

TAUNTON'S

Fine Woodworking

Tool test: Combination squares

December 2002

No. 159

**Installing
butt hinges**

**Steel wool vs.
abrasive pads**

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14-in. bandsaw
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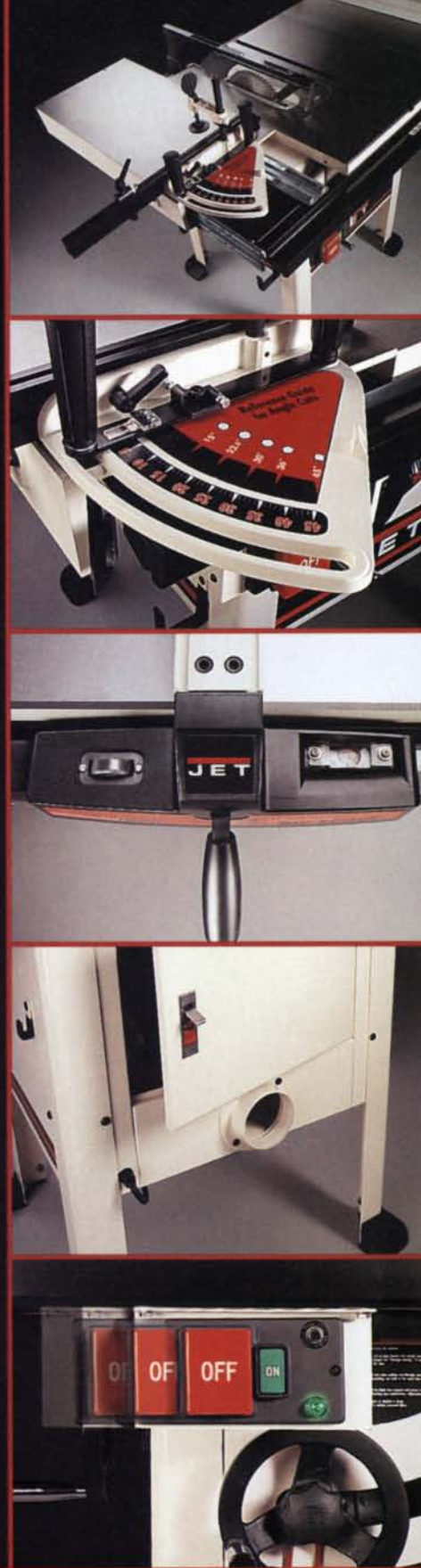


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Departments

- 6 Contributors
- 8 Letters
- 18 **Methods of Work**
Scribing an arc; Cutting small wedges safely; Shopmade router lift; Sacrificial rip-fence cover
- 28 **Notes & Comment**
Period masterpiece on a different scale; "Top" turners gather at national symposium
- 38 **Tools & Materials**
Innovative 3¼-hp router from Down Under; Butt chisels from Crown Tools; A better support stand
- 96 **Current Work**
A gallery of our readers' woodworking
- 102 **Rules of Thumb**
A time and a place for every finishing method
- 108 **Questions & Answers**
Miter for stock of different widths; A nonyellowing finish for maple
- 116 **Master Class**
Shaping curved furniture parts
- 129 **Finish Line**
Removing surface dust



Build a harvest table, p. 62



Epoxy inlay, p. 73



Outfit a bandsaw for resawing, p. 44



On the Cover:
When designing an entertainment center, think components first. See p. 78
Drawing: Bruce Morser

Articles

44 Soup Up Your 14-in. Bandsaw

For resawing, these upgrades will greatly improve performance

BY JOHN WHITE

52 Installing Butt Hinges

The right hinges make a difference when it comes to looks, performance and longevity

BY GARRETT HACK

ON OUR WEB SITE: Watch a video clip of the author chopping a hinge mortise

58 Steel Wool vs. Abrasive Pads

Even with the advent of synthetics, there still is a place for old-fashioned steel wool

BY JEFF JEWITT

62 Harvest Table

This Shaker drop-leaf design can be built for two or for 20

BY CHRISTIAN BECKSVOORT

68 Combination Squares

What sets apart a \$75 tool from one that costs \$6?

BY STEVE LATTA

ON OUR WEB SITE: Tips on tuning up a combination square

73 Epoxy Inlay

This simple technique allows custom colors and designs beyond the scope of traditional inlay

BY KEITH RUST

77 Coloring epoxy

78 Engineering an Entertainment Center

There's more to it than putting a television in a box

BY BROOKS TANNER

84 TOOL TEST 1-hp Mortisers

These machines are bigger, beefier and mightier than benchtop models, but are they worth the extra cost?

BY ROLAND JOHNSON

ON OUR WEB SITE: Take a tour of a 1-hp mortiser

90 Secret Spaces

Create hidden compartments to suit any style of furniture

BY MARK SCHOFIELD

95 A gallery of secrets



Installing butt hinges, p. 52



Combination squares reviewed, p. 68

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Contributors

When **Michael Fortune** (Master Class) is not on the road teaching, he's in his rural studio outside Toronto, Canada, developing his signature furniture designs and building them with the help of an assistant. It's safe to say that Fortune is Canada's best-known woodworker, as he was the first furniture maker ever to win the Saidye Bronfman Award, his country's most prestigious prize for excellence in the fine crafts. He used the \$25,000 cash award to finish restoring a 175-year-old log homestead, where he works and lives with his family. His furniture is on permanent exhibition at the Canadian Museum of Civilization; see some of it at www.civilization.ca/arts/bronfman/traeng08.html.



When **Keith Rust** ("Epoxy Inlay") gave himself a Craftsman tablesaw for his 35th birthday, he never expected it would lead to a profitable and exciting career as a woodworker.

Well, it didn't. He has, however, found comfort in the fact that his profession of 22 years—that of managing a state-of-the-art recording studio in Dallas—has given him the ability to afford the occasional new chisel or router bit. This is his debut article for *Fine Woodworking*; he also has written for *Woodwork* magazine.

Brooks Tanner ("Engineering an Entertainment Center") is a self-proclaimed high-tech dropout. In his previous career he worked on everything from depth sounders to laser storage and hard drives. Tanner started woodworking in 1992 when his house needed a new kitchen. After looking at commercial cabinets, he realized that he could buy the materials and tools and still save money. Over the next five years he developed his skills by studying furniture and by reading as much as possible. As an audiophile and home-theater enthusiast, he saw a need for entertainment centers that were designed from the ground up, keeping in mind the requirements of both the electronics and the users. To fill that need, he started BJ Tanner Custom Cabinet and Furniture (www.bjtanner.com).



Jerry TerHark (Finish Line) has become a regular lecturer at The Woodworking Shows that tour the country, persuading woodworkers of all experiences that finishing isn't so hard after all. He studied under master finisher George Frank, later became a finishing instructor, ran a furniture-restoration business and worked in the research and development department of a large manufacturer of finishes. More information about his books and videos on finishing can be found at www.jerryterhark.com.



Raised in England, **Mark Schofield** ("Secret Spaces" and Rules of Thumb) spent nearly 20 years in the oil industry as a journalist, trader and broker after graduating from Oxford University. Throughout this time he pursued woodworking as a hobby even when apartment living confined him to only hand tools and small projects. Becoming an editor with *Fine Woodworking* has brought the opportunity to meet and learn from many accomplished woodworkers across the country, but ironically it has meant less time for his own woodworking. Having moved to a new house in Connecticut, Schofield spent most of his spare time this past summer creating a garden area, building a deck and rearranging the stones that littered his property.



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Letters

Wondering about safety—I found Ernie Conover's article "Learn to Turn Spindles" (*FWW* #156, pp. 68-73) really useful. In particular, I found the information on the grinding of the spindle gouge helpful—a tool that I have been struggling with on my own lathe.

However, as a matter of safety awareness, I was pretty startled by the photograph on p. 70 (shown here) of



the article that showed Conover grasping/supporting the workpiece from behind while cutting. This may be fine for an experienced turner with a feel for the tools

and the dynamics of the situation, but surely this article was aimed at the relative beginner, who will not have those skills and feel for the subtleties of the rotating workpiece.

On reflection I realize I am prompted to write about this particular case after noticing a number of such incidences in *FWW* that have worried me: pictures of hands pushing workpieces toward unguarded tablesaws and so on. The magazine does make a strong statement on the importance of safety; however, I think you allow your contributors to demonstrate techniques that are really quite suspect.

I accept that they are skilled practitioners with trained hands, but your magazine is read by others who do not have those skills. Let's be honest—there is usually a safer way to do the same job!

—Dave Meyrick, Wokingham,
United Kingdom

ANATOLE BURKIN, EXECUTIVE EDITOR,

REPLIES: The first time I tried this technique, I had a bag of ice ready to preserve the amputation and the phone nearby for the 911 call. Fortunately, nothing bad happened. I had seen Ernie Conover and others demonstrate this technique, and they were all of sound body and mind, so I knew it could be done. Good instruction is invaluable for learning the right way to do woodworking and keeping body parts intact. (In this case, support the piece with your fingers, don't grab it, and keep

sleeves and jewelry away from the action. Or, as an alternative, go out and buy a steady-rest accessory.) Our magazine serves readers of all skill levels, and the techniques have to reflect that wide-ranging interest group. Woodworking is inherently dangerous, but ultimately, it's up to the individual to decide on his or her comfort zone.

Long live the radial-arm saw!—I

found the August 2002 issue to be just excellent. One of my favorite subjects was covered in the issue: "Radial-Arm Saws" (*FWW* #157, pp. 72-77). I love my Ridgid saw. Fifteen years between tests is quite a time period, and this review has made all radial-arm saw users, including myself, quite happy. I am sure that even the skeptics took some interest in this article as well. How do you test any better for machine runout than 0.0000, like the Original Saw Co. model did? I congratulate William Duckworth on his article.

—Paul Jacklin, Corona, Calif.

Generational divide—Allow me to reintroduce myself: 24 years ago *Fine Woodworking* published an article I wrote on proper drawer construction. I would like to offer a few comments with regard to Janet A. Collins' article "Making Traditional Dovetailed Drawers" (*FWW* #157, pp. 78-83).

The article recommends to prepare all stock through planing, scraping and sanding before doing anything else. This is wrong. One of the principles of woodworking is to avoid using sandpaper if you are going to use a chisel or plane afterward.

In the section on pins, the reader is told that the half pins can be as wide as the full pins. The suggestion is that the half pins can be smaller, but that they should not be wider than the full pins. I would like to turn this around by stating that the half pins need to be at least as wide as the full pins and that it does not hurt if they are even a fraction wider. The half pins are the weakest part of the joint, and to make them too small is to make them too weak.

Regarding the drawer bottom, I recommend that the author revise her procedures. It is imperative that the bottom of this drawer be fastened



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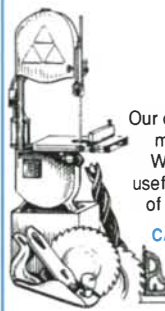
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Letters (continued)

securely to the front of the drawer for two reasons. The first reason is to keep the drawer square, and the second reason is to force all seasonal movement to occur at the back of the drawer. The drawer in the article has a bottom that will move at the front because the resistance there is much less—probably no resistance—than it is at the back where the bottom is held by a screw.

My comments are based on sound woodworking practices. They have nothing to do with personal habits or preferences. And lest I come off sounding overly critical, I wish to say that I like the general direction *Fine Woodworking* seems to be taking. The magazine seems to understand that many of its readers are genuinely interested in acquiring theoretical knowledge as well as practical skills. The recent article on sharpening (*FWW* #157, pp. 36-41) is a good example of what I mean. I found it a superb article.

—Adrian C. van Draanen, Richmond, Ont., Canada

JANET A. COLLINS REPLIES: There is a small risk of dulling an edge tool or dovetail saw on wood that has been sanded. There is a much greater risk of changing the dimension by planing, scraping and sanding the material after the dovetails have been cut. The shoulder lines are marked prior to cutting dovetails based on the thickness of the material. If you change that thickness by planing, scraping and sanding after the dovetails have been cut, you will have gaps in your joinery, perhaps even causing your drawer not to be square. If this is a concern for you, plane and scrape prior to cutting dovetails and wait to sand the inside after the drawer has been glued up.

Regarding dovetail layout: Making the half pins slightly less wide than the full pins does not make them weaker. But changing the angle might make them weaker. Most important, narrower half

pins allow you to place the groove for the drawer bottom lower on the sides and front, allowing for a deeper interior of the drawer. Less important, aesthetically, it is more pleasing to see narrow pins than wide pins. I have not had a dovetail joint fail with narrow half pins, even on drawers that are used daily.

And last, gluing the drawer bottom to the front of the drawer probably will help keep your drawer square if you don't cut your dovetails square and accurate. If you use stock that is flat and square and cut the dovetail adjoining faces square and snug fitting, your drawer will be square and should stay square when glued up. The drawer bottom should also be square, with the bevel fitting snugly inside the groove. The sawkerf on the drawer bottom is cut longer than the screw is wide to allow for expansion occurring at the back of the drawer. A single sawkerf and screw will hold the drawer bottom in place for the drawer shown in the article. You can use more than one sawkerf and screw on wider drawers.

Gluing the drawer bottom to the front of the drawer is totally unnecessary and can only cause problems if the drawer bottom needs to be taken out for repair.

My responses to Mr. van Draanen's comments are based on sound traditional furniture-making practices. However, the methods of work I follow and teach at North Bennet Street School have become personal habits and preferences because they work for me. I would never claim that this is the only proper way to dovetail a drawer. I have found that there is usually more than one way to successfully accomplish any task in furniture making. I think we can find proof of this in the long history of *Fine Woodworking* magazine, including Mr. van Draanen's article in *FWW* #11, pp. 50-53.

Is the sky falling yet?—Having read Mr. Jim Stark's letter cautioning against the practice of forming hooks by heating PVC pipe (*FWW* #156, pp. 8-10), I am fuming a bit myself. There have been several items appearing in this space and others with the same Chicken Little kind of proclamations. Most every-

thing is toxic at some point, even water. If I were to take Mr. Stark's words at face value, I would similarly not drive anymore because many people die while driving.

The fact is that we all face risk every day. And as woodworkers we must face many hazards if we are to enjoy our craft. At what point do we decide that benefit outweighs potential harm or to what extent do we need to protect ourselves? Specifically, what are the risk factors? We each have a different set of circumstances that can substantially affect the overall risk. We need good, solid information so that each of us can make our own informed and wise judgments about our own safety.

Personally, I am getting tired of being on the receiving end of a bunch of dos and don'ts (without any whys) based on the judgments of bureaucrats! Woodworkers are thinking people. We need information and understanding, not just a bunch of one-size-fits-all boilerplate rules.

I offer my apologies to Mr. Stark. Clearly his intentions are honorable, as are others', but this item put me over the top. We really need balanced information to keep all risks in perspective.

—Paul N. Graf, Bellingham, Wash.

Clarification on Greene and Greene chair—For the last dozen years I have been making furniture in the style of Greene and Greene. I have trained as a fine-furniture maker, traveled to meet museum curators, attended conferences, done historical research, and built

About your safety:

Working wood is inherently dangerous. Using hand or power tools improperly or ignoring standard safety practices can lead to permanent injury or even death. Don't try to perform operations you learn about here (or elsewhere) until you're certain they are safe for you. If something about an operation doesn't feel right, don't do it. Look for another way. We want you to enjoy the craft, so please keep safety foremost in your mind whenever you're in the shop.

—Anatole Burkin, executive editor

Writing an article

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Letters (continued)

furniture to the highest standards and accuracy. As my business grew I sought out other fine craftsmen and have had the pleasure of collaboration with Jonathan McLean, Alex Krutsky, Jeremy Nadeau and Paula Garbarino, who is the maker of the chairs on the back cover of the October 2002 issue (*FWW* #158).

My business' name is David B. Hellman and Associates. While I am intimately involved in the design and construction decisions of each piece, associates build most of the work, and I wish to give credit where due.

—David B. Hellman, Watertown, Mass.

A mixed review—The mailman walked in yesterday afternoon and in his bundle of bills, advertisements and other junk, I spied the familiar paper cover peeking out. "Ah, yes," I said to myself, "*Fine Woodworking* is here!"

Like the proverbial kid in the candy store, I am always eager to see your publication. Whether or not I find

something truly unique and new does not matter. The articles are well written, and the photos and illustrations are always great eye candy.

Flipping through the pages of *FWW* #157, I found the usual. Yes, sir, another expository on how best to sharpen. We haven't seen that one in a while. And then, of course, a new feature: how to install a bandsaw blade. And you have cleverly added a tear sheet with visuals! How nice (I am beginning to yawn here). Then there is Chris Becksvoort. I truly do enjoy his meticulous craftsmanship. It is always a joy to read his articles and see his work. Then I found the umpteenth article espousing the use of plywood in fine furniture, and so on.

Aha! Then it struck me. I saw the Notes & Comment write-up on p. 26: "High school woodshop unplugged."

I live and have my woodshop in northwest Denver, a mere 30 miles from the Boulder Valley. I send kudos and congratulations to Rocky Steirs for his

innovation and intestinal fortitude. We could all learn a lesson from this young teacher. His can-do attitude under repressive, restrictive and sometimes downright silly overregulation within the public school system is commendable.

—Stephen Anthony, Denver, Colo.

Article suggestion—As a professional cabinetmaker, I have been reading *Fine Woodworking* for several years because I find it to be highly beneficial in my business. The articles on specific hardwoods are very useful. I have found that if I refer to lumber by its binomial nomenclature, there is no misunderstanding between me, my suppliers and my clients—how much stuff is pawned off as "Bohemian cherry" or "Mongolian mahogany?" It's worthwhile to know that if the genus isn't *Quercus*, then it's not really oak.

So here's my suggestion: an article that explains the system of binomial nomenclature along with a family tree that shows the basic relationship of the common genera. It would help too if you

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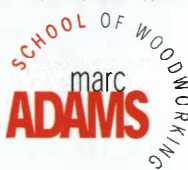
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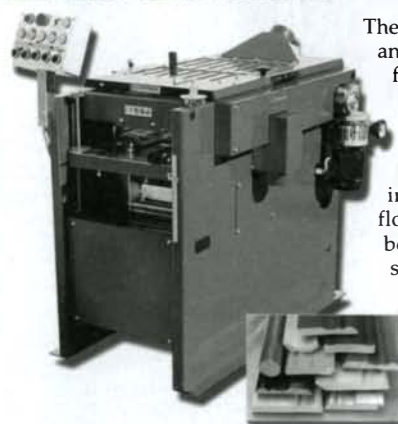
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Letters (continued)

could include a pronunciation guide for the family and genus names.

—Craig H. Schindler, via e-mail

Material or design?—In the Tools & Materials review “Delta’s new 16-in. lathe has a steel bed” (*FWW* #157, pp. 30-31), I noticed the following quote by Bill Ramsey: “Model 46-745 has a steel bed that, according to Delta, offers torsional stiffness 20 times greater than cast iron.” No doubt the bed does have a stiffness 20 times that of a previous cast-iron version, but your readers should not assume that this is due entirely to the material being steel rather than cast iron.

Torsional stiffness depends on both the modulus of the material (30 million for steel vs. approximately 15 million for cast iron) and the polar moment of inertia (a function of the design of the cross section). Therefore, the increased torsional stiffness must be due largely to the design, rather than the choice of material.

Although I’ve been unable to find any

references in my engineering handbooks, I recall that one advantage of cast iron in machine tools is that it is not perfectly elastic and thus has some degree of internal damping, which allows it to absorb vibrational energy.

—Leon G. Wilde, Andover, Mass.

Forrest blade not hard to sharpen—I just received *FWW* #157, and I have a comment regarding the letter published on p. 8 from Doug Christensen of Salt Lake City.

He believes that the real cost of the Forrest sawblade comes in the sharpening. I have had a Forrest blade for over 10 years. It is the sawblade that is on my tablesaw 99.9% of the time. I have a small woodworking business and work with hardwoods almost exclusively, and I cut quite a bit of wood each year. I have only had to have this blade sharpened once every five years. It really lasts that long between sharpenings.

When you factor in how often you sharpen other blades, you will find that

even the sharpening from Forrest is a bargain.

—Alex Savakinas, Williamsport, Pa.

In reading Doug Christensen’s letter regarding the Forrest sawblades, I don’t know what Christensen’s problem is.

I use a Forrest Woodworker II on my Delta contractor saw, and it is clearly superior to other combination blades I have: including Systematic, Oldham and others.

Yes, I sent my sawblade back to Forrest, twice for reshaping in the last six years, and for the same price basically as an excellent local sharpening shop. You can also send other brand blades to Forrest, and they will sharpen them as well.

Perhaps there really is magic at Forrest. My investment in the Forrest blade has made my woodworking much more enjoyable. What other blade can you rip with and get glue-joint smoothness without fussing time and time again?

—Rich Haendel, via e-mail

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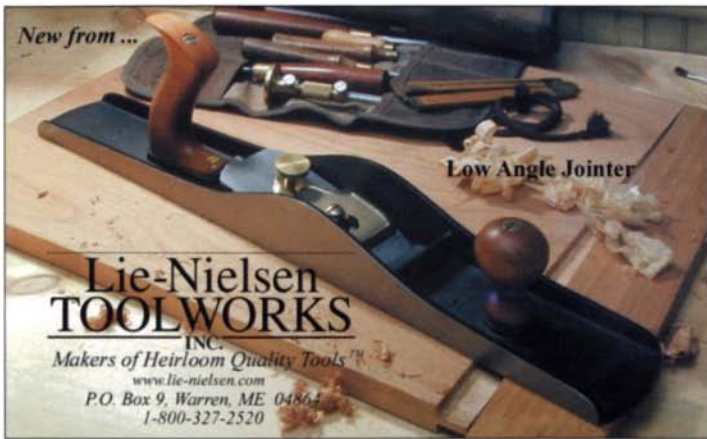
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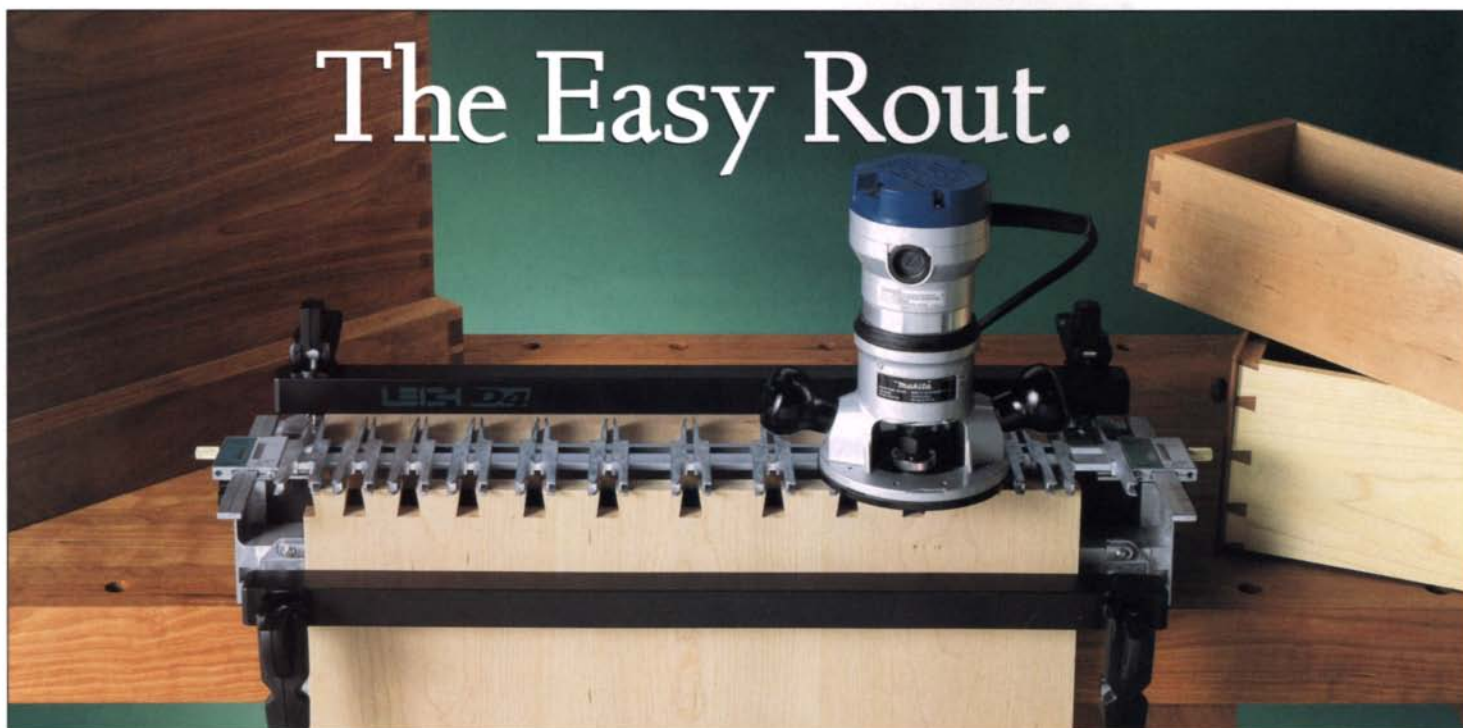
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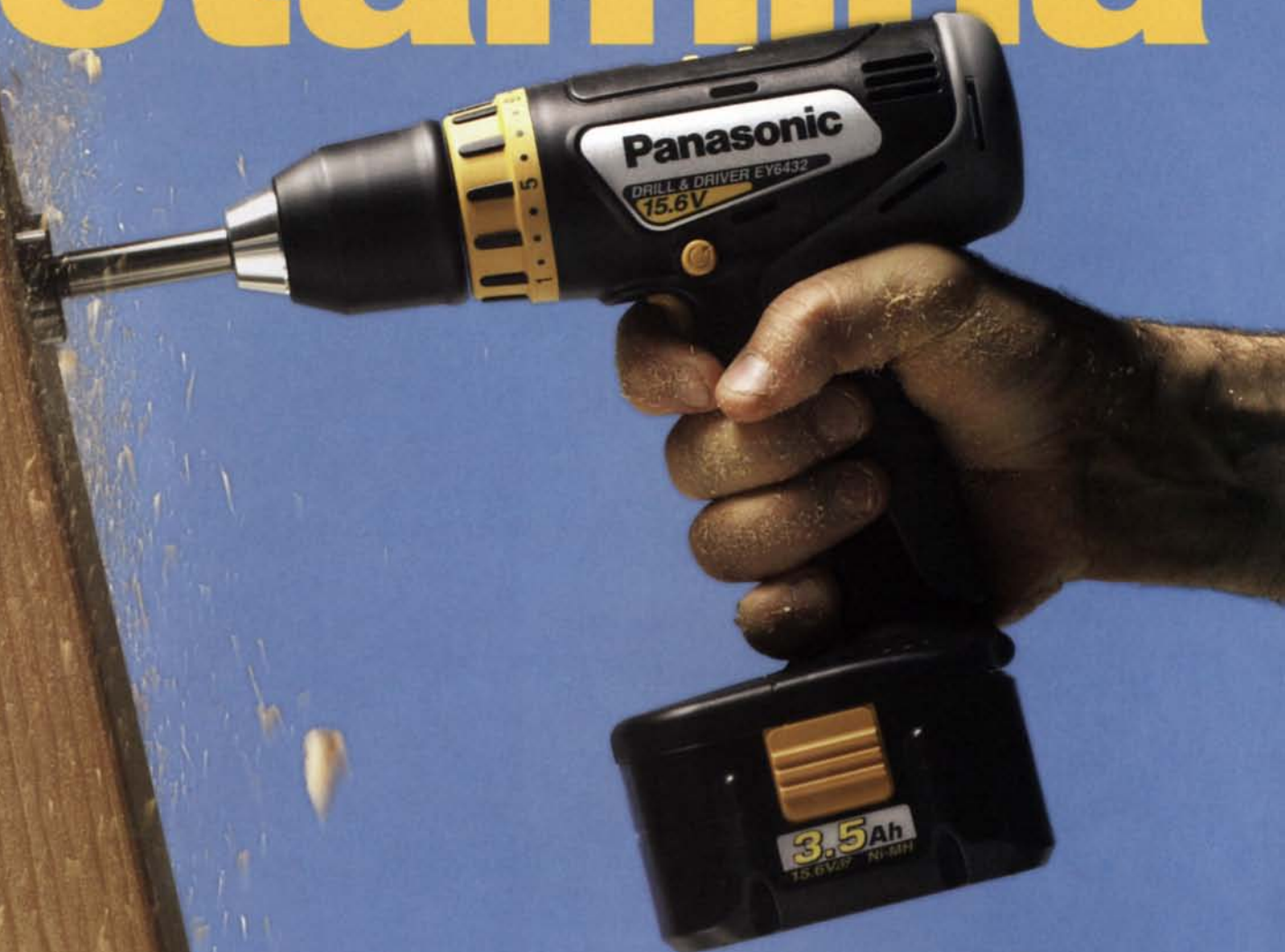
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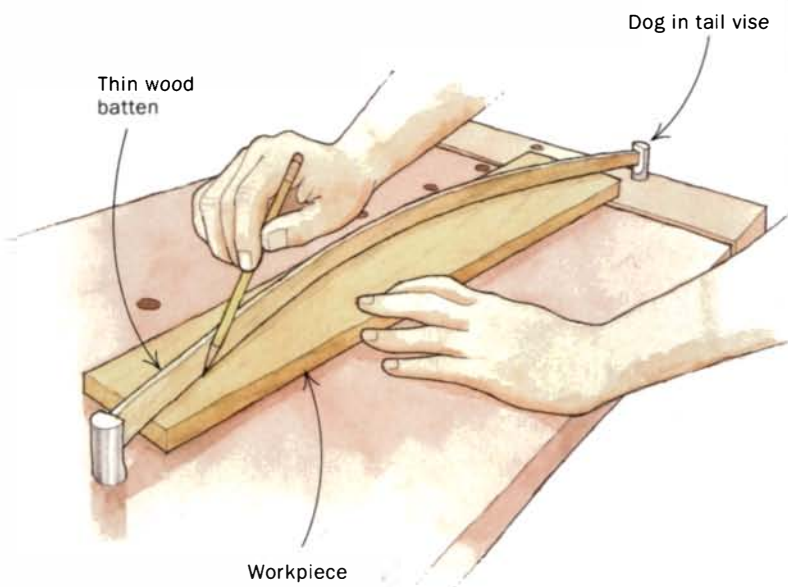
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Methods of Work

EDITED AND DRAWN BY JIM RICHEY

Scribing an arc



I make furniture in the Arts and Crafts style, which often requires a sweeping arc to be cut into an edge. The usual approach to scribing an arc is to bend a thin wood batten to the proper radius with a pipe clamp, lay it on the workpiece and then scribe a line. When I tried this awkward procedure, I needed about three extra hands. So I came up with another approach.

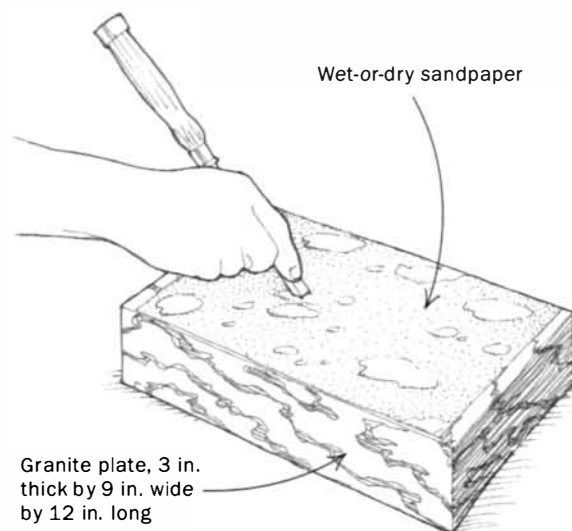
On your workbench, put one dog in the tail vise and another at a distance that will accommodate the length of the batten. Spring the batten between the dogs, allowing enough clearance to slide the workpiece underneath. Now crank the vise either way until you get the arc you want. Slide the workpiece under the batten. You can make fine adjustments with the vise to adjust the arc and easily move the stock to the exact position needed. When everything is lined up, push down the batten so that it is snug to the workpiece. Both hands are now free to steady the workpiece and scribe the arc with your pencil.

—Rich Chapple, West Vancouver, B.C.

Sharpening with a granite plate and sandpaper

My sharpening stones have been gathering dust ever since I discovered this sharpening technique. I use a granite surface plate, 3 in. thick by 9 in. wide by 12 in. long, and various grits of wet-or-dry sandpaper. The plate is available from Harbor Freight (800-423-2567) for about \$20.

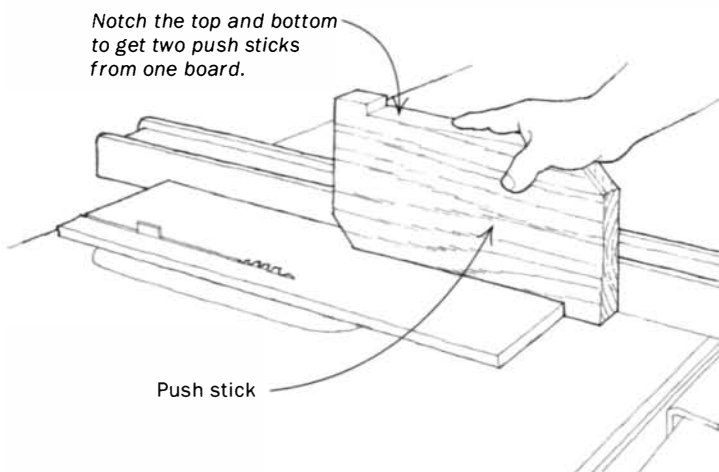
To use the system, I first pull a sheet of sandpaper through a bowl of water so that it is wet on both sides and spread it on the



top of the granite plate. The sandpaper will stay in place because of the surface tension created by the water. The combination of stone and paper produces a large, heavy, water-lubricated, perfectly flat sharpening surface that can be changed from one grit size to another in no time. Going from 240-grit to 2,000-grit in stages, I can put a perfect edge on a new tool in less than five minutes.

—Roy Frampton, Nashua, N.H.

Zero-tolerance push stick



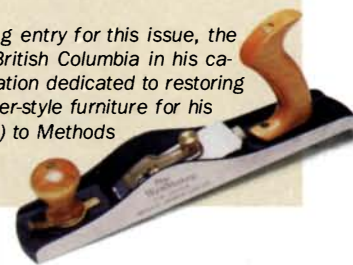
As a full-time toy maker, I use this push stick daily to rip long, wide boards as well as short and narrow ones. After thousands of cuts I can vouch for how safe and useful it is. The tool practically eliminates kickback and enables me to rip narrow and short pieces of wood safely.

These push sticks eventually wear out, so it doesn't hurt to make



A reward for the best tip

When we caught up with Rich Chapple to let him know his tip had been chosen as the winning entry for this issue, the connection was by satellite phone. He was working on remote Langara Island off the coast of British Columbia in his capacity as Director of Salmon Programs at the Pacific Salmon Foundation, a not-for-profit organization dedicated to restoring Pacific salmon populations. In his free time, Chapple enjoys building Arts and Crafts and Shaker-style furniture for his family and friends. Send us your best tip, along with any photos or sketches (we'll redraw them) to Methods of Work, Fine Woodworking, P.O. Box 5506, Newtown, CT 06470-5506.



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This amazing secret is now the foundation for my entire business. I tease my friends it's like the "goose that lays the golden eggs". It lets me make an average of \$1,113 a day (that's \$23,355 a month)

with my woodworking business. Sometimes, I work a week then take the next 3 weeks off. The System continues to bring in money.

