

Fine
WoodWorking

Furniture Build-Off:
\$16,000 in prizes, p. 31

Tools & Shops

ANNUAL ISSUE

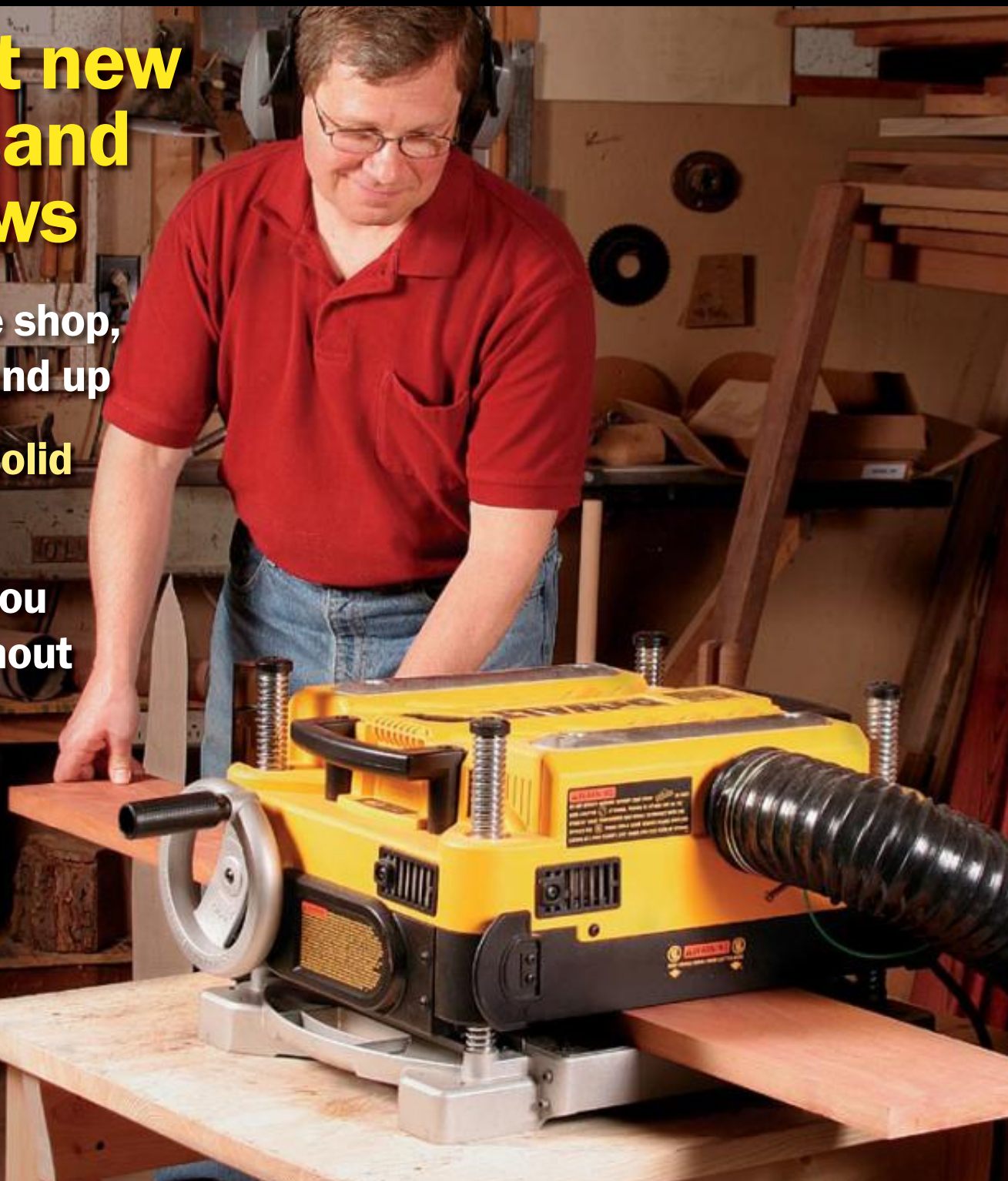
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Tools & Shops

