of Nationally Advertised Duro-Chrome Hand Tools.

1983

Crude oil prices cut by OPEC; U.S. troops invade Grenada; Grizzly Industrial founded

1986

Space shuttle Challenger explodes after launch; keyless chuck introduced

1989

Berlin Wall dismantled; Exxon Valdez spills oil in Alaska; San Francisco earthquake kills 59

1990

U.S. economy in recession with more than 1 million jobs lost in U.S.; consumer prices up 6.1 percent

1992

DeWalt introduces its first line of electric power tools for contractors, remodelers and professional woodworkers

1995

**100th anni-
versary of the
invention of the
first electric
drill by Fein.**

1998

First power tools using Nickel-Metal Hydride batteries sold

1999

Makita's cordless drills used to construct space station; Makita introduces first cordless miter saw



1985
First portable planer

of books and magazines devoted some or all of their space to home-shop instruction and inspiration. Finally, a roaring postwar economy and generous government programs for GIs provided the final piece of the home-shop puzzle — affluence.

Home ownership is a useful barometer of a modern society's wealth. Home ownership in the United States tripled between 1890 and 1930. After World War II, housing exploded again. Between 1946 and 1949 more than 5 million houses were built in this country. By 1961, six out of every ten families owned their own home. New homeowners were young (median age of 35 in 1950) and imbued with the can-do spirit of the recent war. Millions of American men had learned practical skills in the services. Millions of American

women had done the same in war-time industry. After the war, they focused much of their energy and ambition on their homes. Contemporary surveys found that 62 percent of home buyers claimed to have done some work on their new house themselves; 23 percent said they'd done most of it themselves.

Affluence can also be measured by increased leisure time — time that could be devoted to working in the shop. The phenomenal increases in productivity that have characterized the 20th century American economy reduced work hours and increased paychecks for millions. In 1900, for example, a manufacturing worker could expect to log a 59-hour week and be paid about \$.22 an hour. By 1950, the work week had shrunk to just over 40 hours and the hourly wage increased to \$1.44.

Today's Tools at 1970s Prices

The affluence that helped make home workshops possible is now reflected in

the shops themselves. Today's woodworker outfitting a home shop finds a cornucopia of hand and power tools, and a wealth of peripheral equipment and hardware specially designed for wood shops — lighting, dust collectors, storage racks, workbenches, assembly tables. While the essential nature of most woodworking tools and machines has changed little since the 1950s, improvements and innovation abound in cutting-tool technology, accessory design (rip fences, miter gauges, router jigs), and a host

of other areas. Hawked in home centers and shopping malls, in department stores, hardware stores, specialty woodworking stores and mail-order catalogs, and now on the internet, home-shop equipment is not hard to find. And the range of choice for price and quality has vastly increased since I set up my first shop and is exponential since my grandfather's day. The rise of inexpensive Pacific rim manufacturing has more or less frozen prices of home-shop woodworking machinery for the past 20 years. The result is almost surreal — companies have been forced to compete by improving quality at more or less fixed prices. This has, of course, turned the woodworking machinery business upside-down. My grandfather wouldn't recognize many of the names in today's tool catalogs: Jet, Makita, Hitachi, Grizzly, Sun Hill. And he'd be surprised to hear that familiar companies, such as Delta and Powermatic, sell at least some tools made in Taiwan, Mexico, or the latest up-and-coming third-world country.

Back to 1900

When I look at my workshop today, I wonder what my grandfather would make of it. As a young man in the early 1900s, he would have been astonished by the machines. But the old man I knew in the 1950s and 60s would have taken them all in stride; he owned several similar machines and most of the others that I now own were commonplace in home workshops by then. Oddly enough, what might surprise him are my hand tools, a few of which he wouldn't have seen since his youth. Like my dad, as soon as grandpa found a machine to do a job, the hand tool it replaced was consigned to gather dust on a shelf. Having grown up in such surroundings, when I started woodwork on my own in the early 1970s, it was hand tools and the traditional techniques they served that caught my interest. Inspired by Arts and Crafts precepts 100 years old, I joined a growing number of woodworkers interested in rediscovering and revitalizing

New 10-in. Circular Saw

Delta's Latest Quality Unit



The largest, heaviest and most completely rugged circular saw yet offered for the home workshop, school shop, pattern shop and the contractor and builder.

Setting New Standards of Circular Saw Efficiency

Here it is—the long awaited 10-inch Delta Circular saw for the do-it-yourselfer! December 25, 1933. When you read the detailed description of the numerous features of this remarkable tool—or better still, see it in action—you will agree it was worth waiting for! Of course it embodies all the features that were so eagerly a requirement for the Delta 8-inch model in addition to its greater capacity, with longer, heavier blade and with added accessories. Cut down up to 2 1/2 in. thick. Rip to center of the joint with standard 10-pi.-bar blades. Connects 12 in. boards on standard table—and to a full 12 in. table surface in front of table. Cut horizontally heavy cast-iron table, 25 lb. by 27 in. Has many special features including Delta "Micro-Slide" Rip Grip, Auto-Set Mirror gage with Automatic Stop, Self-Loaded Sawing slide at foot for bit of boring, convenient lock-down and worm-gear raising, lowering, and tilting, plus other features too numerous to mention. For full details write for Delta Delta Catalog and Special Circular on 10-inch Circular Saw.

The above illustration shows the new 10-inch Delta Circular Saw—rested on a special Combination Unit with the Delta Circular Sawing Circular Saw is available separately as a bench model, or mounted on special stand, or in combination as shown above.

Write for latest Delta catalog and name of your nearest Delta dealer today.

New Shapers—New Grinders in 1936 "DELTA" Line

The new Delta Shaper is one of the simplest and yet most complete Shaper ever designed for the workshop. It has numerous time-saving improvements. The new Delta Grinders of the new type—ball-bearing, cast-iron and pedestal mounted—new grinders in every new line of designs and construction. The new Delta Shapers, new Delta Grinders, new Delta Tools, **used in every shop—contractor, carpenter, electrician, etc.** They are the greatest that anywhere have every master—and of the famous industry Delta price levels.



If point of Delta superiority were necessary for the craftsman who knows and uses such, it would be afforded to the fact that the Delta Manufacturing Company is the largest manufacturer in the world making this type of machinery exclusively.

Write for New 1936 Catalog

It is replete with photographs and drawings of the new line of 1936 Delta tools. It contains much valuable information that you were interested in, and which you should have. It shows how Delta tools are built to stand the strain of continuous use, and yet to be so light and handy that they will be within the reach of all who have some time, money and energy to quickly use them.

Mail coupon without delay. Enclose only 10 cents to cover the cost of Delta Tools. The Delta Products. It means of new and useful things in nature, with numerous photographs and drawings, and complete directions.

Delta Manufacturing Co.

489-424 E. Vienna Ave.
Deer, (212) Milwaukee, Wis.

DELTA MANUFACTURING COMPANY,
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I enclose 10c. in advance of bill, for which please send me one copy of Delta Tools, "The New 1936 Delta Products." Also please send me your literature dealing with working tools.

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of woodworkers interested in rediscovering and revitalizing hand craftsmanship, too much of which we felt had been usurped by machinery. My first workshop, as a result, looked much more like the the turn-of-the-century example in *The Practical Woodworker* than either my father's or grandfather's mid-century shops. I soon came to appreciate the tedium- and labor-saving qualities of the table saw, jointer and planer, and my shop today integrates machinery and hand tools, contemporary and traditional techniques.

But it isn't the tools or the machines, the materials, or the techniques that I hope my grandfather and father would recognize or appreciate in my shop. It is the spirit of the place, its intangible "measure." My woodworking interests are different than theirs, but my interest in woodworking is much the same. Like them, I find satisfaction in making things and in exercising the skills necessary to do so. Like them, I enjoy passing these skills along to my children. Like them, I have found a certain kind of comfort in my shop. More than anything, I would hope they'd feel as much at home in my shop as I did in theirs. **PW**

Life Lessons From a Jointer Plane

The tools that are designed to cut one piece of wood from the other are also the tools that bring a man and his son together.



BOOT CAMP WINNER

Congratulations to Ray Merritt of Rodman, New York, who wrote the winning essay for the Popular Woodworking Boot Camp contest. Ray won a Jet table saw, a Jet dust collector and will spend a week with us here in our shop in Cincinnati to pick up a few woodworking skills.

I plane a board of butternut. A fragrant spiral shaving rises from the cap iron. I watch the spiral grow until the blade goes silent. It is a good tool, this jointer plane. I spread the spiral out along the bench, release it and it remembers its curly shape. I remember, too.

"This is going to be yours sooner or later, so you might as well have it now." With those words, my father handed over the Bailey No. 7 jointer plane that he inherited from his father. That is as much ceremony as I could expect from a man of few words and many years. But ceremony or not, it is a passing of a legacy from one generation to the next. I know my grandfather owned that plane. His hands guided it, releasing shavings long since swept away, but spiraling down through time to me. I remember Grandpa's workshop, rows of wood screws sized in baby food jars, hand tools stored on stained shelves, a stack of wooden soft drink crates in the corner, filled with glass empties while a locust droned in the tree outside.

I remember Dad's workshop, basement-cool, crammed with tools. It was always in disorder, for there were four of us boys. When I think of how we treated those tools, it is a wonder there now remains

anything to hand down. We cared little for tools then, or for relationships. We had no memories, only dreams: a wooden wagon, a bicycle-drawn cart, a sled. We had no plans, just dreams and the drive to build. Fevered builders, we scattered tools beyond the doors of the shop. Down the driveway, out into the fields, we left a trail of hammers, saws and screwdrivers.

Time spiraled around. The shaving curled from a different place on the board. I grew up, married and had an eager son whose dreams were not of wooden wagons, but of leaping skateboards. I watched as he assembled cement blocks and scrap plywood into rickety ramps. Consequently, I kept watch by his bed in the hospital as he recovered from broken ribs. Like me when a boy, he had no plan, just a vision of air. So we took paper and pencil. We bought lumber and made a 36-foot skateboard ramp. I put tools in his hands and instructions in his head. He built his dream. We built a relationship.

Skateboards to snowboards, the seasons passed. In the spring, with snow melt, I would find some of my rusted tools, some past the point of restoration. I learned this: If you introduce a boy to tools, you will lose some tools. But you will gain a son.

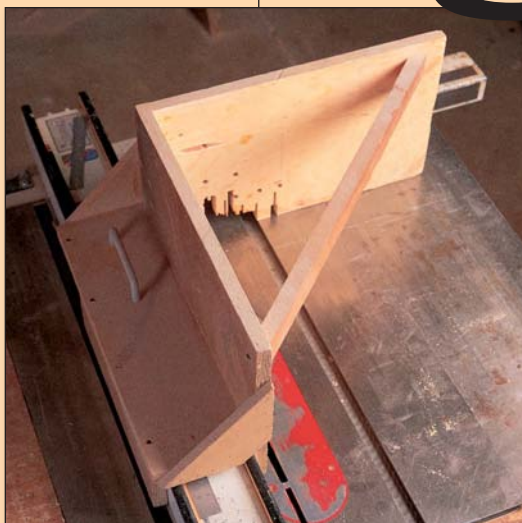
The boy is now a college man. Two years ago we attempted our most ambitious project, wooden strip canoes. We spent weeks of happy hours together learning how to steam bend wood and work with epoxy. Here is a touch of irony: This time he was the one who drew up the plans.

That jointer plane will sit on a shelf in my shop. Young hands will reach up and take it down, check its heft and wonder. Perhaps I will show how it is done. Or perhaps it will be taken out into the back yard and used to make curly shavings from a picnic table — until it strikes a nail. I may find it after a rainstorm. I may find it with the lawnmower. If it survives and I with it, you may be sure that I will someday place it in my son's hands. But if either the tool or I do not survive until that day, no matter. The work is done. The legacy passed. The heritage is not in an abundance of tools, for tools do not make the man. Love makes the man. The real heritage is a father's love for his son. That alone spirals around from generation to generation. **PW**

Ray Merritt is a pastor at Honeyville Baptist Church and has been canoeing all summer in the wooden strip canoes he and his son, Hans, built together.

table saw Tenon Jig

The first tenoning jig I built years ago. It's seen a lot of use on my table saw and my router. When I went to build a new jig, I realized that this one served me so well that I didn't need to add any more features to make it more useful.