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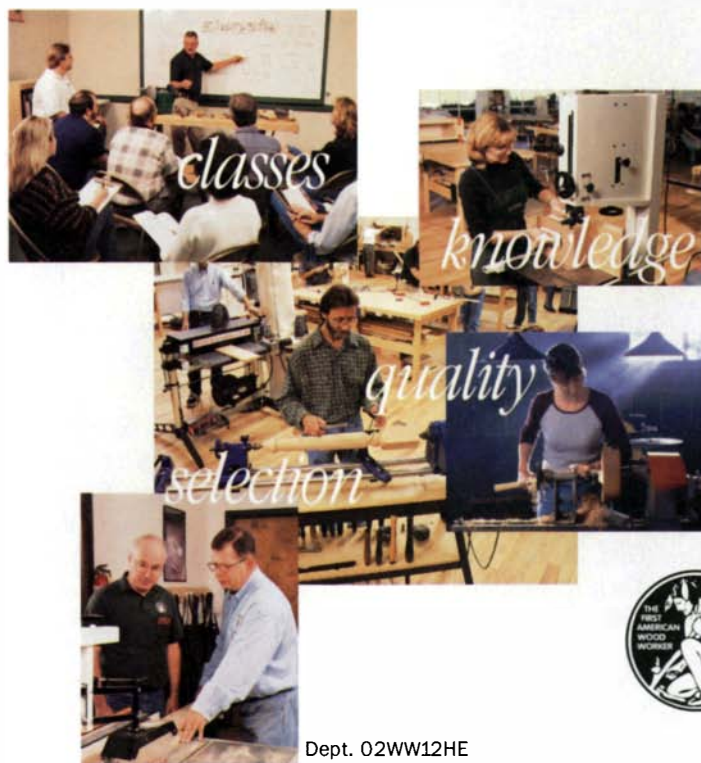
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Methods of Work (continued)

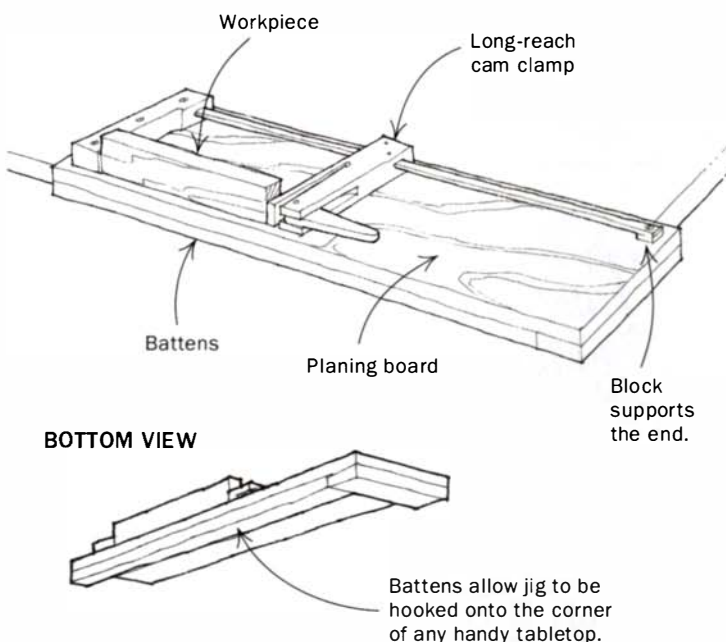
several while you're at it. Start with a 1-ft.-long scrap of 2x8 construction lumber. Notch and bevel the corners on the top and bottom as shown on p. 18. By making a mirror image of the push stick on the top and bottom, you get two for the price of one.

To use the push stick, set your blade approximately $\frac{1}{4}$ in. above the workpiece. Adjust the fence to the desired width of cut, and place the workpiece firmly against the fence. Using the push stick to apply pressure both down into the table and against the fence, push the workpiece through the blade. If you are ripping a narrow piece, as I often am, you will feel the blade cutting into the push stick. The first cut will create a zero-tolerance cut into the push stick that will allow you to repeat that same cut dozens of times safely, even when the workpiece is very thin.

—Warren Paton, Digby, N.S.

Quick tip: Expired credit cards are useful in the shop. The rounded corners are great for smoothing caulk. Use a card like a putty knife to patch drywall or fill nail holes. Drill a series of holes the size of a pencil lead into the card to make a great compass. All this, and it fits into your shirt pocket. —Harvey Thielemier, Florissant, Mo.

Transportable planing board



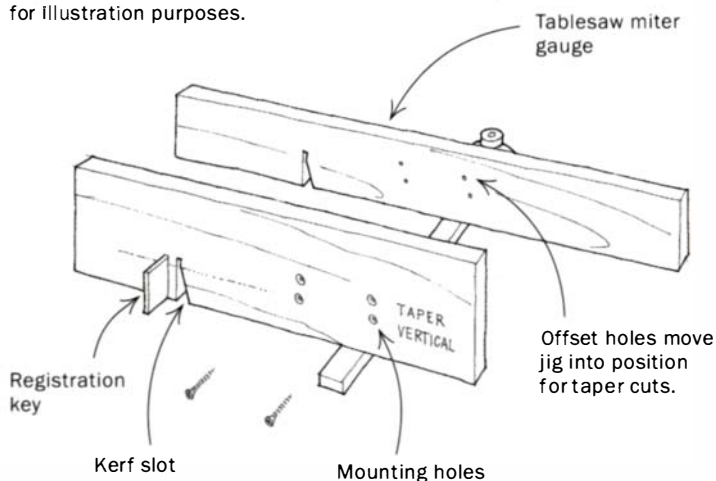
This handy planing board sets up instantly almost anywhere. The key feature is two battens fixed to the underside that work like a shooting board to hold the fixture on the corner of any suitable workbench or table. To make one, simply screw the head of a long-reach cam clamp to a piece of plywood or medium-density fiberboard (MDF) and fix the two right-angle battens to the bottom. Add a small spacer block under the end of the metal clamp bar to support it at the right height.

—Peter L. Giolitto, Epsom, Surrey, England

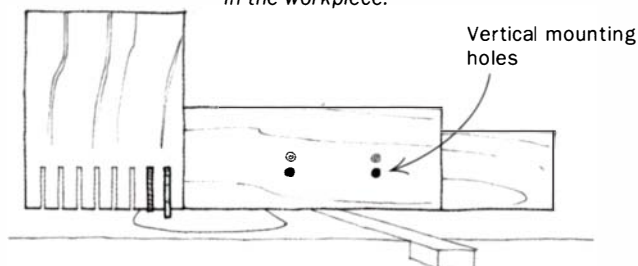
Cutting small wedges safely

I like to use wedged tenons in my joinery, but cutting a set of identical, tiny, tapered wedges is a challenge. So I built a jig that does

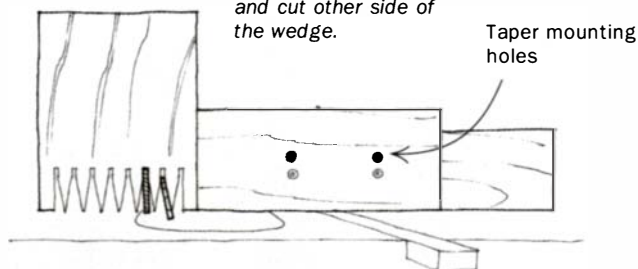
NOTE: Wedge angle exaggerated in all drawings for illustration purposes.



1. Cut vertical slots in the workpiece.



2. Flip the workpiece and cut other side of the wedge.



the job quickly and safely. The jig consists of a 12-in.-long block attached to a wooden miter-gauge fence and fitted with a registration key. It is used in a three-step process to taper the wedges. First, cut tall finger-joint-like vertical slots across the workpiece. Then remove and reattach the jig to move it over slightly, lower the blade a bit, and make two passes with a tilted blade to produce a comb of perfect wedges.

You can make a jig to produce any size or angle of wedge. To illustrate the process, here are instructions for making a jig that produces 1-in.-tall wedges with a 10° taper. Start with a 12-in.-long block of $\frac{3}{4}$ -in.-thick material. Scribe a line across the face of the block 1 in. up from the bottom edge (you will use this line later). Now cut a $1\frac{1}{4}$ -in.-deep vertical slot in the block about 3 in. from the end and glue a thin piece of wood in the slot to make the

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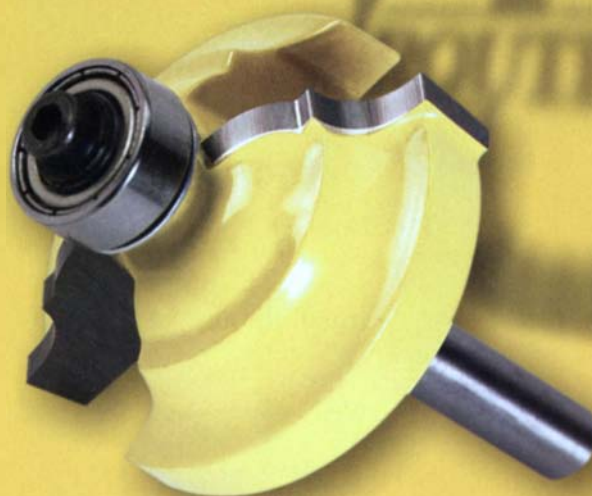
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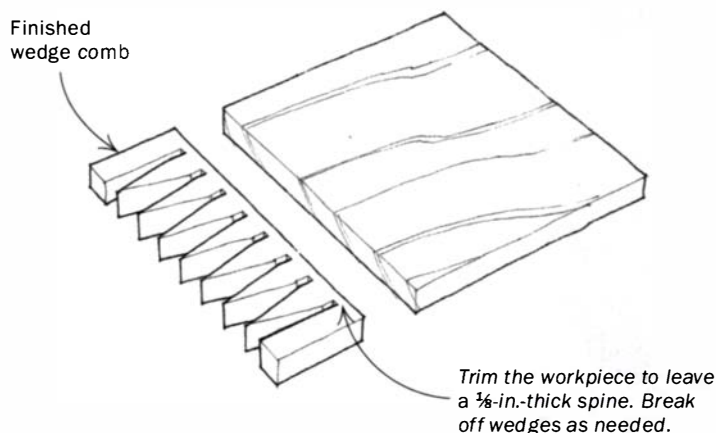
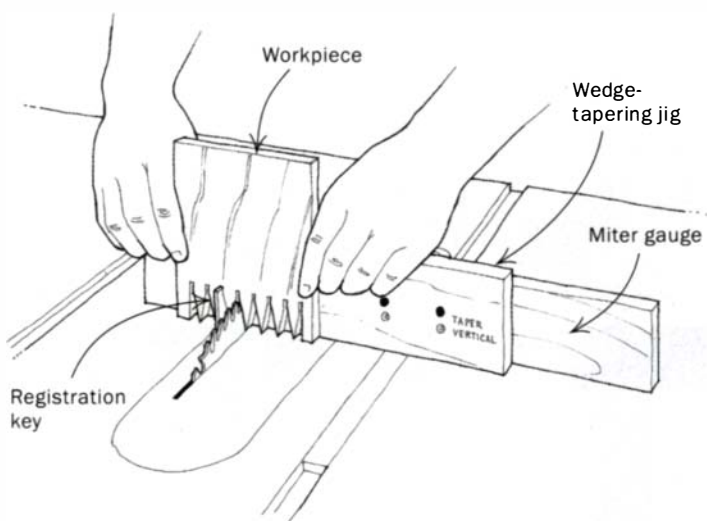
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Methods of Work (continued)



registration key. Carefully measure over from the key $\frac{3}{16}$ in. (the thickness of the fat end of the wedge) and cut another $1\frac{1}{4}$ -in.-deep slot (which I call the kerf slot), leaving a $\frac{3}{16}$ -in.-wide finger. Tilt the sawblade to 5° , lower it to 1 in. and carefully nibble away the edge of the kerf slot until you have beveled it just up to the 1-in. line you scribed earlier.

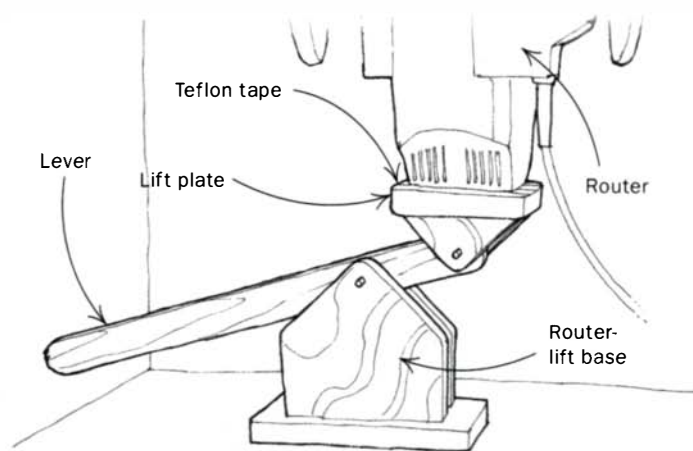
Drill two sets of countersunk mounting holes into the face of the jig. With these holes you will mount the jig to the wooden fence of your miter gauge at two slightly different settings. The first set of mounting holes should center the kerf slot over the vertical blade. The second set of holes should move the jig over so that the beveled edge of the kerf slot touches the blade tilted at the 5° angle. Clearly mark the mounting holes on the jig to avoid confusion when you're using it.

To use the jig, select a piece of wood for the wedge blank and then thickness it to match the desired width of your tenons. Mount the jig to your miter gauge and follow the three-step sequence shown in the drawings to cut the wedges. When you're done, cut the wedge portion from the workpiece, leaving a $\frac{1}{8}$ -in. spine to keep the wedges connected. When you need a wedge, just snap it off the comb.

—Richard Brening, Bellevue, Wash.

Shopmade router lift

I couldn't justify the expense of one of those fancy commercial router lifts. But I needed to do something to keep my sanity when trying to adjust my plunge router. So I created my own lift using

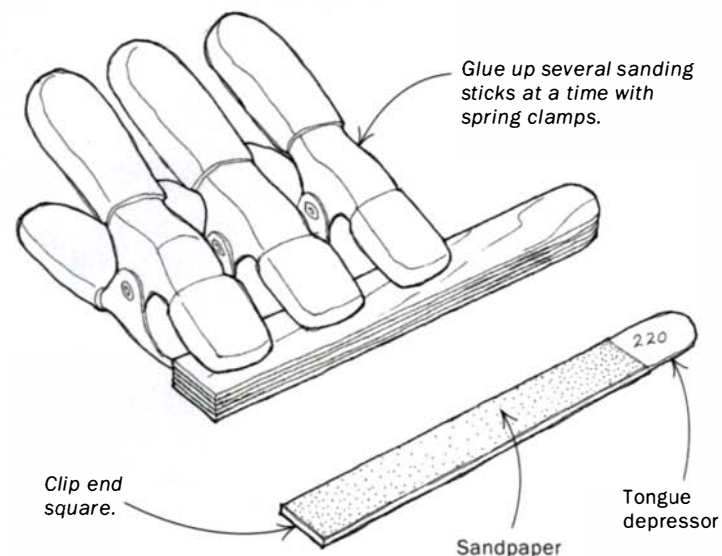


odds and ends from the scrap pile. The lift consists of a base, a lever and a lift plate. With different brands of routers the dimensions and pivot points will differ. In my case I did a mock-up with cardboard and push pins to get the right shape. On the actual lift plate, I added Teflon tape to reduce friction and wear.

To use this setup, I push up on the lever with one hand and make adjustments with the other. After the router has been locked into position, I drop the lift to the down position so that it won't obstruct the cooling vents on the router.

—Dan Durst, Jacksonville, Ore.

Shop uses for tongue depressors



The wood tongue depressor that is a staple in doctors' offices can also be a staple in woodworking shops. There are dozens of uses for these wood blades. For example, if you nip off the rounded end at an angle with tin snips, you have a great pointed stir stick for small cans of varnish or stain. You also can mix epoxy, spread glue and patch holes with one. As a replacement for a metal putty knife, the depressor is less likely to mar the wood and requires no cleaning up. The blades are a consistent $\frac{1}{8}$ in. thick and make handy, accurate shims. They also work great to keep a clamp head from marring the surface of a project.

But more than anything else, I use tongue depressors as sanding

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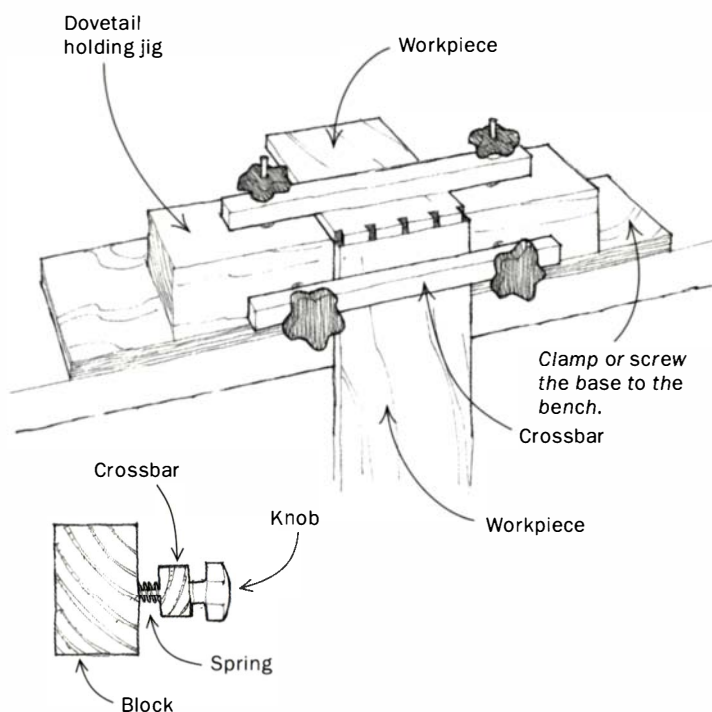
Methods of Work (continued)

sticks. I square off the rounded end and then glue strips of sandpaper to each side, as shown in the drawing on p. 22. I make several sticks at a time by stacking up several layers, adding blank sticks for pressure on the outside, and then clamping the bunch together with three small spring clamps. Finally, I mark each stick with the grade of sandpaper used. These sanding sticks work great for getting into tight spaces where any two or three surfaces meet.

You can buy a box of 500 birch depressors, 6 in. long, from just about any pharmacy for a little more than a penny per stick.

—Grant E. Steffen, Denver, Colo.

Holding workpieces for dovetailing



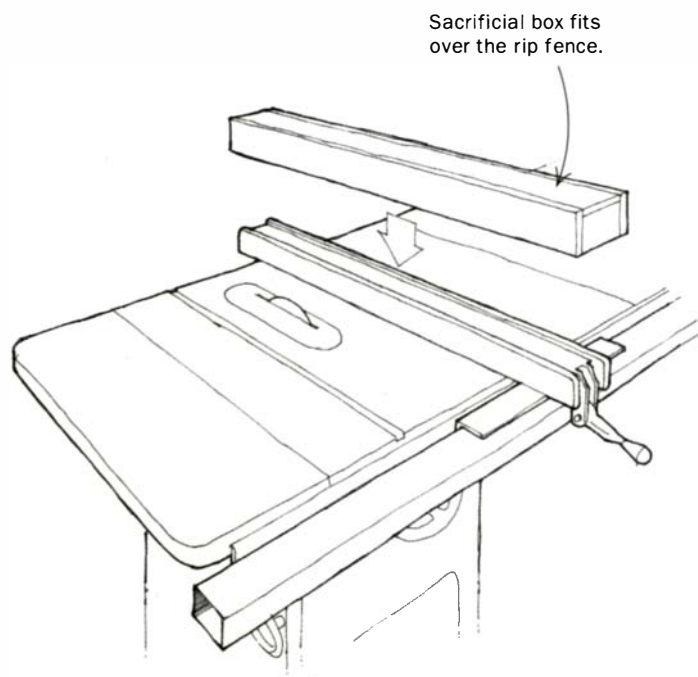
One of my most rewarding woodworking activities is to hand-cut dovetails. After years of jury-rigged setups, I finally learned to appreciate the value of a reliable method of securing the two dovetail workpieces end to end. So I made the jig shown above from a block of wood, four knobs and a handful of other hardware. I use the jig not only to hold two dovetail workpieces in registration for scribing but also to act as a hold-down vise for chopping out the waste between tails and pins.

To make the jig, start with a block that is sized to your needs. I used a 4x4 post ripped down to 2x3. Cut the crossbars from 3/4-in.-thick hardwood and drill holes through the crossbars and into the block for attaching the bolts and knobs. Several pairs of holes will accommodate workpieces of different widths. Finally, screw the block to a plywood base that can be clamped or screwed to your workbench.

—David F. Moyer, Quakertown, Pa.

Sacrificial rip-fence cover

Make a box to fit over your table saw's rip fence. It must be a snug slip fit in both width and length. Use melamine pieces on the outside, and you'll have an almost friction-free fence you can saw or dado into without damaging your regular rip fence. The cover is



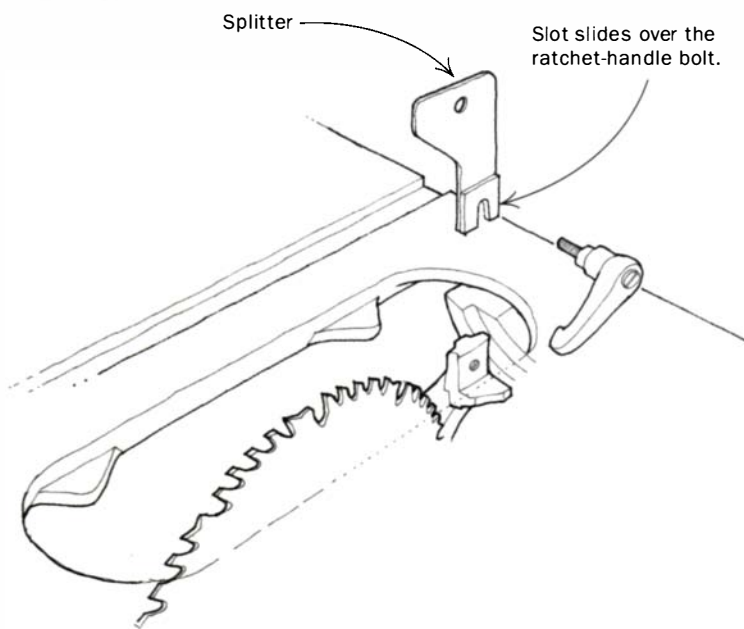
very easy to take on and off, and mine has lasted longer than I thought it would.

—Blaise Gaston, Earlysville, Va.

Quick tip: The chuck key for my drill press was always either lost or in my way. So I placed the key on a large speaker magnet on the front of the drill press. When I need it, it's right in front of my face.

—Robert Koehler, Bohemia, N.Y.

Correction



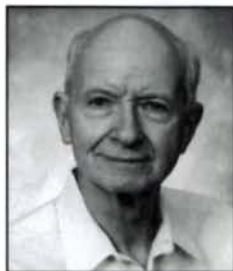
In a recent *Methods of Work* (FWW #157, p. 18), by Bud Ruby, we showed his splitter with a hole for the ratchet handle drilled through it at the bottom. That hole should have been a slot, which would make it easier to install and remove the splitter.



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Also available: 14"x40T x 1" • 14"x30T x 1" • 12"x30T x 1" • 16"x40T • 9"x40T • 16"x30T • 9"x30T • 8"x30T (3/32" K) • 6"x40T (3/32" K). Call for prices.

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NOVEMBER/DECEMBER 2002 27

Notes & Comment

Period masterpiece on a different scale

When Julian Biggers saw Lonnie Bird's 18th-century Pennsylvania secretary on the cover of *FWW* #154, he knew he had to build it. But what the retired psychology professor had in mind was a bit different from the original.

Biggers, whose hobby is making miniature furniture, built a 1/2th-scale replica of the secretary, which he sold recently for \$600. His 6 1/2-in.-tall version, made of mahogany and basswood, features working doors, drawers and hardware, with tiny brass butt hinges and pulls.

Biggers began the project by shrinking the foldout plans to the proper scale—1 ft. equals 1 in. Then it took him a couple of weeks to build the miniature using his array of specialized power tools.

The most challenging parts were the gallery and the incorporation of the false prospect box and document drawers. "Working with materials that

are 1/2 in. and 1/4 in. thick can be very difficult and rather tedious," he said.

The retired Texas Tech University professor has been an avid wooden-model maker since childhood. His family name notwithstanding, Biggers became interested in tiny furniture 20 years ago after seeing Queen Mary's dollhouse at Windsor Castle. Later he joined the International Guild of Miniature Artisans, of which he is now a fellow. For more information about the guild, go to www.igma.org.

—*Christopher Xavier Baumann,*
editorial assistant



Scaled-down secretary.
Julian Biggers built this 6 1/2-in.-tall replica of the Pennsylvania secretary featured on the cover of *FWW* #154.

Wood webs

www.fpl.fs.fed.us

Bookmark the U.S. Forest Products Laboratory (FPL) web site. You will return there more than once to download one of the hundreds of articles on wood technology and uses, with topics ranging from the characteristics of various species to sawing, drying, bending, gluing and finishing. There also is an excellent series on deck construction. All publications are free. Established in 1910 by the U.S. Department of Agriculture Forest Service, the Forest Products Laboratory in Madison, Wis., conducts research on wood use.

www.arne-jacobsen.com

This site was launched as part of the centennial celebration of the life and work of Arne Jacobsen, the Danish designer and architect (1902-1971). Jacobsen is partly responsible for the wave of Scandinavian design and architecture that swept through Europe and North America in the 1950s and is still in evidence today. Aside from his architectural, hardware, silverware and textile designs, Jacobsen is famous for a number of seminal chairs, including The Egg (1958) and The Swan (1958), and a series of stackable chairs with formed plywood tops and steel legs. The web site is top-notch. The most worthwhile feature is a slide show on his professional life. Anyone interested in holistic design—where gardens, architecture, furniture and even hardware spring from a single vision—will be inspired and entertained by this multimedia journey.

—*Asa Christiana, senior editor*



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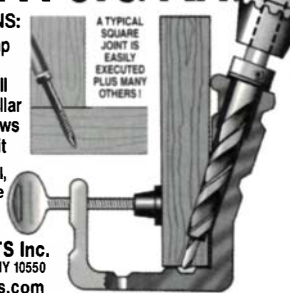
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—Henry David Thoreau

Thoreau was not alone in his desire for quality of life. In the late 1940s in Greenville, S.C., two librarians were moved to create a broad margin in their lives. Charlecy and Gabrielle Austin, sisters of Victorian upbringing and graduates of finishing school, asked Frank Lloyd Wright to design them a house based on Thoreau's principle.

He said no. He was too busy.

But the tenacious Austin sisters stayed after Wright for two years, eventually traveling to Spring Green, Wis., and surprising him in his garden. Finally he relented, and he designed Broad Margin, a masterpiece of innovative architecture nestled among the trees of Greenville.

Perhaps the most striking element of the house is what is does not have. There is not a single stud wall anywhere in the house. There is no plaster, no drywall.

Every wall is solid tidewater cypress. And there are no nails; the house is held together entirely by brass screws.

All of the original furniture in Broad Margin was designed with the house and built in a makeshift shop inside. The original chairs were made of 7/8-in.-thick cypress using only a tablesaw and chisels, with simple dadoes and finish nails as joinery.

When Rick Bristol bought the house in 1997, some of the original furniture had been sold or changed, and he decided to have the pieces re-created. He contacted Greenville furniture maker Michael McDunn. Most of the original plans had been destroyed so that the house and furnishings could never be copied, but Bristol had a single set that had been secreted away by the builders. McDunn, while matching the original design, decided to build the new chairs more in the manner of furniture, making them more durable by replacing the finish nails with through-tenons.

—Kevin McDunn, with help from Roy Palmer, a former owner of Broad Margin

Greenville furniture maker Michael McDunn reproduced the chairs. McDunn worked from a set of original drawings to replicate chairs that had disappeared from Frank Lloyd Wright's Broad Margin.



"Top" turners gather at national symposium



Low-tech top-making from Japan. Using a simple electric motor, shopmade tools and a rudimentary tool rest, Masaaki Hiroi turned a variety of colorful tops, some extremely tiny.

The theme of the American Association of Woodturners 2002 National Symposium, held June 28-30 in Providence, R.I., was spinning tops, and a large selection was on display. Also, turners donated more than 500 tops to be used in physical therapy and play by developmentally challenged children. But the stars of the show were top-turners from Germany and Japan.

Masaaki Hiroi is a third-generation top maker who began turning at age 10. Hiroi awed American turners at the symposium with his simple homemade tools and even simpler lathe: a common reversible electric motor with a friction chuck and foot-pedal switch. The tool rest was an elegant wood device that slid around the benchtop. He showed his mastery by making tops of all descriptions, some so small they were nearly lost in the shavings. So much for the idea that we all need better and more expensive lathes.

More than 800 pieces were displayed in the always-popular Instant Gallery. All attendees were invited to bring examples of their work to be put on display and critiqued by a few well-known turners.

Next year's symposium will be in Pasadena, June 27-29. Call (651) 484-9094 or visit www.woodturner.org.

—Andy Barnum

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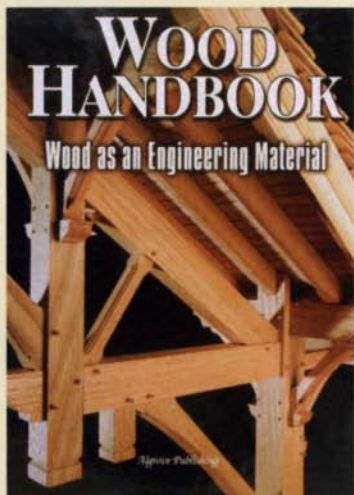
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Book review



Wood Handbook: Wood as an Engineering Material. *Algrove Publishing, Ottawa, Ont., Canada; 2002. Distributed by Lee Valley Tools, \$19.95 hardcover; 464 pp.*

The *Wood Handbook* is the principal publication of the USDA's Forest Products Laboratory, which is the research arm of the Forest Service. This large volume is the latest update of a handbook first published in 1935. Actually, the 2002 version is a reprint of the 1999 version,

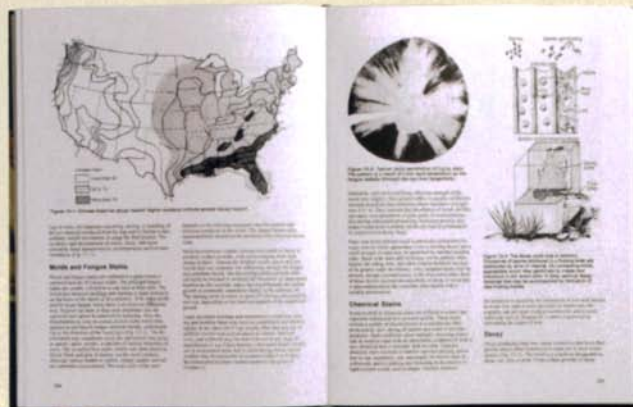
with only the page numbering changed to an easier-to-use system.

In a short forward to the book, Leonard Lee writes, "The *Wood Handbook* is one of the best-kept secrets in woodworking literature." This is undoubtedly true. In fact, the Forest Products Lab itself is also an underutilized resource. The lab (608-231-9200; www.fpl.fs.fed.us) will field almost any question on wood technology at no charge and publishes a host of free, downloadable booklets (see Wood webs on p. 28). The handbook itself can be downloaded for free, chapter by chapter.

The 2002 version of the handbook represents the culmination of 90 years of engineering and research on wood and wood products with a focus on real-world problems and practices. Woodworkers will find invaluable information here, organized in chapters on the anatomy of trees, the structure of wood, the effects of moisture, common lumber-grading practices and terms, adhesive bonding of wood, bending (plasticizing) and fin-

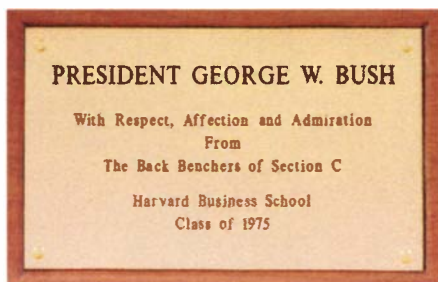
ishing. Newly added chapters are devoted to the latest plywood products and composite materials, such as medium-density fiberboard (MDF). Woodworkers will also find chapters on the various uses of wood—in timber-frame, pole and log buildings and other structures.

The *Wood Handbook* presents a comprehensive and authoritative look at wood technology and, along with R. Bruce Hoadley's seminal *Understanding Wood*, forms the foundation of a solid woodworking library. Like Hoadley's book, this is a resource that will be tapped throughout a career. —A.C.



Vital statistics. The comprehensive *Wood Handbook* represents almost a century of research on a host of topics, including this section on wood decay.

A bench from George W.'s bench mates



In March 2001, Greg Bard, an antiques restorer and furniture maker in Fredericksburg, Texas, got an uncommon commission from a local retail furniture store: to build a bench for President George W.

Bush. The piece was to be a gift from Bush's fellow "back benchers" at the Harvard Business School, class of 1975. There were some design guidelines with the commission: mesquite wood, simple lines and the placement of a commemorative plaque. Also, Bard received the overall dimensions. In May 2002, Bard was pleased to read an Associated Press article reporting that the Bush family had chosen the bench as one of the presidential gifts they wanted to declare and keep.

—A.C.



For a Texan, by a Texan. This mesquite bench, made by Greg Bard of Fredericksburg, Texas, was commissioned by George W. Bush's classmates from the Harvard Business School as a gift for the president.

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Tools & Materials

Innovative 3¼-hp plunge router from Down Under

A new 15-amp, 3¼-hp, variable-speed (8,000 to 21,000 rpm), soft-start plunge router from Triton Manufacturing and Design of Australia has a number of unique and useful features.

For starters, the depth of cut is easily set by turning a knob on the right side of the router. Fine adjustments are made by turning a small knob at the top of the router. A plunge-lock lever is conveniently located on the motor housing.

A lock on the outside center of the right knob serves to disengage both the rack-and-pinion mechanism and the fine adjuster. When disengaged, the machine operates like a typical plunge router. A standard turret-type stop allows successively deeper cuts.

The on/off control is a robust rocker-type switch with a pilot light that lets you know when the machine is plugged in. The switch is protected from accidental starts by a clear plastic shutter. To start the router you must slide open the shutter and depress the rocker switch, which can be done with the left thumb while still maintaining a firm grip on the handle.

The Triton makes bit changes remarkably simple. When the router is lowered all the way, the collet ex-



Standout features. The depth of cut is set by turning the knob on the side of the router (above). Fine adjustments are made with a small knob on top of the router. Also, because the collet extends through the opening in the subbase (top right), bit changes are remarkably simple, requiring only one wrench. When the shaft is extended, a switch lock prevents the router from accidentally starting. A metal subbase (included) attaches quickly and can be used with a fence (bottom right) or as a circle cutter.

tends through the opening in the plastic subbase. At this extended position, the shaft automatically locks the spindle, which means the collet requires only a single wrench. Additionally, the shutter over the switch is locked closed, preventing the router from accidentally starting.

All of these features make the Triton router useful in a table. Height adjustments and bit changes are easy. But the feature that makes the Triton especially suitable for a router table is that the return spring—always a nuisance in router-table setups—can be removed simply by loosening a safety screw and twisting a black plastic cap located over the right guidepost.

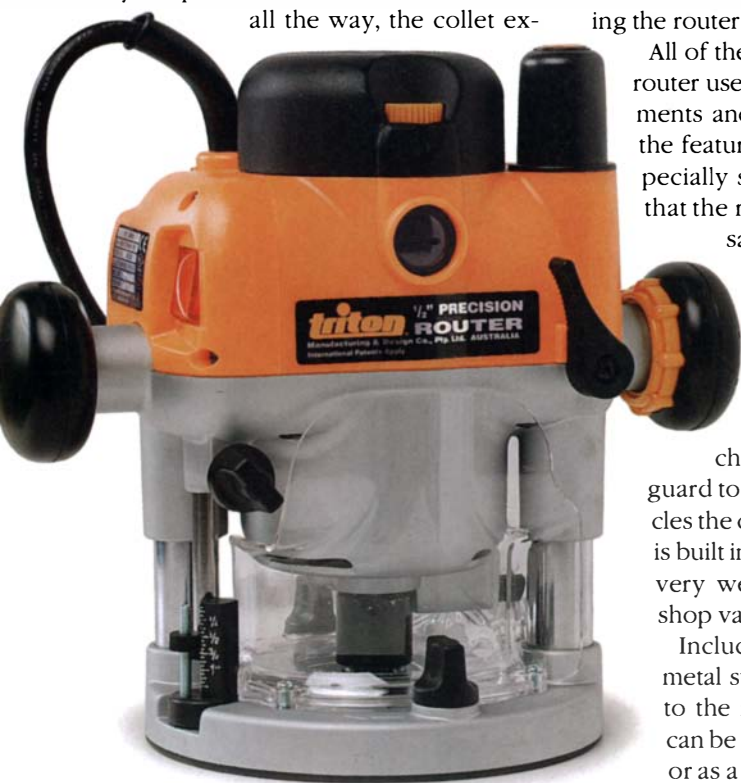
Through-the-base bit changes allow the plastic guard to be installed so that it encircles the cutter. A dust-extraction port is built into the guard, which worked very well when connected to my shop vacuum.

Included with the machine is a metal subbase that quickly attaches to the router's base. The subbase can be used with a fence (included) or as a circle cutter.



The collet runout on this machine measured 0.003 in. That compares with an average of just under 0.003 in. when *Fine Woodworking* tested nine 2-hp plunge routers in the May/June 2001 issue (*FWW* #149, pp. 46-53). Tested for noise levels, the Triton measured 98 decibels (db) compared with an average of 95 db. When it came to vibration, the Triton earned a rating of excellent.

Overall, the Triton router exhibited good workmanship and robust construction. In short, I like it a lot, even at the upscale price of about \$330. For more information, contact Triton (888-874-8661; www.tritonwoodworking.com). —Ernie Conover



A mask-free dust mask

Life in a woodworking shop is a constant battle against wood dust. I've tried an assortment of weapons, including air helmets, respirators, paper masks and, occasionally, a wet handkerchief. But all of these weapons have some drawbacks. So I was intrigued by a novel respirator device called the Resp-O-Rator. To suggest it has an unconventional design is an understatement. At first glance, you might think it's a new type of snorkel. Yet, after giving the Resp-O-Rator a good tryout in my shop, any skepticism I might have had soon disappeared.