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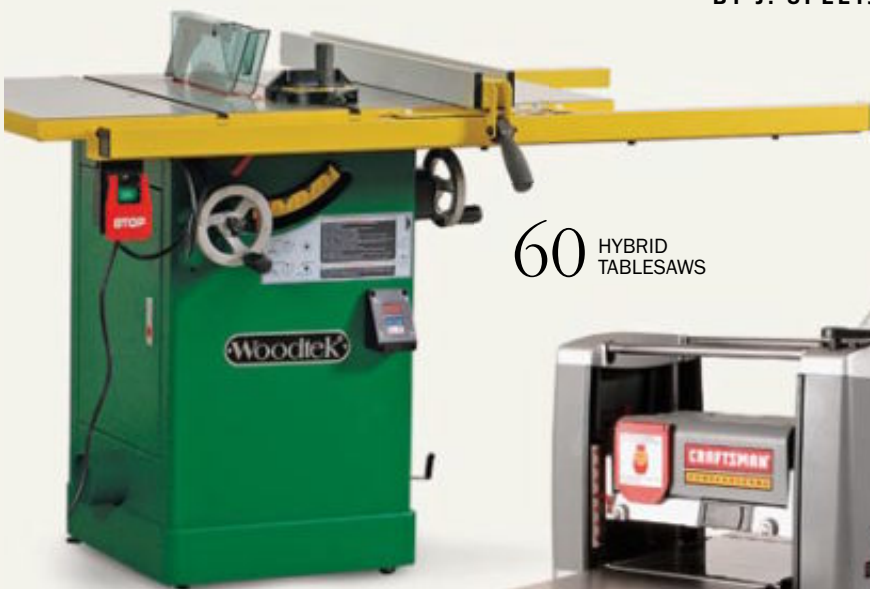
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Back Cover

Woodworker's attaché



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Get the Most From Your Planer

Roland Johnson ("Tool Test: Benchtop Planers") shows how to make a planer cut safely and smoothly, without tearout or snipe.

Hush That Vacuum

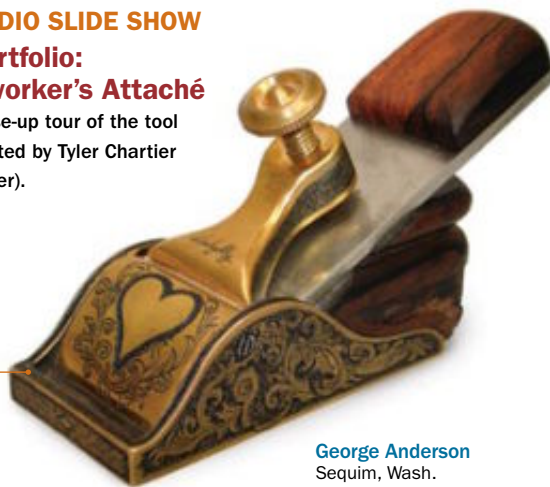
Listen to the difference when you enclose a vacuum with a simple insulated box. Thomas R. Schrunk ("Silence Your Shop Vac") shows the one he built.



AUDIO SLIDE SHOW

Pro Portfolio: Woodworker's Attaché

Get a close-up tour of the tool case created by Tyler Chartier (back cover).



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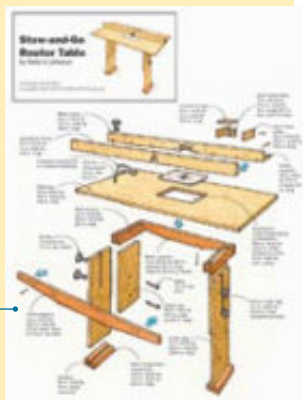
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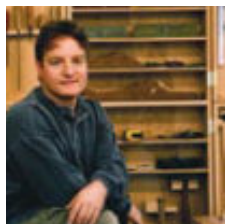
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When **Steven Chant** (*Shop Design*) first thought of using passive solar energy to help heat his new shop, he didn't dream it would work out as well as it has. After a year in the shop, he happily reports that not a single water-based glue, finish, or paint has ended up frozen. Chant, who teaches technical education at Wyalusing Valley High School in Wyalusing, Pa., designed the shop to use heat from the sun to stay above freezing in winter and then shade from plantings and a carefully placed roof overhang to stay cool in summer. A wood stove helps out on cloudy days during the coldest months.