Several years ago my brother-in-law was thinking about buying a commercial tenoning jig because he was having trouble keeping his work flat against his table saw's small fence while cutting tenon cheeks.

"Don't do that," I told him. "I'll show you how to build a jig from a few pieces of scrap that will do the job just fine." So I built the jig in the photo above and have used it just about every day in my shop to cut tenons on my table saw and sliding dovetails on

by Glen Huey

Glen Huey builds custom furniture in his shop in Middletown, Ohio, for Malcolm L. Huey & Sons and is a regular contributor to Popular Woodworking.

Don't spend
\$100 on a
tenoning jig
for your
table saw.
Build your
own with
scraps.



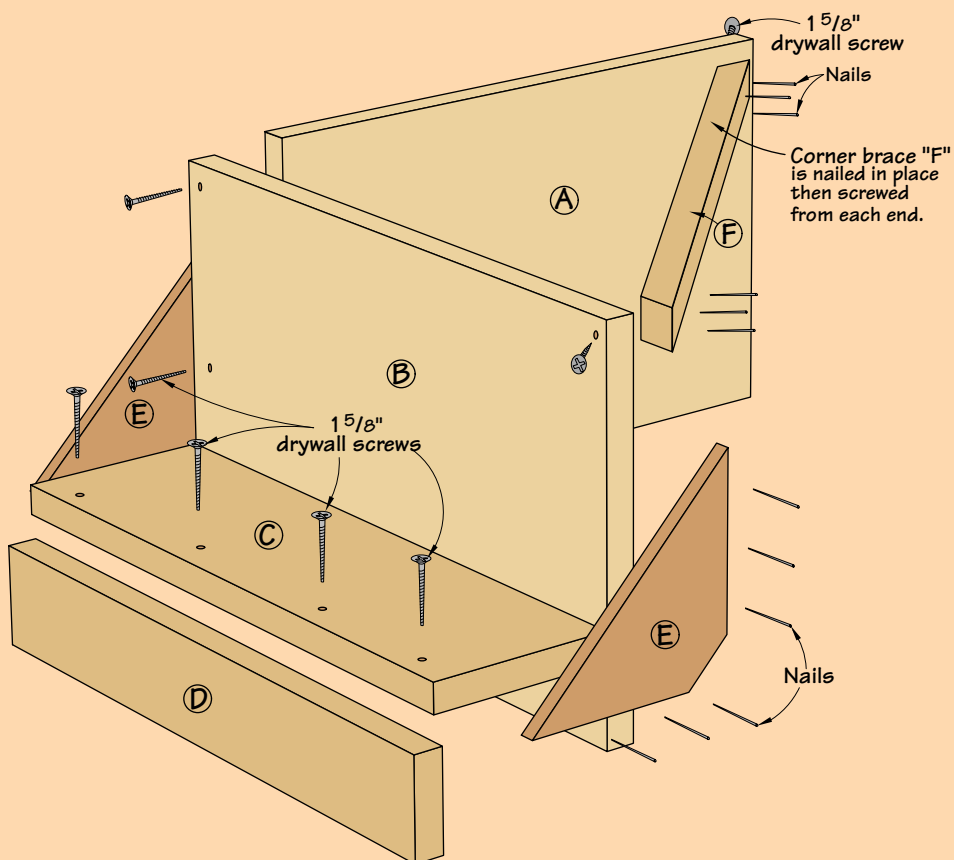




SCHEDULE OF MATERIALS • TENON JIG

No.	Ltr.	Item	Dimensions T W L	Material
1	A	Back	$\frac{3}{4}$ " x 10" x 15 $\frac{1}{4}$ "	Plywood
1	B	Side	$\frac{3}{4}$ " x 10" x 16"	Plywood
1	C	Top runner	$\frac{3}{4}$ " x 4 $\frac{3}{4}$ " x 16"	Plywood
1	D	Side runner	$\frac{3}{4}$ " x 2 $\frac{1}{2}$ " x 16"	Plywood
2	E	Triangular braces	$\frac{3}{8}$ " x 3" x 7 $\frac{1}{2}$ "	Plywood
1	F	Corner brace	$\frac{7}{8}$ " x 1" x 21"	Hardwood*

* Piece is long; cut to fit.



Here's the side piece held in place against the top runner. You want the top runner to be snug against the top of your fence (above left). The triangular braces (above right) keep the side and top runner square and sturdy for years to come.



Take your time fitting the corner brace between the side and back pieces. You want it to hold these pieces at exactly 90 degrees (**left**).

Furniture wax works great to keep the runners moving smoothly over your fence. Be sure to reapply wax when the jig starts to get a little stiff after use (**below**).



my router table. The high side and back keep my tenons in position as I cut the cheeks. It's difficult to mess up a tenon with this jig.

When I decided to retire the old jig and build a new one, I thought about adding some fancy features. Then I realized that simple is best, and I stuck with my original design. This jig is built to be used with a commercial Biesemeyer fence. If you don't have a Biesemeyer, you'll have to change the dimensions of the top and side runners, but that's simple to do.

Simplicity Itself

Basically, this jig is two pieces of plywood in an "L" shape that have a couple pieces of wood screwed to them to allow them to ride the table saw's fence. After settling on the dimensions that are right for your fence, cut all your pieces to size. First clamp the side piece and top runner in position on your fence. Mark where the two pieces intersect and screw and glue the two pieces together. Be sure to countersink the screw heads in the side piece. Position the side runner in place under the top runner. You

pieces, so check your work. Later you'll add a corner brace that will keep this angle fixed at 90 degrees. Attach the two triangular braces to the side and runners. Attach the braces with nails and glue.

Now miter the corner brace to fit. Put an engineer's square between the back and side and adjust the brace until it holds these pieces at exactly 90 degrees. Now nail the brace in place.

Set up and Use

Before you go cutting tenons, wax the areas of the runners that come in contact with your fence. If your jig won't slide, unscrew the side runner and take a light jointer pass on it. When the jig slides smoothly, add some glue to the joint between the side and top runner to make it permanent.

Cutting tenons is now simple. First use your miter gauge and fence to define your shoulders. Then put your jig up on the saw and make your cheek cuts. **PW**



want it to be tight against the fence — but not too tight. Screw it into place. Now glue and screw the large back piece to the side piece. You want the angle to be 90 degrees between the two

The curly maple board attached to my miter gauge minimizes tearout when I make the shoulder cuts for my tenons.



*After making my cheek cuts (which is shown in the opening photo of the article), reset the saw to define the tenon's edge cheeks (**left**).*

*Mortise-and-tenon joints are the staple of my custom woodworking business. I use this jig on every piece of furniture I build. The jig's simplicity and sturdiness have made it one of the workhorses in my shop (**right**).*

STEP tansu

The traditional cabinetry of Japan is simple, stylish and sturdy.

By Christopher Schwarz



The grain pattern of hard maple reminds me of the ink landscapes drawn by Chinese and Japanese artists beginning in A.D. 700. Each painting, with its jagged mountains and forbidding peaks, was supposed to represent a little story. The viewer followed the people in the painting as they journeyed on a path through the painting. So when I decided to build a step tansu, the obvious choice was maple, despite the fact that these chests were traditionally built from Japanese cypress, cedar or elm.

"Tansu" means chest, and the high period of this type of furniture was between

1657 to 1923. The traditional Japanese household would store clothing, valuables and household items in its tansu.

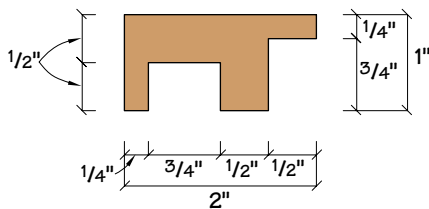
Construction of this chest is simple. You'll need a sheet and a half of $\frac{3}{4}$ " maple plywood, one board of 1"-thick maple that's about 8' long and 8" wide and some $\frac{1}{2}$ " and $\frac{1}{4}$ " plywood scraps for the drawers. The carcasses of the upper and lower cabinets are built the same way. First cut all your pieces to size and iron on veneer edge tape to cover all the exposed plywood edges.

Now cut the grooves and rabbets on the cabinet stiles. The side panels are glued into $\frac{1}{2}$ "-deep x $\frac{3}{4}$ "-wide grooves milled

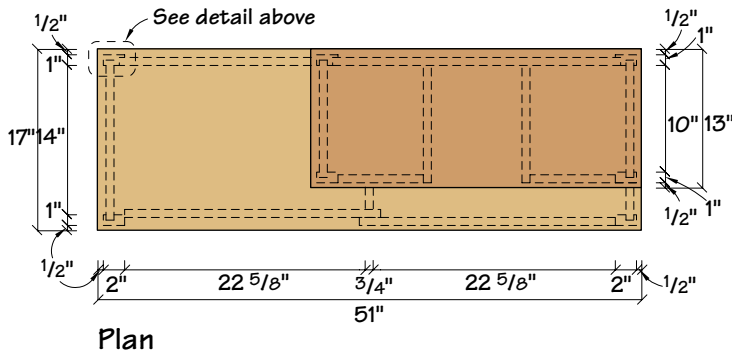
$\frac{1}{4}$ " in from the edge of the cabinet stiles. The back panel is nailed and glued into a $\frac{1}{2}$ "-deep x $\frac{3}{4}$ "-wide rabbet on the inside of the stiles. Screw each assembly to its bottom board. Glue and nail the partitions in place.

Lower Cabinet Doors

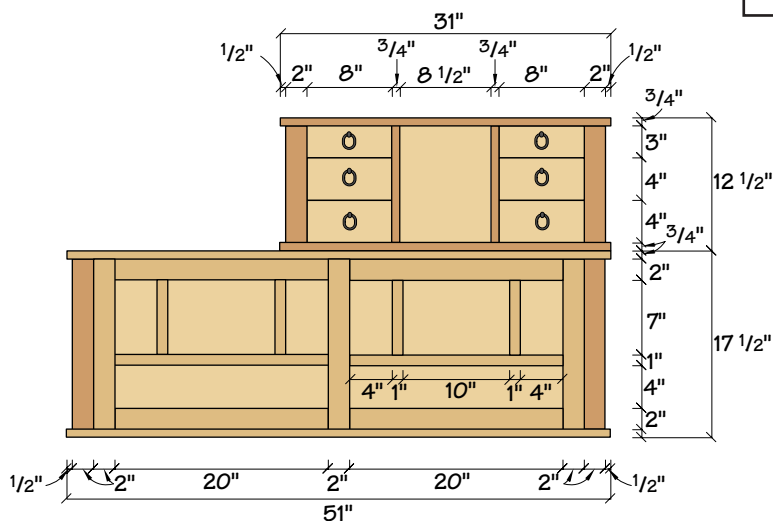
Build the two sliding doors using stub tenons that rest in $\frac{1}{4}$ "-wide by $\frac{1}{2}$ "-deep grooves. The only exception to this is the grooves in the thin rails, which should be $\frac{1}{4}$ " wide and $\frac{1}{4}$ " deep. Also, the interior stiles are merely applied to the doors after construction; they are not structural. After