The device, made by Duxterity, consists of a snorkel-type mouthpiece that connects via check valves to a pair of clear plastic tubes. The tubes extend over the user's shoulders to a plastic crosspiece that holds two respirator-type paper filters that can trap particles as small as 0.3 micron.

To prevent breathing dust through the nose, the Resp-O-Rator includes a small clip, which is tethered to the device and simply pinches the schnozz. For safety's sake, the end of the tether quickly breaks away should it somehow get tangled in a machine.

The Resp-O-Rator has several features I like: It's extremely light; it won't cause your safety glasses to fog; it works whether you're bearded or beardless. And when the device isn't needed, simply remove it from your mouth, and the Resp-O-Rator balances comfortably on your shoulders.

The only drawback is that it also has to be removed from your mouth when you want to talk. And when you're talking, you're breathing in dust.

The Resp-O-Rator has not yet been approved by the National Institute for Occupational Safety and Health (NIOSH). The big



Flippers not included. The Resp-O-Rator, odd looks and all, has some advantages over traditional dust masks.

hang-up seems to be that because the device is unique, NIOSH doesn't have a standards category that applies, so a new one has to be written. That process is under way, but it's going to take time before any hoped-for approval comes along. In the meantime, the Resp-O-Rator can be sold only as a nuisance dust-filtering device.

The Resp-O-Rator costs about \$50. For more information, contact Duxterity (440-237-6116; www.duxterity.com).

—E.C.

Butt chisels from Crown Tools



Compact chisels add control. With short blades and small handles, butt chisels are perfect for working in close quarters.

When I started buying hand tools, one of my luckiest finds was a set of butt chisels. Although they're not top-quality tools, they have served me well for a good many years. Their short length makes them easy to handle, allowing for lots of control when paring or chopping. The tools are so useful that I'm always on the lookout for a higher-quality set.

That's why a set of rosewood-handle butt chisels made by Crown Tools of Sheffield, England, caught my eye. Although generally smaller than most butt chisels, they're heftier, with stout shanks and thick blades.

While tuning them up, I found I could flatten the backs of the blades without difficulty. And later, when the chisels were put to work, the steel proved to be surprisingly good—so good, in fact, that they take and hold an edge better than the steel in my vintage Marples cabinetmaker's chisels.

The handles are quite small, which makes these chisels handy for getting into tight spaces. But when I hold the chisels for paring, my hands tend to swallow the handles.

The Crown Tools butt chisels are available from Garrett Wade in seven sizes ($\frac{1}{4}$ in. to 1 in.), priced between \$15 and \$17 each. For more information, contact Garrett Wade (800-221-2942; www.garrettwade.com).

—William Tandy Young

A better support stand



A stand-up stand. New from Ridgid, this stand is sturdy, stable and easy to store, with a flat, smooth pivoting top (inset).

Ridgid Tool Co. has released a new support stand, called the Flip Top Stand, that is an improvement over other stands.

Instead of using a roller to support a board, the Flip Top Stand uses a large (7-in.-wide by 21-in.-long), smooth, flat top, which makes good sense. A roller can be a nuisance, especially when used to support a board during a ripping cut on the table saw. Unless placed exactly perpendicular to the rip fence, a roller often tends to steer the board off line.

Also, the top can be positioned at a slight downward angle to help catch any on-coming drooping boards. It pivots to the horizontal position as the board slides on the stand. And when the pivoting feature isn't needed, the top can be locked in the horizontal position.

The frame of the stand is tubular steel. Extrawide feet spaced well apart provide excellent stability, a feature often lacking on other support stands. The feet are rubber tipped to help keep them from sliding.

You can adjust the top to sit anywhere from 27 in. to 45 in. above the floor. The support column locks securely in place. And when not in use, the stand folds into a compact, flat package.

The Flip Top Stand arrived in my shop just in time: I was alone and faced with cutting several 4x8 sheets of $\frac{3}{4}$ -in.-thick plywood. I also had to rip and joint some long ash boards. Throughout the ripping and jointing processes, the stand performed well. The stock slid easily across the top, helped, no doubt, by its slick, plastic surface. I judged the drag to be about equal to that of my roller stand.

The Flip Top Stand is a solid performer. It sells for about \$30 at The Home Depot. For more information, contact Ridgid Tool Co. (800-474-3443; www.ridgidwoodworking.com).

—Dennis Preston

Router-collet extension

When a router is mounted in a table, the collet of the router often ends up positioned well below the surface of the table, even after the motor has been raised to its maximum height. That means some bits are not able to reach far enough above the table to provide the full depth of cut.

Recently, MLCS began selling a router-collet extension that remedies the problem. Also, as I quickly discovered, the extension makes bit-changing a lot easier because the extension, which adds $2\frac{1}{4}$ in. in length, allows the collet to be raised well above the table. With the collet exposed, it becomes relatively easy to work a pair of wrenches and change a bit.

Although solidly made, the extension unavoidably adds additional runout and flex to the bit when it's under load.

Overall, though, the extension worked fine when I used it to make light cuts with small to average-size bits. If you use the router table a lot and regularly struggle to install bits, the router extender might be worth a closer look.

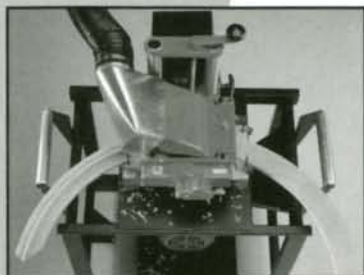
The extension sells for \$25. For more information, contact MLCS (800-533-9298; www.mlcswoodworking.com).

—John White



Collet stretcher. The router-collet extension from MLCS adds about $2\frac{1}{4}$ in. to the length of a router collet, a handy feature in the router table for above-the-table bit changes.

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READER SERVICE NO. 93

Inkra Miter5000 is a well-designed tablesaw accessory

The Miter5000, made by Incra, combines the accuracy of the Miter1000 miter gauge with the advantages of a tablesaw sliding table. And while it can't offer the generous cutting capacity of the dedicated sliding tables found on some big, expensive tablesaws, the 5000 proved to be a worthwhile addition to my Delta Unisaw.

A 36-in.-long fence provided good support for long boards, and it includes a unique stop system that was easy to employ.



When making angled cuts, the 5000 offered remarkable accuracy. The protractor head swings through a complete 180° arc, which is handy for making either right- or left-hand miters. When you're finished using the jig for crosscutting or mitering, and you need to do some ripping, the 5000 simply slides off the saw.

The protractor head may be set in increments as small as one-half of a degree. Easy-to-operate thumbscrews and locking handles keep everything securely locked in position.

The 5000 does have a downside, though. Because it sits on top of the sawtable, the jig reduced the thickness-cutting capacity of my saw by ½ in.

By the way, Incra includes all of the parts needed to use the indexing head as a stand-alone miter gauge, also known as the Miter3000. If you already have the 3000, you can buy a kit that converts it to a 5000 for about \$170.

The Miter5000 sells for about \$320. For more information, contact Incra (972-242-9975; www.incra.com). —Roland Johnson

Ernie Conover is a woodworker, writer and teacher in Parkman, Ohio; William Tandy Young is a furniture maker in Stow, Mass.; Dennis Preston is an engineer and former Fine Woodworking editor living in Brookfield, Conn.; John White manages the Fine Woodworking workshop; Roland Johnson works wood in Sauk Rapids, Minn.

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Soup Up Your 14-in. Bandsaw

For resawing, these upgrades will greatly improve performance

BY JOHN WHITE

The classic 14-in. cast-iron bandsaw, developed by Delta Machinery back in the 1930s, was designed mostly for making curved pattern cuts in relatively thin boards. Delta still makes that saw here in the United States. Over the years, it has changed little. Along the way, it even served as a model for several of the Asian-made clones currently sold in the United States, including a couple now marketed by Delta.

Nowadays, though, it seems more wood-

workers are looking to push the limits of 14-in. cast-iron bandsaws by using them to resaw wide boards. And many are finding out that it's not always easy to do. The feed rate is annoyingly slow, the motor often bogs down, the blade can drift off line, and the cuts sometimes end up far from square.

But don't trade in the saw yet. I've found that by making some relatively minor modifications, a typical ¾-hp to 1-hp, 14-in. cast-iron bandsaw can be transformed into an effective resawing machine. Indeed, my

upgraded machine resaws 12-in.-wide maple boards with little effort.

The basic upgrade

The basic upgrade adds a riser block to increase the resaw capacity, a resaw blade, a heavier tension spring and a tall fence. This upgrade will enable you to start resawing stock as wide as 12 in.

Riser block doubles the capacity—Most manufacturers of 14-in. cast-iron bandsaws

A RISER BLOCK INCREASES CUTTING CAPACITY



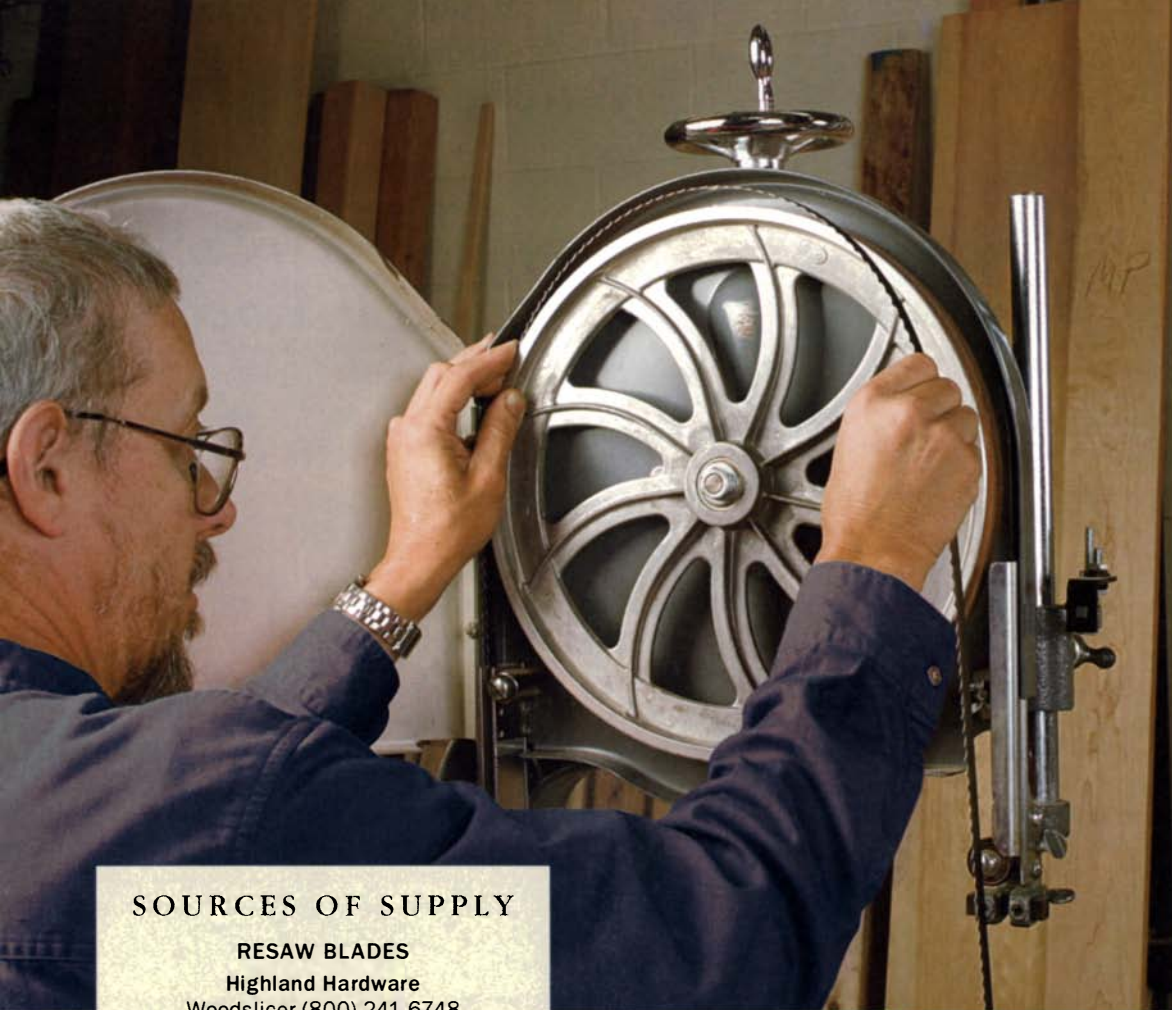
The riser block mounts between the upper and lower frames of the saw. Two pins help position the block on the frame. All three parts are held together with a heavy-duty bolt, washer and nut.

Most 14-in. cast-iron bandsaws can be outfitted with a riser-block kit that's available as an option. Adding a riser block increases the resaw capacity of the machine from about 6 in. to 12 in. With this increased capacity, though, you'll also need longer blades.



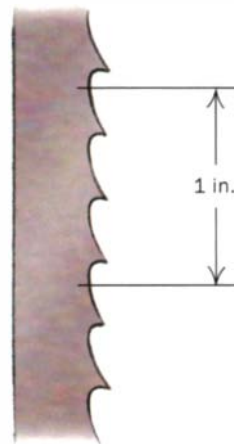
Attach the replacement blade guards and the guidepost. The riser-block kit includes longer blade guards for both the back and front of the saw, and a longer guidepost.





THE RIGHT BLADE FOR RESAWING

Resawing can be next to impossible with the wrong blade. To haul away all of the sawdust created while resawing, you need a blade with big gullets, which means fewer teeth per inch. Also, hook teeth are generally better for resawing.



For resawing, White uses a ½-in.-wide, 3 tpi, hook-tooth, carbon-steel blade.

SOURCES OF SUPPLY

RESAW BLADES

Highland Hardware
Woodslicer (800) 241-6748

Suffolk Machinery
Timberwolf (800) 234-7297

Woodworker's Supply
Carbon steel, hook-tooth, 3 tpi
(800) 645-9292

HEAVY-DUTY TENSION SPRING

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offer a riser-block kit as an optional accessory that increases the resaw capacity from roughly 6 in. to about 12 in. The kit also includes a longer guidepost and a pair of longer blade guards. The block is bolted between the upper and lower frames. All of the kits include extralong bolts to account for the added length.

A good resaw blade is a must—Perhaps more than anything else, a good-quality resaw blade can go a long way toward improving the resawing capabilities of a bandsaw. Resaw blades have large gullets that carry away the considerable sawdust that's generated when cutting through wide boards. Avoid blades with small gullets and lots of teeth because they aren't designed to cut wide stock.



Replace a worn-out spring. If your cut wanders, chances are that the spring is not providing enough tension to the blade.

In general, a ½-in.-wide hook-tooth blade (2 tpi or 3 tpi) will work fine. I've also had good experience with both the Timberwolf and Woodslicer blades.

Beefier spring adds more tension—To provide the best possible cut, a bandsaw blade must be tensioned properly (see FWW #147, pp. 80-83). A blade lacking ad-

equated tension is more likely to wander from the cut or produce a bowed cut when resawing.

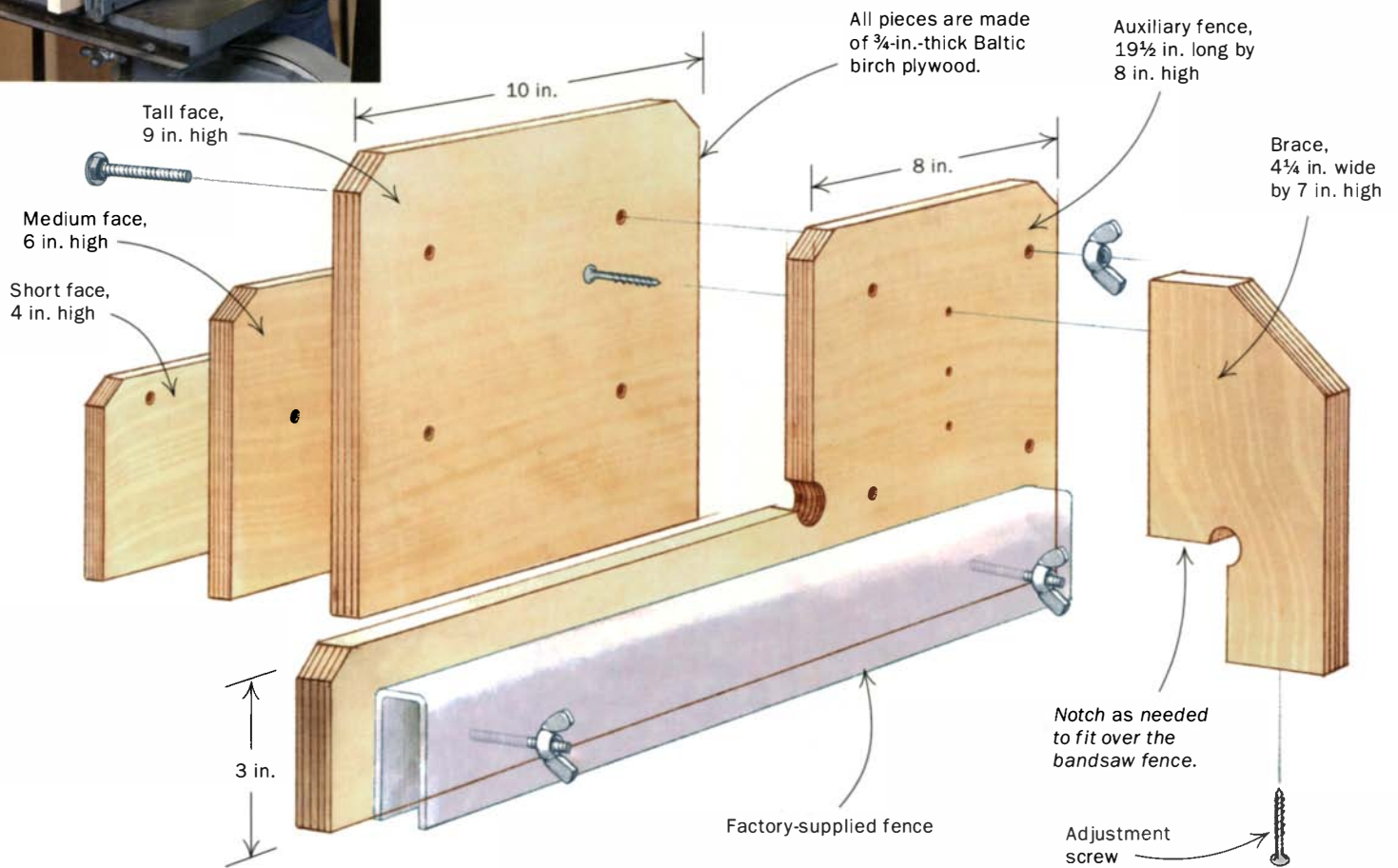
The source of the blade tension is a compressed spring behind the upper wheel. It's not uncommon for this spring to lack some vitality. When that's the case, the spring can't apply enough tension.

The solution is to replace the original spring with one that has more muscle (see the photo at left). But first check with the supplier to make sure your saw can handle the additional load; otherwise, you might end up with a burned tension mechanism or prematurely worn bearings.

Add an auxiliary fence—I also made a tall auxiliary fence to support a board during resawing (see the drawing and photos on the facing page). The fence is short in length but sturdy enough that it remains square to the table when pressure is applied. In addition, it is easy to adjust the fence angle to eliminate blade drift—the propensity for a bandsaw blade to wander from a straight line during a cut. One thing to note: If the factory-supplied fence on your bandsaw is of little value, you'll need

A VERSATILE AUXILIARY FENCE

While being resawn, wide stock has a tendency to tip unless it's supported by a tall fence. Also, the fence has to be square to the table of the bandsaw. White's fence, with three interchangeable faces, offers plenty of support. And it can be tweaked to end up perfectly square to the table. Plus, as shown at left, it's easily adjustable to correct for blade drift simply by adding a spacer between the original and auxiliary fences.



to get a better fence before you can add this resaw fence.

My auxiliary fence extends to just past the trailing edge of the blade. There's a reason for this short length. Thick stock often has a fair amount of tension in the wood, even when carefully dried. When you're resawing, the tension in the wood is released, sometimes causing the offcut to bend or twist into the fence, which means you'll have to push pretty hard to keep the board against the fence. By using a fence that is short in length—much like that on a European-style tablesaw—you can keep the uncut portion of the board firmly against the fence while the offcut is free to bend or twist into the open air.

The fence I installed has two main components: a back piece with a brace that bolts to the original fence and a set of interchangeable faces, each one of a differ-

ent height. The idea here is to use a face that is narrower than the board to be resawn but wide enough to support the board adequately during the cut. That way, both for safety and maximum blade support, the blade guard along with the upper blade guide can be lowered close to the top edge of the board.

With this fence, it's easy to adjust for blade drift by adding spacers between the original fence and the auxiliary fence, changing the angle of the fence relative to the blade. (For more on testing and adjusting for blade drift, see *FWW* #157, p. 52.) Dowels or small hardwood blocks work fine as spacers. On some blades, the drift can be considerable. One blade I use needs a 3/4-in.-thick spacer before it cuts straight.

For accurate cuts, the auxiliary fence should be square to the table. Sometimes, however, a factory-supplied fence won't



The face of the fence extends just past the sawblade teeth. That way, should the cutoff piece curl outward, it can't push the board away from the fence during the cut.

be quite as square as you'd like. To correct for this out of squareness, mount thin shims (I use strips of aluminum flashing attached with double-faced tape) to the back of the fence. The shims should be long enough to bear on any spacer that is added to correct for blade drift. Once the auxiliary fence has been squared to the table, adjust the screw on the bottom of the brace to give the fence added support.

Advanced upgrade

I recommend the advanced upgrade for a bandsaw being used exclusively for resawing. It adds infeed and outfeed supports to make it easier to support wide and long boards. Except for the ones on the Delta models, the trunnion support is going to need some beefing up (see the story at right). Also, the factory-supplied base is replaced with a shorter, shopmade base that lowers the saw table to a more comfortable resawing height.

Add the infeed and outfeed supports—

The infeed and outfeed supports are simply $\frac{3}{4}$ -in.-thick plywood panels that tip out from the top of the base. The panels are held in place by support rods made out of large turnbuckles. The rods attach to the saw by slipping around the shank of the knobs that lock the table trunnions. The turnbuckles make it easy to fine-tune the supports to the bandsaw's table height. The panels rest against stop blocks on the saw's base. Eyebolts screwed into the stop blocks help position the piece on the base. And the support rods just hook over the knobs. Removing the panels takes only a few seconds.

To enlarge the stock steel base enough to accept the infeed and outfeed supports, add a piece of plywood between the steel base and the cast-iron frame (or make a larger base like the one shown on p. 50).

To make a support rod, replace the right-hand threaded eyebolt on each turnbuckle with a longer bolt that has an eye large enough to slip around the shank of the trunnion lock-knob. Once the eyebolts have been adjusted, add nuts to lock them in place. Because one of the threads in each turnbuckle is left-handed, you'll need a left-handed nut to lock that side. I had no problem finding all of the hardware I needed at the local hardware store.

The infeed support should tilt at about a 45° angle. That way, the top end of the support can't be easily pushed and lifted by



Weak trunnion supports equal tilting table. Pushing down on the saw tables with the heel of his hand, White discovered that cast-aluminum trunnion supports were easily deflected out of square.

On the downside, adding the plate sacrifices $\frac{3}{4}$ in. of resaw capacity, but I feel the trade-off is worth it. The plate is a rectangular piece of $\frac{3}{4}$ -in.-thick birch plywood, with a notch to clear the blade path. It also has a slot to catch an eyebolt that attaches to the back edge of the table. Tightened with a wing nut, the eyebolt locks the table against the 90° stop bolt, virtually guaranteeing that the table stays square to the blade.

The plate dimensions at right should work on most 14-in. cast-iron saws. If you need to revise the dimensions, design the plate so that it ends up 2 in. wider than the trunnion support and projects $\frac{1}{2}$ in. past the back edge of the table.

To locate the holes for the two pins that stick up from the cast-iron saw frame, slide the plate down over the bolts that hold the plate in place and strike the top of the plate with a mallet. Remove the plate and use the dents left by the pins to center and drill the pin holes.

To fully support the trunnion casting, you may have to slip a washer between the plywood and the casting at the two outboard ends of the casting where the bolts that lock the trunnions come through.

To account for the thickness of the plywood, use longer bolts to hold the casting and the blade-guide assembly.

The eyebolt that holds the saw table tightly against the stop bolt slips through a hole drilled in the lip that reinforces the edge of the table. A sharp drill will easily go through the thin cast iron. I cut away a quarter of the loop in the eyebolt to make it easy to fit through the hole. A spacer on the bolt allows the wing nut to clear a flange cast into the top edge of the saw's lower frame.

Shopmade trunnion-support plate eliminates table flex

Delta's 14-in. cast-iron bandsaw has a trunnion support made from cast iron. But most 14-in. cast-iron saws have a cast-aluminum trunnion support. Aluminum castings are usually thinner than the Delta version and tend to flex easily, so anything other than a lightweight board can make the saw table tip a bit. That's not helpful when you want a square cut.

Adding a simple plywood plate to a saw with a cast-aluminum trunnion support will eliminate almost all of the table move-

ment. On the downside, adding the plate sacrifices $\frac{3}{4}$ in. of resaw capacity, but I feel the trade-off is worth it. The plate is a rectangular piece of $\frac{3}{4}$ -in.-thick birch plywood, with a notch to clear the blade path. It also has a slot to catch an eyebolt that attaches to the back edge of the table. Tightened with a wing nut, the eyebolt locks the table against the 90° stop bolt, virtually guaranteeing that the table stays square to the blade.

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INSTALLING THE SUPPORT

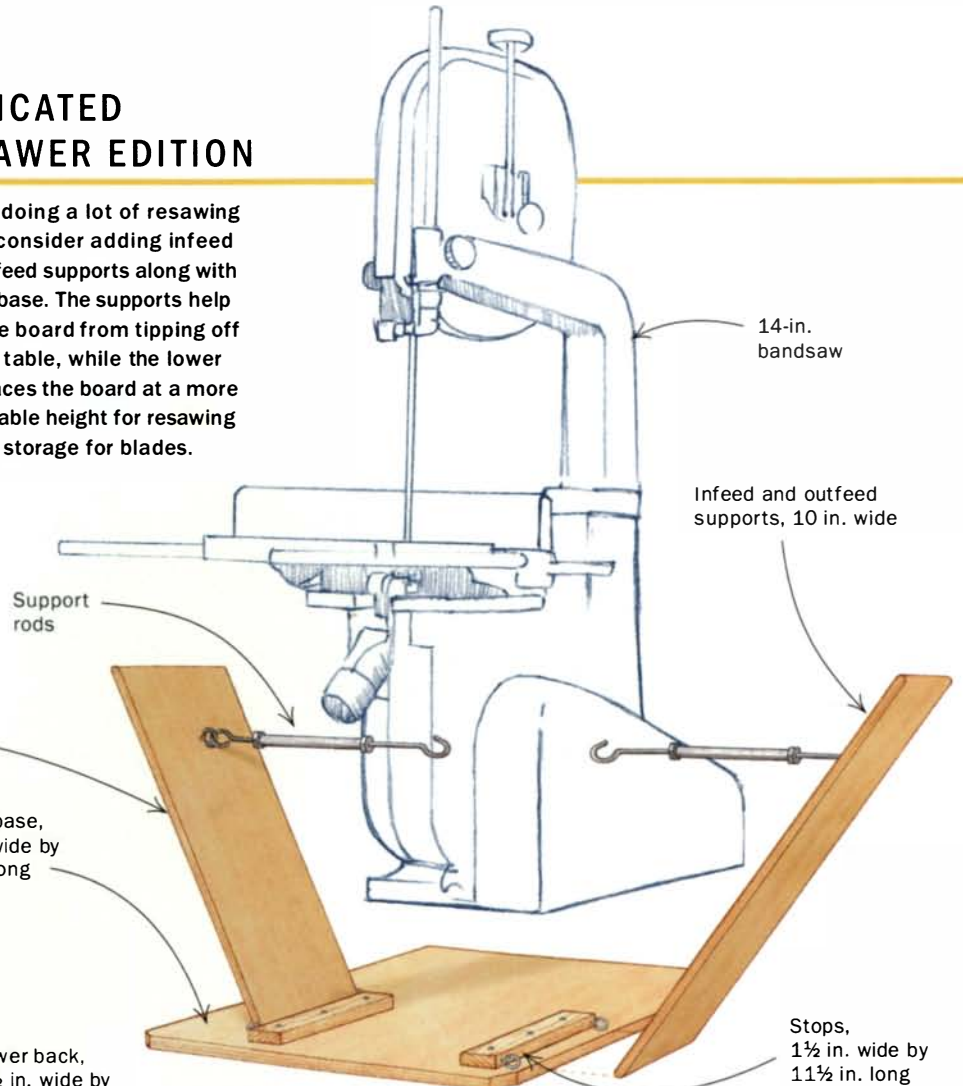


A look under the hood. Before the trunnion support can be removed, the table of the bandsaw must be removed.



DEDICATED RESAWER EDITION

Anyone doing a lot of resawing should consider adding infeed and outfeed supports along with a lower base. The supports help keep the board from tipping off the saw table, while the lower base places the board at a more comfortable height for resawing and has storage for blades.



All Baltic birch pieces are $\frac{3}{4}$ in. thick.

Dividers, $\frac{1}{4}$ in. thick by $12\frac{7}{8}$ in. wide by 11 in. high

Shelf, $2\frac{1}{2}$ in. wide by $12\frac{1}{2}$ in. long

Drawer back, $12\frac{1}{2}$ in. wide by 11 in. high

Support block, 1 in. wide by $3\frac{1}{2}$ in. long

Slots, $\frac{1}{4}$ in. wide by $\frac{1}{4}$ in. deep

Back, 19 in. long by 10 in. high

Divider, 22 in. long by 13 in. high

Sides of base, 34 in. long by 13 in. high

Bottom of base, 24 in. wide by 36 in. long

Casters, 4 in. dia.

Storage area for supports

Hardwood tracks

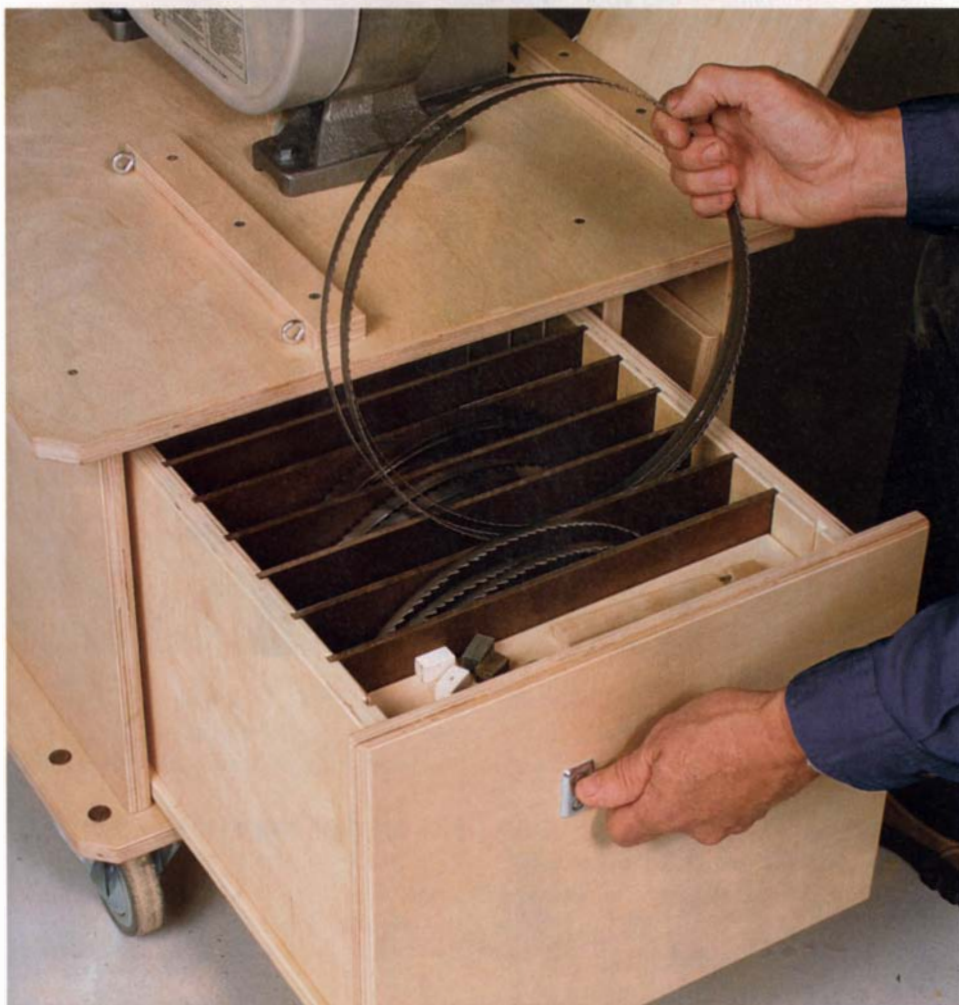
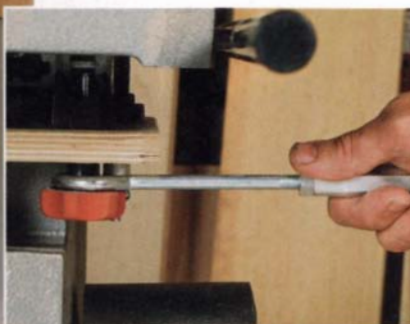
Drawer sides, $23\frac{1}{2}$ in. long by 11 in. high

Drawer bottom, $14\frac{1}{2}$ in. wide by $23\frac{1}{2}$ in. long

Drawer front, 16 in. wide by $12\frac{7}{8}$ in. high



Supports assemble in seconds. Mounting the infeed and outfeed supports is simple. One end butts against a stop, and the other hooks to the underside of the saw table.



Drawer offers storage. The single drawer can hold several coiled bandsaw blades, while the shelf in front is a handy place for small parts. The supports slide into the compartment on the right.

the board it's holding up. The outfeed support, however, should be installed at a more upright angle so that you can move the outfeed table's stop block away from the saw and clear the cover for the drive belt. The top end of the support cannot lift because, on the outfeed end, the drag of the board pulls against the support rod.

There's a simple way to determine the length of the supports. Make them longer than necessary. Hold them in position against a straightedge placed across the saw table, mark and cut. The top and bottom edges of the supports are rounded over with a $\frac{3}{8}$ -in.-radius router bit.

Make the base—For ripping and resawing, the table of a bandsaw should be close to the height of a tablesaw, not the 42-in. to 45-in. height typical of bandsaws on factory-supplied bases. A high table is fine for cutting small stock, but it's awkward for working with large boards being run against a fence. I made my new base as low as possible. The saw's table ended up just shy of 39 in. high, and now it's much easier to handle stock.

The base is a simple box made of Baltic birch plywood and assembled using butt joints and screws. A large drawer provides room for bandsaw blades and miscellaneous small parts. In addition to the drawer, a compartment on one side serves as a place to store the infeed and outfeed supports. The bolts mounting the casters thread into capped insert nuts. The 3-in.-wide gap above the back panel of the box allows access to the motor-mounting bolts.

The motor is simply bolted in place with its pulley in line with the pulley on the saw. The belt tension is adjusted by adding or removing sections from a link belt. Using a link belt eliminates the need for a sliding motor mount. On my saw I was able to reuse the original belt guard. If that's not possible on your saw, make a simple plywood box to cover the belt and pulleys.

The drawer slides on hardwood tracks attached to the bottom of the base. A single hardwood block attached to the top back edge of the drawer prevents the drawer from tipping when extended. The block is slightly oversize and mounted with two recessed screws. Then, for a smooth sliding fit, trim it to size with a block plane. □

John White is the author of Care and Repair of Shop Machines (The Taunton Press, 2002).

Installing Butt Hinges

The right hinges make a difference when it comes to looks, performance and longevity

BY GARRETT HACK

You can't beat butt hinges for durability, clean looks and straightforward installation. I'll demonstrate the most common use for this hinge: hanging an inset cabinet door. If you can install hinges in this type of flush door, you can handle any other butt-hinge application.

Woodworking catalogs offer a variety of butt hinges—some steel, others brass; some with thick extruded leaves; others pressed from thin metal. Some hinges, such as those for a jewelry-box lid, have a built-in stop. While these hinges come in a range of lengths and widths, they all have two flat leaves—usually the same size—with a barrel, or knuckle, joining them.