J. Peter Schlebecker ("Rock-Solid Router Table") meandered into a woodworking career after earning an anthropology degree from Iowa State University in 1980. Four years later, he was working as a studio furniture maker. He returned to the classroom for a master's degree in furniture design at the Rhode Island School of Design. He now lives in Camden, Maine, and teaches at the Center for Furniture Craftmanship in nearby Rockport.

Having moved around a lot, **Matthew Teague** ("Smart Garage Workshop, From the Ground Up") is a veteran at designing and relocating workshops. His previous shop was much smaller, and his article about it, "Smart Shop in a One-Car Garage" (*FWW* #160), still gets a regular stream of reader comments and queries. Teague's latest shop is in Nashville.



J. Speetjens ("Consider a Shaper") lives with his family in Greensboro, N.C., where he has a furniture and cabinetry shop. He recently used his 5-hp shaper to make Gothic-style door casings and other millwork for a custom-built house. He teaches aikido, a Japanese martial art, at a Greensboro dojo, and says he incorporates the concepts of aikido into his original designs.



Anyone who has paid a visit to contributing editor **Roland Johnson** ("Benchtop Planers") will tell you that it's an adventure. This Renaissance man has more hobbies than we can count. On any given day, you might find him out riding his ATV, cruising the byways of Minnesota in a sports car, or playing guitar and mandolin while struggling to conquer his Boss digital recorder. He and his wife, JoAnn, also maintain a huge vegetable garden.

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From the Editor

THE ONE-BOARD BUILD-OFF

Picture a single maple plank. Good-sized, say 8/4, 10 in. wide, about 10 ft. long. Could be curly, bird's-eye, maybe perfectly clear and white. What would you make with that one maple board? A table, a chair, a small cabinet with doors or drawers? Would you resaw some of it into book-matched panels, or rip some into strips for a bent lamination? We'd like to know.

Turn to p. 31 for full details on our first annual "Furniture Build-Off," including how to sign up and send in pictures of your work.

Here's the short version: This year's wood is maple (soft, hard, whatever), so find a big board, roughly 2 in. thick by 10 in. wide by 10 ft. long. (Or use an equivalent amount of smaller boards—about 17 bd. ft. total.) Then start sketching. By the way, you can stain the wood, even use inlay or marquetry—just make sure it is all maple. We'll pick 24 semi-finalists and post them on FineWoodworking.com, where the public will choose three winners. Each of these woodworking wizards will win a shopful of new tools from Delta/Porter-Cable!

In the hands of a craftsman, one board has a thousand possible lives. Unlock one.

—Asa Christiana



Avoiding mold when air-drying lumber

For the most part, Garrett Hack's answer on drying freshly cut lumber is very good (Q&A, *FWW* #193). My problem is with the drawing of the lumber stack. If one stacks fresh-cut wood, especially softer species like cherry, that close together, it will rot. From experience I have learned that on a 4-ft.-long sticker, less than

3 ft. of wood should be stacked, width-wise (3 in. to 4 in. between the planks horizontally). You should be able to see the ground and also check to make sure the planks aren't being used for seed storage and porta-potties by chipmunks and field mice.

—DON CREGO JR., Elm Grove, Wis.

Garrett Hack replies: The drawing didn't convey this, but my air-drying stacks are rarely

over 42 in. wide, and if they are, I leave a "chimney" or gap up the center to maximize drying. But I prefer to keep my piles narrow and tall, leaving a small gap between each board in a layer, just so they don't touch.