Detail of back cabinet stiles



Plan



Elevation

SCHEDULE OF MATERIALS • STEP TANSU

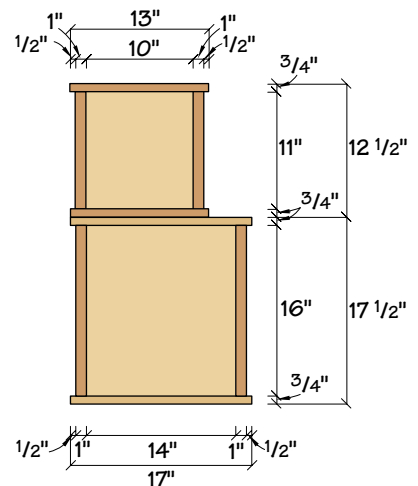
Lower Cabinet

No.	Item	Dimensions T W L	Material
2	Top & bot.	3/4" x 17" x 51"	Ply
4	Cabinet stiles	1" x 2" x 16"	M
2	Side panels	3/4" x 15" x 16"	Ply
1	Back panel	3/4" x 16" x 47"	Ply
4	Dr stiles	3/4" x 2" x 16"	M
4	Dr rails	3/4" x 2" x 21"	M
2	Thin rails	3/4" x 1" x 21"	M
2	Top panel	1/4" x 7 1/16" x 21"	Ply
2	Lower panel	1/4" x 4 1/16" x 21"	Ply
4	Interior stiles	1/4" x 1" x 7"	M
4	Runners	1/4" x 1/4" x 46"	M
1	Partition	3/4" x 13" x 16"	Ply
3	Cleats	3/4" x 3/4" x 13"	M

Upper Cabinet

No.	Item	Dimensions T W L	Material
2	Top & bot.	3/4" x 13" x 31"	Ply
4	Cabinet stiles	1" x 2" x 11"	M
2	Side panels	3/4" x 11" x 11"	Ply
1	Back panel	3/4" x 11" x 27"	Ply
2	Vert dividers	3/4" x 10 1/2" x 11"	Ply
4	Lg drw frts	3/4" x 4" x 8"	M
8	Drw sides	1/2" x 4" x 10 1/8"	Ply
4	Drw backs	1/2" x 4" x 7 1/2"	Ply
6	Drw bot	1/4" x 7 1/2" x 9 3/4"	Ply
2	Sm drw frts	3/4" x 3" x 8"	M
2	Drw sides	1/2" x 3" x 10 1/8"	Ply
4	Drw backs	1/2" x 3" x 7 1/2"	Ply

M= Hard maple, Ply= Maple plywood



Profile

dry-assembling your doors, glue up and clamp them up.

When dry, glue the interior stiles in place and cut a 1/4"-wide by 1/2"-deep groove on the top and bottom of each door that will allow the door to slide on the runners. Then cut the four runners; make sure they slide smoothly in the doors' grooves. Attach the runners to the top and bottom of the lower cabinet using brads and glue.

I spaced my runners so that the front door is flush to the front edge of the cabinet stiles. Then I left a 1/16" gap between the two doors. Fit the doors to the opening in the chest. Now screw the top to the

carcase through cleats that are screwed to the sides and partition of the case.

Upper Cabinet Drawers

Here's how I built my drawers. Cut 1/2" x 3/8" rabbets on the ends of the drawer fronts. Then cut 1/2" x 1/4" rabbets on the back edge of the sides to hold the back piece. Then cut a 1/4" x 1/4" groove to hold the drawer bottom on the sides, back and front that's 1/4" up from the bottom edge. Glue and nail the sides to the drawer front. Slip the bottom in place. Glue and nail the back to the sides.

How you hang the drawers is up to

you. I cut 1/4"-deep x 5/8"-wide stopped dados that were centered on each side of the drawer. Then I nailed drawer runners to the carcase's partitions and drawer runners with plywood build-up strips to the sides. When the drawers move smoothly, nail the top to the case. Putty any nail holes. Apply three coats of a clear finish.

You might have noticed from the photo that I made the grain direction of the drawers run vertically instead of horizontally. This is OK for such small drawers, and I did this because each bank of drawers now reminds me of one of those Japanese landscape paintings. **PW**





Here's my wife's closet before I remodeled and put in the custom closet interior. There was a lot of wasted space in the old closet.

closet overhaul

A few sheets of
plywood and a weekend
are all you need to promote
marital harmony.

♦ If you like fishing, you're going to like this project. You see, while a good deal of my business is building custom furniture and cabinets, a lot of my clients have asked me to revamp their closets. I've gotten pretty good at it. So good, in fact, that my wife, Terri, asked me to customize her closet. What does this have to do with fishing? Well, once I installed these new shelves and brackets, Terri was so happy she insisted I relax after that tough job (wink wink) and go fishing in Canada.

Adding adjustable shelves and extra hanging rods in your closet will typically give you at least 30 percent more space for stuff. And you don't need a lot of tools or materials to do the job right. I customized Terri's closet with only three sheets of plywood (plus a few scraps I had lying around) and some iron-on edge tape. The closet

by Troy Sexton

Troy Sexton designs and builds custom 18th century furniture and is a private woodworking instructor in Sunbury, Ohio, for his company, Sexton Classic American Furniture.



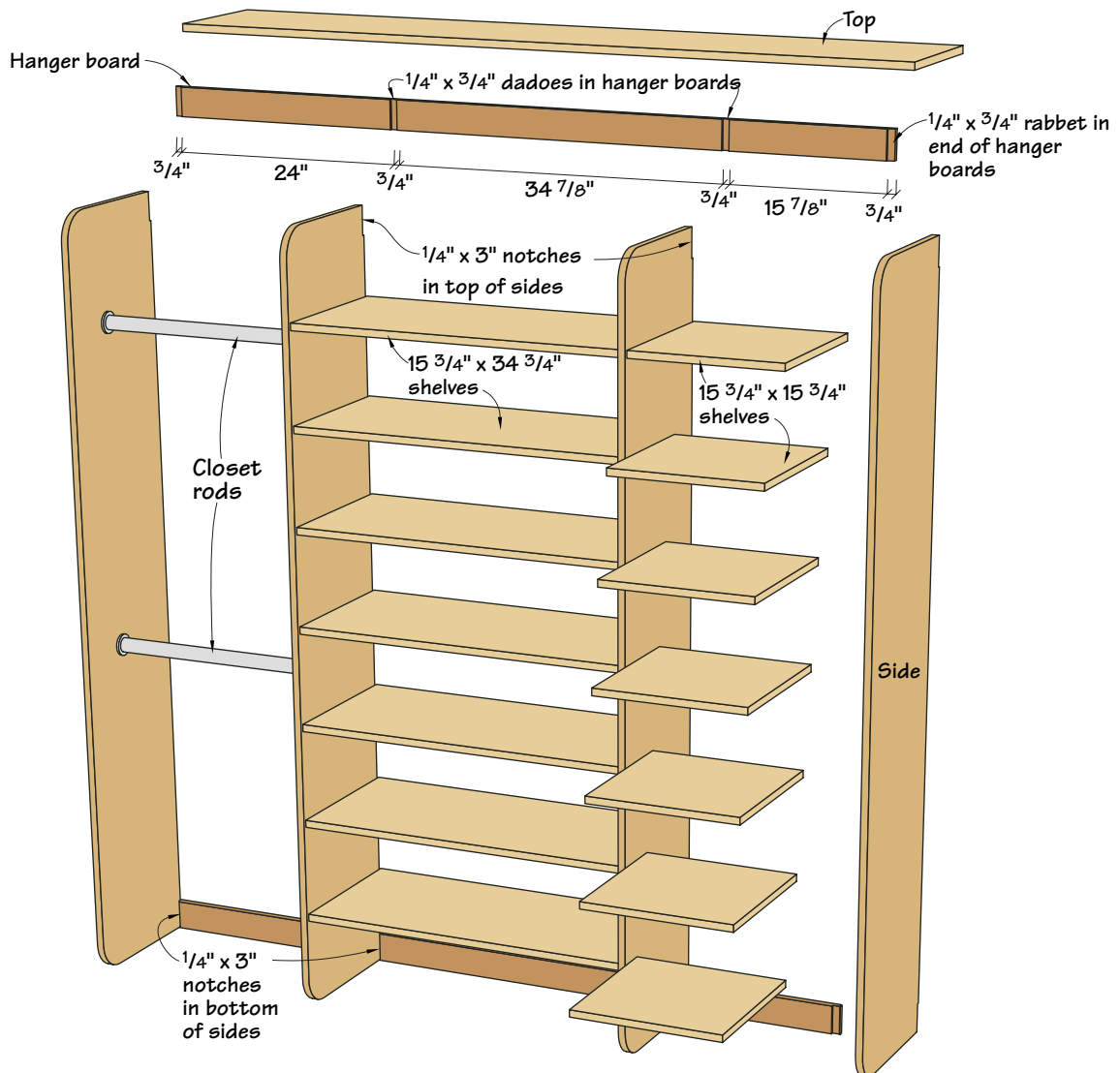
Attach the hanger boards to the wall with screws that are at least $2\frac{1}{2}$ " long. Here you can see how all the shelf pins are in place before I began the installation.

measured 26" deep, 78" wide and 100" high, which is pretty typical. You can adjust the shelves and hanger boards to fit your space.

Construction is not complicated. There are two hanger boards screwed to the studs on the back walls of the closet. One near the baseboard, one near the ceiling. The tall sides are notched around these hanger boards and screwed into the hanger boards and top shelf. Then you install the adjustable shelves and hang rods. Done. Here's how to make this process go as quickly as possible.

Preparation is Key

The more fussing you do before the installation, the quicker the whole process



will go. Begin by cutting the plywood to size. I've included my materials list so you can adapt it for your closet. Start by working on the hanger boards. First cut the dados and rabbets that will hold the sides in place. It's easier to cut the dados and rabbets on a wider piece of ply and then rip the two hanger boards from that piece.

Cut a $\frac{1}{4}$ "-deep by $\frac{3}{4}$ "-wide rabbet on the end of each hanger board. Then cut $\frac{1}{4}$ "-deep by $\frac{3}{4}$ "-wide dados at the intervals you've decided are best for your closet. I have one small section of shelves that has dados that are $15\frac{7}{8}$ " apart. The larger shelves use dados that are $34\frac{7}{8}$ " apart. And the dados for the section with the hanging rods are 24" apart. After cutting your dados, rip the two hanger boards from that piece.

Next turn to the side pieces. First cut the $\frac{1}{4}$ "-deep by 3"-long notches on the back edge of each side. Now drill all your shelf pin holes using a shop-made or commercial jig. I drilled 5mm holes every 1" that were $1\frac{1}{4}$ " in from the back and front edge. When you're drilling shelf pin holes on both faces of a piece of plywood, be sure to offset the holes a tad on one face. Otherwise you might end up drilling holes all the way through and your shelf pins will hit each other. Now cut pocket holes to screw the sides to the hanger boards and the top shelf. I use a commercial jig. Cut a 3" radius on the top and bottom of the front edge with a router and a pattern. Iron edge tape to the plywood edges that show on the sides and shelves. Add a clear finish to all the parts.

Now install the brackets that hold the hang rods. I put one 36" up from the bottom and another 77" from the bottom. It's easier to install these brackets now before you start screwing all the parts together.

Finally, put your shelf pins in. I know this sounds odd, but after doing this for years I've found it much easier to do this

Fit the sides into the rabbets and dados in your hanger boards. You can see the pocket holes I predrilled to attach the sides, top and hanger boards. I've found this method to be fast and reliable.

before the installation when you can easily line everything up.

Installation Time

First install the hanger boards. Find the studs in the closet and screw the bottom hanger board to at least four of them. Then use a piece of scrap that's exactly as long as the space between the two notches on the side pieces to position the top hanger. Screw it into the studs.

Now attach the side pieces into the dados and rabbets in the hanger boards. You'll notice that this arrangement leaves a bit of space between the wall and sides. This allows you to get electrical cords behind the sides in case you ever want to conceal a stereo or TV in your closet, and leaves a gap for any bows in your walls.

Now put the top shelf in place and screw the sides to the top. You're almost finished. Put the adjustable shelves in and pop the hang rods in place.

Now splash some water on your face (you want to make it look like it was a lot of hard work) and tell your spouse you're done with the closet.