For fine furniture, brass hinges are always my first choice. The best of these have thick leaves that make a strong hinge. Often the leaves are tapered, so they're thicker toward the knuckle for strength where you need it. Low-cost butt hinges are made by pressing thin sheet metal around the pin to form the knuckle. Extruded hinges are



tighter than these pressed hinges because the knuckle is fitted together and then drilled in one shot for a precisely fitted hinge pin. Extruded hinges cost more and may not be available in your local hardware store, but they will keep your doors swinging smooth and true for a long time.

Steel is stronger and tougher than brass, but brass hardware usually looks better on fine furniture and ages well. I avoid steel hinges for another reason: They rust. Summer humidity or storage in a basement or

unheated space can discolor and tighten a steel hinge. For these reasons, there's a far wider selection of brass hinges than steel.

Pick the right hinge for your door

Two numbers typically describe a butt hinge: the length of the hinge (listed first) and the fully open width (second). A typical cabinet-door hinge is 2 in. by 1¼ in., with leaves 2 in. long and ⅝ in. wide. Some catalogs further classify butt hinges as narrow or wide, but what really matters is the

CHOOSING A HINGE

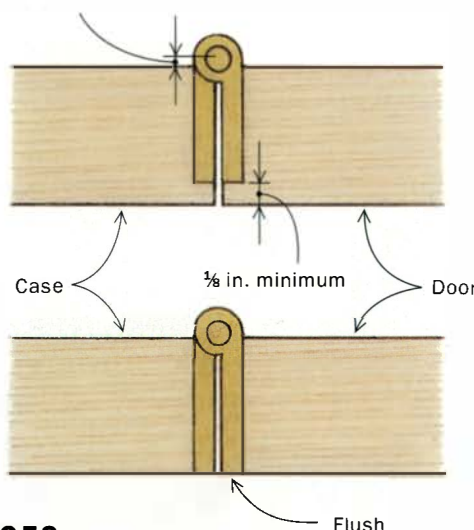
Don't compromise. Choose a high-quality extruded brass hinge (bottom) for your furniture. Cheaper stamped hinges (top) will not be flat, square or drilled accurately, and there will be slop around the hinge pin.



THE RIGHT SIZE FOR THE JOB

Choose a hinge size that leaves at least $\frac{1}{8}$ in. of wood at the back of the mortise, or this area will be too fragile. Another option is to choose a hinge that reaches all the way across the stile.

The centerline of the hinge knuckle should be about $\frac{1}{2}$ in. proud of the door and case.



The top hinge is the wrong size for this door. It would leave a fragile sliver of wood at the edge of the mortise. The bottom hinge is a more appropriate size.

WHERE TO LOCATE THE HINGES

It's pleasing to the eye if you relate the hinge locations to the rails (below left). However, this may not be possible on doors with thin rails (below right).



length and width. I prefer fixed-pin hinges over loose pins (the hinge comes apart for lifting off a door easily) because they are stronger with less play in the knuckle.

Choose and purchase hinges during the design stage of a project. You don't want to be ready to hang a door and then realize that the hinge leaf to be mortised into the door is wider than the door stile, or that it leaves just the thinnest ribbon of wood at the back of the mortise to break away someday. Knowing door and carcass dimensions, you can narrow down the possibilities of hinges that will fit. If you're unsure of the best choice, buy two sizes.

How many hinges and where?—Typically, I use two hinges on cabinet doors under 3 ft. high. For greater strength and stability (for heavy doors or for doors on which objects will be hung), I prefer to use longer, heavier hinges rather than add a third hinge in the middle of the door. With the leaves snugly mortised and screwed into place, two butt hinges will support a surprisingly heavy door. However, for passage doors and very tall cabinet doors, adding a third hinge in the middle can help hold the stile and door in alignment, keeping them from binding.

A critical aspect in the appearance and action of the door is how far the hinge knuckle sticks out from the front of the door. For the door to swing smoothly without binding, the centerline of the hinge pin need only be slightly proud of the door—about $\frac{1}{2}$ in.

Hanging a flush inset door

After choosing the right hinges for the job, the challenge is to set the hinges precisely, leaving a fine, even gap around the door and a flush surface between the door and the case.

Hanging a door neatly depends as much on building a true door and an untwisted carcass as it does on accurately mortising for the hinges. Slip the door into place and look for any misalignment. There often is some twist in the case or the door, especially if the door is large; this can be addressed in a variety of ways. You can plane the door or case slightly, and you can set one or both of the hinges farther into or out of the case to minimize the effect of the twist. Of course, the idea is to head off these problems by using solid construction

LAYING OUT THE HINGE MORTISE

Use marking gauges and a marking knife to make fine layout lines. Take all of your settings directly from the hinge for accuracy.

WIDTH



Set the first marking gauge for the width of the hinge. Set it about $\frac{1}{2}$ in. short of the center-line of the hinge knuckle. The light pencil lines at the end of the mortise indicate where to stop the marking-gauge cut.



DEPTH



Set a second marking gauge for the depth of the mortise. If the hinge leaves are tapered, set the gauge at their thickest point.



LENGTH



Again, use the hinge itself to set the length of the mortise. Holding the hinge in place, cut tick marks into the corner of the door stile. Then carry those lines across the mortise with a square.



techniques and stable material to build square cases and doors.

Mind the gap—Every door has to have a gap around all four edges (as uniform as possible) so that the door doesn't stick as it grows or shrinks during seasonal changes in humidity. A narrower gap looks better. Knowing how much of a gap to leave is a matter of experience and skill. I'm guided

by a wide board hanging in my shop whose width I measure from time to time and mark on the board. I can tell in early May that I should leave a slightly wider gap to allow for the higher humidity in the coming months. Somewhere between $\frac{1}{16}$ in. and $\frac{1}{2}$ in. is about right.

Hinges vary in one way that usually isn't indicated in catalogs. If the two leaves do not close flat on one another, you have an

unswaged hinge. This built-in space will be the gap between the door and carcass along the hinge line if you mortise both leaves fully flush. The leaves on a swaged hinge close flat to one another, so to set the door gap, mortise the leaves slightly proud of the door or frame stile, or both.

At this point trim the edges of the door for a close fit all around, leaving a tighter gap than the final one and thus some extra wood for trimming after you've set the hinges. Then shim the door into position with veneer scraps and locate the hinges.

Laying out the mortises—Before you lay out your first mortise, look over each hinge. For a neat mortising job, the leaves should have square and straight sides. Sometimes they will need a little dressing with a fine file.

To set butt hinges consistently and accurately, use a fine-bladed marking knife, a couple of marking or cutting gauges, one wide and one narrow chisel and a pencil. Set the mortise width slightly less than the width of the leaf to the center of the hinge pin, to make the hinge pin and knuckle protrude the proper amount.

Sometimes I mortise the case sides or the frame first, before they are glued up, and then transfer them to the door later. It's easier to work with case pieces loose on the benchtop than it is to wrestle with a large cabinet and to work in the cramped corners of an assembled case or face frame. The cabinet pictured here, however, is small, so I mortised the door first.

Cut very fine lines; heavy cuts will leave a less precise mortise. To see the knife marks more clearly, sharpen a pencil to a very fine point and drag it along the lines.

After scribing the width and depth with marking gauges, lay the hinge in position and cut a precise tick mark at both ends. For small cabinet hinges like these, the safest way to lay out the ends of the mortise is to extend these tick marks with a square. For larger hinges, like those used in passage doors, it's better to use the hinge itself to lay out the ends of the mortise. Just be careful the hinge doesn't slip while you are marking.

Rough out the mortise, then chop and pare to the lines

I usually cut hinge mortises completely by hand, with chisels. The first step is to chop out the waste, leaving each knife line un-

CUTTING THE HINGE MORTISE



Whether by hand or by machine, the idea here is to clear out the bulk of the mortise while staying clear of your layout lines.

TWO WAYS TO REMOVE THE WASTE

Chop it out with a chisel. Make a series of chopping cuts in one direction, then remove small chunks of wood by chopping in the other direction.



Or rout it out freehand. Set the bit depth to the thinnest part of the hinge and stay clear of the layout lines. For thin doors, you can clamp on an extra board to help support the router base.

Watch it on the web

To see the author chop a hinge mortise, go to www.finewoodworking.com.



Finish the mortise with sharp chisels. Chop and pare gradually until you reach your layout lines and get a good fit. Save your widest chisels for the final cuts.

ATTACHING THE HINGES TO THE DOOR



Mark for the center screw. Offset this location slightly toward the back of the mortise to draw the hinge tightly into place.



Drive in one steel screw. This leaves two hole locations unused to allow the hinge to be adjusted in or out later. Use a steel screw to avoid damaging your softer brass ones.

touched. Remove much of the wood with a series of aggressive chops down the length of the mortise, then do the same thing in the opposite direction. When 98% of the wood has been removed, creep up to the layout lines with a wide chisel. If you chop down into your layout lines first, the wood in front of the chisel will push it backward, leaving a wider mortise than you intended. Finally, to establish the floor of the mortise, make paring cuts inward from the open side.

For extruded hinges with tapered leaves, the mortise must be slightly deeper at the hinge knuckle. Approximate this taper when you're wasting out the mortise, and fine-tune it later when trial-fitting.

A router can be quicker—Although I finish all of my mortises by hand, I sometimes rough them out with a router, working freehand and going as close to my lines as



Transfer the hinge locations to the case. With the hinges installed temporarily in the door, shim the door into its final position and use a marking knife for a precise transfer.

I dare. Afterward, I finish up the mortise by hand as usual, paring and chopping carefully for a tight fit.

Trial-fitting is important—Trial-fit each hinge to check and adjust its mortise. To find any high spots in the mortise, I scribble on the back of the hinge with a soft pencil, which rubs off when I slide the leaf into place. Trial-fitting can damage the

fragile edges of the mortise, so the fewer times you do it, the better.

Attach the hinge temporarily and cut the other mortise

When you are satisfied with the fit of the first hinge leaf, mark for its center screw with an awl, drill and fix the leaf with a single steel screw.

Cutting the mortises on the carcass is ex-

actly the same as in the door stiles. To transfer the hinge locations from the door, slip or wedge the door into position with the hinge fully open and make fine knife lines along the top and bottom of the knuckle. A spare hinge of the same size makes it easy to test-fit the mortise and to mark the screw locations. Otherwise, you have to remove a hinge from the door.

Secure each hinge with one steel screw and see how the door swings. The advantage of leaving the door snug in its opening while fitting the hinges is that it allows for some slight mortising errors. You can adjust for these by deepening a mortise or mortises and by planing the door edges for a consistent gap all around.

There's still room for adjustment

A typical problem is that the gap along the hinge line is too large or uneven. The solution is to mortise in one or both leaves of each hinge slightly deeper.

Sometimes, to get a better-fitting door, you may need to pull out a hinge from its mortise slightly, in essence pushing the door further back into the opening. Fixing the door with only a single screw in each leaf at this point gives you some flexibility to do this, but it creates a noticeable gap at the back of the hinge leaf. Cut a filler piece from a scrap of the same wood, glue it and then clamp it in place by screwing the hinge leaf into its new position.

Set the brass screws, and you're done

The final step to fitting the hinges is setting the screws. Each hinge is drilled and countersunk for a specific size screw, which is often noted in the catalog description. I order the screws along with the hinges—with a few extras.

If the countersinks are not deep enough, the heads of the screws will stop slightly proud of the hinge leaf. This can cause a hinge to bind and exert tremendous leverage on the screws. If necessary, deepen the countersinks so that the heads end up just below the surface of the leaf. In setting the brass screws, I try to have some consistency in the pattern of the head slots.

If the hinges are installed correctly, your doors and lids should swing sweetly for many decades to come. □

Garrett Hack is a contributing editor, a furniture maker and a woodworking teacher. He lives in Thetford Center, Vt.

INSTALLING THE DOOR AND CHECKING THE FIT



Cut the mating mortises in the case and attach the door. Continue to use only one steel screw at this point. Check the fit of the door. If necessary, remove the door and plane it to fit.



Adjust the countersinks. Use a countersink bit to deepen the holes in the hinge so that the screw heads can sit just below the surface.

Making fine adjustments

Sometimes you must shim a hinge up (below) or out (right) to even out the hinge-side gap on a door or adjust the fit of a lid.



If you've cut too deep. To shim a hinge outward, trim a card to fit into the bottom of the mortise.



If you've cut too wide. To move a hinge out toward the front of the case, plane a sliver of long-grain wood to fill the gap at the back of the mortise. Glue it in and plane it flush for an invisible repair.

Steel Wool vs.



Steel wool leaves more uniform scratches than pads

I had always wondered why one grade of steel wool worked better than another, and why good steel wool seemed to produce a superior-looking surface on a clear finish than a comparable synthetic abrasive pad. Writing this article spurred me to do some real detective work.

With the assistance of Case Western Reserve University in Cleveland, Ohio, I looked at the various grades of steel wool and abrasive pads under an optical microscope. I then rubbed a clear acrylic sheet with 000 Liberon-brand steel wool and another sheet with a gray Mirlon abrasive pad made by Mirka. The products have roughly similar abrasive powers. I then looked at the scratch pattern using a scanning-electron microscope.

The acrylic samples, coated with a thin layer of palladium to make them electrically conductive, were placed in an ultrahigh vacuum. Electromagnets then bent an electron beam, which produced an image on the screen.



Steel wool magnified 20 times (above) shows uniform, tightly woven strands. Magnified 500 times, the scratch pattern left by 000 steel wool (right) is more uniform and less harsh than that left by an abrasive pad.

STEEL WOOL



Abrasive Pads

BY JEFF JEWITT

Even with the advent of synthetics, there still is a place for old-fashioned steel wool



I've been finishing and refinishing wood for going on 25 years, and of all the tools I have used consistently in that time, steel wool in one form or another has to rank among the most useful. My dad showed me how to use the stuff, and when I asked him how it was made I remember him saying, "It comes from metal sheep, silly." Since that first time, I've used it for removing, polishing and cleaning finishes, sanding between coats of finish, and once I even experimented with it for applying finishes (with disastrous results).

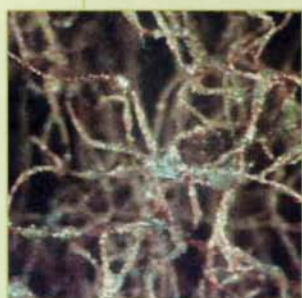
The major change in this field has been the advent of synthetic steel wool, also known as nonwoven abrasive pads. This product has replaced steel wool for some applications, such as rubbing finishes between coats and stripping paint, and with abrasive pads constantly improving, they may continue to encroach on the uses for steel wool. But for rubbing out the final coat of clear finishes, applying waxes and cleaning old furniture finishes, nothing beats steel wool. Abrasive pads and steel wool differ greatly in quality, so let's start by seeing how both are made and learning how to sort out the (metal) sheep from the goats. Then I'll tell you which products are best for which tasks and how to use them.

Size of individual strands determines steel-wool grade

Steel wool begins life as a 3,000-lb. roll of $\frac{1}{8}$ -in.-dia. steel wire. This wire is drawn across serrated knives that scrape off tiny wire shavings from the larger wire. These shavings are carded into an irregular, interlocked steel-wool mat, which is formed into rolls or pads and cut to final shape. The larger the diameter of the shavings, the coarser the texture of the steel wool. The machine oil used in the manufacturing process may cause problems with certain finishes, which I'll talk about later.

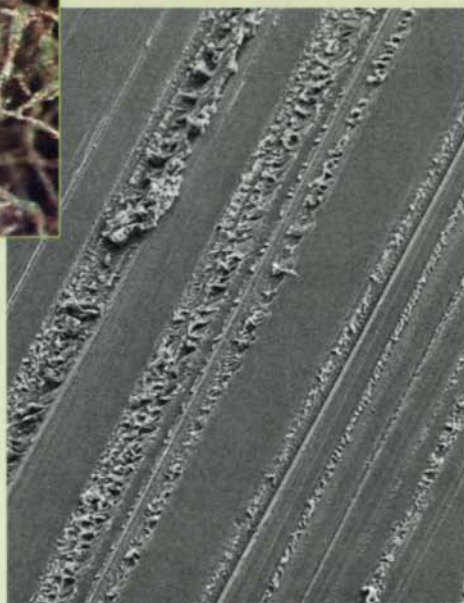
Steel wool is graded in a numerical "aught" (a bastardization of the word naught or zero) scale, the coarsest being graded 4 and the finest graded 0000 (pronounced four aught).

Over the years I've used a lot of steel wool, and some brands have given me good results every time: For everyday use, Pro's Best by International Steel Wool was my favorite for years, but the company recently shut down operations, so I now use Rhodes American's product. My first choice for finishing is steel wool made by Liberon, which is hands down the best. One advantage



ABRASIVE PAD

A gray abrasive pad magnified 40 times (above) shows how the abrasive/glue mixture forms irregular lumps on the strands. When magnified 500 times (right), the scratches left by the abrasive pad are deeper and more uneven than those left by steel wool.





SMOOTHING BETWEEN COATS

Jewitt prefers to use an abrasive pad for large, flat surfaces. To lessen the risk of cutting through the finish, he uses short, controlled strokes near the edges. Steel wool's ability to scrunch down makes it ideal for smoothing complex shapes.



of Liberon's product is that it is manufactured with less machine oil, though it's hard to quantify exactly how much less.

Abrasive pads are color-coded based on grit

About 20 years ago, the Scotch-Brite dishwashing pad was introduced by the 3M Co. Made from a nonwoven plastic, the pad has real sandpaper-type grit (aluminum oxide or silicon carbide) impregnated throughout its 1/8-in. thickness. Unlike steel wool, the grade of the pad is determined by the coarseness of the grit, not by the thickness of the individual plastic strands. It quickly became obvious that this material had some real advantages over steel wool. The tough synthetic pad doesn't tear apart or shred little bits of metal wire, making it ideal for sanding between coats of finish and, in particular, on items such as chairs and table legs, where broken bits of steel wool collect. Like sandpaper, the pad does shed some abrasive particles, but a gentle blast of compressed air or a swipe with a tack cloth removes them.

Steel-wool grade	Abrasive-pad color	Grade	Sandpaper equivalent
	White	Extrafine	Not available**
0000		Finest	400-600
000	Gray	Fine	280
00		Medium	180-220
	Maroon	Medium	180
0		Coarse	120-150
	Green	Coarse	100
**The mineral impregnated in white pads is talc, which is too soft to grade for a definitive scratch.			

Most manufacturers offer a wide selection of pads and grades, and there seems to be an agreement among manufacturers to color-code the pad based on the abrasive grade (see the table above). For woodworking you really need only three or four grades. In general, look for a pad that's flexible and durable.

Use steel wool and abrasive pads to abrade an intermediate layer of finish

The process of smoothing and leveling intermediate layers of finish is known as cutting back. For large, flat surfaces, my choice is an abrasive pad regardless of the type of finish. Lacking oil or metal, they are compatible with water-based finishes. The shed particles of abrasive are much easier to remove than shavings of steel wool before applying the next coat of finish.

You can, however, use steel wool to cut back solvent lacquer, oil-based varnishes and shellac. Do not use it between coats of water-based finishes or paint. There are always some tiny bits of steel wool left behind that can rust. Another problem is that the machine oil used in the wool's production can throw the chemistry of water-based finishes into rebellious fits.

To cut back a finish, take a piece of 000 steel wool, or a maroon or gray abrasive pad, and rub around the edges of the workpiece in short, choppy strokes. Then do the center section in long, straight strokes going with the grain.

On contoured areas like thumbnail molding and concave surfaces like crown molding, steel wool does a better job than any

RUBBING OUT A FINISH

Use steel wool for a satin finish. The scratch pattern left by a gray abrasive pad on the top is more aggressive and uneven than that left by 0000 steel wool.



Use a white pad for rubbing out. Rubbing the pumice with a white pad is less likely to form clumps than rubbing with a damp cloth. Spray the surface with soapy water, shake the pumice evenly onto it and rub away.

other rubbing material I know. It conforms to contours better than stiff abrasive pads. Just immerse a chunk of the wool in some rubbing oil or soapy water and rub away.

Steel wool is better for achieving a satin finish

Regardless of the finish, you get a better surface by rubbing out the final coat with steel wool than with an abrasive pad. The steel wool tends to cut the surface of the finish, while pads tend to tear it.

Once the finish has cured, sand the surface with 600- or 800-grit sandpaper to shear off any dust pimples and to level brush marks and drips. Then use 0000 steel wool wrapped around a softwood or cork block to produce a hand-rubbed, satin finish. If you use a pad of steel wool, unravel it and wrap it around the block. If you use a roll, cut off enough that can wrap the block several times.

Squirt the surface with soapy water (a capful of dishwashing detergent per quart of water) or diluted Murphy Oil Soap, or use a lubricant designed for use with steel wool, such as Wool-Lube. Rub the block around the perimeter first, then do the center section with long, straight strokes, keeping the pressure uniform and your strokes parallel to the grain.

You can use a white abrasive pad for a slight deglossing of a finish. For increased abrasiveness, use the pad with pumice and rottenstone. This method will leave a glossier surface than one produced using 0000 steel wool. I prefer a pad to a felt block because it holds the abrasive better and doesn't allow clumping.

For rejuvenating an old finish and polishing metal, steel wool has the edge

Steel wool has several advantages over abrasive pads when it comes to cleaning and polishing wood or metal. One is its ability to hold a liquid. Second, unlike a pad, it conforms to tight contours. Recently introduced abrasive pads show improved ability to mold to contours, but steel wool still is superior. There's no better way to revive an old finish without stripping it than to use steel wool to clean and then wax it. The gentle action of 0000 steel wool removes grime without cutting through thin finishes.

First, unravel a 0000 steel-wool pad and squirt some naphtha on the surface of the metal (about an ounce). Then rub the surface gently with the steel wool. Periodically, stop and wipe the residue with a clean cloth. This method quickly cuts through oil-based dirt and grime. When the surface is both clean and smooth, you can use a new piece of 0000 steel wool to apply a coat of paste wax.

For removing light rust on cast-iron machine tops, abrasive pads are handy on these flat surfaces. The grade you begin with depends on the severity of the rust, but apply some wax to the pad and some mineral spirits to the tabletop and rub away. Gradually move up to finer pads until the luster of the damaged area matches the rest of the surface. □

Jeff Jewitt is a furniture finisher and restorer in Cleveland, Ohio.



CLEANING MACHINE SURFACES



A clean bed. Apply paste wax to the tool bed, splash on some mineral spirits and then rub away with abrasive pads in successive grits to remove rust.

Harvest Table

This Shaker drop-leaf design can be built for two or for 20

BY CHRISTIAN BECKSVOORT



The drop-leaf table is one of the most versatile designs that I build. I've made small, 30-in. square end tables, 10 footers for major dinner parties, tables with drawers, tables with one leaf, and tables with leaves that hang almost to the floor. The form can be used not just for dining tables but also for side, end, serving and couch tables.

Recently, I was commissioned to design and construct a drop-leaf table and a set of chairs to seat eight. The base should provide diners with adequate chair space, with no one straddling a leg. Figuring 24 in. (or more) per serving area, I came up with a base that's 28½ in. by 79 in.

For the top dimensions, I figured 31 in. wide by 84 in. long. The top extends beyond the base so that the two 9-in. leaves can hang below. When down, the leaves allow for chairs to be slid under them. With the leaves up, the total width of the table-top becomes roughly 48 in. (because of the rule-joint overlap). I made this tabletop 1⅝ in. thick, but ¾ in. is the minimum—less than that and the quirk (or filet) on the leaf rule joint becomes too thin or fragile.

Glue up the top and build the base

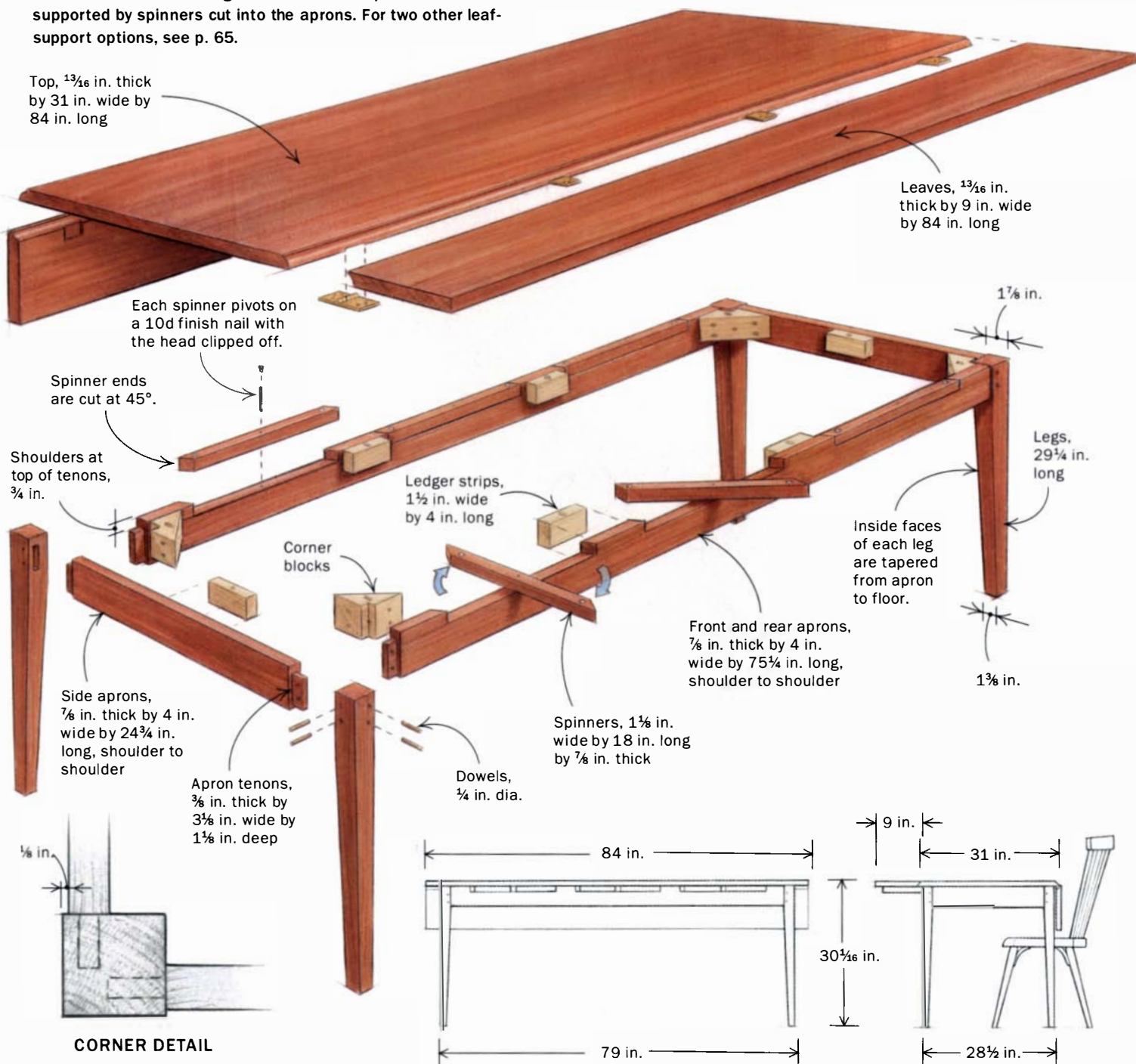
Start by gluing up the top and leaves from 7⁄8-in.-thick stock. When flattened and sanded, the finished product is 1⅝ in. thick, a smidge more than minimum. Next, cut the legs to 1⅞ in. square by 29¼ in. long. Taper the four legs to 1⅜ in. on the tablesaw using a jig, then clean them up on the jointer.

The mortises in the 4-in.-wide aprons are ¾ in. thick by 1⅞ in. deep by 3⅜ in. wide (located ¾ in. from the top of the leg and ⅛ in. from the apron bottom). I'm fortunate enough to own a horizontal slot mortiser, but this joint is easily cut by hand, with a drill press and chisels or with a router.

The aprons are milled from 7⁄8-in.-thick

CHERRY DINING TABLE

This classic Shaker dining table features drop leaves that are supported by spinners cut into the aprons. For two other leaf-support options, see p. 65.



stock: two pieces 4 in. by 28 in. and two pieces 4 $\frac{1}{4}$ in. by 79 in. (The long side aprons are purposely oversize in both dimensions.) Before you cut and chop up the long aprons to make the leaf supports, or spinners, make a story stick. The stick shows the location of the two legs, the three spinners, the four hinges and the four attachment points where the top will be screwed to the base. With the story stick,

you can then make witness marks in the appropriate locations on the aprons: two short 3-in. ends, three 18-in. spinners and two spacers between the spinners. Then rip 1 $\frac{1}{4}$ -in.-wide strips the full length of both aprons and joint the pieces. With the witness marks in place, cut the spinners and the spacers to length with the miter gauge set to 45° (for other leaf-support options, see p. 65).

Now it's time to reconstruct. Starting from the center, line up the spinner with its witness marks. On either side, glue and tape the two spacers onto the apron, place the other two spinners and glue the two end spacers. Then remove the spinners and clamp the spacers. Drill $\frac{1}{8}$ -in. holes through the center points of each of the six spinners. Once the glue has dried, attach the spinners using 10d finish nails. Let the

SPINNERS SUPPORT THE DROP LEAVES



Let it spin on a nail. Becksvoort uses nails to act as pivot pins, because they are stronger than brass and can be let into a smaller hole.

heads protrude about $\frac{1}{4}$ in. and nip them off with pliers. Then sand the aprons, cut them to length and cut all of the tenons.

Now glue the long aprons to the legs and pin the joints with $\frac{1}{4}$ -in.-dia. pins. When the two long sides of the table are ready, glue and pin the short aprons between them.

With the base assembled, make corner blocks from $1\frac{3}{4}$ -in. by $3\frac{1}{2}$ -in. stock to strengthen the joint. Screw each block into both the aprons and leg. The aprons are only $\frac{7}{8}$ in. thick, so add $1\frac{1}{2}$ -in.-wide ledger strips to the top inside surfaces between the spinners. These ledgers are drilled out for a $\frac{1}{4}$ -in. by $\frac{3}{8}$ -in. slot to allow for movement of the top. Near each leg, there is also a similar slot in the corner blocks, as well as a 1-in.-dia. access hole on the bottom of the blocks. On the end aprons, add a ledger strip with just a $\frac{1}{4}$ -in.-dia. hole at the center. These two holes anchor the tabletop and ensure even wood movement across the top.

Cut the rule joint

Once you've established the critical dimensions of the rule joint (see the story on p. 66), it's time to set up the router. I have two, so I can have one set up for the roundover cut (table edge) and the other for the cove cut (leaf). That allows me to go

1 CUT THE SPINNERS FROM THE APRON

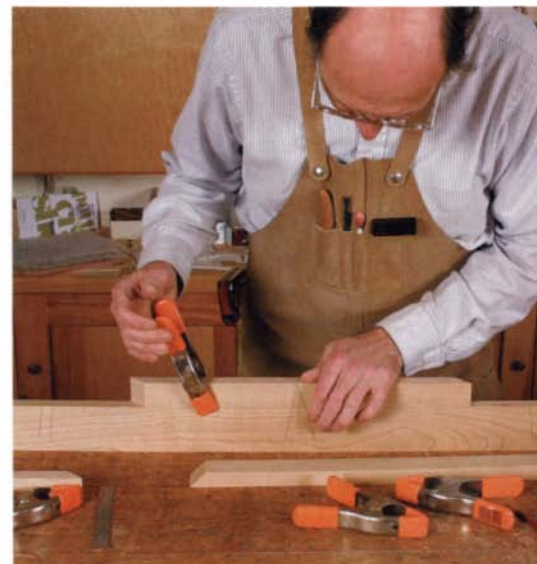


Cut apart the apron. At the tablesaw, rip the spinner stock from the top edge of the apron.



Separate the spinner stock. Becksvoort cuts the spinners using a 45° crosscut sled.

2 REASSEMBLE THE APRON



Position the spinners. Starting at the center of the apron, clamp the first spinner in place.

back and recut either portion of the joint if I'm not happy with the fit.

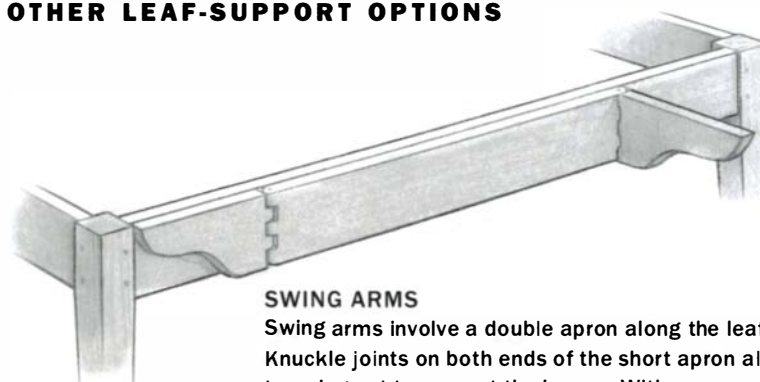
Make the roundover cuts first on the tabletop. Three passes usually get me to the appropriate depth. The router bit's bearing rides on just a sliver of edge on the final pass, so you need to clamp an auxiliary wood fence to the router base for a longer bearing surface.

Next, mount a cove bit in the router and make three passes under each leaf. Now fit each leaf next to the tabletop, and sight down the joint. Differences in height will, for the most part, be pulled together by the four hinges. Differences in width or parallelism will have to be adjusted. First use a block plane to remove tight areas (usually on the leaf, which is more prone to bowing). Once the gap between leaf and table is a constant width, flip over the leaf and rerout the cove. Because the bearing rides on the quirk that you've just planed to fit, that's where all of the routing takes place. Once you're satisfied with the fit of both joints, you can install the hinges.

Attach leaves and fine-tune the fit

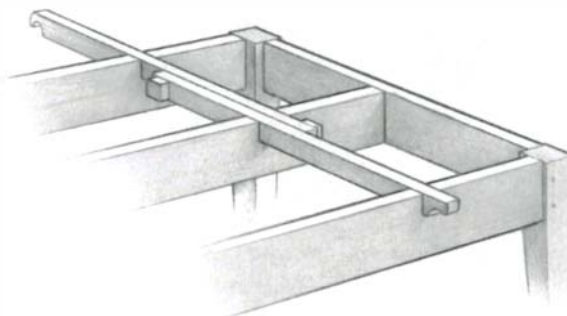
First, locate the hinges using the story stick. Because the hinges are perfectly flush to the underside (if properly installed), the locations can be altered if you have a severe

OTHER LEAF-SUPPORT OPTIONS



SWING ARMS

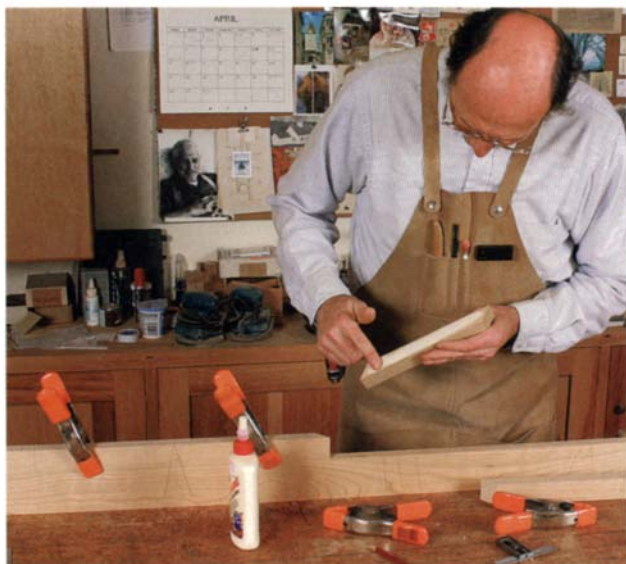
Swing arms involve a double apron along the leaf sides. Knuckle joints on both ends of the short apron allow the ends to swing out to support the leaves. With proper spacing and planning, one or more swing arms can be used. With well-made knuckle joints, this is arguably the strongest leaf-support system because it does not involve cutting the apron.



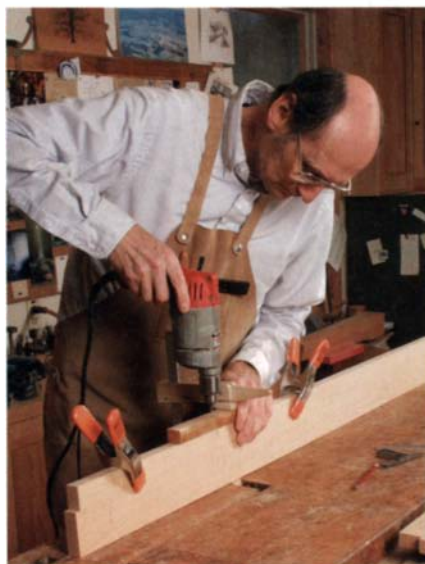
SLIDING SUPPORTS

Although a bit more work than making spinners, sliding supports are a neat and clean alternative. They should be no more than a third the height of the aprons. They work best where the leaves are less than half the width of the tabletop. For a complete description, see *FWW* #111, pp. 75-79.