The most challenging wood I dry is white pine. It can mold in a week. Cherry rarely gives me any trouble, even if I leave it stacked for many years. Two things work in my favor. One is that my stacks are well off the ground in a sunny and windy location, on sandy ground with plenty of air underneath and no weeds or grass restricting the flow. The other key to drying lumber with little to no mold is cutting and stacking it early in the spring. I cut the logs in

the winter, and then get them drying in the breezy weather of April and May. Hot weather with inadequate airflow will mold your piles.

Advice on router-made doors

Just like the author of "Frame-and-Panel Doors Made Easy" (*FWW* #193), I couldn't find a plywood panel that fit the 1/4-in. groove that cope-and-stick bits make. But after spending a day visiting all the lumberyards in the city, I found that two pieces of 1/8-in.-thick plywood laminated back-to-back fit the 1/4-in. groove perfectly. This might save someone having to buy an expensive adjustable bit set.

—ROSS P. VIGIL, Pueblo, Colo.

In his article on cope-and-stick doors, Michael Pekovich suggests that doors made with these router bits are only suitable for plywood and MDF panels, so the panel can be glued to the rails and stiles to add strength. I have made too many raised-panel doors with such bits to let that comment stand. Some of those panels have exceeded 12 in. wide. The only doors that failed were in a TV cabinet where you tugged on the edge of the door to open and close it.

—JIM DWIGHT, Lexington, S.C.

Michael Pekovich replies:

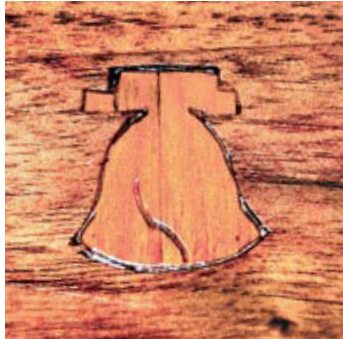
Many folks (pretty much the entire kitchen cabinet industry) rely on the strength of cope-and-stick joinery alone to hold doors together. The point I was trying to make is that with a panel glued in, the strength of the cope-and-stick joint rivals that of a traditional mortise-and-tenon joint. The real question is: How strong is strong enough? Living with two young children who like

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to slam doors and hang on them, I like the insurance of the glued-in panel.

A piece of history



Maker's mark. John P. Faris likes to tell the story of how he got the wood for the Liberty Bell inlay he uses to sign his projects.

I enjoyed the article about how craftsmen sign their work ("What's Your Sign?" *FWW* #193). My dad, John P. Faris, now 92, is still making furniture and has a unique method of signing his pieces.

More than 40 years ago, as he tells it, while on business in Philadelphia, he walked past Independence Hall during a major restoration. There were hand-hewn beams stacked carefully in the street, but there also was a trash pile of smaller bits of wood and debris from the historic building. My dad asked the policeman on duty if he might have a small piece of the heart-pine scrap. The policeman said absolutely not. My father visited with the officer for another half-hour,

telling him about his furniture making and just making conversation.

After a while, the policeman looked my Dad in the eye and said, "I've got to go on break now. I'll be gone for 15 minutes." Then, Dad says, the policeman looked down, kicked at a 6-in.-sq. block of old Independence Hall, and left. That block has been sawed into thin slices, and many small Liberty Bells carefully cut out. Dad inlays one into each piece he builds.
—JOHN FARIS JR., Spartanburg, S.C.

Be kind to your sawyer

Mario Rodriguez did a nice job bringing attention to us millers ("Lumber From Mini-Mills," *FWW* #193). But I have to take issue with the idea of getting lumber "you just won't find anywhere else" for "10% to 50%" savings over big mills because they don't have the overhead. I cut high-end, furniture-grade lumber for a discerning market, and I spend a lot of time and energy procuring logs that will yield unusual and hard-to-find boards. I don't advertise to the bargain hunters, as they aren't worried about my livelihood.

The next time you go look at some maple from a little mill and notice that it's curly, let the sawyer know it's at least two times more valuable, and give him a little more.