Fishing hole here I come. **PW**



Make sure you check for square before you screw the sides to the top. If you don't it will throw everything off, guaranteed.

SCHEDULE OF MATERIALS: CLOSET OVERHAUL

No.	Item	Dimensions T W L	Material
4	Sides	$\frac{3}{4}$ " x $15\frac{3}{4}$ " x 80"	BP
2	Hanger boards	$\frac{3}{4}$ " x 3" x $77\frac{3}{4}$ "	BP
1	Top	$\frac{3}{4}$ " x $12\frac{1}{4}$ " x 78"	BP
7	Small shelves	$\frac{3}{4}$ " x $15\frac{3}{4}$ " x $15\frac{3}{4}$ "	BP
7	Large shelves	$\frac{3}{4}$ " x $15\frac{3}{4}$ " x $34\frac{3}{4}$ "	BP

BP = Birch plywood





CONTEMPORARY Shelves

This simple plywood unit would look at home in a SoHo loft or suburban great room. Special knockdown hardware makes it a snap to build.

It's rare that bookshelves look as interesting as the objects you display on them. After all, how much can you decorate the edges of your shelves and sides? This unit is unusual because the shelves and sides are beefier than you would normally see, and the two bevel cuts on the front edges give these shelves nice visual interest.

Best of all, perhaps, is that this piece is simple and quick to build.

Dividers and Shelves

Start by cutting out the sides and shelves. The 1½"-thick sides are made by gluing two pieces of ¾"-thick plywood together. The 1¼"-thick shelves are made by gluing ¾"-thick plywood to a ½"-thick piece. Note that the finished sides have a ¾" x ¼" rabbet for the back that's formed by gluing a narrower piece to a wider one. The adjustable and fixed shelves in the side openings are all the same width. The center shelves are ¼" wider to account for the lack of a back.

To cut the sides, crosscut a whole sheet of plywood to the length of the sides first, then rip them to width (11" and 11¼"). Cut the sides a little wide (⅛"), initially, to give yourself a little room to saw off a square straight edge. This will give you a clean edge for attaching a piece of maple later. Now nail and glue the dividers together, remembering to offset the back edge for the rabbet. Place your nails so the shelves will hide them.

Here's an easy way to cut the shelves. Rip them to width from a

Once you've got your parts cut to size, glue and nail them together leaving the rabbet at the back. Set and putty the nails, then rip the dividers to their final width.

Edges and Angles

The last step is to bevel the edging. The photo shows how I did this on the table saw. Remember that the setup must change for the different width pieces.

The next step is to mill stopped grooves in the topmost and bottommost shelves to accept the tapered sliding connectors that attach the sides together. The grooves in the ends of the shelves are $\frac{3}{4}$ " wide by approximately $\frac{3}{8}$ " deep, and milled with a dado set on the table saw. It helps to make a practice joint because the depth of the groove is critical to a snug fit using this style of connector.

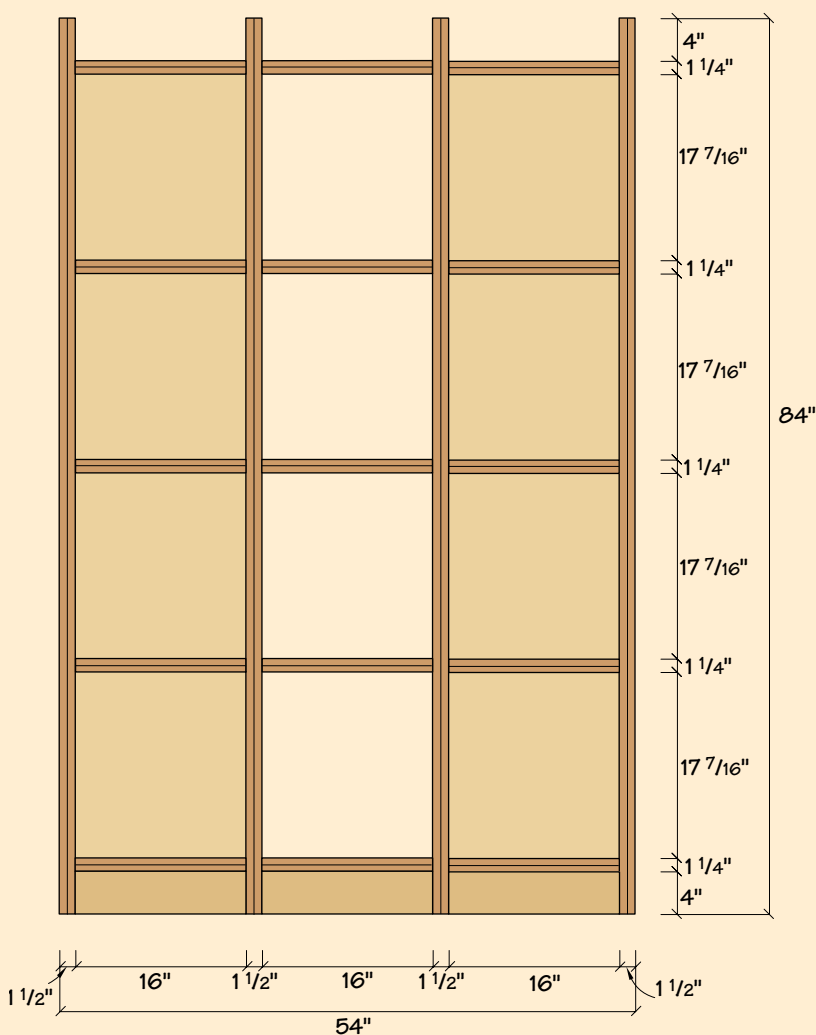
After cutting the slots in the shelves, lay out and mount the small part of the tapered connector to the side. The large connector will mount to the shelf groove with the wide end towards the shelf front. Do a test fit on the shelves. The shelves in the side units should be flush to the rabbet in the back edge of the sides. The center shelves should be flush with the back.

The next step is to cut the stopped grooves in the rest of the shelves for the hidden wire shelf supports. If your blade is too narrow, take two cuts to get the $\frac{1}{8}$ " groove necessary to slide the shelf onto the wire supports. Some drill and chisel work will be necessary to lengthen the kerf to accept the entire $9\frac{3}{4}$ " length of the shelf wire. This requires drilling and chiselling into the end of the front edge. Lay out and drill the locations for the wire supports in



Now it's time for all the parts come together. Begin by assembling the two outside units of the bookcase. Tip them onto

their backs and attach the aprons to the bottom shelf using cleats and screws. Next attach the side units together forming the center section. The best way to do this is to assemble with the front facing up. Use a

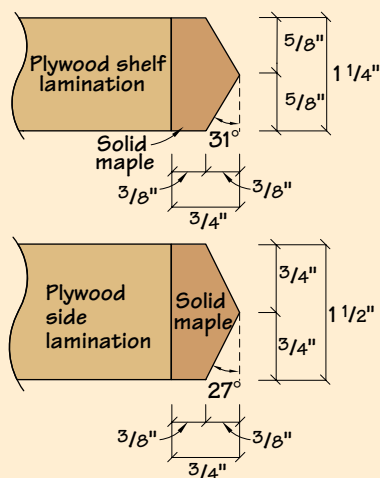


Elevation

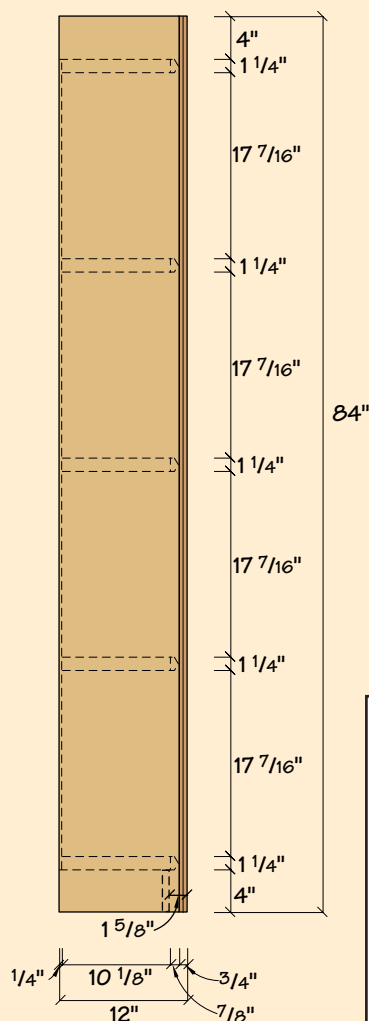
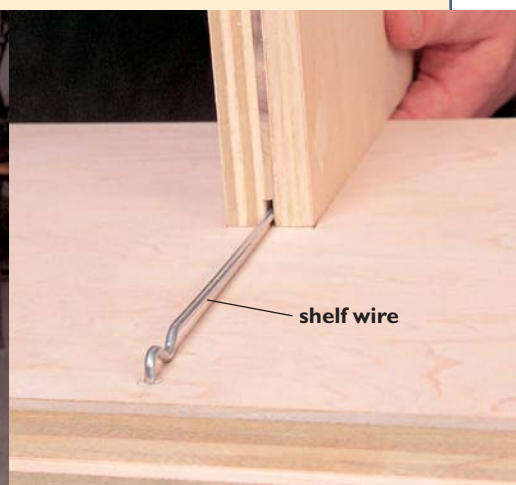
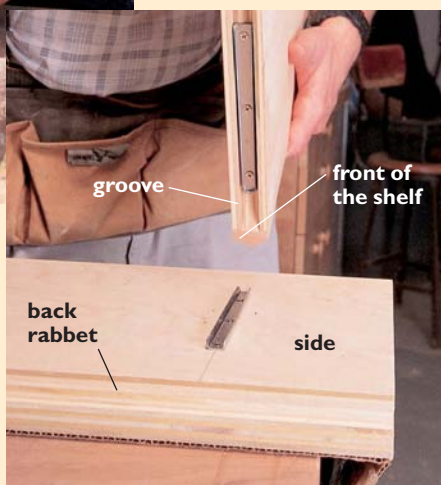


Profile

The bevels on the edges are basically a "V" shape on the entire edge. See the diagram at right for the details and cutting angles. Clean up your saw marks with a plane.



Detail of bevel profiles



Profile

Mount Knockdown Hardware

Use a dado stack to cut a $\frac{3}{4}$ " x $\frac{3}{8}$ " groove from the joint where the edge attaches to the shelf to the back of the shelf. The knockdown hardware is mounted in about the middle of the shelf. It pulls together pretty tightly, so you might want to sand any bumps or ridges off the ends of the shelves to keep from scratching the sides.

Magic Wire

After cutting the $\frac{1}{8}$ " grooves in the shelf sides, assemble the case. Tap the wire shelf supports in and slide the loose shelves in place.

handscrew clamp to hold up the sides while you're assembling. The apron on the center bottom can be screwed onto the shelf and braced with corner blocks prior to assembly. Push the lower shelf into place and mark the location of the apron, also called

a "kick" or a base. Then remove the shelf and add two stop blocks to the sides to support the center apron from behind.