3 ATTACH THE SPINNERS



Rebuild the apron. Reglue the parts of the apron, making sure everything remains in the correct order. Keep things tight, and work from the center toward the ends.



Don't just drive a nail. With the spinner clamped in place, drill a hole in the center to accept a 10d finish nail.



Bumpers allow smooth spinning. Before installing the spinners, Becksvoort planes them slightly, then sets nylon bumpers into place.

A SMOOTH-OPERATING RULE JOINT

1 ROUT THE TABLETOP AND LEAVES



Cut half a rule joint. Take several light passes before setting the bit to final depth and cutting the roundover portion of the rule joint (left). Then cut the leaf of the tabletop in several passes with a cove bit.

warp in a leaf, for example. However, if your table is narrow, and you have attachment screws that go through the aprons, the hinges cannot go in the same place as the screws. Bring a line from the quirk on the tabletop to the underside of the table. Set a marking gauge $\frac{1}{4}$ in. closer to the table's edge and mark through all eight hinge locations. Then center the hinge pins over the scribe marks, with the long leaves extending onto the table leaves. With a pencil, mark the locations of the hinge barrels and draw these lines parallel to the scribe marks.

Using a $\frac{1}{4}$ -in. bit, rout out for the hinge barrel. This trough can be a bit deeper and wider than the barrel, but no longer. Clean the ends with a $\frac{1}{4}$ -in. chisel. Clamp both ends of the table and leaves right at the joint. Place the hinge barrel into the trough, keep the pin centered on the scribe line and use a sharp knife to scribe all four sides of the hinge. With the router set to the thickness of the leaves, rout the mortise

and clean the corners with a chisel. The hinge should be snug and flush. Drive in all six screws (at least $\frac{1}{8}$ in. shorter than the top thickness). Repeat for each hinge.

If the table and leaves are straight, fitted and laid out accurately, fine-tuning the joint is a minor chore. I fold down the leaf and take a few passes with a block plane along the bottom edge of the top. A bit of hand-sanding, and that's it. Frequently, it is a bit more involved. When I fold the leaf back up, it invariably rubs and squeaks. Of-

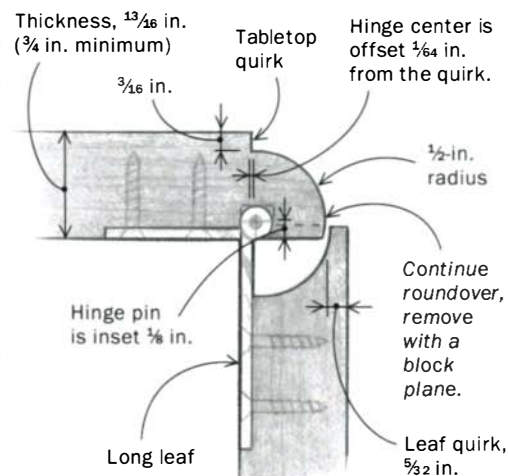
The rule joint: It all hinges on the barrel



Locate the hinge barrel. Square a line up from the quirk.

When hinging a rule joint, convention says to center the hinge under the quirk, but I've found that it's better to offset the center of the hinge $\frac{1}{4}$ in. closer to the edge of the tabletop. The center of the hinge pin is buried $\frac{1}{8}$ in. above the bottom surface, which is the rotating axis of the joint. Consequently, the quirk height is the sum of the depth of the hinge pin ($\frac{1}{2}$ in.) plus the radius of the roundover bit ($\frac{1}{2}$ in.), which totals $\frac{5}{8}$ in., subtracted from the total thickness of the top. To keep the quirks substantial, I made this tabletop $\frac{13}{16}$ in. thick, but $\frac{3}{4}$ in. is minimum. For a $\frac{13}{16}$ -in.-thick top, that leaves a $\frac{3}{16}$ -in. quirk on the tabletop. On the leaf, a $\frac{1}{32}$ -in. clearance is ideal between it and the table, meaning that the leaf quirk is only $\frac{5}{32}$ in.

RULE-JOINT DETAIL



2 ADJUST THE REVEAL AND REROUT THE LEAVES



Mark the contact spots. Set the leaf in place, and mark spots where the joint makes contact.



Trim the leaf, not the tabletop. A few passes with a handplane helps achieve an even reveal. Once the joint closes up, rerout the profile on the leaf and try another test fit.



ten I can visually locate the points of contact and eliminate them with a rabbet plane and sandpaper. More often than not, I get out my supply of ancient carbon paper and slide it between the leaf and table, then fold the leaf up and down a few times to locate the friction points. I do this along the entire length, two or three times, planing and sanding the dark spots each time.

When both leaves fold smoothly, mark equal distances from the end hinges for an 84-in. length, square a line across both ends and cut the assembly to length. I use a circular saw with a fence clamped in place. I belt-sand through to 320 grit, hand-sand using 320 grit and then polish with 0000 steel wool.

Attach the top, open the spinners 90° and mark under the tabletop for stops. A small ½-in. by ½-in. by 1-in. block glued to each of the six marked locations allows the spinners to open perpendicular to the table aprons. If I detect any sag in the leaves, I glue a small wedge-shaped shim in front of the stop blocks to level the leaves.

My finish of choice is Tried & True varnish oil, four or five coats applied over a three-week period. Rub with 0000 steel wool after the first coat, and let subsequent coats build to a satin sheen. □

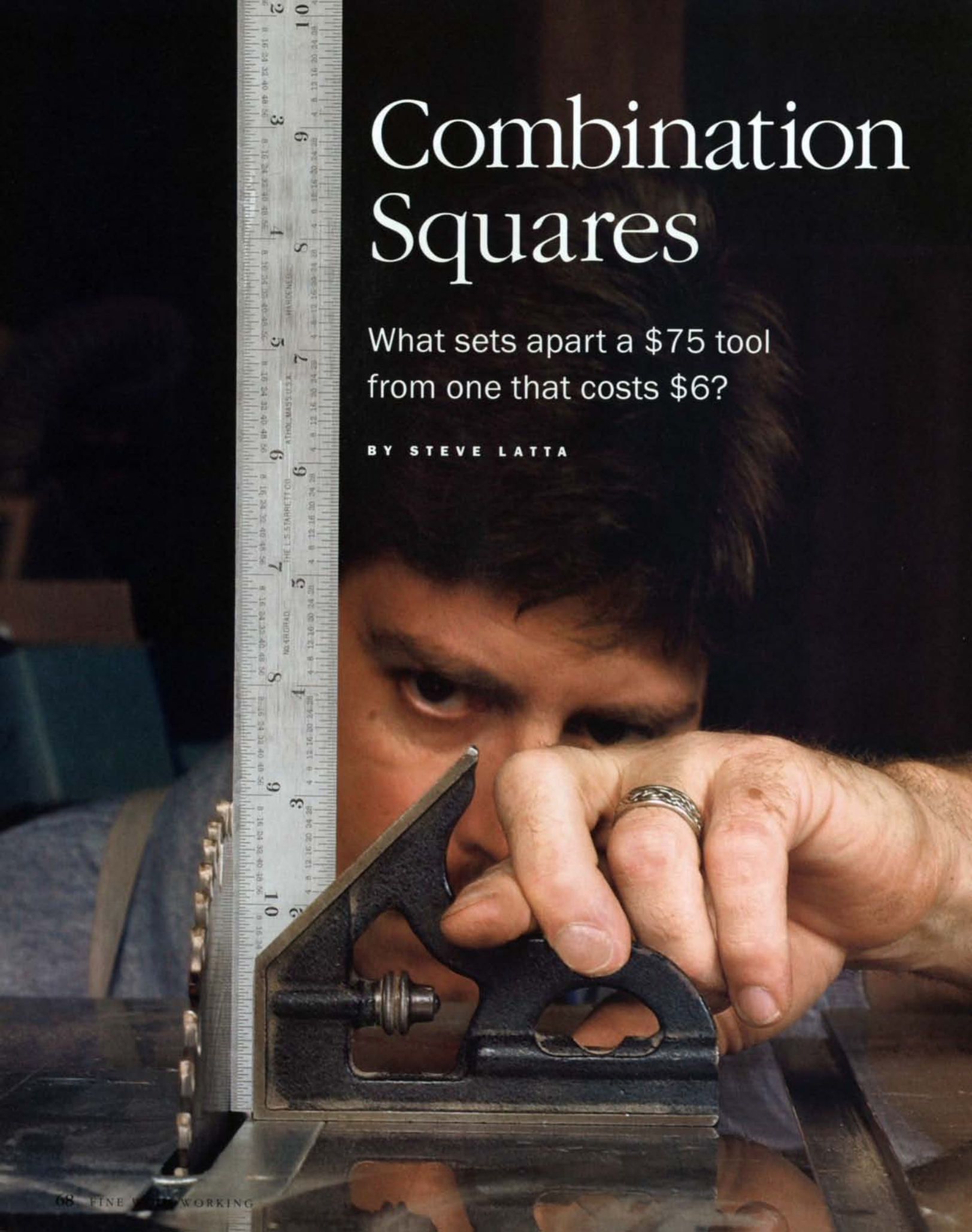
Christian Becksvoort is a contributing editor.

3 INSTALL THE HINGES AND CHECK THE FIT



Carbon paper still has a use. Becksvoort holds carbon paper between the joint as he opens and closes the leaf. Black marks are left where the joint is too tight. Those spots are trimmed with sandpaper or a block plane.





Combination Squares

What sets apart a \$75 tool from one that costs \$6?

BY STEVE LATTA

A combination square is one of the most frequently used tools in my arsenal. I carry a 4-in. version in my apron pocket and a 12-in. square with an additional 24-in. blade in my toolbox. As the name implies, this tool combines the capabilities of a machinist's square and a flat, straight rule. Throw in a rarely used bubble level and a scratch awl, and you have a tool that tackles a variety of common shop tasks, such as machinery setup, layout, marking and measuring. Although it is a relatively basic tool, there are myriad differences in the manufacturing details, sizes and styles that you can buy. You can get a simple tool for as little as \$6.50, or you can spend \$75. If you opt for all the extras, the cost climbs to \$200.

What you get for the money

The two main components of a combination square are the head and the blade—what manufacturers call a two-piece set—and that's all you get with most of the lower-priced tools. Once you jump into the higher price brackets, all of the major brands also offer center heads and protractor heads. The addition of these two items makes up what's called a four-piece set, which typically sells for slightly more than double the cost of a two-piece set.

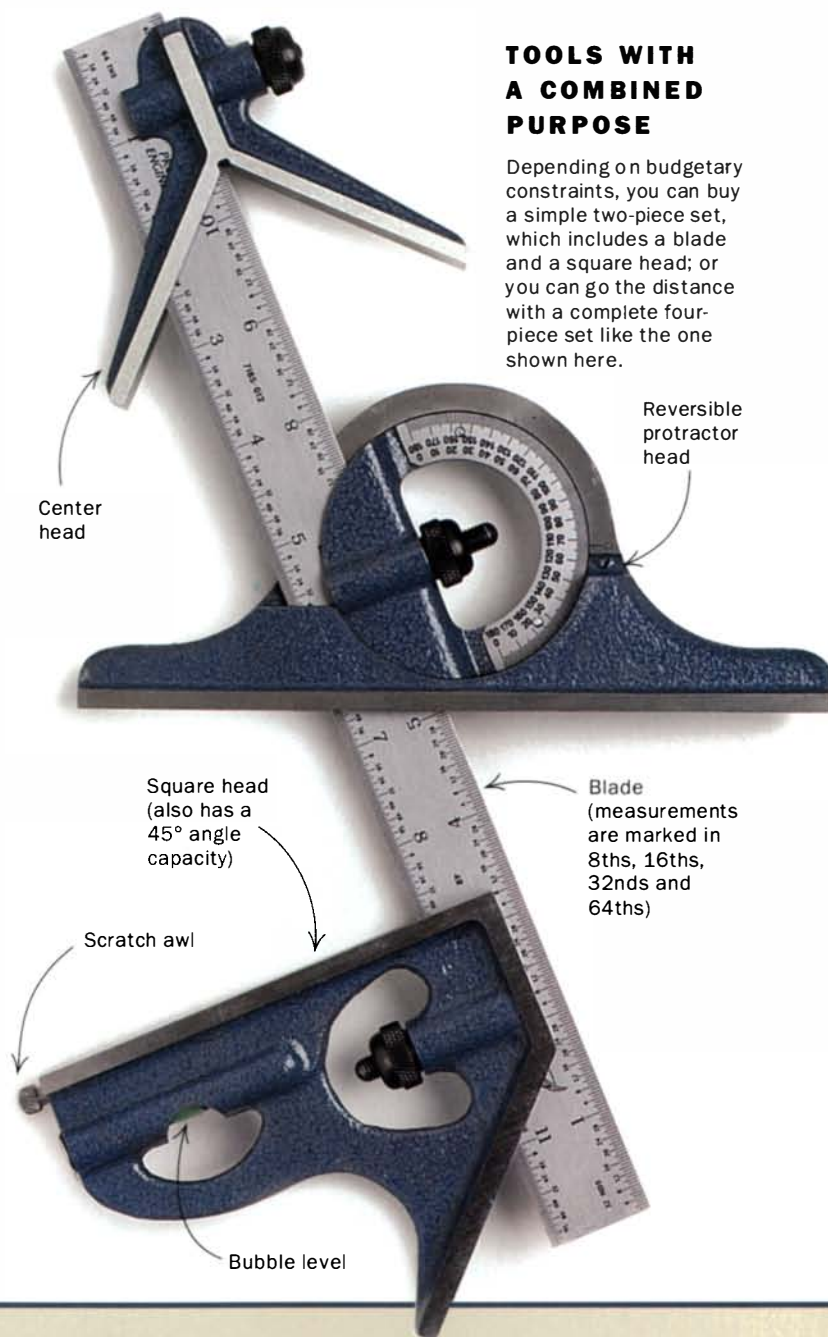
A center head locates the center of turning blanks and large dowels, but a lot of other tools work just as well. My center head is buried away until that once-a-year lecture to my students on layout tools. A protractor head is handy at times and is classified as either reversible or nonreversible. On a reversible head, the blade slides between two machined surfaces and can be adjusted anywhere along an edge within a range of angles that span about 110°. With a reversible head, it's easy to transfer lines across the face of a single piece of stock or from one workpiece to another simply by flipping the tool. With a nonreversible head, the blade sits on one side of a machined surface, so you can't flip the tool to transfer angled layout lines. Most sets include a reversible head, but some manufacturers offer sets with a nonreversible head—you should confirm what's included before ordering one.

Blades should be easy to read

Blades come in a variety of sizes ranging from 4 in. to 36 in. long. The better manufacturers offer blades in one of two finishes—satin

TOOLS WITH A COMBINED PURPOSE

Depending on budgetary constraints, you can buy a simple two-piece set, which includes a blade and a square head; or you can go the distance with a complete four-piece set like the one shown here.



A tool of unequalled utility

A combination square is a vital tool for performing the most basic shop operations, such as layout, marking, measuring and machinery setup. Its versatility is unparalleled by any other single tool. The photos below and at left illustrate a few of the many tasks this tool is particularly suited to do.



Checking a frame for square



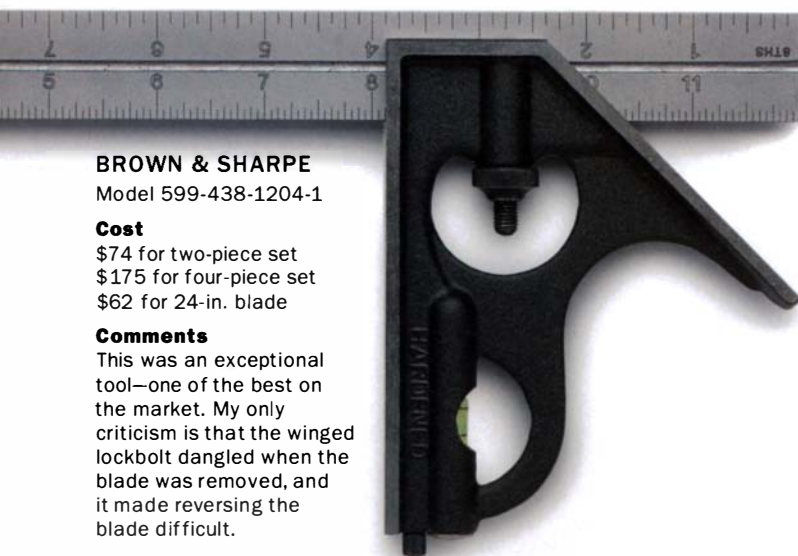
Setting the height of a router bit



Checking the depth of a groove



Marking shelf-pin locations



BROWN & SHARPE

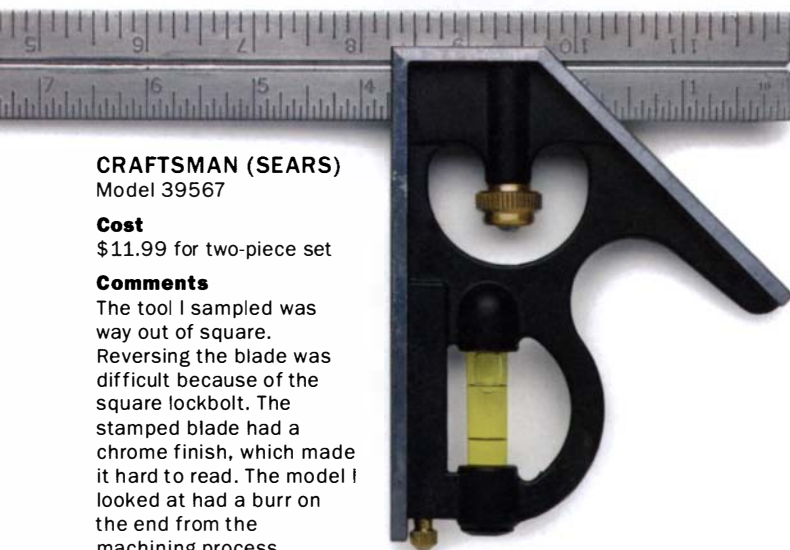
Model 599-438-1204-1

Cost

\$74 for two-piece set
\$175 for four-piece set
\$62 for 24-in. blade

Comments

This was an exceptional tool—one of the best on the market. My only criticism is that the winged lockbolt dangled when the blade was removed, and it made reversing the blade difficult.



CRAFTSMAN (SEARS)

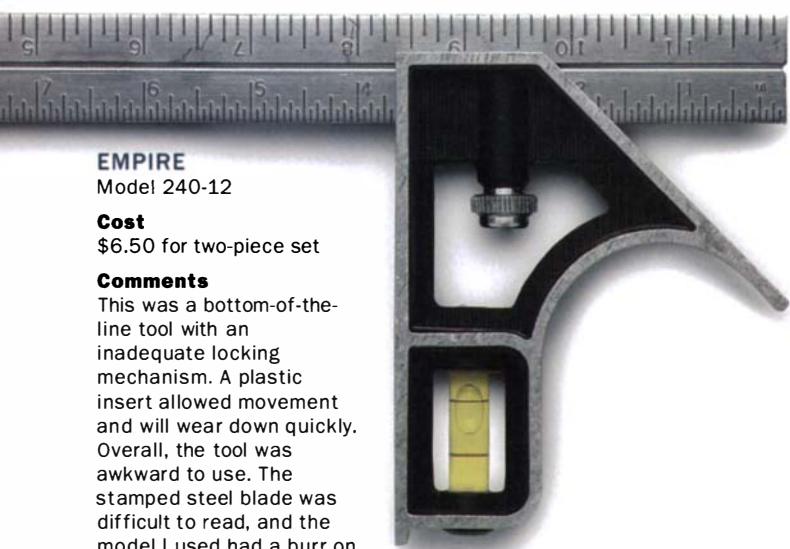
Model 39567

Cost

\$11.99 for two-piece set

Comments

The tool I sampled was way out of square. Reversing the blade was difficult because of the square lockbolt. The stamped blade had a chrome finish, which made it hard to read. The model I looked at had a burr on the end from the machining process.



EMPIRE

Model 240-12

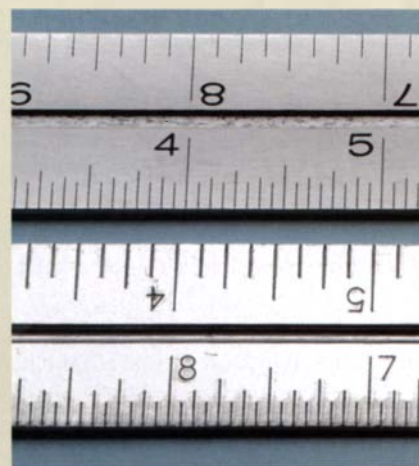
Cost

\$6.50 for two-piece set

Comments

This was a bottom-of-the-line tool with an inadequate locking mechanism. A plastic insert allowed movement and will wear down quickly. Overall, the tool was awkward to use. The stamped steel blade was difficult to read, and the model I used had a burr on the end from the machining process.

STAMPED OR ETCHED BLADE?



The reliability of the blade is directly related to manufacturing techniques. A satin-chrome finish is easier to read than a shiny, reflective finish. The graduations on the satin-finish Mitutoyo blade (top) have been acid-etched and paint-filled to make them more readable. The stamped surface of the Empire blade (bottom) is hard to read.

chrome or polished. Of the two, satin chrome is preferable because it doesn't reflect glare under shop lights and is much easier to read. Blades are made in a variety of graduations with 4R (8ths, 16ths, 32nds and 64ths) being the most common in the United States. You also can buy blades marked solely with metric scales or in several different combinations of Imperial (or what some manufacturers call English) and metric.

Brown & Sharpe, Mitutoyo, Products Engineering Corp. and Starrett machine their blades in multiple steps. According to a company spokesman, Starrett's oversize blades are cut from grooved bar stock. The bar is then varnished and has the graduations cut into it with a CNC machine. The markings are acid-etched for further definition. The blades are ground to final length and then chromed or satin-chromed. Afterward, the graduation marks are blackened in. On inexpensive squares, the blades are stamped out of a blank—graduations and all—and clear-coated to prevent tarnishing. These blades often come with a burr on the end (caused by the stamping process) that needs to be removed with a file, and many are difficult to read.

In application, different length blades can serve specialized functions. Although a 12-in. blade is the most common for general cabinet work, a 4-in. one is every bit as essential: It's unsurpassed for laying out joinery and hardware, setting up machines and checking small drawer openings. For case work involving dadoes, laying out shelves and transferring dimensions, an extra 24-in. blade comes in handy. A satin-chrome 24-in. blade costs between \$50 and \$80, depending on the manufacturer, and is well worth the money. You'll wonder how you ever lived without one.

Heads are cast or forged

The square heads of some of the cheaper tools are die-cast aluminum or zinc, or plastic. Heads of the more expensive squares are either cast iron or forged-and-hardened steel. Cast iron is a softer material but more than adequate for a lifetime of woodworking. Forged-and-hardened bodies are more durable and more expensive (typically about \$10 more), and often preferred by metal shops. Heads come with a flat, glossy, textured or satin finish in an assortment of colors, depending on the manufacturer. For metalworking, where oil is prevalent, the smooth finish is easier to

keep clean. For woodworking applications, I don't see any particular advantage in choosing cast iron over forged and hardened, or textured over smooth: It boils down to personal preference.

Lockbolt designs vary

The lockbolt assembly consists of a central bolt, spring and knurled knob. The lockbolt secures the blade to the head and is an all-too-often overlooked yet essential element for the smooth function of the tool. Like most cabinetmakers, I regularly pull the blade out of the head and use it as a ruler. It is critical that the lockbolt assembly stay in place when the blade is removed. On many models, the assembly dangles or, in the case of the Fisher, falls out. If the blade is to slide back in smoothly, the lockbolt cannot rotate, and manufacturers achieve this in a variety of ways (see the photos on p. 72). Empire and Craftsman use a square lockbolt to prevent rotation. Brown & Sharpe, and a whole herd of copycats, place a wing on the bolt that keeps it from both rotating and falling out when the blade is removed. Starrett and Mitutoyo add a washer that slides over the bolt and keeps it from rotating.

Does all of this jargon about lockbolts really matter? Absolutely. I'm constantly flipping my blade from side to side to set sawblades, shaper cutters and router bits. To flip the Starrett blade, I had to slide it out, pull down the lockbolt and rotate the shaft 180°. It took seconds and was a process that became instinctive. With the Brown & Sharpe tool, the knurled nut must be loosened to the point where it just about comes off, and then the winged shaft can be pushed above the head's face and rotated. When I used these squares over the course of a week, several of the nuts came loose in my hand when I tried to flip the blade. To reverse the blade on several of the models tested, the assembly had to be taken apart and removed from the head, then reassembled with the lockbolt reinserted 180° to its original position. It was an annoying process.

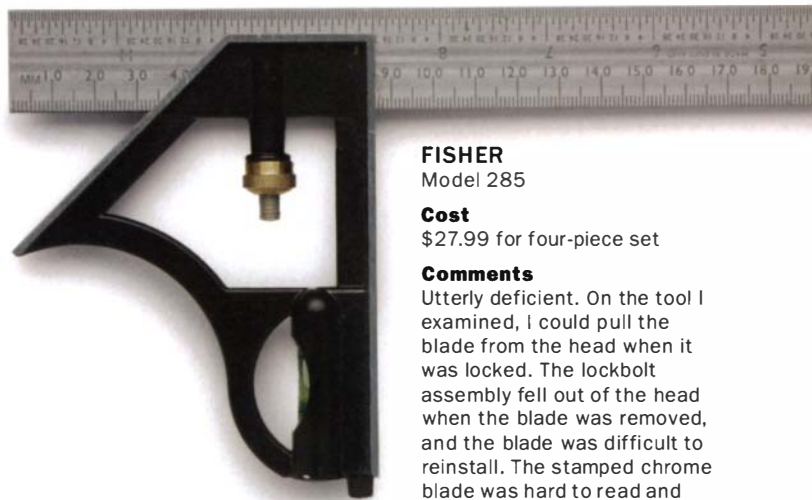
Buy as much square as you can afford

Fortunately, buying a combination square is likely to be a one-time purchase because all of the better models will outlast you. I recommend picking up a 4-in. pocket model along with a 12-in. four-piece set that comes with a center head and a reversible protractor head.

FLAT OR GLOSSY?



The painted finish doesn't really affect the way the tool works, though some people find a glossy finish to be distracting under the glare of shop lights.



FISHER

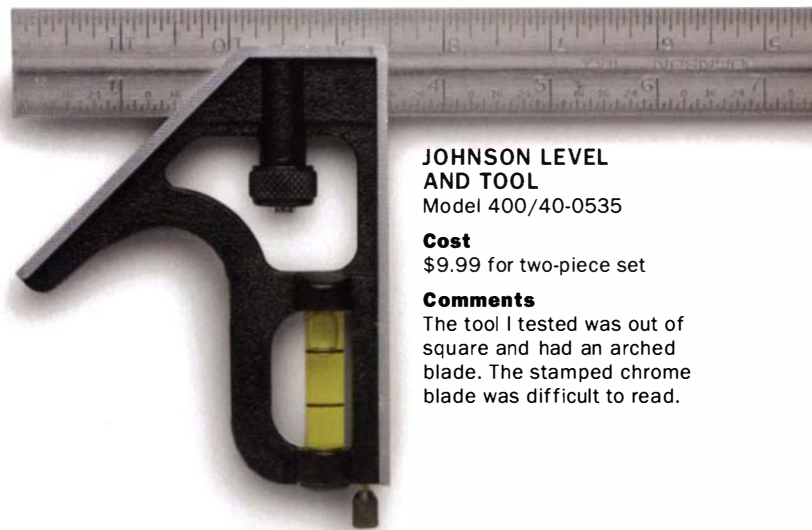
Model 285

Cost

\$27.99 for four-piece set

Comments

Utterly deficient. On the tool I examined, I could pull the blade from the head when it was locked. The lockbolt assembly fell out of the head when the blade was removed, and the blade was difficult to reinstall. The stamped chrome blade was hard to read and had a burr on the end from the machining process.



JOHNSON LEVEL AND TOOL

Model 400/40-0535

Cost

\$9.99 for two-piece set

Comments

The tool I tested was out of square and had an arched blade. The stamped chrome blade was difficult to read.



MITUTOYO

Model 180-112 head with 180-501 blade

Cost

\$65.50 for two-piece cast iron
\$76.50 for two-piece forged
\$176 for four-piece set
\$64.50 for 24-in. blade

Comments

Nice tool in terms of head and blade machining and finish (hardened, satin-chrome), but in use, the blade often came loose. The two-piece lockbolt assembly prevented the lockbolt from rotating and allowed it to be reversed easily.

PRODUCTS ENGINEERING

Model 7118-012-H

Cost

\$57 for two-piece set
\$113 for four-piece set
\$54 for 24-in. blade

Comments

The tool had a hardened head and excellently machined satin-chrome blade. Although I didn't care for the winged lockbolt, this is a very nice set at a reasonable price. The lockbolt mechanism dangled when the blade was out, but it never fell out.



STANLEY TOOLS

Model 46-123

Cost

\$16.21 for two-piece set

Comments

This was the best tool among the inexpensive models. Extra steps were taken in the manufacture of the blade, leading to a superior product. Although the lockbolt rotated freely, it did not fall out of the head. The blade was reversed easily.



L.S. STARRETT CO.

Model 434-12-4R

Cost

\$64 for two-piece cast-iron
\$78 for two-piece forged
\$169 for four-piece set
\$70 for 24-in. blade

Comments

This model had a hardened head and a chrome blade. The small, tabbed washer prevented the lockbolt from rotating and allowed easy reversal of the blade. I think this is hands down the best tool on the market. It was very easy to use and to read.



LOCKBOLTS

The lockbolt fastens the blade to the head. When you need to remove and reinsert a blade, most manufacturers provide a system to keep the lockbolt from turning around and falling out. The Craftsman and Empire tools have a square bolt (top). The Brown & Sharpe and Products Engineering Corp. models have a small wing on the end of the bolt (middle), so you have to push it clear of the edge to turn it around for another blade setting. The Starrett tool (bottom) is Latta's favorite. It has a spring-loaded tabbed washer on the lockbolt that serves as a positive locator.



Add to that a 24-in. satin-chrome blade, and you should be good to go for all of your machinery setup and layout operations. Regrettably, inexpensive models don't come in many of these sizes or offer other heads. Fisher is the only low-budget model I could find that came as a four-piece set, and the quality was not good.

What if you don't have \$200 to buy a full set? For \$16.21, the Stanley is a pretty good tool overall. In fact, it is the model I specify for my incoming students at the school where I teach. It has a nice satin-chrome blade that can be reversed relatively easily. The sample I purchased was a little out of square, but a few licks with a file took care of that. (For more on squaring up a square, go to finewoodworking.com.) If money is not a major factor, the upscale brands (Brown & Sharpe, Products Engineering Corp., Mitutoyo and Starrett) are in a different league. When I consider my individual work habits, I prefer the Starrett tools. I pull and flip my blades regularly, and the Starrett just works more smoothly in my opinion. If asked to label one of these as a "best buy," I'd give that award to Products Engineering Corp. It's a good tool, and at \$113 for the four-piece set, it costs about \$60 less than a Starrett or Brown & Sharpe tool. Over a lifetime of work, however, \$60 isn't really that much.

When you order a square, make sure you get what you really want. Woodworking catalogs notoriously provide inadequate information regarding a specific product. Ask about the graduations and blade finish as well as the construction of the head. A great deal can go sour if that satin-chrome blade you expected turns out to be polished. Commercial suppliers, such as MSC Industrial Supply (800-645-7270; www.mscdirect.com), offer many models from each of the major manufacturers. □

For tips on tuning up a combination square, go to www.finewoodworking.com.

Steve Latta teaches woodworking at the Thaddeus Stevens College of Technology in Lancaster, Pa.

Epoxy Inlay



This simple technique
allows custom colors and designs
beyond the scope of traditional inlay

BY KEITH RUST

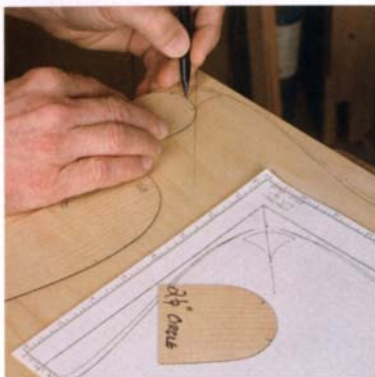
Inlaying with epoxy allows you to do work that is either difficult or impossible to accomplish with traditional inlay materials. You don't have the concerns of working with (or against) the grain of your inlay, and curved surfaces don't require the inlay to be bent, clamped or taped. As a viscous material, epoxy can fill any void you create; therefore, your patterns are limited only to the extent that you success-

fully make good grooves for them. Because of the methods used to cut the inlay groove, and the fact that the epoxy mixture will fill any pore it finds, the better woods to choose for this technique are fine-grained ones like cherry and maple.

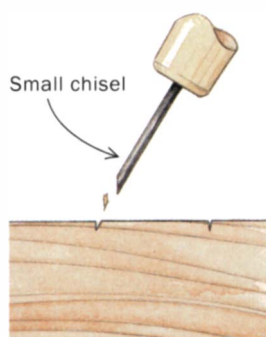
Trace the design and cut the grooves

After laying out my ideas full size on paper, I make matching templates out of plastic

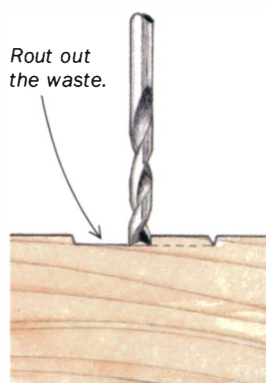
USE A ROUTER FOR WIDE INLAYS



1. Drawing a design. Transfer the inlay design from the full-size drawing to the workpiece, using the templates to maintain accurate curves. One finger presses the blade against the template while the other hand pushes down. Most of the knife is wrapped in masking tape to make it safer for handling.



2. Widen the scribe lines. After removing the template, use a $\frac{1}{16}$ -in. chisel to cut perpendicular to the knife cut.



3. Rout out the center. Remove the waste between the two grooves by freehand-routing using a small spiral-cut bit. Any remaining high points can be cleaned up with hand tools.



laminate, labeling them so that I can keep track of which curve goes where. I rough out the shape on the bandsaw and then use files and sanders to refine the design and smooth the edges.

I use the templates to trace the design in pencil on the workpiece. Usually only one face of each template is used for each section of inlay, but moving the template slightly after the first cut creates parallel lines; shifting the template at only one end makes lines that taper.

Workpiece preparation—After the design has been drawn, I do two things to keep the inlay mixture from seeping into the wood: First, I wipe on a 2-lb. cut of shellac, which helps diminish any bleeding of the epoxy mixture into the end grain of the grooves. Then I rub the whole area with a block of paraffin wax, which prevents the epoxy from contacting and penetrating the wood and makes removing excess epoxy a breeze.

Because I prepare my surfaces almost to the point of being ready for a finish, leaving only a light scraping to do after the inlays are complete, I can make the grooves less than $\frac{1}{16}$ in. deep.

Three ways to cut a line—The first step is to affix the templates to the wood with double-sided tape. Because the pressure of the cutting tool against the edge of the template is fairly light, the same piece of tape still holds adequately even after moving the template to cut parallel or tapered lines.

For wider inlays I first define the borders with an X-Acto knife riding against the template. Then, with a Lee Valley (800-267-8735) $\frac{1}{16}$ -in. chisel, I remove a line of material using the knife cut as my stop cut. I remove more waste with a small router or rotary tool, cleaning up to the line with hand tools.

For cuts with a template or across the grain, I use a cutter adapted from a tool that Garrett Hack uses (*FWW* #116, p. 61). My cutter has two curved X-Acto knives, used either side by side for a very thin line, or separated by a thin spacer for wider lines. This sandwich of blades and spacer is held together by thin wire and then wrapped in tape. I prefer curved blades to straight ones because I get more control by having my hand down by the blade.

Another way to cut narrow grooves is with a shopmade scraper that is basically a

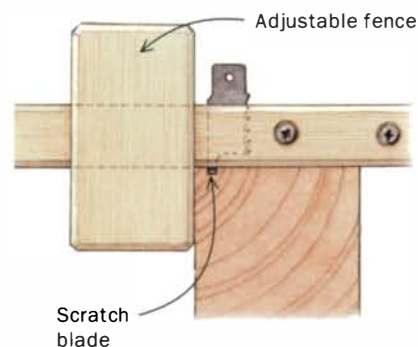
USE SCRATCH STOCKS FOR LINES OF INLAY



Use a scratch stock made from sawblades (inset) or a cutter made from X-Acto knives (below) to plow narrow grooves. The shopmade holder (above) can be used with a fence (left) or without (bottom).