—KELVIN POTTER, Bath, Mich.
(www.ravenfarm.com)

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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. Find another way. We want you to enjoy the craft, so please keep safety foremost in your mind whenever you're in the shop.

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Best Tip **Sturdy, simple lumber rack**



Tony O'Malley runs a small woodworking business in Emmaus, Pa., specializing in custom built-in cabinetry. Over the last 10 years he's written several articles for *Fine Woodworking*, including "Built-in Basics" (*FWW* #166).

When I began thinking about a lumber-storage rack for my commercial shop, I was poised to purchase some of those huge, free-standing, cantilevered I-beam things that would cost \$750 or more. The rack I built cost about a third of that in materials, plus a few hours of labor—and it is equally suitable for the home shop.

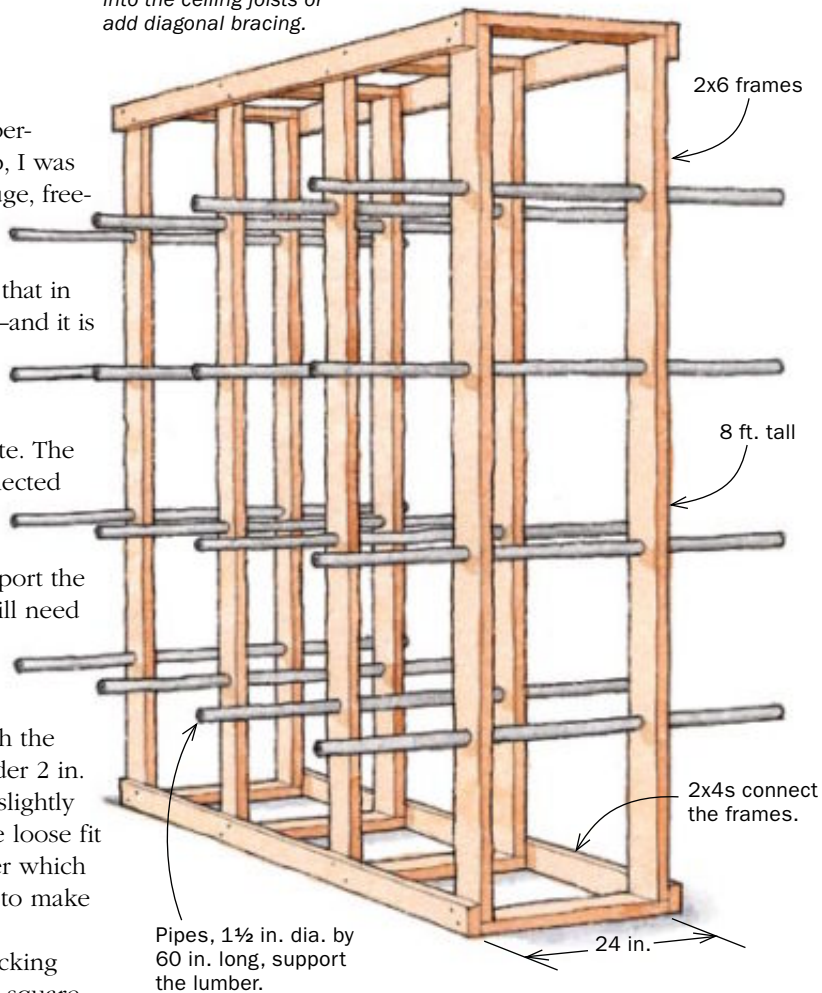
Each 24-in.-wide frame is made from 2x6 lumber and consists of two posts and a top and bottom plate. The frames are nailed together and connected with 2x4s at the top and bottom corners. Sixteen pieces of iron pipe make the four shelves that support the lumber. To stabilize the rack, you will need to attach it to joists overhead or add diagonal bracing on the sides.