When you're happy with the fit of the parts, disassemble the bookcase and finish. I applied a coat of light stain to give the maple an aged appearance. (I used about two ounces of linseed oil and colored it with Olympic stains, one-half Early American #41552, and one-half Red Oak #41567. $\frac{1}{4}$ teaspoon of each.) Wipe on an even coat of oil. Wipe off the excess and let it dry for 24 hours. The next day, lightly sand the surfaces and clean them with a tack rag. Finish with two or three coats of a clear finish. **PW**

SCHEDULE OF MATERIALS • CONTEMPORARY SHELVES

No.	Item	Dimensions T W L	Material
4	Sides	$\frac{3}{4}$ " x $11\frac{1}{4}$ " x 84"	Plywood
4	Sides	$\frac{3}{4}$ " x 11" x 84"	Plywood
10	Outr. shelf tops	$\frac{3}{4}$ " x $10\frac{1}{8}$ " x 16"	Plywood
10	Outr. shelf bottoms	$\frac{1}{2}$ " x $10\frac{1}{8}$ " x 16"	Plywood
5	Cntr. shelf tops	$\frac{3}{4}$ " x $10\frac{3}{8}$ " x 16"	Plywood
5	Cntr. shelf bottoms	$\frac{1}{2}$ " x $10\frac{3}{8}$ " x 16"	Plywood
2	Backs	$\frac{1}{4}$ " x $17\frac{1}{2}$ " x 76"	Plywood
3	Aprons	$\frac{3}{4}$ " x 4" x 16"	Plywood
4	Side edging	$\frac{3}{4}$ " x $1\frac{1}{2}$ " x 84"	Maple
15	Shelf edging	$\frac{3}{4}$ " x $1\frac{1}{4}$ " x 16"	Maple

Supplies: Woodworkers' Supply (800-645-9292), 12 6" taper connectors, # 928273 \$4.95/pkg. of four. 18 wire shelf supports, # 826028, \$1.45 apiece for 10+.

The Incredible Tilting Router Stand

Sometimes what holds the tool is every bit as important as the tool itself.



During the past 25 years, I've designed more than a dozen whiz-bang router tables for various books and articles, each one supposedly packing a bigger bang than the last. But what finally dawned on me a few router tables ago is what makes this fixture truly useful has less to do with the tabletop than the stand it rests on.

Whether you build or buy a router table, you're faced with the same dilemma. The router is designed to be a portable power tool. All the controls and adjustments are easily accessible when the router is resting upright on a workbench. Bolt it to the underside of a table to convert it to a stationary tool and suddenly your router is a good deal less cooperative. Many of us spend a lot of time on our knees in front of our router table, fumbling underneath to change bits and adjust the depth of cut. A woodworker I know calls this "praying to the router god."

Some woodworkers solve this problem by mounting the router to a plate that rests in a rabbet, then removing the plate when they need to get at the router. Unfortunately, the sides of the rabbet wear as you pop the plate in and out. As the plate becomes loose in its rabbet, new problems arise with safety and accuracy.

A tilting router stand makes the router easily accessible and lets you secure the

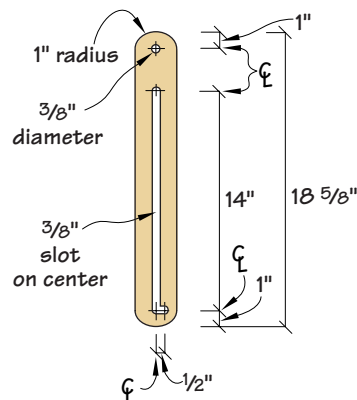
by Nick Engler

Nick joins us this issue as a contributing editor to Popular Woodworking. He's written 52 books on woodworking, and has invented more jigs and fixtures that he cares to count. You can visit him at his web site, nickengler.com.



If you use a plunge router with your router table, this little gizmo takes all the frustration out of setting the depth of cut. Just thread it onto the post, then crank the router up and down as needed.

A green and black electric router is mounted on a wooden workbench. The router has a black handle and a black power cord. The workbench is made of light-colored wood. The router is positioned diagonally across the frame.

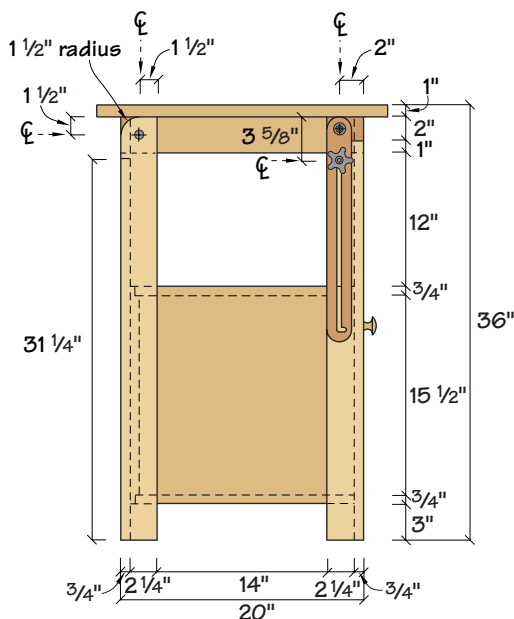


The legs should hold the table at countertop level — roughly 36". My router table is part of a “work island” — the table saw, workbench and router table are all at the same level. So I cut the legs on my table a fraction of an inch longer than what the drawings show.

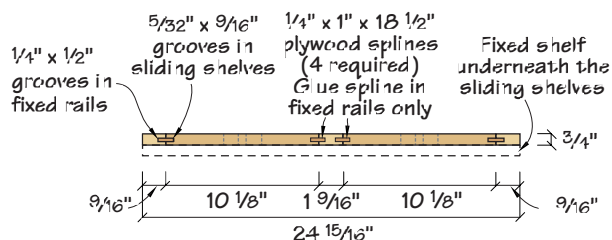
Of course to get this amazing convenience, you have to build a complex mechanism and a special table, right? Nope. Most parts are rectangular boards, butted

Begin with the frame under the table. It should be about 6" smaller side-to-side and 4" smaller front-to-back than your router table. If the table has slots to mount the fence, make sure that the frame mem-

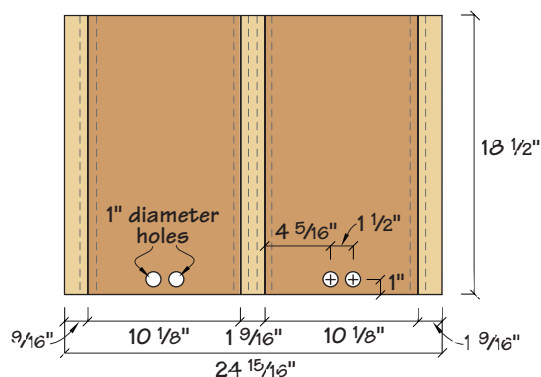
The most complex part in the table is



Profile



Elevation of sliding shelves



Plan of sliding shelves

The sliding shelves shown in the photo are removable so you can take your bits where they are needed.

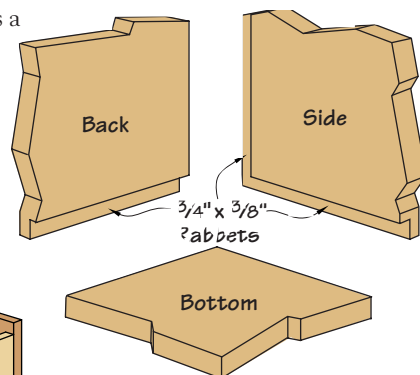
the support arm.

It has a L-slot — a long slot with a little hiccup at one end. I made the “hiccup” first, drilling a few overlapping holes to create a short slot. I routed a long slot perpendicular to the short one, then cleaned up the edges of the short slot with a file. When mounting the support arm to the stand, the short portion of the slot faces front.

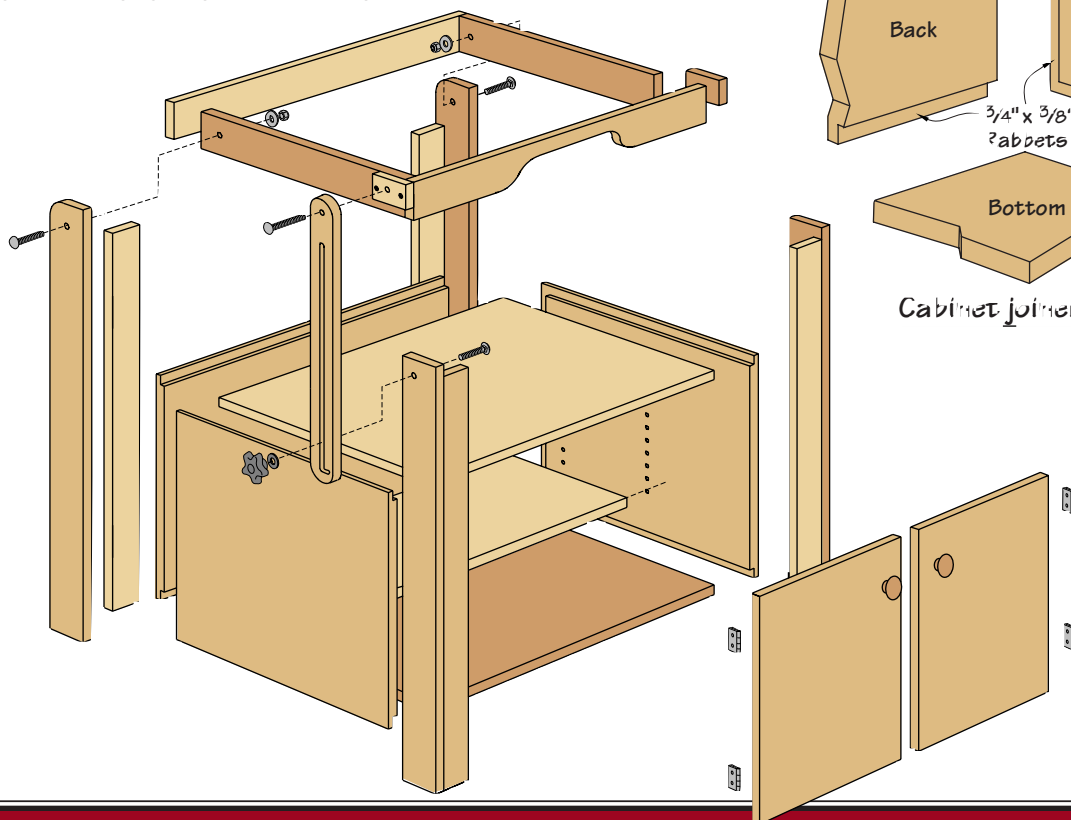
To help organize all my router bits and collars, I mounted two sliding shelves to the fixed shelf inside the storage box. You needn't purchase expensive hardware to get the sliding action. Make narrow hardwood rails to guide the shelves, then cut matching grooves in the sliding shelves and fixed rails. Glue splines in the grooves in the rails, then glue the rails to a fixed shelf. Fit the sliding shelves to the splined guides, enlarging the grooves in the edges

and sanding a little stock from the bottom faces so the shelves slide easily. Wax the grooves in the shelves to help them move smoothly. I drilled holes and mounted dowels in the sliding trays to help organize the bits and accessories and keep them in place. The shelves slide all the way out of the storage box so you can use them as a caddy or tray to carry the bits.

To raise the top of the router table, lift it all the way up and push down near the bottom of the support arm to slip the locking bolt into the short portion of the L-slot. Tighten the knob to make sure the top doesn't slam down unexpectedly. **PW**



Cabinet joinery detail





H A N G I N G

China Cupboard

The perfect place to
store and display your
everyday china so it's at arm's
length when dinnertime comes.

by David Thiel

*i*f you want to show off your dinnerware, glass doors and open shelving do a better job than standard kitchen cabinets. So rather than remodeling your kitchen, add this hanging cupboard to your dining area.

I chose ash because its light color complements the cabinet's open design. Begin construction by gluing up any panels you might need.

When the glue is dry and the panels have been sanded or planed flat, cut them to finished size. Then cut a $\frac{1}{2}$ " x $\frac{1}{2}$ " rabbet on the back edge of the top and bottom pieces, and the same sized stopped rabbet on the sides. Next mark the horizontal divider, vertical divider, sides, top and bottom for biscuits to hold the case together. Cut the slots and assemble the case by first gluing the horizontal divider in place between the two vertical dividers. Then glue this assembly in place between the top and bottom, flushing it to the inside of the back rabbet. Finally glue the sides on.

Next cut the pieces necessary to form the $\frac{3}{8}$ "-thick back. The diagram shows a detail of the back pieces.

When the glue is dry, chisel out the cor-



SOURCES

Rockler 800-279-4441, or
www.rockler.com.