STRAIGHT LINES

For cutting with the grain and parallel to the workpiece edge, fit the scratch-stock holder with an adjustable fence and plow the recess with the blade.



scratch stock. Instead of an adjustable fence that references off an edge such as a leg or a tabletop, the cutter itself references the edge of the template. After defining the edge of the groove with the double blade, I use a scraper that is just a hair thinner than the width of those lines to remove the waste. Here, too, it's important to maintain good contact with the template so as not to scar the nice outside edges that have been defined with the blades.

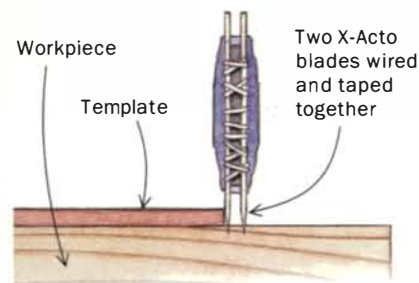
In situations where the lines follow the general direction of the grain and are parallel to an edge of the workpiece, I add a movable fence to the scratch stock. I find that it is best to cut toward the center of the line from both ends because this reduces the chance of overshooting the end.

Cutting dots, circles and rings—Creating perfect circular patterns with real wood inlay is very frustrating. But with epoxy, circular patterns are simple—the only challenge is to cut a clean groove.

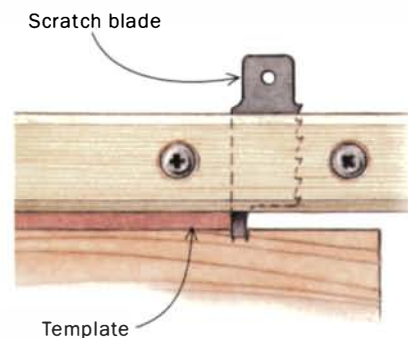
For large rings, I modified a spade bit by grinding off the center spur and one of the outside cutters, and then grinding and honing the remaining spur to cut a clean groove. This cutter yields a pretty thin line. Run the drill press under 600 rpm and



CURVED LINES



1. Define the lines. A custom-made cutter, made from two X-Acto blades, follows a template to cut the twin sides of the groove.



2. Remove the waste. The waste between the parallel knife cuts is scraped out with the scratch stock. The blade rides against the template.

CUTTING CIRCULAR INLAYS

Drilling a small circle. Mounted in a drill press, a sharp brad-point drill bit will form a clean-cut circle, with no tearout.



Cutting a large ring. This spade bit has been modified so that it cuts a thin circular groove. The ring can be left as is and filled with epoxy, or the center can be routed away and filled.

work very carefully. For smaller circles, conventional brad-point drill bits used in a drill press work fine as long as they are sharp and don't leave tearout around the edge of the hole. For small dots, a standard center punch leaves a very neat hole about $\frac{1}{8}$ in. dia.

Fill the grooves and remove the surplus

Inlaying small areas at a time, I have had success with an ordinary, hardware-store clear-gel epoxy with a 10-minute set time. However, if you have a large area to fill, find an epoxy with a slower set time.

I put enough glue in a mixing cup to do the job, mix it just a little and then start adding the color until it looks right and maintains the consistency I want (for more on coloring epoxy, see the sidebar on the facing page). I rarely mix any more than around 50% by volume of dust or dye to epoxy, and in most cases less than that. The universal tints are especially potent—just a

drop or two goes a long way. Be gentle with your mixing to minimize the introduction of air bubbles that can cause voids later in the process.

Using scrap laminate strips, apply the epoxy mixture liberally in the groove, leaving it a bit proud of the surrounding surface to allow for shrinkage.

If I'm working on a flat or convex surface, I use an old spokeshave blade to slice off the surplus after the epoxy hardens. I find it best to do this about 45 minutes to an hour after filling the grooves.

During this window the epoxy has hardened but is still flexible enough that it comes away in a single sheet rather than chipping away when it is fully cured. For concave surfaces, a chisel and a scraper work well, but make sure your scraper has a good, crisp burr so that it doesn't tear the surface of the inlay.

After removing the excess epoxy, use naphtha or mineral spirits and a scraper to remove the wax left on the surface around

the inlay. A final sanding, and you are ready to apply the finish.

A word of warning concerning dye powders: Make sure your first finish coat won't dissolve your dye powder. You've exposed dye granules in the epoxy by scraping away the excess, and they will react with their solvents and smear the color. Don't use shellac over alcohol-soluble dyes, or water-based finishes over water-soluble dyes. I've had success with hand-applied finishes of oil, shellac and varnish, but I don't have experience with lacquers or water-based finishes.

Inlaying with epoxy can be a quick way to add interest to a piece when conventional inlay or stringing is too time consuming or impractical. You'll find that it's easy once you build up a library of templates, become familiar with an epoxy mixture and have a few simple cutting tools on hand. □

Keith Rust is a woodworker in Arlington, Texas.

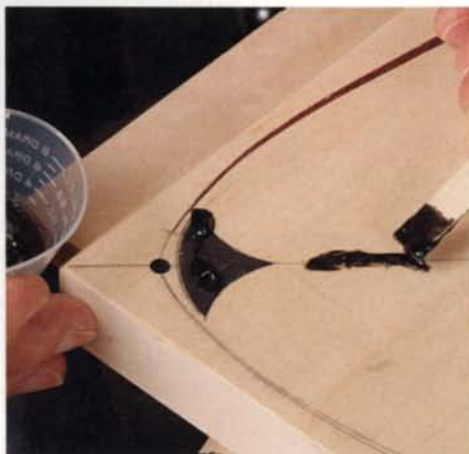


APPLYING EPOXY

Ten minutes to fill. After combining the two-part quick-setting epoxy, mix in the coloring powder and spread it into the recess using scrap laminate. Leave the filler slightly proud of the surrounding surface to allow for shrinkage.



Remove the waste. Slice away the surplus epoxy with a spokeshave blade. Because the wood surface was waxed before application, the epoxy comes off easily.



If at first you don't succeed. Don't be dismayed if the inlay has small air pockets in it or if you remove a corner when slicing away the surplus. Fill these voids with more colored epoxy.

Coloring epoxy

For the dark inlay on the tabletop and legs, I used a mixture of ebony dust and graphite lubricant (available from art supply stores) to give it sparkle. I created the dust by belt-sanding a small piece of ebony with 180 grit. When making dust, make sure it's clean dust. Small flecks of another color will show up quite readily against the black of the ebony.

Other powdered colorants include dye powders and earth pigments (available from art supply stores). With the dye powders I use (Behlen), there are small flecks of colors other than the primary color that can add texture to the inlay. For a uniform color, use liquid colorants like universal tinting colors available at some paint and hardware stores.

SAWDUST

Use pure ebony dust for a rich black. Add graphite lubricant to give the inlay sparkle.



LIQUIDS

You also can use liquid colorants like universal tinting colors.

POWDERS

Other powdered colorants you can use include graphite lubricant, dye powders and earth pigments.

Engineering an Entertainment Center

There's more to it than putting a television in a box

BY BROOKS TANNER

Entertainment centers have been around since the days of the Victrola, but with the advent of enormous televisions and sound systems that would astonish Thomas Edison, entertainment centers too need to evolve. A modern cabinet not only needs to house the television but also sound and video media, satellite receivers, DVD players, CD players, audio amplifiers and the center-channel speaker.

Most designs today are large boxes that differ little from bookshelves or display cabinets, their only concession to electronics being that they have holes for wires. But a good design for an entertainment center takes a little more planning. It starts by examining the requirements of each component and then integrating everything seamlessly.

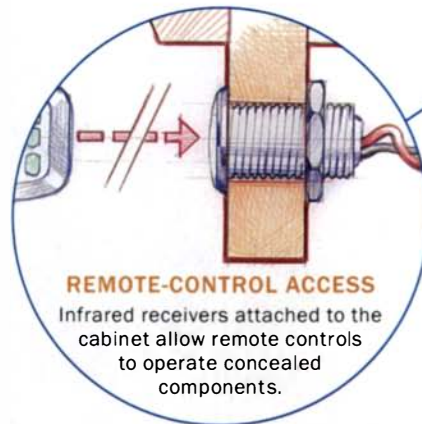
Television is the focal point of the cabinet

Television placement is of primary importance. The center of the screen should be at eye level—approximately 43 in. from the floor, assuming an 18-in.-high seat and 25 in. to eye level from the seat.

Any cabinet built today should be made to house a high-definition television (HDTV), whose wide-screen format will be the only one sold by the year 2006. A screen that is now 24 in. high has a width of 32 in. Under the new format, that same 24-in.-high screen will be approximately 43 in. wide. A cabinet that is made for a present television without extra room on the sides will only fit a future television of shorter height.

The new HDTVs allow for six audio channels, so the entertainment center requires a place for center-channel audio. Because this is where most of the dialog comes out, it is important that the sound seem to emanate from the screen, requiring the speaker to be in the middle of the cabinet, directly above or below the television. If it must be placed away from the television, the speaker should be angled toward the listener; otherwise, information from that speaker will sound as if it's above the listener's head or coming from the floor, depending on the height of the speaker.

Drawers for media storage are almost always located in the bottom of the cabinet, convenient for both children and adults. CDs,



REMOTE-CONTROL ACCESS

Infrared receivers attached to the cabinet allow remote controls to operate concealed components.



DEADEN THE SHELVES

Constructing the shelves from a lamination of MDF and hardboard makes them acoustically dead and less likely to resonate when you listen to music.

DESIGN AROUND THE COMPONENTS

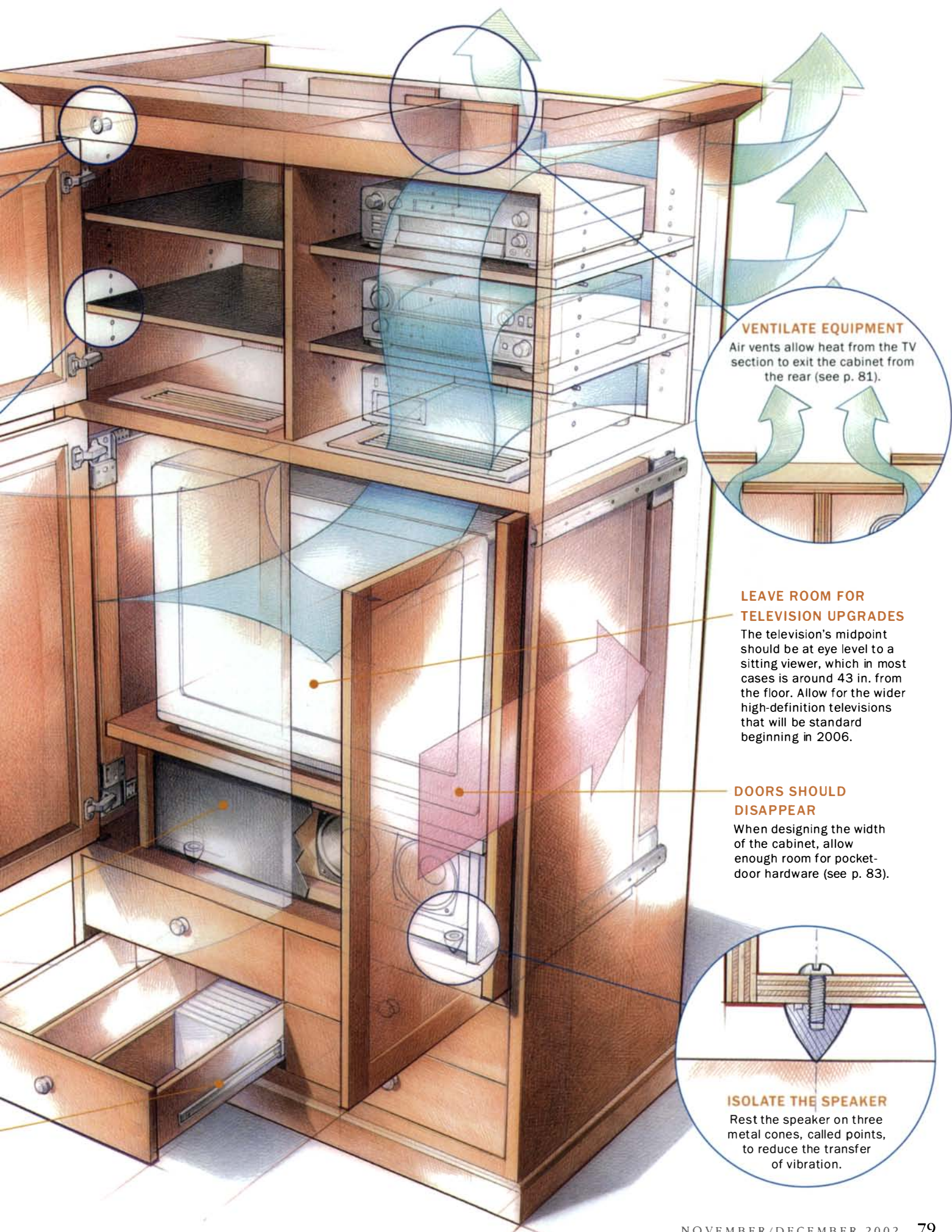
A number of features distinguish a dedicated entertainment center from an ordinary cabinet that happens to house your television and stereo system.

CENTER SPEAKER SHOULD BE HEARD, NOT SEEN

Modern home-theater systems include a center-channel speaker, which must be placed as close as possible to the television. Raw silk forms an attractive screen for the speaker but won't alter the tone.

DON'T SKIMP ON HARDWARE

Cheap drawer slides are likely to vibrate and rattle when you crank up the volume.



VENTILATE EQUIPMENT

Air vents allow heat from the TV section to exit the cabinet from the rear (see p. 81).

LEAVE ROOM FOR TELEVISION UPGRADES

The television's midpoint should be at eye level to a sitting viewer, which in most cases is around 43 in. from the floor. Allow for the wider high-definition televisions that will be standard beginning in 2006.

DOORS SHOULD DISAPPEAR

When designing the width of the cabinet, allow enough room for pocket-door hardware (see p. 83).

ISOLATE THE SPEAKER

Rest the speaker on three metal cones, called points, to reduce the transfer of vibration.

DIMENSIONS TO CONSIDER

The needs of the components determine the dimensions more than aesthetic considerations do.

COMPONENT SIZES

Standard components are less than 18 in. wide and about 5 in. high. Allow at least 6 in. of space between the shelves for airflow.

CABINET DEPTH

HDTVs are shallower than conventional models, so a cabinet deep enough to accommodate current technology should be fine for future televisions.

CABINET HEIGHT

The height of the cabinet is determined by the number of components and the amount of media storage needed.

TV DIMENSIONS

The new HDTV format is wider than current televisions, with a 24-in.-high screen having a width of 43 in.

TV STAND

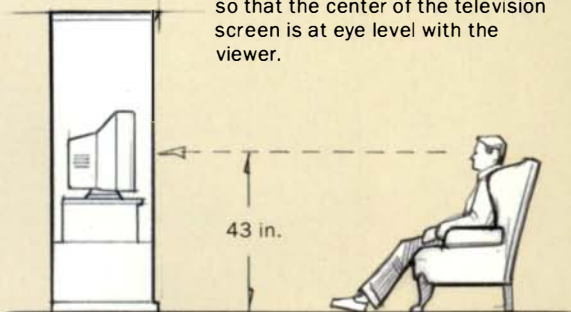
The stand must be sturdy enough to support the weight of the television. The stand cannot be installed until the pocket-door hinges have been attached. Allow up to 2½ in. of clearance on both sides for the pocket-door hinges.

MEDIA STORAGE

CDs, videos and DVDs all require a drawer that is a little over 6 in. high. Audio cassettes require an exterior height of a little over 3 in.

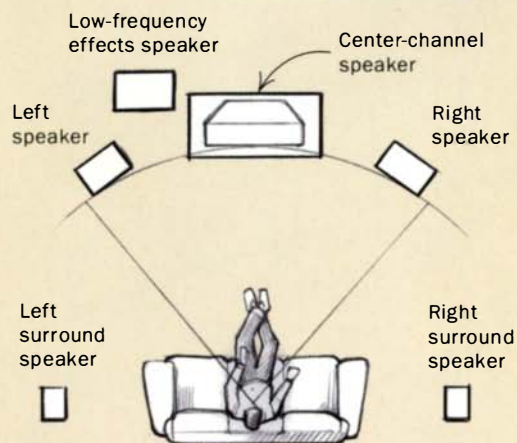
KEEP THE VIEWER IN MIND

Design the entertainment center so that the center of the television screen is at eye level with the viewer.



SURROUNDED BY SOUND

The HDTV format allows transmission of six audio channels. While the center-channel speaker is the most important, delivering up to 80% of the sound, correct placement of the other speakers is necessary to appreciate the full effect.



DVDs and videotapes fit in a drawer that has an external height of a little over 6 in. To separate media and keep them in neat rows, I usually attach a ¾-in.-high wood spline to the drawer bottom with double-faced tape. The spline can be removed if the drawer function changes. If small children will use the drawers, plastic media holders usually work better at keeping the contents in order.

The space above the television is reserved for the other electronic components, such as VCRs and CD or DVD players. Mount-

ed on adjustable shelves, the equipment is at eye level for adults and out of reach of young children.

A solid structure minimizes vibration

In addition to eating prime cabinet space, the center-channel speaker may introduce vibration into the cabinet, if played at a high volume. Vibration can cause both visual and audio distortion. Another effect is the rattling of doors and other cabinet compo-

RATTLE-FREE PANELS

More panels make less noise. Small rear panels are less likely to resonate than one large sheet.



Hot-melt glue makes a cushion. To reduce vibration, shim the rear panels down into their grooves and then apply hot-melt glue in a few areas. Remove the shims after the glue has set.



nents. For this reason, antivibration solutions should be employed in cabinet construction as well as in speaker mounting.

Cabinets should be as acoustically dead as possible. This is done by keeping the structure rigid and eliminating as many large, thin, flat areas as possible. Medium-density fiberboard (MDF) is one of the better readily available materials for carcass construction. Although MDF is acoustically superior to plywood, I still usually use veneer plywood for the primary carcass. It is stronger and lighter, and by designing a rigid structure, I believe I minimize the acoustical difference between the two materials.

The main sections of the center are glued and dadoed, reinforced with angled nails from a nail gun. I also use multiple rear stress panels, not just one over the entire cabinet back. Hot-melt glue applied around each rear panel eliminates any chance of a

rattle and also allows some flexing during seasonal changes. Pocket doors have tight closure hardware, with thick felt padding between the door and the face frame. Use good, tight slides for drawers. Most important, use your head when constructing the cabinet—look and listen for anything that may rattle or resonate.

The transmission of vibration from the center-channel speaker to the cabinet also should be minimized by mounting the speaker on three points—which are sharp metal cones available from audio suppliers. By minimizing contact between the speaker and the cabinet, the points reduce the transmission of vibration energy. An easier and cheaper method is to place foam rubber between the speaker and the cabinet.

Designing airflow into the cabinet keeps components cool

The television and the other electrical components all produce heat and require constant airflow to prevent overheating. The easiest solution is not to use doors, allowing the components to sit in free air. A typical cabinet, however, has doors in front of the components, and with the doors closed, there is no airflow. Many commercial units have air slots in the rear panel that allow heat to escape and also serve as a wire chase. The problem with these slots is that the shelves block the slots and reduce or eliminate airflow.

My solution to the airflow problem is twofold: First, I make a labyrinth in back of the shelves consisting of two panels attached to the cabinet sides and a third panel screwed to the rear of the center divider. A 2-in.-thick batten is then attached to the top and bottom of these three panels, and two panels of 1/4-in.-thick plywood are screwed to the battens. These panels overlap the side and center panels and disguise the opening. The labyrinth

WIRE CHASE AND VENTILATION



A labyrinth of overlapping panels provides airflow and access for wires. Attach a piece of 1/2-in.-thick hardwood to the back of the top vertical divider.

Install the side panels. Use pocket screws or biscuits to attach similar hardwood panels to the sides of the cabinet.



Two plywood panels come last. Attach 2-in.-thick battens across the top and bottom of the opening. Then screw on two 1/4-in.-thick panels so that they overlap the center and side panels.



To make a grille for ventilating the TV cabinet, first build a mitered frame with a rabbet on the inside and outside edges. Then glue in strips of wood with smaller pieces acting as spacers.

SHOPMADE AIR GRILLE



creates two wire chases for each side of shelves, allowing separation of AC power and signal. This design also creates a rear outlet for airflow.

By itself this labyrinth is insufficient to cool the electronics because air must flow across the components. For better cooling I set the shelves a couple of inches back from the door. An air grille is then inset in the front of the shelf above the television to allow air to flow from the compartment below. With this method, cool air is

drawn into the TV area and flows up through the grille, across the components and out the back. If additional cooling is necessary, fans may be located in the grille area for forced ventilation.

Considerable importance rests on the shelves

After time has been spent designing a center that is rigid and rattle free, many woodworkers put in shelving without thought. A shelf is just a shelf, right? Well, not really. A shelf should be acoustically dead: One of the worst shelves I see in many cabinets is glass. It's beautiful, and it saves space. But from an acoustical standpoint, it is one of the poorest-performing shelves you could use. The rigidity of glass makes it highly resonant at audio frequencies. Just think of how well a fine wine glass resonates when you tap it.

Composite shelves work well and look good—

Shelves for the serious audiophile are available at specialty stores, starting at \$100 per shelf and increasing to more than \$1,000. These prices indicate the importance placed on shelving, but inexpensive, shopmade alternatives are available. From a cost and availability standpoint, MDF is a good choice. But a better choice is to use a lamination of dissimilar materials, such as MDF and hardboard. Together, dissimilar materials acoustically dampen each other, a process called constrained layer dampening. I join ½-in.-thick MDF on one side



Make the composite shelf. Use contact cement to laminate sheets of ½-in.-thick MDF and ½-in.-thick hardboard.

SHELVES THAT DAMPEN NOISE



Paint it black. Tanner applies black dye followed by a clearcoat. Afterward, he edge-bands the shelves with solid wood. To simulate the appearance of slate, the finish is rubbed out with 0000 steel wool and then wax (right).



to 1/8-in.-thick hardboard with contact cement. To give an exotic look to this laminated shelving, I apply a black dye to both surfaces. After the dye has dried, I apply wood edge-banding to the edges. When clear coated and rubbed with steel wool and wax, the surface has the luster of polished slate.

Give thought to how the shelves are attached—In a typical installation, I use basic L-type hangers that fit into 1/4-in.-dia. holes. Shelves simply placed on the hangers may rattle at particular frequencies. Attaching the shelf to the hanger with a screw stops the rattle but transfers the vibration from the carcass to the shelf, which in turn will vibrate the component. To stop the rattle you can add a rubber pad that is typically used for mounting glass, but doing so may actually increase the vibration to the shelf at specific frequencies, due to the high rebound (bounce) of the rubber. The best solution I have found is simply to apply a thick felt pad to the surface of the hanger. Felt has a low rebound and allows the carcass and the shelf to move independently of one another, decoupling the vibration.



Cloth-covered frame hides speaker. A raw-silk screen conceals the center-channel speaker but doesn't distort the sound.

Cosmetic touches add class

Unlike Victorian children, the center speaker should be heard and not seen, which is why the speaker is hidden behind a cloth-covered frame. Many commercial cloths are available as covers, but according to speaker designers, raw silk adds the least acoustical distortion of any fabric. Raw silk does not have the tight, fine weave as the silk used for clothing and scarves. Instead, its texture and appearance are similar to burlap. Usually available through large fabric stores, raw silk is a strong fabric that stretches. When stapling or tacking the fabric to the frame, place thin cardboard tack strips (used in upholstery)

over the fabric edge (see the photo above). The strips keep the pressure even and minimize tearing from the staples. Attach the cover to the cabinet with hook-and-loop fasteners, but be sure to leave a pull-tag so that you can access the speaker for maintenance.

Doors in front of electronic components can create problems with remote controls. Several solutions exist: The easiest is to use a glass panel in the door, allowing direct access with the remote. If solid-wood doors are used, a remote repeater may be used. A repeater typically has a receiver that is attached to the outside of the cabinet and has stick-on elements that are placed on the remote-receiver area of the component.

Adding these touches to a cabinet designed around the components distinguishes an entertainment center from a cabinet that just happens to house the television. □

Brooks Tanner builds custom, high-end entertainment centers in Manchester, N.H.

POCKET DOORS

Place the hinges. Although the manufacturer recommends that the hinges be installed on the rails of the door, Tanner prefers to locate them on the top and bottom of the stiles to avoid drilling the 35mm holes just above the tenons.



Do a dry run first. A wood follower connects the upper and lower slides. Tanner finds it easier to measure the cabinet and then test-fit the follower to the slides before installation.



Install the lower slide. To make sure the door closes flush with the front of the cabinet, place shims behind, below and in front of the slide to account for the face-frame overhang and the location of the hinge.

1-hp Mortisers

These machines are bigger, beefier and mightier than benchtop models, but are they worth the extra cost?

BY ROLAND JOHNSON

MOVING TABLES



Some mortisers use a single wheel (left) to move the table side to side and forward and backward. Other machines use two wheels to do the job (above). The Fisch (bottom left, facing page) has one wheel in front to move the table sideways and a second wheel in back to move the fence in and out.



When faced with cutting a bunch of mortises, I like to use a mortiser. Properly set up and used, the mortiser, also called a mortising machine or hollow-chisel mortiser, cuts straight, square-sided mortises in relatively short order.

Stand-alone mortisers have been around for nearly a century, but they've always been big, expensive, industrial-quality machines. Relatively recently, though, several manufacturers have introduced more-affordable stand-alone mortisers, with features that make them practical for serious hobbyists and small commercial shops. Compared with the drill-press add-ons and benchtop mortisers currently on the market, these mortisers feature lots of cast-iron tables that move, sturdy hold-downs, 1-hp motors and extralong lever handles.

Curious to find out just how well these newcomers work, I tested seven of them: Bridgewood MS-10 (sold by Wilke Machinery), Fisch FM-99-66252, Geetech CT-920 (sold by Sunhill as the CT-1913), General International 75-075 M-1, Grizzly G8620, Powermatic 719-A and Woodtek 924-020 (sold by Woodworker's Supply).

Tables move in two directions

Each of the seven machines has a sturdy table and an attached fence that allows a workpiece to be clamped securely. But what's special about the table is its ability to move both side to side and forward and backward. That means you don't have to unclamp, reposition and reclamp a work-



HEAVY-DUTY HOLD-DOWNS



The four look-alikes—Bridgewood, Geetech, Grizzly and Woodtek—and the General have sturdy clamps with leadscrews that tilt downward to hold a workpiece against the fence and help keep the workpiece from lifting when removing the chisel from a mortise. Depending on the thickness of the stock, the clamp on each look-alike bolts to the table in any one of three front-to-back positions (above). The Fisch and Powermatic have clamps whose leadscrews are parallel to the table, a system less effective at holding down the workpiece (above left).

piece for every cut. You just move the entire table and the attached workpiece.

The Bridgewood, Geetech, Grizzly and Woodtek each uses a large handwheel on the front to move the table side to side and forward and backward.

Both the General and Powermatic mortisers have two relatively small handwheels. One wheel provides side-to-side movement, and the other moves the table forward and backward.

Fisch takes a different approach, with the table and fence moving independently of one another. A small handwheel at the front moves the table sideways while one at the back moves the fence forward or backward. But before the table can be moved, the clamp holding the workpiece

against the fence must be released. That's a drawback if you're using stops to establish the mortise locations. Should the workpiece move while it's unclamped, the length of the mortise is going to change.

Table stops—With the exception of the Fisch, all of the machines have a system of stops that can limit the side-to-side movement of the table. When making several mortises, these stops ensure that the mor-

FISCH FM-99-66252

Has the largest table area and longest side-to-side table travel, but front-to-back travel is shortest. Slowest motor speed of the bunch—a plus. Angle of lever handle is adjustable. No table stops for setting mortise length. Made in China.

GENERAL 75-075 M-1

The only machine with a tilting head and fence. Effective downward-tilting hold-down. Angle of lever handle is adjustable. Features a smooth-operating gas-strut counterbalance, table lock and workpiece stops. Made in Taiwan.

POWERMATIC 719-A

Has the longest vertical travel and front-to-back table travel. Angle of lever handle is adjustable. Features a smooth-operating gas-strut counterbalance, table lock and workpiece stops. Made in Taiwan.



COUNTERBALANCE SYSTEMS



A counterbalance system makes it easier to raise and lower the heavy mortise head. To help counterbalance the weight of the mortise head, the General and Powermatic use a gas strut; the Bridgewood, Geetech, Grizzly and Woodtek use a hanging weight (above left and inset); and the Fisch uses a spring (above right).

tises start and stop at the same place on each workpiece.

Both the General and the Powermatic have stops that slide along a rod at the bottom front of the table. When cutting short mortises, setting these stops can be a chore because the control wheel gets in the way. The General has adequately sized locking knobs, so tightening them took little effort. Powermatic, however, uses knife-blade-style handles that required more effort to tighten securely.

The Bridgewood, Geetech, Grizzly and Woodtek mortisers incorporate a stop rod behind the table. Stop clamps slide along the rod and, once positioned, are secured with a small Allen wrench.

Workpiece stops—Two machines, the General and Powermatic, have a stop system on the table that positions the workpiece. The stops, which can be used on either end of the table, are especially handy for doing multiple parts. They were easy to use and locked securely.

Hold-downs—Each of these machines has a single, viselike clamp mounted to the table that holds the workpiece securely against the fence, preventing it from shifting sideways during a cut. The clamp also helps hold the workpiece against the table. That's important, because if the work lifts up even slightly during a cut, the chisel is likely to bind in the mortise. Then you're faced with the chore of extracting the chisel. Also, when a chisel binds, I've noticed

FOUR LOOK-ALIKES

Except for the color of the paint and some differences between the motors and the on/off switches, four of these mortisers—the Bridgewood, the Geetech, the Grizzly and the Woodtek—look very much alike. Even the owner's manuals are identical.

The biggest difference among the machines is the motor in the Grizzly. As shipped, the Grizzly has a 110-volt motor, a plus if your shop is not wired for 220 volts. The Bridgewood, the Geetech and the Woodtek ship with motors wired for 220 volts.



BRIDGEWOOD
MS-10



GEETECH
CT-920



GRIZZLY
G8620

that the bit gets pushed against the chisel, creating unwanted friction and heat.

The clamp on each of the Bridgewood, Geetech, Grizzly, Woodtek and General has a leadscrew that tilts downward. The Fisch and Powermatic each has a clamp whose leadscrew is parallel to the table.

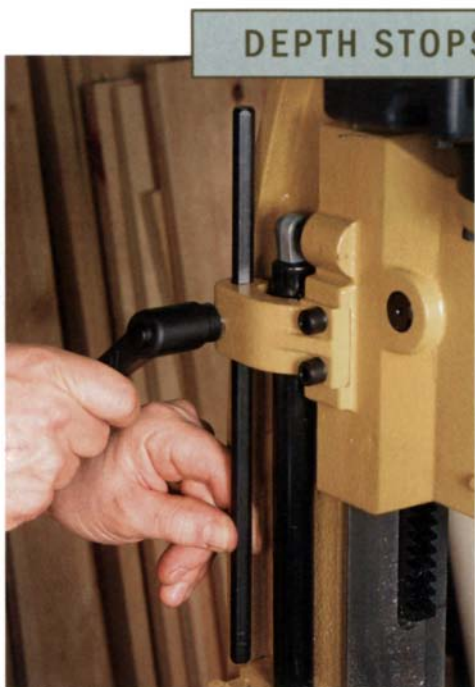
I prefer the downward-tilting clamps because they more securely hold the workpiece, preventing it from lifting when the chisel rises out of the hole. The parallel clamps don't enjoy that mechanical advantage, so it takes a lot more clamping pressure to keep the workpiece down on the table.

The General has a long, Acme-threaded rod that provides the clamping power. On the machine I tested, the rod tended to bind in the threaded nut in the clamp base as the distance increased between the handwheel and the threaded nut. Releasing a pair of bolts allowed the clamp to tilt to the side when I made cuts with the fence in the tilted position.

The Fisch includes an assortment of clamps. Among them, a tabletop clamp holds the work securely to the fence. But because the fence doesn't travel with the table, you have to release the clamp before the table can be moved.

Long handles provide good leverage

The mortising head of a mortiser is made up of a large casting, an electric motor, a drill chuck and a bit and chisel. The head is raised and lowered with a lever. All of the machines' handles were long enough to provide sufficient leverage.



Stop systems set the depth of cut simply by stopping the travel of the mortise head. The Bridgewood, Geetech, Grizzly, Woodtek and Powermatic use a sliding stop that's secured with a lock knob (left). The General incorporates a threaded rod with lock collars (right).

At first glance, such a long handle might seem like overkill, but that's really not the case. Granted, it doesn't take a lot of force on the handle to feed the drill bit into a workpiece. But to chisel away the waste around a hole, especially when using a big chisel, can take quite a bit of force.

The handles on the Bridgewood, Geetech, Grizzly and Woodtek are pinned in place, so they can't be adjusted. I prefer an adjustable handle, such as that found on the Fisch, General and Powermatic mortisers, because it can be positioned at a comfortable working angle. Unlike the handles

on the other mortisers, the Fisch handle attaches to either side of the machine, a plus for southpaws.

The heavy mortising heads on these machines need some sort of counterbalance system. The General and Powermatic use gas-strut counterbalances. The Bridgewood, Geetech, Grizzly and Woodtek incorporate a cable, weight and pulley. And the Fisch uses a simple spring to hold the head at the top of its travel.

The gas-strut system provided a smooth and effective counterbalance. The mortise head stayed put, even when I removed my hand from the handle. The cable, weight and pulley system, while not quite as smooth as the gas strut, was reasonably effective. The spring system on the Fisch worked okay.

Each machine has an adjustment system that allows you to stop the bit and chisel at a preset depth. Setting the stop on each of the machines I tested was a breeze. Simply position a sliding stop rod and lock it in place with a knob.

For improved leverage, the four look-alikes let you mount the head at any one of three vertical positions.

Bit and chisel changes are straightforward

When it's time to change the bit and chisel, you want the process to be as easy as possible. But it can be a challenge. After all, one hand is always occupied supporting



Adjustable mortise head. To improve leverage when cutting stock of various thicknesses, the Bridgewood, Geetech, Grizzly and Woodtek each has a mortising head that can be adjusted vertically along the column.



TILTING HEAD AND FENCE



The General is the only machine that has a tilting fence (above) and mortise head (left), handy features for cutting angled mortises.

the sharp chisel and an equally thorny auger bit. Your other hand has to work to get the bit and chisel mounted. So a clumsy holding system is not appreciated.

All of the mortisers here use a setscrew to secure the bit into a collet located beneath the drill chuck on the mortise head. Most of the machines use a bushing for

small-shank bits. The screw passes through a hole in the bushing, allowing direct pressure on the bit shank.

The General is the hands-down favorite here. By adding an adequately sized lock handle to the screw, the bushing and bit can be easily and securely clamped in the collet.

All of the other machines use an Allen-head setscrew, so you need to keep an Allen wrench handy.

Runout is reasonable

A mortising bit with a lot of runout (wobble) is going to be a problem. A wobbling bit rubs against the inside of the chisel, creating excess friction and heat between the two parts. And in a procedure that inherently creates plenty of heat, any extra is not going to be welcome. As a matter of fact, too much heat can eventually cook the tips of the bit and chisel.

I used a dial micrometer to measure the runout on all of the machines. And although far from machinist tolerances, all measured in the 0.005-in. to 0.010-in. range, which I believe is reasonable for their intended purpose.

Slow motor speed is better

The drill bit on each of these machines spins at the same speed as the motor. The Bridgewood and Grizzly motors operate at 3,600 rpm, the Fisch at 1,200 rpm and all of the others at 1,720 rpm.

With that in mind, I ended up preferring the models with lower-speed motors for a couple of reasons.

First off, when making a cut, particularly a deep one, the bit and chisel are inevitably



**MULTICO
PM 22**

Multico 1-hp mortiser is a benchtop unit

Unlike the stand-alone mortisers reviewed in this article, a typical benchtop mortiser is likely to have an anemic ½-hp motor, a small, fixed table and a hold-down system that leaves a lot to be desired. But one benchtop mortiser on the market isn't typical. The Multico PM 22, made in England and sold in the United States by Garrett Wade, has features closely related to the floor-standing mortisers reviewed here. It includes a 1-hp motor, a good-size table and substantial hold-downs.

It also has some other unique goings-on. The table tilts 45° to the left or right. It even can be positioned vertically for mortising the end of a board. And while the table on the Multico is fixed, the mortise head itself moves. The price is unique, too, about double what you'll pay for other 1-hp mortisers.

The hold-down clamps did an adequate job. But the dog-bone handle on the clamps always seemed to be at odds with the table. I prefer handwheels. The Multico incorporates table stops that screw to the table—a plus. And I like the gas-strut counterbalance system, which made for smooth travel of the lever handle.