4 - No-mortise hinges -
#28712, \$1.79 per pair

4 - Sash knobs - #36459,
\$3.69 each

18 - Necktie pegs - #21980,
\$1.89 per pack, 8 in each

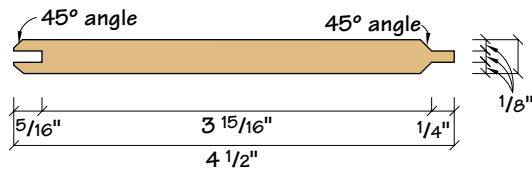
2 - Brass ball catches - #28613,
\$2.99 each

8 - Shelf pins - #30437, \$1.99
per pack, 16 per pack

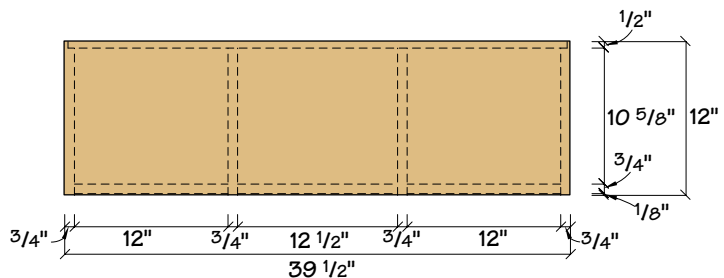
SCHEDULE OF MATERIALS: HANGING CHINA CUPBOARD

No.	Item	Dimensions T W L	Material
2	Sides	3/4" x 12" x 16"	Ash
2	Top & bot.	3/4" x 12" x 38"	Ash
2	Vertical dividers	3/4" x 11 1/2" x 14 1/2"	Ash
1	Horizontal divider	3/4" x 11 1/2" x 12 1/2"	Ash
2	Shelves	3/4" x 10 1/2" x 11 7/8"	Ash
4	Door stiles	3/4" x 1 1/4" x 14 1/2"	Ash
4	Door rails	3/4" x 1 1/4" x 10 1/2"	Ash
1	Drawer front	3/4" x 2 1/2" x 12 1/2"	Ash
2	Plate supports	5/8" x 3/4" x 12 3/8"	Ash
2	Drawer sides	1/2" x 2 1/2" x 10 1/4"	Ash
1	Drawer back	1/2" x 2 1/2" x 12 1/8"	Ash
1	Drawer bot.	1/4" x 10 1/4" x 11 1/8"	Ash
9	Back pieces	3/8" x 4 1/2" x 15 1/2"	Ply
2	Glass panes	1/8" x 10 3/8" x 12 3/4"	Ash
18	Tie hangers	1/4" x 3"	

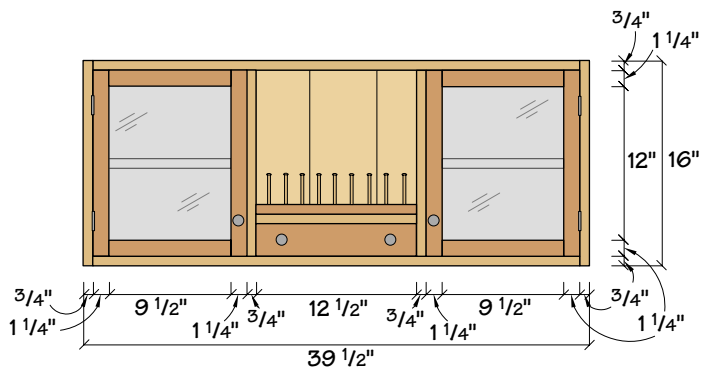
Photo by Al Parrish



Detail of back piece



Plan



Elevation

ners of the back rabbet. Then fit the back. The tongue-and-groove joint allows the solid back to move with humidity changes, so leave a little room between each piece. Don't permanently attach the back pieces until the cabinet is finished.

With the carcase complete, cut the pieces for the door stiles and rails. I used 1/4" x 1/2"-long stub tenon joinery on the doors, cutting the groove in the stiles the full length. After the doors are assembled, use a 1/2" rabbeting bit in a router table to cut the back side off the groove in the stiles, forming a rabbet to accept the glass panes. Now cut the same rabbet in the rails.

Next build the drawer. I used a tongue-and-lap joint to attach the front to the sides, and a simple rabbet joint for the back piece. Tack the bottom in place in a 3/16" x 1/4" rabbet on the bottom of the four drawer pieces.

Next make the two plate holders, which consist of wood strips with store-bought necktie hangers glued into holes spaced 1 1/4" apart.

Now check the fit of the doors and drawer. I held the doors and drawer 1/8" in from

the front edge of the cabinet.

Drill shelf pin holes for the shelves, and add a stop block at the rear of the drawer cavity to hold the drawer 1/8" in from the front. The piece is ready to finish.

After the finish is dry, permanently attach the back. I used a single nail centered on each piece (top and bottom) to hold the back in place and allow the pieces to expand. To hang this somewhat heavy cabinet on the wall directly through the back, I reinforced two of the back pieces with

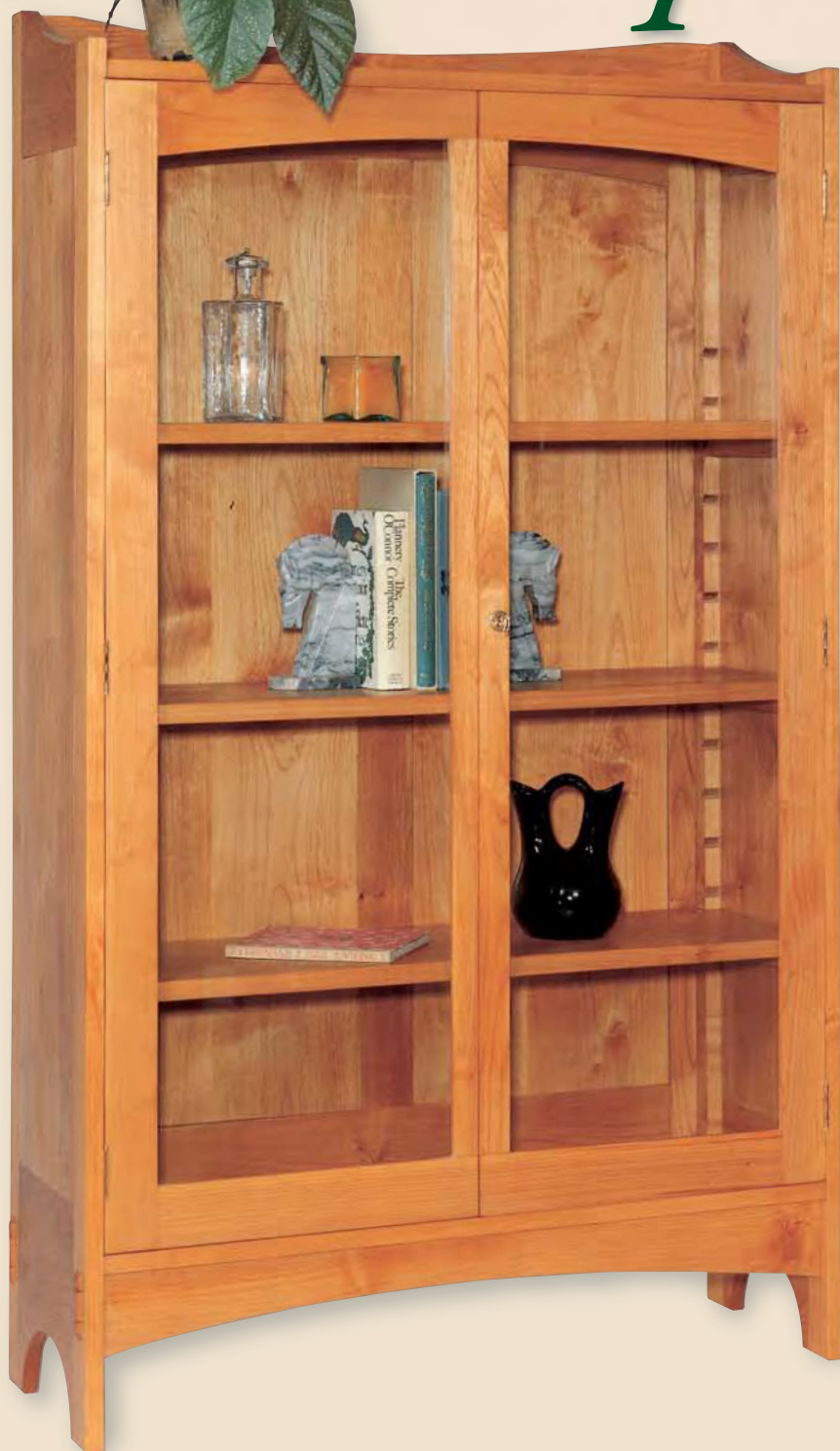
1 1/4" screws. Next put the glass in the frames and pin 1/4" x 1/4" ash strips behind the glass to hold it in place.

Mount the doors. Screw the plate holders in position, checking the spacing between the two rails to hold your plates slightly above the surface of the cabinet. The last step is to add door and drawer knobs and a couple of door catches.

With the cabinet hung in a place of honor, the rest is a matter of deciding which plates and glasses will go on display. **PW**

ARTS &
CRAFTS

Display Cupboard



For books, pottery, art or trophies, this timeless display piece is built for generations of use.

*T*his versatile display cabinet features old-fashioned “bird’s mouth” adjustable shelf supports, wedged through-tenons, arched doors and an arched frame-and-panel back. I borrowed a number of design elements from the Arts & Crafts movement and added some special touches of my own to create an updated hybrid that fits handsomely into any decor.

Arts & Crafts-style furniture was typically built with oak, but as I wasn’t attempting to create an authentic reproduction, I felt free to use alder. Living in the West where alder is common, I’ve found that it works easily, is

by David Camp

David Camp was the editor of Popular Woodworking from 1985 to 1992. He is the owner of NewslettersNOW in Santa Fe, New Mexico.



You'll use templates to guide the router in shaping the top rails, the aprons and gallery rail. You'll also use it to make a reverse template for shaping the back panels, so they'll fit precisely into the arc of the top rail.

SCHEDULE OF MATERIALS: CHINA CABINET

No.	Ltr.	Item	Dimensions TW L	Material
1	A	Door top rail	$\frac{7}{8}$ " x $3\frac{7}{8}$ " x $38\frac{1}{8}$ "	Alder
1	B	Left door bot. rail	$\frac{7}{8}$ " x $3\frac{7}{8}$ " x $18\frac{5}{8}$ "	Alder
1	C	Right door bot. rail	$\frac{7}{8}$ " x 12 " x $18\frac{5}{8}$ "	Alder
1	D	Back top rail	$\frac{7}{8}$ " x $3\frac{7}{8}$ " x $37\frac{1}{4}$ "	Alder
1	E	Back bottom rail	$\frac{7}{8}$ " x $2\frac{7}{8}$ " x $37\frac{1}{4}$ "	Alder
4	F	Door & back stiles	$\frac{7}{8}$ " x $2\frac{1}{2}$ " x $53\frac{1}{2}$ "	Alder
1	G	L. center door stile	$\frac{7}{8}$ " x $1\frac{7}{8}$ " x $53\frac{1}{2}$ "	Alder
1	H	R. center door stile	$\frac{7}{8}$ " x $1\frac{1}{2}$ " x $53\frac{1}{2}$ "	Alder
1	I	Back center stile	$\frac{7}{8}$ " x 3 " x $53\frac{1}{2}$ "	Alder
2	J	Side front stiles	$\frac{7}{8}$ " x 2 " x 64 "	Alder
2	K	Side back stiles	$\frac{7}{8}$ " x 2 " x 67 "	Alder
2	L	Side top rails	$\frac{7}{8}$ " x 8 " x 11 "	Alder
2	M	Side bottom rails	$\frac{7}{8}$ " x 11 " x 11 "	Alder
2	N	Back panels	$\frac{7}{8}$ " x $15\frac{1}{4}$ " x $48\frac{5}{8}$ "	Alder
2	O	Side panels	$\frac{7}{8}$ " x 11 " x $48\frac{3}{4}$ "	Alder
1	P	Gallery rail	$\frac{7}{8}$ " x 4 " x $37\frac{1}{4}$ "	Alder
2	Q	Aprons	$\frac{7}{8}$ " x 4 " x $39\frac{3}{4}$ "	Alder
4	R	Shelf supports	$\frac{3}{4}$ " x $1\frac{1}{8}$ " x $53\frac{3}{8}$ "	Alder
6	S	Cross pieces	$\frac{3}{4}$ " x $\frac{3}{4}$ " x 12 "	Alder
3	T	Shelves	$\frac{7}{8}$ " x 12 " x 37 "	Alder
2	U	Top and bottom	$\frac{7}{8}$ " x $14\frac{1}{4}$ " x $38\frac{1}{4}$ "	Alder

relatively inexpensive and has a nice golden tone to it.

In designing the piece, I wanted the grain figure of the top and bottom door rails and the center stiles to match, so I cut the door stiles out of consecutive rips of the same board (and the top rails of the doors) from one piece. Because the doors also have an overlapping rabbet, the left stile had to be $\frac{3}{8}$ " wider than the right.

Start the project by cutting all the rails and stiles for the doors and case to the sizes given in the Schedule of Materials. The back frame and the doors use corner bridle joints that create an expressed and visible joint, truly in the Arts & Crafts fashion. But before cutting the joints, you need to cut the curve onto the upper door rails so the curve continues uninterrupted.

Template routing makes it easy to shape pieces accurately and consistently. Make a $\frac{1}{4}$ " MDF template for the arched top rails

using the scaled template provided. Band saw wide of the pattern line, then use a drum sander to refine the shape.

Using the center line location, position the template over the top

door rail and trace the pattern onto the rail, then band saw wide of the line. Now attach the template to the rail, and use a flush-cutting router bit to trim the curve.

Now lay out the bridle joints on the rails and stiles. I used a tenoning jig to guide the workpieces through a $\frac{1}{4}$ " dado set. First cut the $\frac{1}{4}$ "-thick tenons on the outer ends of each door rail and both ends of the center door stiles. The shoulder on the top tenon of the center door stiles will

need to be hand fit to match the arch in the top rails. While tenoning, also cut a tenon on both ends of each back rail. All the tenons can be left slightly oversized, then trimmed to fit with a shoulder plane or a chisel.

Next reset the tenoning jig to cut $\frac{1}{4}$ " from the center thickness to form the bridle part of the joint. Run the inner ends of the door rails, both ends of the outer door stiles and both ends of the back stiles. Test fit the door frames, and when they fit together nicely, glue them up making certain they're square.

Because the doors are rather large and the glass will make them heavier, it's a good idea to peg the joints for added strength. Using a $\frac{3}{8}$ " bit, drill two staggered holes at each corner from the back of the doors. Drill a little more than two-thirds of the way through the thickness of the frames, then glue in short lengths of $\frac{3}{8}$ " dowel. Sand flush when dry.

To prepare the doors for glass and mounting, two types of rabbets are required. First cut the $\frac{3}{8}$ " x $\frac{3}{8}$ " overlapping center rabbets on the doors. Next rabbet the inside edge of the door frames to accommodate the glass. I'd suggest using $\frac{1}{8}$ " tempered glass for the doors to reduce weight and still retain strength. Make the glass rabbet



Set up the dado head to cut a rabbet halfway through the thickness of the doors. You're going to rabbet the back of the right hand door and the front of the left hand door so that they overlap when closed. Size the width of these rabbets so that the total width of the doors, when closed, equals the width of the back. Use a piece of scrap to back up the door frames and prevent tear-out as you cut these rabbets.



FLUSH CUTTING BIT: A router bit that has a guide bearing mounted either above or below the cutting edges that is designed for trimming a wood piece to match a template or pattern. Also called a pattern cutting bit.

Half scale outline of arched rail
One square = 1"



To keep the two arches on the sides symmetrical, clamp the two sides together, (outside to outside), then flex a thin piece of wood to guide your pencil in drawing the upper arch. Cut this curve with a jigsaw, and keep the two pieces clamped together while you sand it smooth.

edges of the panels fit in the grooves.

To cut the tongue on the panels, use a $\frac{3}{8}$ " rabbeting bit in a router. It will take several test cuts on a scrap piece before the depth of the rabbet on both sides will yield a tongue that is the right thickness. Once you're set up, cut tongues on the back panels, side panels and on the ends of the side rails.

Apply your finish to the back and side panels, then assemble the back frame around its panels. Don't glue the panels in place; they should be allowed to float.

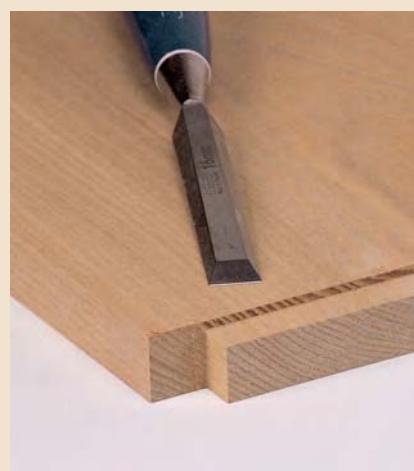
You're now ready to determine the sizes for the rest of the case pieces using the dimensions of your assembled back. Cut the top and bottom to length by measuring the width of the back and add 1" to reach into the dados in the sides.

Cut the gallery rail a little longer than the width of the back so it can be cut to fit after assembly. Cut the aprons $2\frac{1}{2}$ " longer than the width of the back to allow for the through-tenons.

Form $\frac{3}{4}$ " x 2" x $1\frac{1}{4}$ "-thick tenons on the ends of the aprons and on the top and bottom. Size these tenons so that the distance from shoulder to shoulder equals the width of the back.

Use your top rail template to mark the curves on the aprons and gallery rail and to trim them after rough cutting on the band saw.

Start the case assembly with the side panels. Tape the two side bottom rails to-



Use a dado setup to remove $\frac{1}{8}$ " from the upper surfaces on the ends of the top and bottom leaving $\frac{3}{4}$ "-thick x $\frac{1}{2}$ "-long tongues. To avoid having to square out the side dados with a chisel, cut $\frac{1}{2}$ " x $\frac{3}{4}$ "-wide notches at the front and back corners of the top and bottom.

gether and cut out the arch as shown on the diagrams, then assemble the two sides. Next mark the location of the $\frac{1}{2}$ " x $\frac{3}{4}$ " dados for the bottom, then mark the length of the back to position the dado for the top. Lay out the through-mortises for the aprons directly under the bottom dado, centered in the width of the side stiles.

For the sake of simplicity and symmetry, finish shaping the side assemblies while you can work on both together. This is also the best time to chisel out the hinge mortises on the front side stiles.

To make the adjustable shelf supports, start with a $1\frac{1}{8}$ " x $3\frac{3}{4}$ " board that is the length of the back. Raise the radial arm saw and tilt the head 45 degrees to cut part of the bird's mouth slots. Readjust the machine to complete the "V" cuts, then rip the shelf support material into four $\frac{3}{4}$ " strips.

Use a marking gauge to scribe a line $\frac{7}{8}$ " from the edges of the two side assemblies. This line indicates the depth of the back and the doors and also shows where to attach the shelf supports. Glue these in, then glue up stock to make panels for the shelves. Notch the corners to fit around the shelf supports. Make the shelf support cross-pieces from $\frac{3}{4}$ " x $\frac{3}{4}$ " stock and cut the ends at 45 degrees.

Assembly of the case is a bit of a juggling trick, so to reduce the number of things you have to worry about, glue the aprons to the underside of the bottom ahead of time. Position the bottom and top of the cabinet in their dadoes in one of the side assemblies. Spread glue along the top edge of the aprons and fit them into their mortises; then apply the other side assembly, just as if you were putting the whole thing together. Use a couple of handscrew clamps to press the bottom down snug



After the glue is dry, install the gallery rail. Spread glue on the edge and two ends of the rail, position it, then drill and counterbore for a couple of wood screws at each end. Cover the screws with plugs made of your carcass material.

against the aprons.

Practice dry-assembling the carcass, and get all your clamps ready to go. If possible, recruit somebody to spread glue on the apron tenons while you put glue in the dadoes. When everything is ready, go for it. Assemble the four sides; then put glue on the back edge of the rear shelf supports and along the back edge of the bottom and glue the back in place. Measure diagonally to check the case for square and make any necessary adjustments before driving the wedges into the apron tenons. Attach the gallery rail as shown.

To attach the doors, lay the cabinet on its back and put a few shelves in place. The shelves will support the doors as you adjust their fit. Plane a little bit from the edges of the doors so that they operate smoothly without rubbing anywhere. Mark the hinge positions on the doors directly from the mortises you cut in the sides of the cabinet. Clamp the doors in a vise, and cut matching mortises in their stiles.

With the doors installed, put the center shelf in place and position the lock so the shelf won't interfere. Bore the hole and chisel the mortise as necessary to fit the lock. (See the source list below for information about where to get the lock, elbow catch and hinges.) Install the elbow catch at the top of the left hand door.

Now remove all the hardware and apply the finish. I used three coats of Watco Danish Oil, allowed it to saturate for 45



To form the through-mortises in the sides, drill a starter hole and use a jigsaw to remove most of the waste. Cut inside the line; then use a chisel to clean up the mortise. Trim the apron tenons to fit. Band saw two kerfs in each apron tenon to accept the wedges. By cutting them at a slight angle to the grain you will avoid splitting the wood when you drive in the wedges. Make eight wedges from a contrasting hardwood.

minutes before wiping off the excess, and allowed 24 hours between coats. I then followed the oil with a coat of paste wax. The last step is to glaze the glass into the doors, and reattach the hardware. **PW**



Round the ends of the apron's through-tenons with a file, being careful not to scratch the cabinet. It helps to apply layers of masking tape to protect the wood.

SOURCES

Constantines (800-223-8087) Ball tipped cabinet hinges #VH1414, elbow catch #75B3, furniture lock #32H88.

CARTOON

Illustrated by Bob Rech
www.bobrech.com



Adam Kimball, from Concord, New Hampshire, is the winner of our Cartoon Contest from the September issue and recipient of the Makita LS1013 sliding compound miter saw. The following runners-up each receive a one-year subscription to *Popular Woodworking*:

"This clock is having a part attack!"

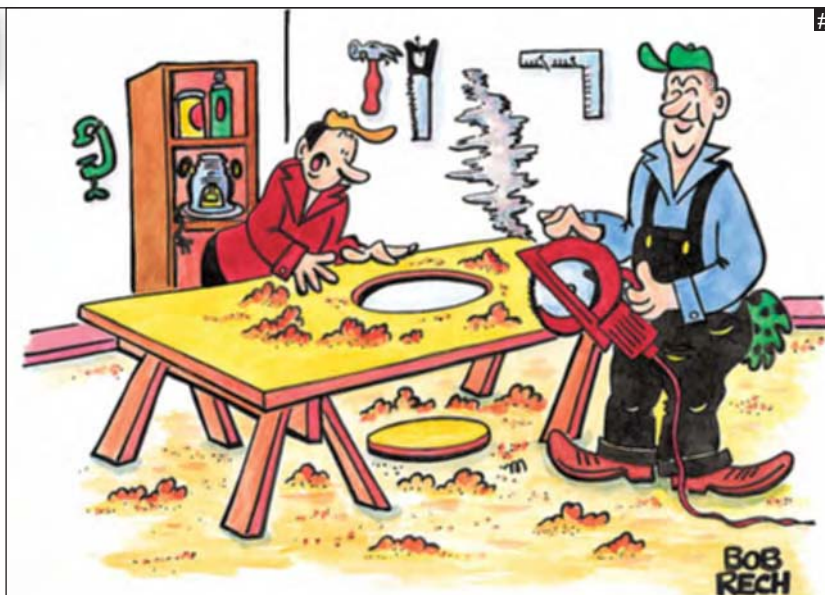
Charlie Oliver, Hampton, New Hampshire

"Yep! Here's the problem.
It's one quartz low."