The easily adjusted stop rod with a multistep turret stop similar to those found on routers could be a real help when cutting haunched mortises.

The Multico is a good machine; however, for the upscale price, I expected it to be significantly superior to the others in the test.

MORTISER	MOTOR	CHISEL CAPACITY	CHISEL AND BIT SET INCLUDED	TABLE SIZE	TABLE TRAVEL (Front to back, side to side)	VERTICAL SPINDLE TRAVEL	NET WEIGHT
BRIDGEWOOD MS-10 (800) 235-2100 Price: \$895	7 amps 220 volts 3,600 rpm	1 in. (softwood) ¾ in. (hardwood)	None	6½ in. by 20 in.	3½ in., 16 in.	5 in.	381 lbs.
FISCH FM-99-66252 (724) 663-9072 Price: \$800	8 amps 110 volts 1,200 rpm	1 in. (softwood) ¾ in. (hardwood)	¼ in., ⅝ in., ⅜ in., ½ in.	9¾ in. by 25¾ in.	2⅞ in., 21½ in.	7 in.	178 lbs.
GEETECH CT-920 (800) 929-4321 Price: \$700	7 amps 220 volts 1,720 rpm	1 in. (softwood) ¾ in. (hardwood)	None	6½ in. by 20 in.	3½ in., 16 in.	5 in.	370 lbs.
GENERAL 75-075 M-1 (514) 326-1161 Price: \$958 (\$848 with open stand)	10 amps 110 volts 1,720 rpm	1 in. (softwood and hardwood)	¼ in., ⅝ in., ½ in., ¾ in.	7⅞ in. by 18 in.	3 in., 14½ in.	6 in.	244 lbs. (with closed stand)
GRIZZLY G8620 (800) 523-4777 Price: \$895	14 amps 110 volts 3,600 rpm	1 in. (softwood) ¾ in. (hardwood)	¼ in., ⅝ in., ⅜ in., ½ in.	6½ in. by 20 in.	3½ in., 16 in.	5 in.	364 lbs.
POWERMATIC 719-A (800) 248-0144 Price: \$800	11 amps 115 volts 1,720 rpm	1 in. (softwood and hardwood)	None	10 in. by 20 in.	4 in., 16 in.	8 in.	261 lbs.
WOODTEK 924-020 (800) 645-9292 Price: \$995	7 amps 220 volts 1,720 rpm	1 in. (softwood) ¾ in. (hardwood)	None	6½ in. by 20 in.	3½ in., 16 in.	5 in.	352 lbs.
MULTICO PM 22 (800) 221-2942 Price: \$1,895 (without stand)	5 amps 220 volts 3,300 rpm	⅞ in. (softwood) 1⅞ in. (hardwood)	None	6½ in. by 23⅜ in.	Mortise head travel: 3⅜ in., 7¼ in.	7¼ in.	175 lbs.

going to deflect some. When that happens, the two parts often start rubbing against each other. Usually the result is a high-pitch squeal, a telltale sign that friction is hard at work. Where there's friction, there's sure to be heat. And the faster motors create more of both.

Also, as you might expect, the slower motors produced chips at a slower rate, which allowed the chips to eject from the hollow chisel slot with little difficulty. But the higher-speed motors made chips a lot faster, and sometimes those chips couldn't eject fast enough from the chisel. When that happened, the chips quickly got jammed in the chisel, causing the bit and chisel to heat up even faster.

Picking a favorite wasn't easy

All things considered, I was pleased to find that all seven of these machines were well made and did a decent job cutting accurate mortises, even when running a ¾-in. bit. That puts them head and shoulders above

Watch it on the web

Take a tour of a 1-hp mortiser
at www.finewoodworking.com.

any of the drill-press add-ons or benchtop mortisers I've used. So it wasn't easy for me to choose a favorite.

In terms of power, the Fisch had plenty, cutting ¾-in. square holes with little effort. But compared with the other machines I tested, the fence, the table and the hold-down systems were rather awkward to use and less-than-perfectly effective. Also, with no dampening system, the spring return was less than ideal. The farther down the head was moved, the faster it wanted to snap back to the uppermost position.

The Bridgewood, Geetech, Grizzly and Woodtek all did an adequate job boring any size mortise up to ¾ in. Their hold-down systems worked great, the tables moved smoothly, and the stops for the table and mortise head worked satisfacto-

rily. Bit changes were relatively easy, even more so when I switched to a T-handled Allen wrench over the standard-issue L-shaped version. Keep in mind, though, you need a 240-volt circuit to run the Bridgewood, Geetech and Woodtek.

The General and Powermatic were a bit more pleasurable to work with than the others. Bit changing was especially easy on the General, which also has thick, brass wear strips on all of the dovetailed ways found on the table and mortise head. The brass ways provided a smooth sliding action and should help ensure long life for the castings.

Overall, when it comes to cost, quality of construction and ease of use, it's almost a toss-up between the General and the Powermatic for top honors. But I give the nod to the General, mainly because of the added versatility provided by the tilting head and fence. □

Roland Johnson is a professional woodworker in Sauk Rapids, Minn.

Secret Spaces

Create hidden compartments to suit any style of furniture

BY MARK SCHOFIELD



FALSE DRAWER BOTTOM

One of the simplest hidden compartments is a shallow space below the main drawer. This trick, which has withstood the test of time, can conceal anything from a lover's letter to some rainy-day funds.

To lessen the chance of discovery, keep the hidden compartment shallow.



Most woodworkers associate hidden compartments exclusively with 18th-century furniture. At that time, growing wealth, a lack of banks and a reliance on custom furniture combined to spur innovation in secret compartments. While today's period furniture makers continue to build secret compartments into their pilasters and moldings, fans of Arts and Crafts or Shaker-style furniture have largely ignored this design element in their work.

Got something to hide? It really is possible to incorporate secret compartments into any style of furniture, taking advantage of dead space inherent in the design or subtly altering your plans to create a space and an entry mechanism that only you and those you trust will know about.

Three considerations when designing a hidden compartment

Before designing a piece of furniture that includes one or several secret locations,

there are a few things that you should consider: First, how large a space do you need and is it practical in the piece that you plan to build? You may have trouble concealing your prized shotgun inside that Shaker nightstand. Even if you decide to incorporate the hiding place into a larger piece, don't be greedy: Those 10-in.-deep drawers in that 20-in.-deep desk may arouse suspicion.

Second, how accessible do you want the secret space to be? Hollowing out the

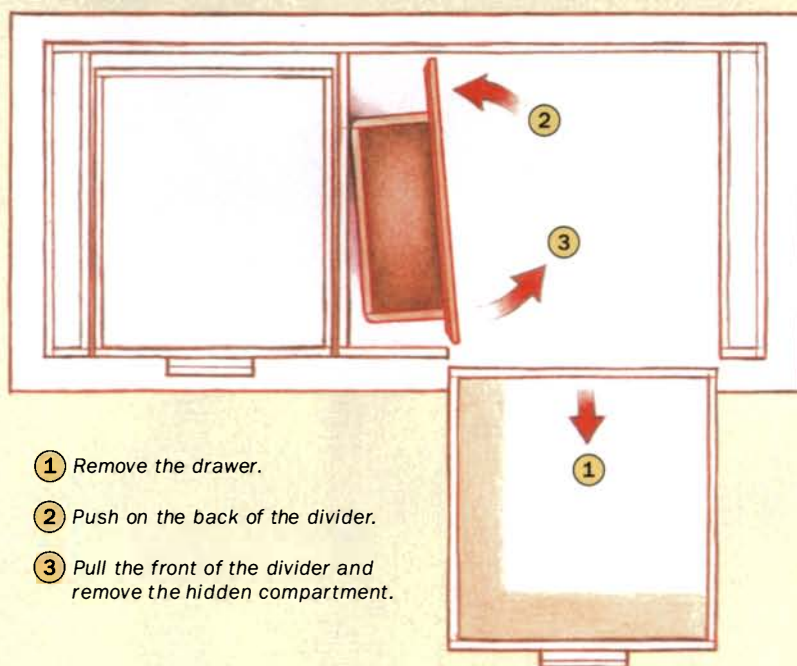


A DRAWER BETWEEN DRAWERS

Built by Billy Sisson at the Oregon State Penitentiary's woodworking shop, this pie safe contains a hidden compartment attached to a drawer divider.



Nothing complicated here. After one drawer is removed, the hidden compartment, which rests in a dead space between two drawers, may be pulled out.



- ① Remove the drawer.
- ② Push on the back of the divider.
- ③ Pull the front of the divider and remove the hidden compartment.

leg of a chest of drawers might have seemed like a good idea when you built the piece, but when you have to turn over the chest just to get at your horde of bonbons, you may have second thoughts. On the other hand, that copy of *The New York Times* announcing your birth can probably lie undisturbed.

Third, how are you going to secure the compartment? Some hiding places rely on blending into the workpiece, and any kind of latch or lock would give them away. Other compartments may need these kinds of mechanisms to remain concealed, so think carefully about how best to incorporate them invisibly.

Your secret compartment is not a bank vault—When it comes to storing valuables, 18th-century Americans lacked the choices we enjoy today. Banks were often far away and none too secure, while domestic safes were unheard of. But before creating a hidden compartment to store your 21st-century stock certificates and rainy-day funds, remember that your “bank” is not FDIC insured. Neither is it theft-proof nor fireproof, and unfortunately, your insurance carrier is unlikely to cover items that should have been kept in a genuinely safe place.

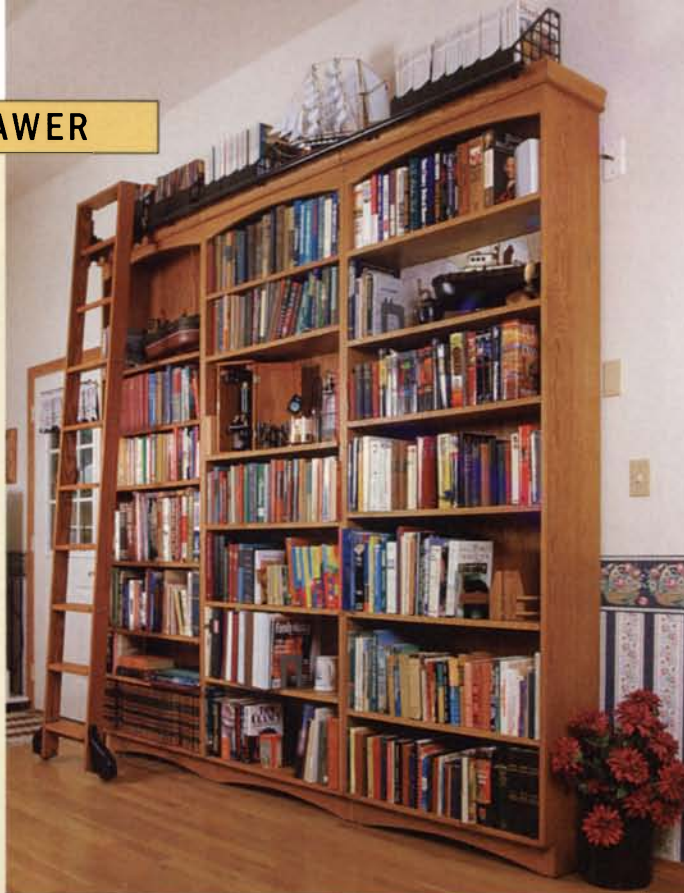
Hidden compartments in today's furniture are primarily a chance for the woodworker to demonstrate his or her ingenuity in design and construction. It is ironic that the better you are, the less likely your skills will be noticed.

Making use of available space

The simplest way to incorporate a hidden compartment into your piece is to make use of dead space inherent in the design. Examine your plans for likely areas, trying to think in three dimensions as much as possible and putting aside preconceived

TOE-KICK DRAWER

A novel place for a hidden compartment. Even in a piece as open as this bookshelf, it is possible to hide a compartment. Behind the center toe kick is a shallow but wide drawer.



ideas. It is this ability to think “inside the box” and to display cunning that is critical to creating good hiding places.

Andrew Parker, the woodworking instructor at the Oregon State Penitentiary, said he never ceases to be amazed by the creativity some inmates display when it comes to hiding contraband and weapons. Their skills have created a reputation for hidden compartments in furniture built by the penitentiary’s woodworking program. Now many customers ask to have hidden compartments built into their pieces.

Compartments hidden away—Secret compartments using dead space fall into two categories: those that are hidden from view and those that are in plain sight. An example of the former is a pie safe built at the Oregon State Penitentiary (see p. 91): Behind the facade between the two drawers is a lidless box with a divider attached to one side. To access the compartment it is necessary to remove the right-hand drawer, and then push on the rear of the di-





SLIDING BACK PANEL

The cornice molding on this cabinet surrounds a small compartment that is accessible via a sliding back panel.

vider to make the front of the divider protrude. The box is extracted by pulling on the leading edge of the divider. Although simple in design, the plan relies on tight-fitting joinery for its success.

Two more examples of hidden compartments using existing dead space come from period furniture maker Randall O'Donnell. His cherry secretary (see p. 95) incorporates a pair of drawers in the bonnet top, visible and accessible only when the top center drawer is removed.

Hidden compartments in full view—

Other locations for compartments using existing dead space rely on what Parker describes as “creating a false sense of permanence.” In the large bookshelf that Parker designed (see the facing page), no one would think of checking the toe-kick boards. The center board, however, is the front of a drawer that slides out, revealing a shallow space for storing documents or, in this case, spare shelf supports.

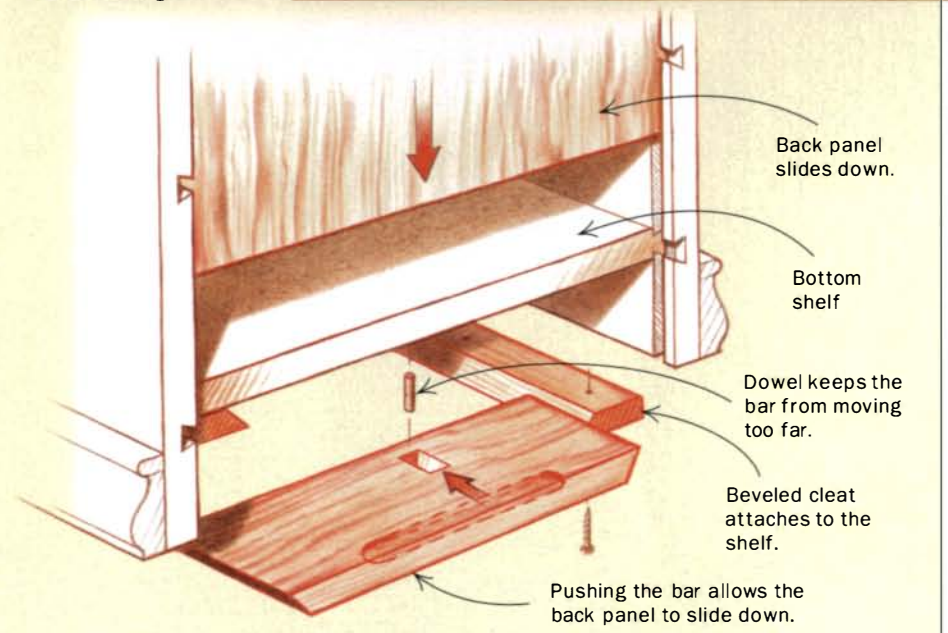
O'Donnell has hidden no less than six compartments in plain sight by using the pigeonhole valances in his secretary. Tight joinery makes the valances appear permanently fixed in the pigeonholes, but pulling on the valances reveals narrow yet deep drawers.

Creating space for compartments

When it comes to designing projects to accommodate hidden compartments, your imagination is the only limiting factor. Christian Becksvoort, renowned for his Shaker-style furniture, often employs hidden compartments. In the drop-front desk he recently built (featured on the cover of



A hidden catch. The rear of the spice cabinet has a bar on which the back panel rests. When pushed, the back panel slides down to reveal a compartment that's hidden behind the cornice molding.





SECRET DOOR PANEL

This side table has a large secret compartment built into the rear of the piece.



Hidden latch. First remove the drawer to reveal the latch. Sliding the latch forward allows the rear panel to be swung open to access the hidden compartment behind all of the drawers.



last year's *Tools & Shops* issue), Becksvoort hollowed out a space in the underside of a lid support to hide the key to the desk.

Becksvoort also employs perhaps the most common form of secret compartment: the double-bottomed drawer. In this example, he leaves a gap between the two bottoms large enough to hide some notes and coins (see the photos on p. 90).

A more elaborate variation on this theme, built at the Oregon State Penitentiary, hides a second drawer in the back of the large center drawer of a floor-standing spice chest. A second compartment is hidden behind the crown molding (see the photos on p. 93). Access is gained by pushing in a bar at the base of the rear, allowing the back panel to slide down.

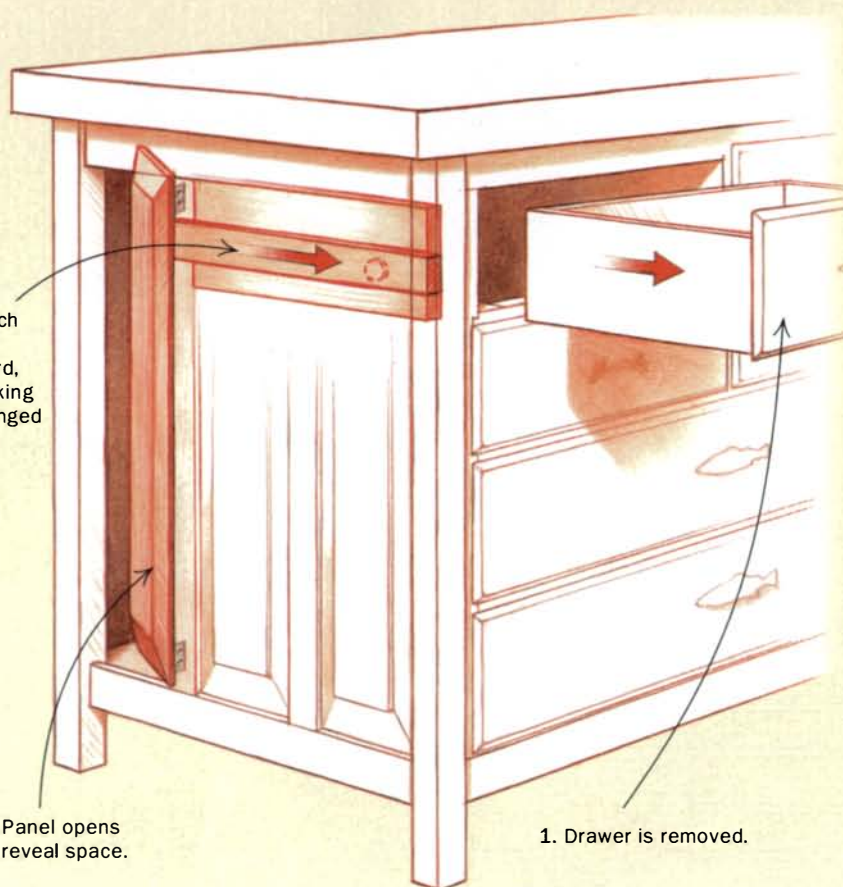
The spaces you create can be small—In their version of Thomas Jefferson's writing desk, the Oregon inmates have created a tiny secret compartment. When a drawer divider is removed, a concave pencil tray can be lifted out to reveal a space underneath. Although it was not in the original desk, Jefferson might well have appreciated the secret space for keeping documents from prying eyes.

In the secretary that featured compartments hidden behind the pigeonhole valances, O'Donnell created several other hiding places (see the photos on the facing page). Behind each of the three drawers in the prospect box is another box, while the pilasters also slide out.

Larger spaces are harder to hide and access—An example of a large hidden compartment appears in a side table made by Parker (left). The drawers extend only two-thirds of the way to the back of the piece, leaving a large area of dead space. The real challenge was to design a concealed opening to match such a large space; after all, there is little point in having room for your prized collection of 78-rpm albums if the opening is only big enough for a CD. Parker's solution was to make a hinged rear panel on one side. The panel remains locked until you pull on a latch tucked in beside a drawer.

With a little thought and ingenuity, it is possible to create a hidden compartment in any piece of furniture. It's the woodworker's version of a magic trick. □

Mark Schofield is an associate editor.



2. Latch slides forward, unlocking the hinged panel.

3. Panel opens to reveal space.

1. Drawer is removed.



A gallery of secrets

Hidden compartments reached their zenith in high-style 18th-century furniture, whose elaborate carvings and masses of drawers and cubbyholes made it relatively easy to conceal one, two or in some cases a dozen secret places.

There were practical reasons for making hiding places in furniture. Banks were few and far between, and even if they were convenient, the funds were neither secure nor insured. It therefore made sense to keep valuables hidden at home.

In this 18th-century highboy, Randall O'Donnell hid a pair of drawers in the bonnet top, and six drawers are cleverly concealed behind the pigeonhole valances. The three drawers in the prospect box each hides another drawer, and the pilasters slide out to reveal secret storage.



Unlocking the top drawer. First, screw in a small knob and slide back the well. Then reach in and move a pair of sliding bolts inside the top drawer.



Pigeonholed. The valance above each pigeonhole is the front of a hidden drawer. Tight joinery makes the valances appear permanently fixed in the pigeonholes. The drawers are narrow but deep.



A moving column. The pilasters in this secretary slide out to reveal themselves as hidden compartments.



Drawers behind drawers. Three drawers are hidden behind the three front drawers in the prospect box.

Current Work

Current Work provides design inspiration by showcasing the work of our readers. For more details and an entry form, visit our web site at www.finewoodworking.com. Send photos and entry forms to Current Work, *Fine Woodworking*, 63 S. Main St., Newtown, CT 06470.

Nathaniel Smelser Bradenton, Fla. ►

Asked by one of his best clients to build this maple and poplar chest of drawers (22 in. deep by 46 in. wide by 40 in. tall) based on an antique original, Smelser said the easy part of the job was the construction of the serpentine front carcase and the scalloped base. He ran into problems, however, duplicating the gold stencil pattern over the black lacquer finish. "We finally brought the original chest into the office, took the lid off the copier and struggled to copy the entire pattern by flipping the piece on all sides." From there, it was a matter of having the copies scanned into a local sign shop's computer, where the pattern was printed onto an adhesive-backed vinyl stencil, which was used to spray the gold details accurately.



◀ Jeff Collingwood Ramona, Calif.

Signing up for a Morris-chair class at Palomar College in San Marcos, Calif., Collingwood, an engineer by trade, took it upon himself to build this entire Arts and Crafts ensemble. The chair (38 in. deep by 34 in. wide by 38 in. tall) reflects the work of William Morris. "Although normally made from white oak," said Collingwood, "I chose mahogany for its warmth." The chair and ottoman are upholstered in leather, and the stained-glass lamp shade was purchased in Mexico. The whole set has a lacquer finish. Photo by Archie Breedon

James F. Conley Troy, Va. ►

Made of cherry with pine as a secondary wood, this china cupboard (19 in. deep by 48 in. wide by 94 in. tall) was built based on plans of a Stauffer corner cupboard in Franklin H. Gottshall's *Heirloom Furniture* (out of print). The cherry used in the cupboard's construction was harvested from the yard of Conley's uncle. The finish is varnish.



◀ **Joshua Schiffman**
San Francisco, Calif.

Built as a birthday gift for Schiffman's sister, this coffee table (26 in. deep by 48 in. wide by 17 in. tall) is made of quarter-sawn white oak. The walnut and epoxy inlays in the top represent the four seasons and were inspired by metal artwork that hung in Schiffman's parents' living room during his childhood. The piece is finished with three coats of polyurethane gel.



Dale Manor Menomonie, Wis. ►

Manor built this reproduction 17th-century Ming Dynasty recessed-leg side table (21 in. deep by 68¾ in. wide by 33 in. tall) and accompanying chair (17 in. deep by 23 in. wide by 44¼ in. tall) to help keep his woodworking skills sharp. Patterned after a piece that he had seen at the Minneapolis Institute of Art, the table is made of jatoba and finished with a sprayed semigloss lacquer. The chair is constructed of jatoba, bird's-eye maple and curly maple and has a hand-rubbed tung-oil finish.





◀ **Brad Greenwood** Clio, Calif.

To pay tribute to the pioneering spirit of his ancestors, Greenwood built this unique sideboard (21 in. deep by 78 in. wide by 38 in. tall). Dubbed as the Great Plains Buffet, it is made of 11 different hardwoods. The Western motif is incorporated throughout: The backslash, shaped like a mountain silhouette, has a carved covered wagon flanked by a miniature barbed-wire fence. The tusk tenons are pegged with black walnut pistols. Secret compartments are built behind the two top locking drawers. The buffet has a tung-oil finish. Photo by Elijah Cobb

Thomas Skaggs Champaign, Ill. ▶

Skaggs designed and built this tall dressing chest (24 in. deep by 24 in. wide by 72 in. tall) for his wife. Made of cherry, curly cherry and curly maple, the chest serves multiple functions: The lower drawers hold lingerie, the upper drawers and drawers in the gallery are for jewelry, and the two spaces on both sides of the gallery house necklace hangers that pull out on sliding dovetails. A unique feature of this piece is the connection between the carcass and its base. A large bearing ring is hidden between the two, and the entire case spins around to reveal a full dressing mirror on the back. The chest has a shellac-and-oil finish.



◀ **Dan Mosheim** Dorset, Vt.

These two Hepplewhite five-legged card tables (18 in. deep by 36 in. wide by 29 in. tall) were designed after a piece on display at the Clark Art Museum in Williamstown, Mass., and from Benjamin Hewitt's *The Work of Many Hands: Card Tables in Federal America, 1790-1820* (out of print). Each of the tables is constructed of crotch mahogany, satinwood, quartersawn pine and ebony, and both are finished with shellac and oil.

John Robinson ►
Kettleby, Ont., Canada

This low-back sawn-arm settee (20 in. deep by 55 in. wide by 30½ in. tall) was designed from a photograph of a similar piece featured in the *Maine Antiques Digest*. Robinson used basswood for the seat, cherry for the turned components and walnut for the arms, the arm crest and the knuckle hands. The settee is finished with black over red over green milk paint, with a light crackle medium, and then three coats of Danish oil. Photo by John Bradbury



James Seaman Trumansburg, N.Y. ▲

This mahogany mantle (20 in. deep by 120 in. wide by 60 in. tall) was designed and built for Sage Hall, a historic building at Cornell University that underwent an award-winning renovation in 2001. Many of the mantle's carved details were inspired by the building's ornate Victorian exterior. The mantle has a polyurethane finish.

Tips for photographing your furniture

1. Clean and dust the furniture.
2. The furniture will appear more three-dimensional if it is lit so that each plane has a different brightness. Take care, however, to avoid excessively bright highlights or dark shadows.
3. To be sure the photos will be free of distortion, avoid the use of wide-angle lenses, and photograph with the camera positioned even with the center of the furniture both vertically and horizontally.
4. Use 35mm color print (negative) film of moderate speed (ISO 200-400). If you're using a digital camera, shoot at the highest resolution and place the image on a CD.
5. Photograph the furniture from several angles. Include some head-on shots, as well as some shots that show both the front and side of a piece.
6. Keep the background simple. A cluttered or otherwise distracting background may draw the viewer's attention away from the subject.

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A time and a place for every finishing method

In the two years that I have been helping readers with their finishing questions, there has been a consistent theme: Give me a finish that is easy to apply and hard to mess up; doesn't require expensive equipment; can be applied to everything; retains the wood's natural appearance; is durable; is not dangerous; and can be wiped on.

The bad news is that there is no one solution in this search for the finishing Holy Grail. The good news is that there are many different solutions that will meet all of your finishing needs—providing you show some flexibility and not be wed to just one application method. In order of simplicity, there are three main ways to apply a finish: wiping, brushing and spraying.

Wiping away those finishing blues

If you are wed to wiping, you are in good company. *Fine Woodworking* recently featured articles by three contributing editors about their favorite finishes (Garrett Hack, *FWW* #150, pp. 36-39; Christian Becksvoort, *FWW* #152, pp. 74-75; Lon Schleining, *FWW* #154, pp. 46-49). While each uses a different kind of finish, they all wipe it on.

The popularity of wipe-on/wipe-off finishes has grown in the last decade for many reasons: the invention of gel stains and gel varnishes designed for wiping; the growing preference for a natural-looking thin finish as opposed to the traditional high-gloss look; and the growth of amateur woodworking where ease of application takes precedence over saving time. The main advantage of wiping is that it is very hard to do badly. Because so little finish is applied to the wood with each coat, there is no chance of causing sags or runs. The thin coating also attracts very little dust while it dries. And, as far as tools go, you only need the

T-shirt off your back, or any other lint-free cotton cloth.

Another plus is that wipe-on finishes can be applied to any type of work. For instance, Hack wipes his oil/varnish mixture on everything from tables to garden-tool handles.

Wiping is relatively safe, because the fumes released are unlikely to be potent enough to cause a headache, let alone an explosion. However, you should let the oil-soaked rags dry before disposal to avoid the risk of spontaneous ignition.

One drawback to wiping is the very thin layer of finish it applies. Even with multiple coats, the degree of protection is insufficient for prolonged moisture contact. Finish-wiping advocates tout its easy repairability, but this makes a virtue out of necessity. Very few surfaces treated with wipe-on finishes are able to withstand a wet glass left on them for a few hours without incurring some damage. For this reason, tabletops and kitchen counters benefit from a different finishing method, such as brushing or spraying.

The other drawback to wiping is the amount of time it takes to build a finish. Shaker furniture maker Becksvoort's preferred wipe-on oil finish adds three weeks to the length of a project, because four or five wipe-on coats equal just the thickness of one brush-on coat.

Brushing has stood the test of time but still takes time

Anyone who has brushed on a finish has gone back over their handiwork to discover a large sag or run right in the most obvious spot—or a stray bristle left in the middle of an otherwise pristine tabletop.

Choosing the right brush and using it correctly can make brushing on a finish a less-frustrating experience (*FWW* #156, pp. 38-43). Part of the problem is the range of drying times for different finishes. If you have



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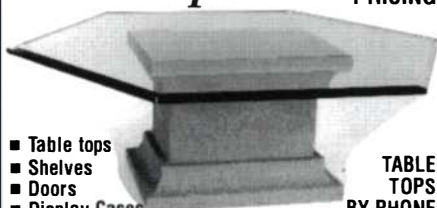
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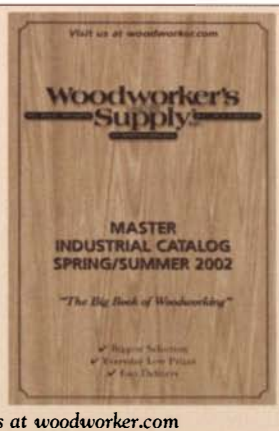
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Rules of Thumb (continued)

been brushing on oil-based varnish, with its long drying time, then you are used to going back over the wet surface two or three times, perfecting the finish. Switching to fast-drying lacquer requires a different technique: The finish should be applied with a single sweeping brush stroke and then left to dry. Any blemishes can be sanded out or melted away with the next coat.

The great advantage of brushing is the much faster rate of build and the degree of protection given to the wood. Two or three coats are sufficient for areas subject to light use, while tabletops need four or five coats to pass the wet-glass test.

While a good set of brushes costs more than a set of rags, it is a minimal expenditure in the overall cost of woodworking. The main downside to

brushing is the time involved, which is why professionals have switched to the third finishing method.

Nothing matches spraying for speed, results and cost

Only a small minority of amateur woodworkers spray on

tank that also can be used for air-powered tools.

Your choice of guns is high-volume low-pressure (HVLP), low-volume low-pressure (LVLP) (*FWW* #152, pp. 121-122) and smaller touch-up guns (*FWW* #154, pp. 62-63). As with most big-ticket items, buy the best you can afford, not a

blowing air from behind the operator across the workpiece (*FWW* #139, pp. 84-85).

A better solution is to spray only water-based finishes. These still require a good flow of air through the spray area, but there is no risk of an explosion. Large sheets of corrugated cardboard and furnace filters form a cheap but effective spray booth, stopping overspray from covering everything in the shop. With a little practice, you can achieve professional-quality finishes by spraying in a fraction of the time it would take by brushing.

Once you wield a spray gun, it is unlikely that you'll go back to your brushes or cloths. However, if time is no object, by all means continue to use those other methods of application—just don't ask me for a durable wipe-on finish. □

Once you wield a spray gun, it is unlikely that you'll go back to your brushes or cloths.

finishes. Among the reasons are the high initial cost of even a small-scale operation and the confusing number of spraying options. You need an adequate source of compressed air. This can be either a turbine system dedicated to spraying (*FWW* #137, pp. 62-67) or a compressor and a

system you'll outgrow quickly.

Then there is the problem of where to spray and what to spray. Spraying solvent-based finishes should take place in a dedicated spray booth with an explosion-proof fan. Many woodworkers set up temporary spray booths outside on a warm, calm day, with a fan

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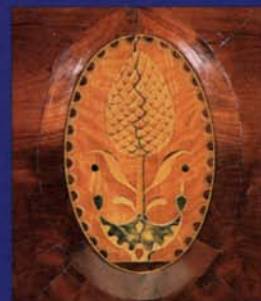


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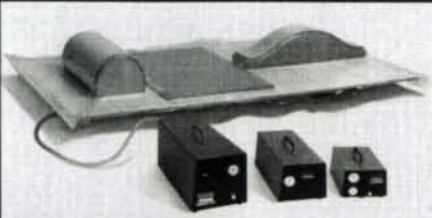
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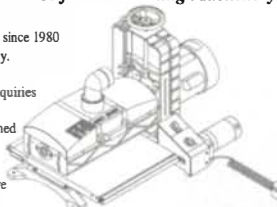
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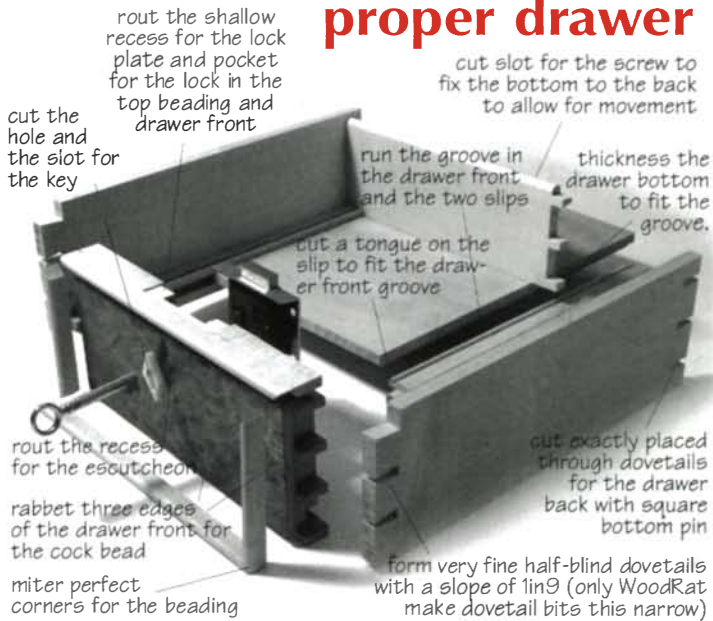
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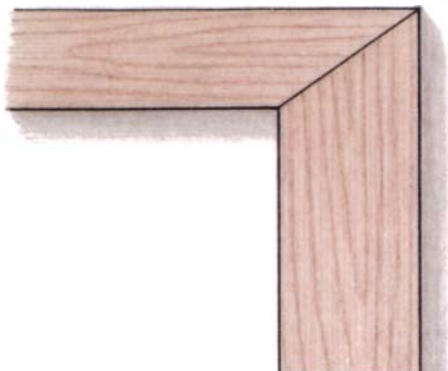
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Miters for stock of different widths



I am trying to join two pieces of wood in a miter, but they are of different widths. How do I lay this out and cut it?

—Howard Milford, Chicago, Ill.

Christian Becksvoort replies: In several pieces of my furniture, I have a foot molding where I have this exact problem. It's not a hard one to solve, but it does mean that the miter will not be 45°. With pieces of unequal width, you have to use the pieces themselves to help you mark your lines to cut.

First scribe the width of the narrower piece onto the wider piece, and then

the width of the wider piece onto the narrower piece. Now mark a diagonal cut line from the outside corner of the piece down to the line you've just marked (see the drawing below).

You may need to make the cut by hand or on a bandsaw because a chopsaw may not be able to handle this angle. Clean up your mitered edges with a handplane or sander for the best fit. Now the two pieces will join at 90°.

[Christian Becksvoort is a contributing editor.]

The difference between high-speed steel and carbide bits

I see a lot of router bits made from high-speed steel, and the price is awfully tempting. Are there different uses for high-speed steel and carbide bits?

—Les Saunders, Marietta, Ga.