Adam Rum, Huntington, New York

"Gee Doc, you weren't kidding about killing some time in the shop today were you?"

Keith Bradley, Rio Rancho, New Mexico



Submit your caption(s) for this issue's cartoon on a postcard to *Popular Woodworking*, Cartoon Caption #40, 1507 Dana Ave., Cincinnati, OH 45207 by Dec. 13, 1999. Winners will be chosen by the editorial staff.

The winner will receive a selection of Quick Grip clamps from American Tool Co. Inc. Newly redesigned, these one-handed clamps are a must-have tool. Winners will receive five 12" clamps and five 24" clamps. A \$170 value!

The runners-up each win a one-year subscription to *Popular Woodworking*.

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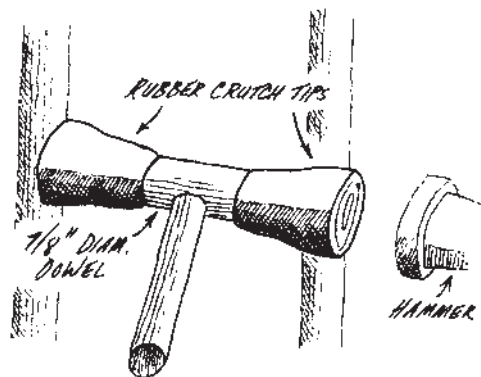
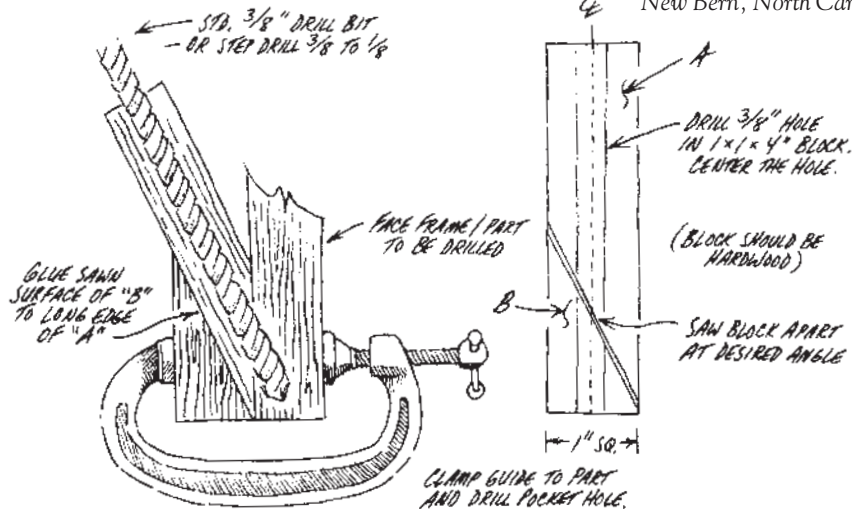
WINNER!

Inexpensive Pocket Hole Guide

When you're building a project that could be made using pocket holes, and you don't have a guide, this fixture can be made in a short time and greatly simplifies the drilling of pocket holes in face frames, aprons, etc. Drill a hole down through the center of a 1" square piece of hardwood. Saw the block apart at a 15-degree angle. Then glue the two pieces together as shown. Next, clamp the guide to the piece to be drilled and drill the pocket. Maple works well for this guide.

D.F. O'Donnell

New Bern, North Carolina

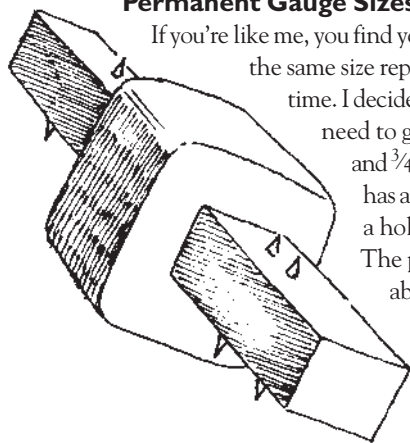


The Persuader

If you've ever had to knock apart a dry fit or disassemble a piece of furniture for repair, you know there's a chance of damage. Things get even harder when you're working in a confined space between slats, or inside chair rungs. The little "persuader" I made allows me to get into tight spots, while the rubber crutch tips won't damage the finish like a plain wood block. The side handle, while optional, makes it a bit easier to hold in position in those tight spots.

R.B. Himes
Vienna, Ohio

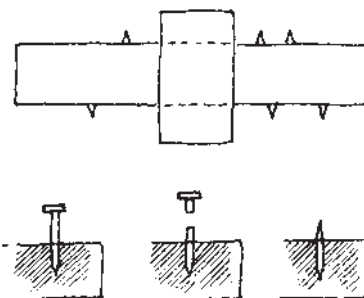
Permanent Gauge Sizes



If you're like me, you find yourself frequently setting marking and mortise gauges to the same size repeatedly and maybe not always getting them exact each time. I decided to make a fixed gauge for commonly-used sizes. I often need to gauge centerlines as well as mortises and tenons in 1/2" and 3/4" material. You can pick sizes to suit your needs. My gauge has a stop 2 1/2" square and 1" thick for a comfortable grip, and a hole cut squarely through it. The stem is 1" square by 6". The pins are fine nails driven into the stem, then cut off at about 3/16" long and filed to chisel-shaped points. At one

side of the stop are pins to mark centerlines. On the other side are pairs of pins for mortises. If your scratched lines are not exactly right the first time, you can correct them by filing more off one side of a point. You can arrange up to four settings on each side of the stock. **PW**

Percy W. Blandford
Stratford-on-Avon, England



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Illustrations: John McCormick

The Tale of the Ping-Pong Hammer

The day my wife, bless her, tried to go tool shopping.

Be it known that I certainly do not consider my wife to be a stupid woman; actually quite the opposite is true. Though she is well educated, I admit she is far from her field of expertise when it concerns my passion for woodworking. Despite her fascination with my creations, her lack of tool knowledge, their use or any of the terminology has produced several funny anecdotes. But no doubt the most amusing took place during the Christmas of 1997.

With the holidays rapidly approaching, I found myself working evenings and weekends to complete some personalized gifts for family members. These projects included a curio cabinet for my wife's collection of crystal figurines, a combination cat house/climber/scratch post, and fancy shelving for my new mother-in-law. Unfortunately, I wasn't making much progress. Many of my tools, some of which had been left to me by my grandfather, were old and unreliable. So my projects were becoming more of a struggle of love than a labor of love.

Unbeknownst to me, my wife had made a mental note of every tool she heard me complain about. She opted to make those items my Christmas gift.

Thinking that she had become familiar with some of the tools I'd wished for, and others I had circled in a catalog, she set off to do her shopping at a large, reputable department store. Once inside, it didn't take long until a salesman approached and asked if she needed any help. That's when the troubles began. She first asked to see a "jack hammer." After several minutes of confusion, the salesman concluded what she really wanted was a hammer drill.

She perused the store's selection, then skipped to the next item on her list. Next she asked for a "Ping-Pong hammer." Apparently, the salesman didn't send her to the sporting goods section and surmised that she meant "ball peen." The situation

continued its downward spiral when she asked the frustrated salesman to point her in the direction of a "wasp." I suppose she hadn't been listening too intently when I said that I needed a new rasp.

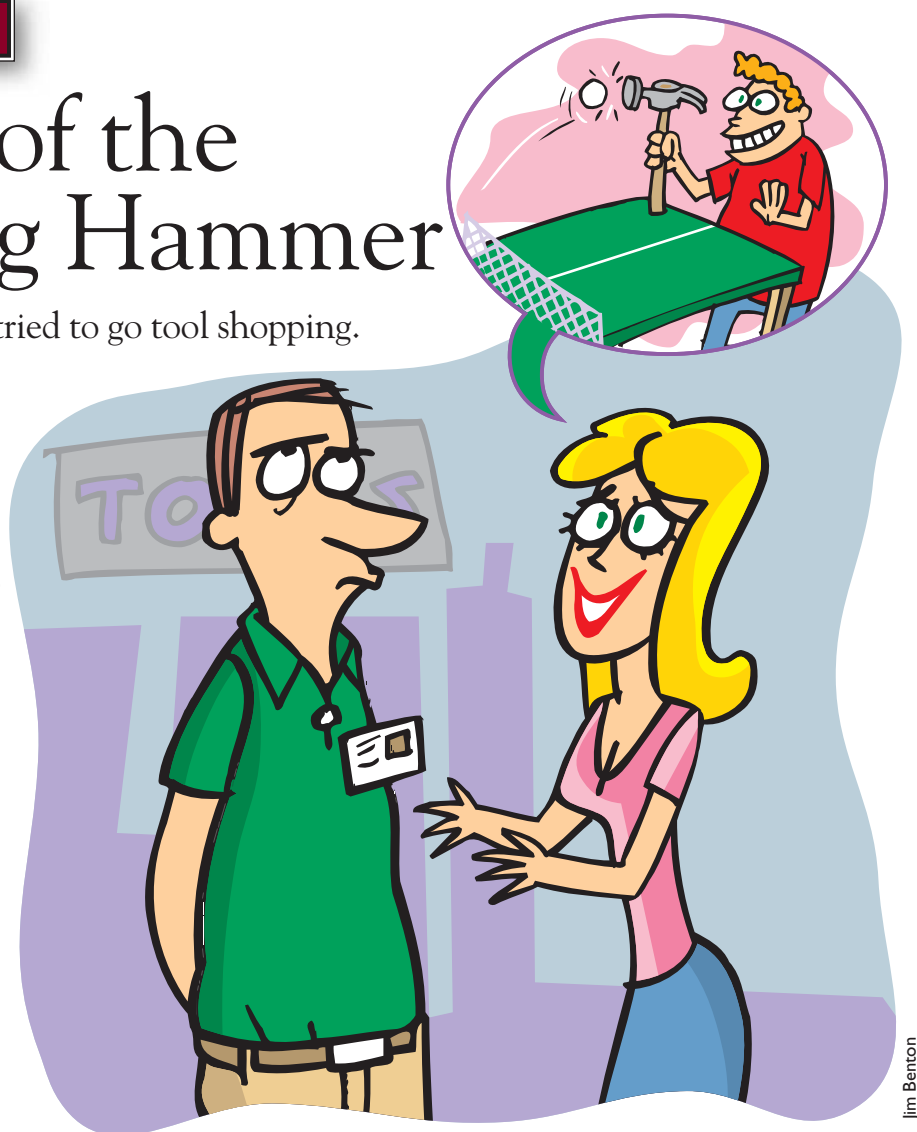
The highlight of this tool shopping fiasco came when she began to act out a commercial featuring Bob Vila. My wife could not remember the name of the product that was advertised, only that several times I had remarked favorably on the item. Try as he might, the salesman was not able to identify the tool she struggled to describe and did little else but laugh at her pantomime of the ad. Realizing that she wasn't making much progress, my wife turned her attention to power tools, in particular scroll saws. She asked for information and price differences. And as she did so, the salesman noticed the linen department in the far corner of the store. He decided it was time to guide her in a different direction by in-

forming her that the bed and bath department was having a huge sale, and he thought she would be more successful there.

An hour later, my better half returned home teary eyed and too embarrassed to tell me what had happened. I overheard her make a phone call to her father. Shortly thereafter, he arrived to take her back out shopping. He gladly clarified the requests with the salesman and helped her purchase everything on her list. The presents I opened that year may not have been my wife's choice, but the wrapping and fancy bows were definitely her loving touch.

The next Christmas I woke to find the old standbys under the tree: socks, underwear and aftershave. **PW**

Robert Lonsdale is a project manager for a large contracting company in Toronto, Canada, and is looking forward to building nursery furniture for his first child. He is grateful that his wife is more knowledgeable about children.



Jim Benton