Pat Warner replies: High-speed steel (HSS) is a good material and capable of very sharp edges that can be resharpened—but it doesn't hold up under prolonged use. With HSS, expect only 10% to 20% of the running time of carbide. Its value today is for short runs of custom profiles or perhaps for an

experiment. For instance, if you are wondering about how the actual profile of a \$35 carbide ogee might look on a project, an \$8 HSS bit will give you the answer.

Another advantage of HSS is that woodworkers skilled in tool grinding can make custom profiles. HSS router-bit blanks are available for this purpose. I especially like HSS bits for mortising, because they are often ground to plunge better than carbide-faced steel bits. And because mortising doesn't remove vast amounts of wood, the bits will last a while.

Carbide on steel (the most common material and design) will outlast HSS five to 10 times. Its actual life will vary, but it is clearly the best compromise for router-bit flutes, both economically and practically. The material can be reground sharp enough (but never as well as the factory setup) to run nearly as long as it ran when new. In my view, hand diamond-honing is largely ineffective, and only professionals should grind carbide router bits.

Carbide is the gold standard in tool-bit material today, although it does vary in hardness, durability and density. Some carbide bits are selected for their durability in specific materials; one grade does not fit all occasions.

[Pat Warner is a woodworker and the author of *The Router Book* (The Taunton Press, 2001).]

Keeping wood green

I have some green cherry that I intend to make into chairs using green woodworking techniques. Unfortunately, time constraints keep me from doing this quickly, so I need a method for keeping the wood green. In The Workshop Book (The Taunton Press, 1991), Scott Landis notes that Brian Boggs keeps wood in a tank until he can work it, which is what I tried.

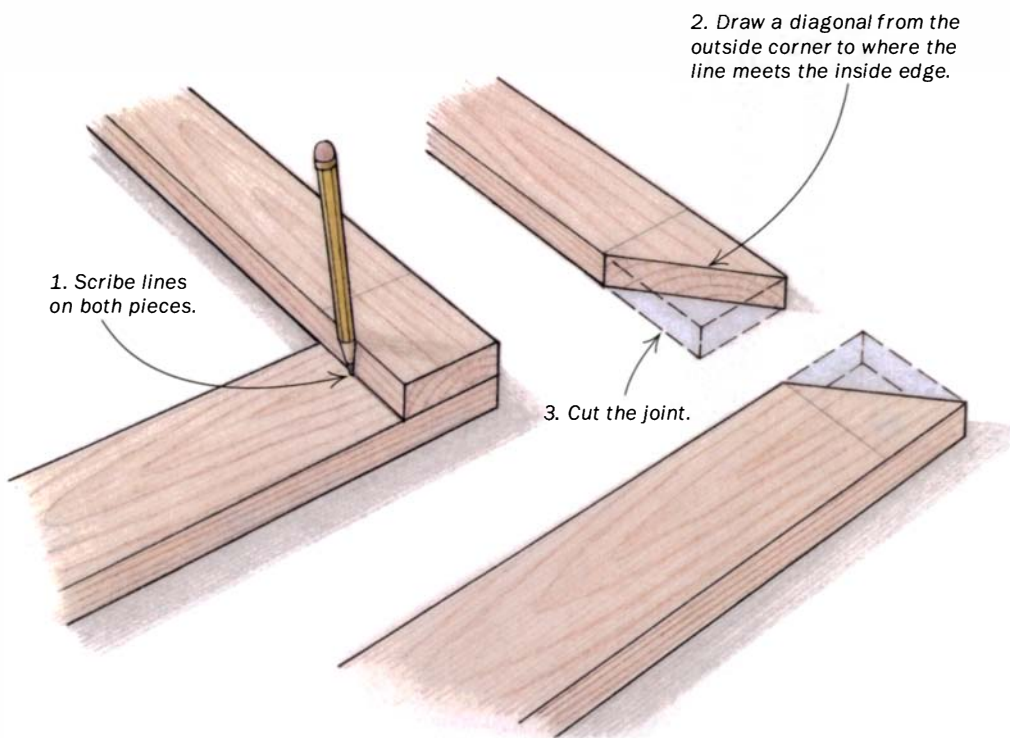
The tank is outside, and in two or three days, the water was seething with thousands of mosquito larvae and gave off a very strong, disgusting smell.

Any suggestions?

—John Hansen, Beverly Hills, Mich.

Brian Boggs replies: The picture you saw in Scott Landis' book was a short-lived experiment. I had been enjoying the

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efficiency of green woodworking for about 10 years and had been keeping green wood in the log form as long as I could, making sure to work it up into chair parts before fungus set in or cracking became a problem. In the balance of trying to meet deadlines and live a life, sometimes the fungus got the upper hand. Like every natural system, there's always something lurking in the shadows. I tried soaking wood in water to buy a little time. This resulted in a backyard full of mosquitoes and foul-smelling wood. I think it is possible to manage water-bath preservation, and there are experts in water management (talk to your local public-pool manager). An oil film on the water can kill mosquitoes, and you can certainly use a larvicide. Bleach might keep down the odor, but all of these solutions still require a fair amount of management.

Timing can help. I have found that wood cut in the fall keeps just fine until about June as long as I have kept the ends coated. Wood cut in April also lasts until about June. Part of winning the game too is to keep a manageable amount of wood on hand. I've heard of some woodworkers freezing their stock in a large freezer until they get a chance to use it. This will work, but it may not be an efficient way of using the freezer.

In our culture we have for generations tried to beat nature, using chemicals, usually, to protect us or our food or materials. I like working wood that is just wood, no additives, no funny smells. So I just work my wood as soon as I can and keep moving. If the wood dries out too much for steam-bending, I soak it for a few days and dump the water before the mosquitoes hatch. I lose wood sometimes by not getting it worked quickly enough. In fact, I still occasionally ruin wood with mistakes in the shop. But I just keep moving and put the waste to good use with an occasional wood-fired barbecue. [Brian Boggs is a chairmaker in Berea, Ky.]

A nonyellowing finish for maple
I am making a chest with a walnut frame and bird's-eye maple panels. I want to

keep the maple as light as possible. What finish will darken it the least?
 —Martin Pollock, Beverly, Mass.

Jeff Jewitt replies: The lightest finish for the maple—one that will contrast nicely with the walnut—is colorless, avoids the darkening effect you get with most finishes on light woods, will not yellow over time and will keep the maple itself from yellowing, which occurs when the wood is exposed to air and oxygen.

I recommend an acrylic finish, and you can go two routes:

1. A water-based acrylic or acrylic/urethane blend. This has both the advantage of being colorless when dry and, due to the coalescing nature of the way it forms a film, of keeping the finish resin on the surface of the wood.

This route leads to the slightest deepening effect from the wetting-out of the cellulose. Applied by spraying, brushing or wiping, this finish looks like plain sanded maple. To pop the grain a bit, first wipe the maple with an ultrapale shellac sealer.

2. A solvent-based acrylic or butyrate lacquer or blend, such as a CAB-acrylic. The CAB stands for cellulose acetate butyrate. This will give you more wetting-out of the cellulose and hence more figure. The finish will be just a touch darker than the aforementioned choice. Also, you must apply this type of finish by spraying.

You also could try an amino-alkyd or vinyl conversion varnish. This finish requires careful preparation and application because it's sprayed. But it's tough as nails once it cures. Avoid conversion lacquer, which is the amino-alkyd resin with nitrocellulose added. Nitrocellulose will yellow significantly over time.

A final option is a dewaxed colorless shellac. Ultrapale and super blonde will have just a hint of color, while bleached shellac has virtually no color. All will deepen the color of the wood but won't provide any UV protection.

Of all of these, I prefer to use an acrylic finish on maple. An acrylic is not only colorless, but it also has a natural screening effect for blocking UV light, which yellows maple.

[Jeff Jewitt is a frequent contributor to *Fine Woodworking* on finish topics.]

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More figure. A solvent-based acrylic pops the figure but needs to be sprayed.



Deeper wood figure now, yellow later. While a shellac will give a good finish now, it offers no UV protection, so the wood and finish may yellow.



Clear finish with no yellowing. A water-based acrylic is easy to apply and remains clear over time, but it brings little depth to the grain.

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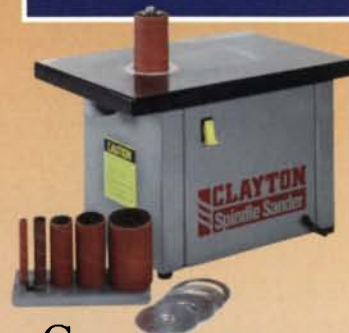
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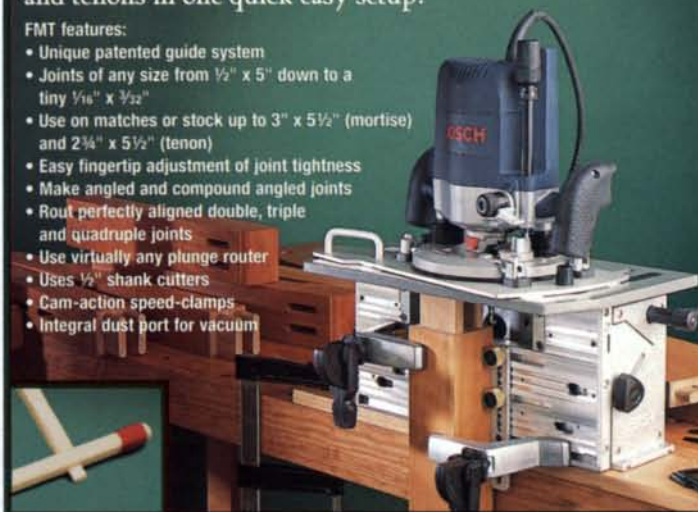
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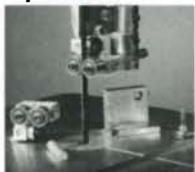
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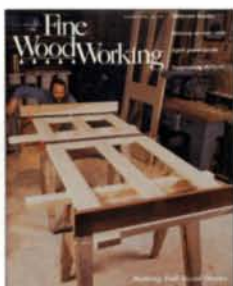
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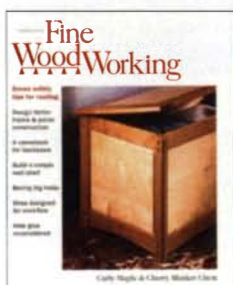
126

- Krenov-style planes
- Coopering a door
- Fuming wood
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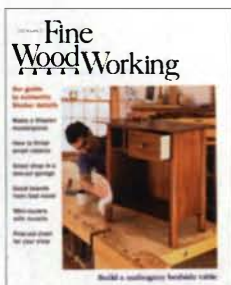
129

- Router safety
- Backsaws
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- Garden bench
- Mortising techniques
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- Mission mantel
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- Laptop desk
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- Blanket chest
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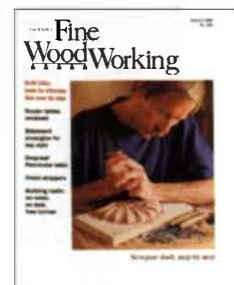
135

- Chippendale stool
- Finishing curly maple
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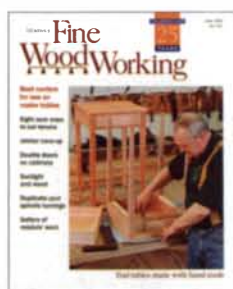
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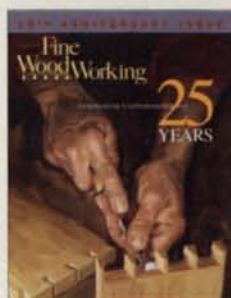


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Shaping curved furniture parts

BY MICHAEL FORTUNE

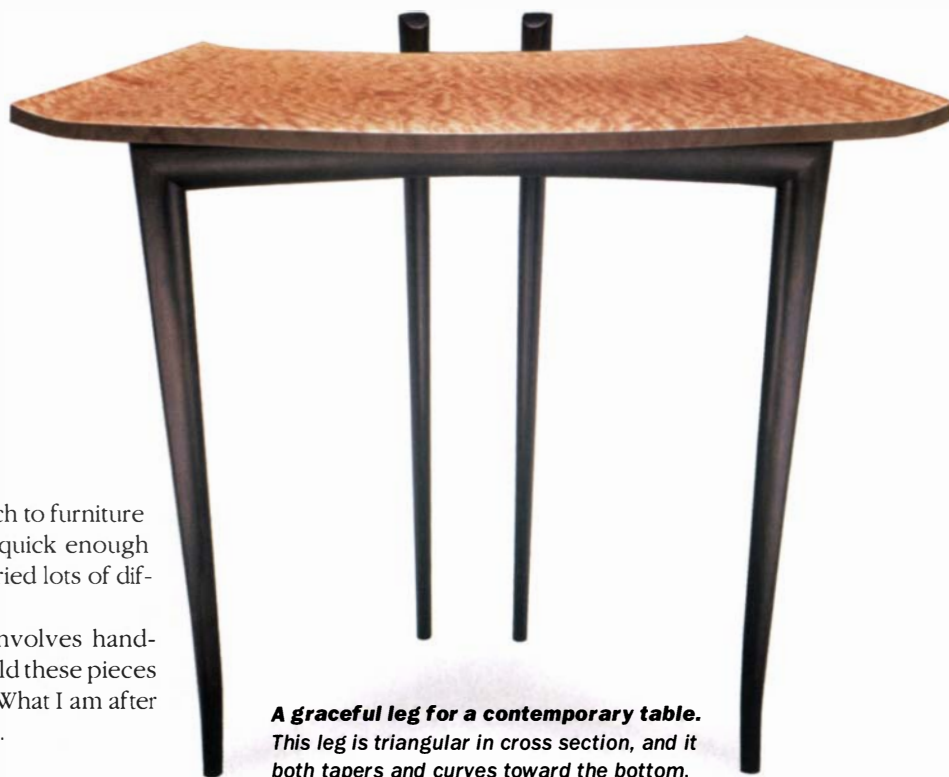
Over the last 25 years I have worked out an approach to furniture making that satisfies my design sensibilities yet is quick enough to allow me a decent living. Along the way I have tried lots of different tools and put them aside.

Most of the furniture that I design and make involves hand-shaped, curved elements. I'll demonstrate how I hold these pieces for shaping, as well as the series of tools that I use. What I am after is an enjoyable, fast, efficient and rhythmic process.

Holding on is the first step

It is one thing to have the right tools to shape wood, but if the piece is not held securely, a lot of your effort will be wasted. While rectangular pieces are easily held with clamps or a bench vise, curves and tapers are another matter.

My favorite and most frequently used clamping method for holding sculptural, linear shapes like table and chair legs is a device I make from a deep-reach pipe or bar clamp (see the photos below). The pipe clamp is a little easier to modify because it comes apart. Any length pipe can be used, but I have found that a 42-in.,



A graceful leg for a contemporary table.
This leg is triangular in cross section, and it both tapers and curves toward the bottom.

3/4-in.-dia. pipe accommodates most furniture parts. I prefer this benchtop holding device to a shave horse because I prefer to stand rather than sit when shaping a long piece.

The shaping sequence

To start with, whether I am working with exotics or domestic wood, I always cut my joinery first and then use templates to lay out the curved sections. I carefully cut the curves on a bandsaw to within 1/2 in. of the finished dimensions.

It is important to smooth the curved surfaces evenly. The more accurate and even these initial surfaces are, the more even the final sculpted part will be. I plane all of the sur-



A BENCHTOP HOLDING DEVICE FOR SCULPTING

Fortune adapts a deep-reach pipe clamp to hold thin parts securely without impeding his tools.



Changing the clamping surfaces. He grinds away much of the fixed clamping pad, and then drills, taps and grinds a steel rod to create a spur that resembles a lathe's drive center (above left). At the adjustable end (above right), he removes the clamp pad and grinds a slight cup into the ball tip.

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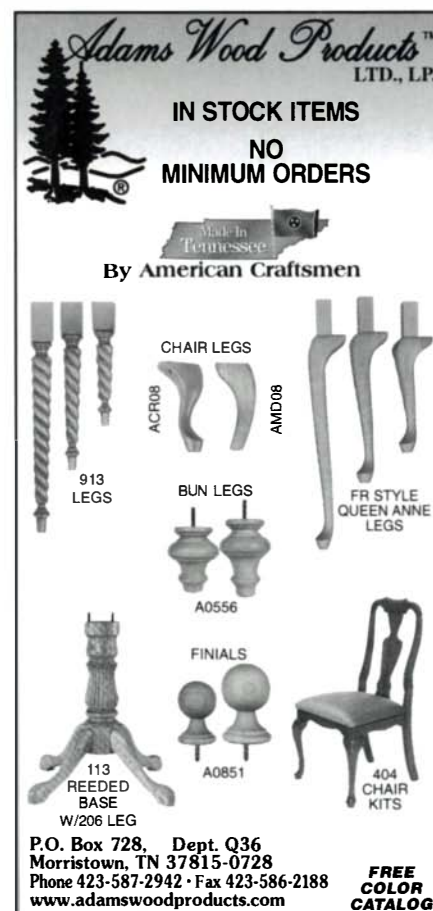
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Mark the corners of the triangular leg. On the sides, this is done simply by offsetting the leg template. These marks should still be barely visible when the shaping is done.

SHAPING STRAIGHT-GRAINED WOODS

First, make a template for the curved leg and cut the profile on the bandsaw. The curves must be smoothed carefully because all later steps use them as a reference.



Chamfer away the waste. These deep, even facets will guide the rest of the shaping process. Fortune uses a Kunz No. 65 chamfering spokeshave that has two angled, adjustable guides. The depth of cut varies down the leg.

faces, using a compass plane to smooth the concave areas. Never smooth a curve with an edge sander or sanding drum if cutting tools are to be used later. The grit left in the wood is murderous on finely honed cutting edges. Even a file will lose its edge to trapped grit.

Heavy chamfers come first—Before hand-shaping, I use a router or chamfering spokeshave to chamfer all parts that will be round or ovoid in cross section. This removes waste wood and gives me convenient faceted guide surfaces, making it less likely that I will hand-shape past where I had in mind. It also builds uniformity into the process, which is necessary when making sets of legs.

Use edge tools on domestic woods—For straight-grained woods, my usual next step is to sculpt the part with a block plane and various spokeshaves, gradually removing the facets left by the last step. The rule of thumb is to use a plane or spokeshave with as much contact as possible between the sole of the tool and the surface of the wood. This allows the tool to bridge small dips that may have been created by previous processes. The limiting factor is whether or not the sole of the tool lifts the cutter off the wood. Skewing the tool will work sometimes; otherwise, a tool with a shorter or curved sole will have to be used.

My favorite plane for this step is a small Lie-Nielsen regular-angle brass block plane. If that is too large, I use smaller specialty and customized planes and spokeshaves.

Rotary tools and rasps for exotic woods—Tropical woods often won't respond well to planes and shaves, so I use power carving tools and wood rasps to shape these materials efficiently.

In years past I used an electric die-grinders tool, commonly used by metal workers to deburr castings or pipes. Made by Makita, Bosch and Metabo, these range in price from \$80 to \$300, respectively. However, the electric rotary tools don't last very long in a professional shop. Air-powered rotary tools are the right choice for heavy use. They are also lighter and cheaper, but they require at least a 5-hp, two-stage, 60-gal. compressor to run them. I use



Let the chamfers and pencil lines guide your sculpting. Fortune uses a variety of standard and customized planes and spokeshaves to finish shaping the piece.



Scrapers smooth all surfaces. To keep the contact area manageable, use a scraper radius that is slightly larger than that of the workpiece.



Sanding is the final step. A piece of an old truck mud flap makes a flexible but firm sanding pad.

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SCULPTING DIFFICULT WOODS

For exotic and tropical woods with rowed, interlocked grain that won't respond well to spokeshaves, Fortune does the sculpting with power tools and wood rasps.



Cut the initial chamfers. A laminate trimmer and a chamfer bit are an alternative to the chamfering spokeshave, though the trimmer can change depths only in steps.

machine-ground, high-speed steel cutting burrs made by Severance Tools (989-777-5500; www.severancetool.com). I have collected a dozen or more different shapes, but I use only two with any regularity (see the top photo at right).

The rasp I use most often is an odd bird: It looks like a series of crisscrossed hacksaw blades riveted together. It is made by a Japanese company, Shinto, and is relatively inexpensive (\$15 from Highland Hardware; 800-241-6748) and lasts a long time. The blade is flat on both sides, and there are coarse and fine sides. For concave curves, I use a random-tooth cabinetmaker's rasp made by Nicholson. It comes in a coarse-tooth version, #49, and a finer version, #50. One side is flat, and the other is rounded. The random-tooth pattern leaves a series of striations, but none pronounced or particularly deep. Unfortunately these rasps are expensive, about \$40 each, and they don't stay sharp very long.

Profiled scrapers work on all woods—One of the tools that I am very thankful I took the time to master is the cabinet scraper. It smooths curves on all wood species. I grind the radius of the profiled edge a little larger than the area being scraped; this way, the scraper won't have too much contact with the wood.

Sanding is always last—Before I begin sanding, I make every effort to ensure that the shape I have created is exactly what I want. Long curves must be free of short bumps or dips.

For tight areas and corners I use aluminum-oxide sandpaper backed with duct tape. I can cut strips to the exact size or shape that I need, in any grit. The tape keeps the paper flatter and makes it strong enough to be pulled back and forth. I sand the more wide-open areas with a flexible pad I make by wrapping sandpaper around a piece of an old truck mud flap. The thick rubber evens out my finger pressure and conforms to the piece. □



Next is a rotary tool with a cutting burr. Fortune does most of his sculpting with the tree-shaped bit, and uses the round one to carve out chair seats. The heavy-duty cut shown here will not burn the wood, and the crosscut serrations break up the fibers as they cut. Use a climb-cut to control the tool. The rotary tool will leave slight dips and undulations that will be leveled with a wood rasp.



An inexpensive, durable rasp. This model, which looks like a series of crisscrossed sawblades, works well on most of the piece.



Use a traditional rasp for the concave areas. This round-backed cabinetmaker's rasp has a random-tooth pattern that leaves shallower marks. But the tool is expensive.

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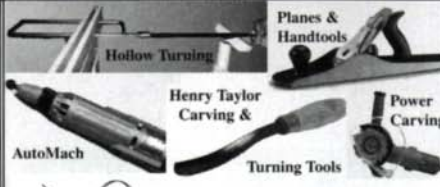
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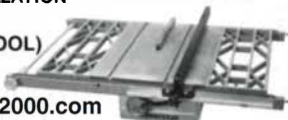
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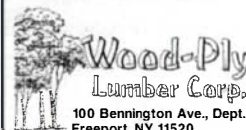
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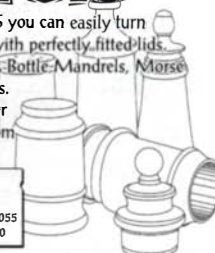
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INDEX TO ADVERTISERS

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Reader Service No.	ADVERTISER, page #	Reader Service No.	ADVERTISER, page #	Reader Service No.	ADVERTISER, page #	Reader Service No.	ADVERTISER, page #
	Abacus Chair Parts, p. 109		Electrophysics, p. 14	40	Luthiers Mercantile Intl., p. 14	112	Specialty Tools, p. 124
37	Adams Wood Products, p. 117	122	Engraving Arts, p. 125			118	Suffolk Machinery, p. 122
9	Airware America, p. 122	95	Everlast Saw & Carbide Tools, p. 107	30	M.L. Condon Lumber, p. 105	44	Super Shop by Smithy, p. 105
199	Akeda Jigs, p. 31			78	MEG Products, p. 124	132	System One, p. 121
71	Allred & Associates, Inc., p. 119	38	Fein Power Tools, p. 15	158	MLCS Ltd., p. 29		
7	American Furniture Design, p. 123	174	Felder USA, p. 29	200	Manny's Woodworker's Place, p. 7	76	Talarico Hardwoods, p. 123
81	American School of French Marquetry, p. 124		Fine Woodworking on CD, p. 34	144	Mao Shan Machinery, p. 105	110	Target Enterprises, p. 29
68	American Turbine, Inc., p. 117		Fine Woodworking Back Issue Sale, p. 114	218	Marc Adams School of Woodworking, p. 13	194	Tech Mark, Inc., p. 103
201	Apollo Spray, p. 103		Fine Woodworking Slipcases, p. 112		Marc Blanchette Windsor Chair, p. 125	119	Tech-Wood, Inc., p. 125
136	Ashman Technical, Ltd., p. 119	217	Flamingo Specialty Veneer, p. 13	190	Mark's Tool School, p. 124	29	Tenryu America, Inc., p. 42
99	Australian School of Fine Furniture, p. 105	141	Forrest Manufacturing, p. 25	20	Mass Bay Wood Products, Inc., p. 125	55	Thewindsorinstitute.com, p. 121
		181	Freud, p. 37				Thomas Golding School, p. 124
166	Bailey's, Inc., p. 13	102	Fuji Industrial Sprayers, p. 13	41	McFeely's Square Drive, p. 41	58	TigerStop, p. 122
23	Ball & Ball, p. 119	70	The Furniture Institute of Massachusetts, p. 122	77	Microplane, p. 106	108	The Tool Chest, p. 122
79	The Bartley Collection, Ltd., p. 123			131	Micro-Rip 2000, p. 124	63	Tool Dock, p. 117
146	Bauhaus Apprenticeship Institute, p. 123		GRS Tools, p. 41	54	Mini Max, p. 41	195	Toolcrib.Amazon.com, p. 29
24	The Beall Tool Co., p. 124	151	General Manufacturing Co., p. 23	167	Mini Max, p. 105		Tools for Woodworking, p. 123
109	Belcher Veneer Co., p. 122	72	Gilmer Wood Company, p. 123	88	Misugi Designs, p. 122	182	Tropical Exotic Hardwoods, p. 121
114	Bench Dog, p. 100	86	Goby's Walnut Wood Products, p. 123	215	Molding Knives.com, p. 100	191	Turbinaire, p. 19
205	Berea Hardwoods, p. 12	150	Good Hope Hardwoods, p. 122	85	Murray Clock Craft Ltd., p. 122	225	Tyler Tool Company, p. 41
204	Berea Hardwoods, p. 109	53	Gorilla Glue, p. 9	155	Noah's, p. 126		
126	Better Built Corp., p. 14	11	Gougeon Brothers, p. 126	168	Northend Hardwoods, p. 119	47	Vac-U-Clamp, p. 14
	BrandNew Industries, p. 123	10	Groff & Groff Lumber, p. 41	26	Northland Forest Products, p. 125		Vacuum Laminating Technology, p. 117
116	Brookside Veneers, Ltd., p. 117		Guitar Making, p. 125	124	Northwest Timber, p. 100	98	Vacuum Pressing Systems, p. 105
				84	Norwood Sawmills, p. 122	39	Valley Custom Door, p. 121
142	CT Valley School of Woodworking, p. 123			18	Oakwood Veneer, p. 126	89	Vari-Fence Systems, Inc., p. 121
	Cabinetparts.com, p. 125	6	HTC Products, Inc., p. 106			186	Viel Tools Inc., p. 107
59	CabParts, p. 106	221	Halder, Inc., p. 123	175	Omer Direct, p. 119	149	Viper Router Bits, p. 21
121	Carter Products, p. 113	173	Hammer USA, p. 107	156	Oneida Air Systems, p. 23	8	Virutex.com, Inc., p. 14
	The Centro Company, p. 13	61	Harris Woodworking, p. 124	46	Originalfurnitureplans.com, p. 126		
49	Certainly Wood, p. 123	48	Hearne Hardwoods, Inc., p. 113	170	Packard WoodWorks, p. 124	73	W. Moore Profiles, p. 109
208	CinchStrap, Inc., p. 9	143	HerSaf/Safrane, p. 100	198	Panasonic Power Tools, p. 17	171	WGB Glass, p. 103
135	Classic Designs by Matthew Burak, p. 7	153	Hida Tool & Hardware, p. 100	66	Peck Tool, p. 123	101	Waterlox Coatings Corp., p. 119
5	Clayton Machine Corp., p. 111	32	Highland Hardware, p. 9	87	Philadelphia Windsor Chair, p. 124	105	West Penn Hardwoods, p. 125
134	Cohasset Colonials, p. 100		Homestead Heritage Craft Center, p. 122	2	Plans Now, p. 122	52	Whitechapel Ltd., p. 106
196	College of the Redwoods, p. 123	21	Iturra Design, p. 111	96	Pootatuck Corporation, p. 122		Wild Goose Carvings, p. 117
45	Colonial Saw Company, p. 109	107	J.B. Dawn, p. 122	175	Porter-Cable, p. 43	145	Wilke Machinery Co./Bridgewood, p. 36
163	Colonial Times Clock Co., p. 124		Jack Rabbit Tool, p. 7	183	Porter-Cable, p. 131	165	Williams & Hussey, p. 41
	Colonial Williamsburg Conference, p. 104	152	The Japan Woodworker, p. 107	91	Pygmy Boats, Inc., p. 125	162	Wizard Detectors, p. 112
123	Conover Workshops, p. 125	223	JessEm Tool Co., p. 12			19	Wood River Veneer, p. 122
34	Cormark International, p. 124	15	Jet Equipment, p. 2-3		Quality VAKuum Products, p. 109	25	Woodbooks, p. 126
224	Crown Plane, p. 125	216	Jet Equipment, p. 101	33	Quick Wood Epoxy Sticks, p. 125	206	Woodcraft Supply, p. 19
	Cut List Plus, p. 124	90	Jointech, p. 16			207	Woodcraft Supply, p. 36
120	The Cutting Edge, Inc., p. 123	14	Jordan Wood Boats, p. 125	169	Rare Earth Hardwoods, p. 124	210	Woodcraft Supply, p. 112
				100	Red Wagon Bookworks, p. 123	111	Woodjoy Tools, p. 122
219	DIY Network, p. 11	211	Kay Industries, Inc., p. 36	35	Ridge Carbide Tool Co., p. 122	176	Woodmaster Power Tools, p. 7
139	Dakota County Technical College, p. 109	12	Keller & Company, p. 9		Ridge Publishing Group, p. 19	177	Woodmaster Power Tools, p. 119
31	Dana Robes Wood Craftsmen, p. 125	172	Kreg Tool Company, p. 113	17	Robert Larson Company, p. 124	50	Wood-Mizer, p. 117
	David Warren Direct, p. 121	103	Kremer Pigments, p. 122	187	Rockingham Community College, p. 124	65	Wood-Ply Lumber Corp., p. 124
28	Delmhorst Instrument Co., p. 113	193	Kuffel Creek Press, p. 100	93	Rosewood Studio, p. 41	160	WoodRat, p. 106
184	Delta Machinery, p. 26	214	Laguna Tools, p. 33	192	Rousseau Company, p. 119	104	Woodsmith Store, p. 113
106	Diefenbach Benches, p. 125	213	Laguna Tools, p. 111	82	Router Bits on the Web, p. 105	1	WoodsmithStore.com, p. 126
	Diefenbacher Tools, p. 124	94	Launstein Hardwoods, p. 106				Woodworker.com, p. 125
62	Dimestore Cowboys, p. 122	157	Lee Valley & Veritas, p. 23		The St. James Bay Tool Co., p. 123	3	Woodworker's Depot, p. 12
161	Dowelmax, p. 125	64	Lee Valley & Veritas, p. 109	148	Sandy Pond Hardwoods, p. 7	178	Woodworker's Hardware, p. 111
197	Downdrafter, p. 123		Leigh Industries, p. 16	137	Sauers & Co. Processed Veneers, p. 124	189	Woodworker's Source, p. 125
42	Dust Boy, Inc., p. 126		Leigh Industries, p. 112		Sawhelper, p. 113	113	Woodworker's Supply, p. 103
		69	Librawood, p. 122	92	Scherr's Cabinet & Doors, p. 103	179	Worcester Center for Crafts, p. 103
74	Eagle America, p. 107	80	Lie-Nielsen Toolworks, p. 16	202	Shaker Workshops, p. 105	83	World Timber Corp., p. 125
222	Eagle Tools/EuroShop, p. 16	36	Lignomat Moisture Meters, p. 36	4	Sharp Tools USA, p. 123		
51	Eagle Woodworking, p. 124	220	Lonnie Bird' School of Woodworking, p. 123	159	The Shepherd Tool Co., p. 112	188	Yankee Hardwood Specialties, p. 126
				212	Simp'l Products, Inc., p. 29	43	Yestermorrow, p. 107

Finish Line

Removing surface dust

BY JERRY TERHARK



Tack cloths can ruin a finish. Not always, but depending on the finish being applied, you may want to use an alternate method to remove sawdust from the surface of your project. That's because the sticky residue from tack cloths can wreak havoc on some finishes.

Another method to remove dust safely from the pores and surfaces of your projects before laying on a finish uses a vacuum and compressed air. Whichever method you use, vacuuming, blowing or tack cloths, there are a few tricks to getting the cleanest surfaces, free of debris and residue.

The right way to use a tack cloth

A tack cloth is a piece of cheesecloth that has been treated with resinous materials that remain soft and sticky almost indefinitely. Unlike the homemade cloths made using linseed oil and varnish, commercially made cloths pose no fire hazard because they won't ignite spontaneously.

The sticky residue makes the cloth work but is also its greatest drawback. Many woodworkers take a cloth from its cellophane bag and start using it in its folded-up state, slowly unfolding it as each section becomes saturated with dust. Then they rub the wood vigorously to get every last bit of dust, pushing down with white-knuckle determination. While this method picks up the dust, it leaves behind a large amount of sticky residue both on the surface and crammed into the pores. A better way to use a tack cloth is to

HOW TO USE A TACK CLOTH



Pushing down hard on a folded tack cloth straight from the bag leaves a sticky residue (left), which may react adversely to water-based finishes. A light touch with a crumpled cloth leaves far less residue.



Unfold the cloth before using it. Then gently crumple it into a ball. A crumpled cloth is more effective than one that is folded flat.



Gently does it. Lightly drag the crumpled tack cloth across the wood, turning it to a fresh side after each pass.



Still effective at gathering dust. Even after a few passes, the crumpled tack cloth still attracts dust and sanding residue.



A BETTER WAY TO REMOVE DUST

Vacuum first. Use an old but clean paintbrush to sweep out dust from the pores and then vacuum it up (left). Next, a blast of compressed air (below) will clear the pores of dust, leaving the wood ready for a finish.

open it fully, crumple it into a light ball and then gently wipe it across the wood surface, using a new side of the cloth ball with each pass. With this technique, it will take several passes to collect all of the dust, but the residue left on the wood is much reduced.

Problems with tack cloths and finishes

The waxy residue left behind on wood doesn't pose much of a threat to solvent-based finishes. That's because these finishes dissolve the residue.

Wax and water are highly incompatible: A water-based stain applied to wood that has been wiped heavily with a tack cloth may leave white patches where the waxy residue repelled the stain. With a water-based clear finish, the problem will be poor adhesion, and the finish eventually may peel off.

If you use a tack cloth treated with varnish on a surface that is then finished with lacquer, you could end up with hot spots, which are places where the finish remains sticky because the two products are incompatible.

A more effective method of removing dust

Most woodworkers have a shop vacuum in their workshop, and while the noise it makes is a pain, a vacuum is wonderful for removing dust from a workpiece in two different ways.

To gather the bulk of the dust and sanding residue, move the hose up and down the workpiece, keeping the tip just off the surface. To improve the effectiveness, hold either a soft brush or an old paintbrush in your other hand and thoroughly dig the hairs into the pores of the wood (see the top photo, above). This combi-



nation of brushing and sucking removes the majority of the dust. To give the surface a final cleaning, attach the hose to the exhaust hole of the shop vacuum and blow any remaining dust off the surface. Resist the temptation to stroke the surface with your hand; otherwise, you run the risk of leaving a trace of oil on the surface, which is what you are trying to avoid.

If you do not own a shop vacuum, use a household vacuum or a central dust-collection system. Neither of these tools can be used to give a final blast of air onto the surface, but a compressed-air system works even better than a shop vacuum.

If your finishing products are entirely oil-based, by all means, continue to use a tack cloth. But for other finishes, using a vacuum and a blast of air will leave a surface dust and residue free. □

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It's been an amazing journey thus far for John Gush, but he finally has found his passion in craft and country. Gush's woodworking odyssey began in his native Johannesburg, South Africa, reproducing Cape Dutch period pieces.



While working in the United States in the mid-1980s, Gush visited the National Gallery of Art in Washington, D.C., to view the exhibition American Furniture, from the Kaufman Collection. The visit turned out to be his woodworking epiphany:

"The exhibition awakened in me great interest in American Federal period furniture, and the catalog served as a source of inspiration." The first of many pieces that would follow, this piece is based on the desk by John and Thomas Seymour in the Kaufman Collection, but with inlaid bell-flower swags in the tambour doors similar to those on the Seymour desk in the Winterthur Museum. Gush recently became a naturalized U.S. citizen, and he says he plans to spend his retirement years in devotion to both furniture and flag.