Before assembling the frames, I measured and drilled holes through the 2x6s for the 1½-in. I.D. (slightly under 2 in. O.D.) cast-iron pipe. I drilled holes slightly larger with a 2-in.-dia. hole saw. The loose fit made it easy to insert the pipes, after which I wrapped the pipes with duct tape to make the fit more snug.

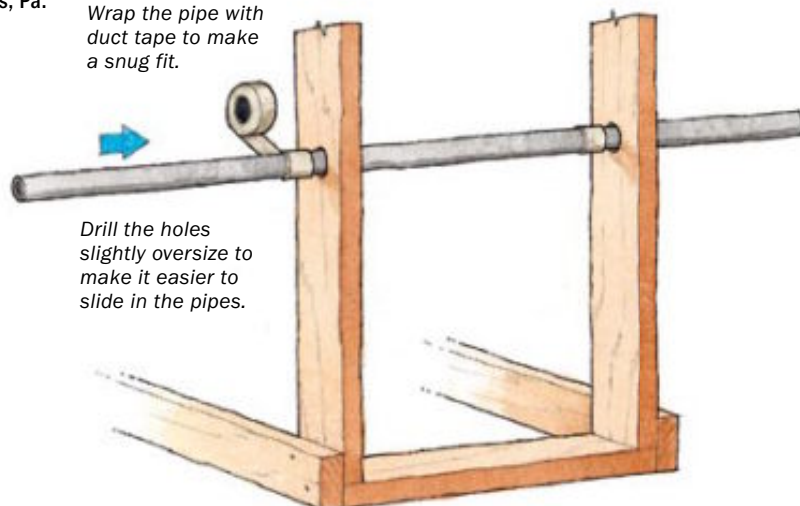
The shelf width is just right for stacking typical lumber. Dollar for dollar and square foot for square foot of storage, this is a great wood rack.

—TONY O'MALLEY, Emmaus, Pa.

For stability, tie the frames into the ceiling joists or add diagonal bracing.



Wrap the pipe with duct tape to make a snug fit.

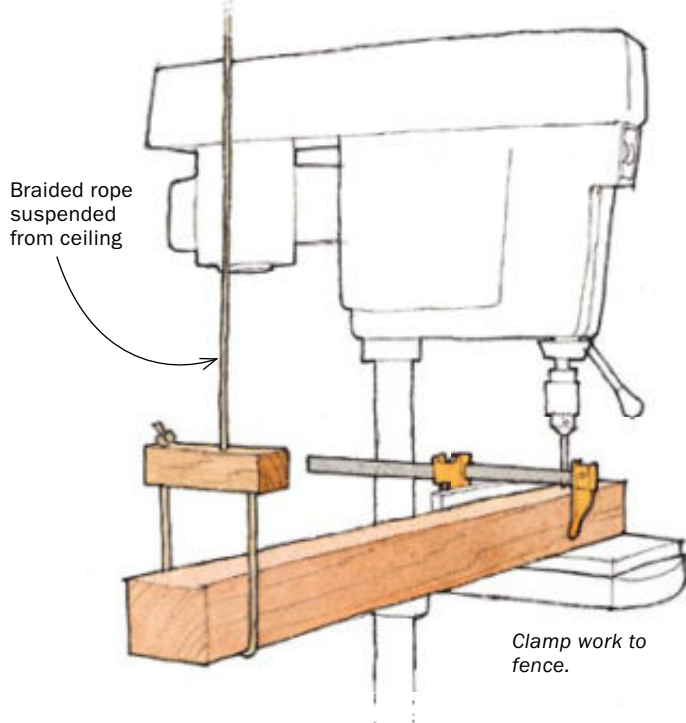


A Reward for the Best Tip

Send your original tips to *Methods of Work*, *Fine Woodworking*, PO Box 5506, Newtown, CT 06470, or email fwmow@taunton.com. If published, we pay \$50 for an unillustrated tip; \$100 for an illustrated one. The author of the best tip gets a pair of Brian Boggs spokeshaves (one flat, one curved) made by Lie-Nielsen Toolworks.



Support sling for the drill press



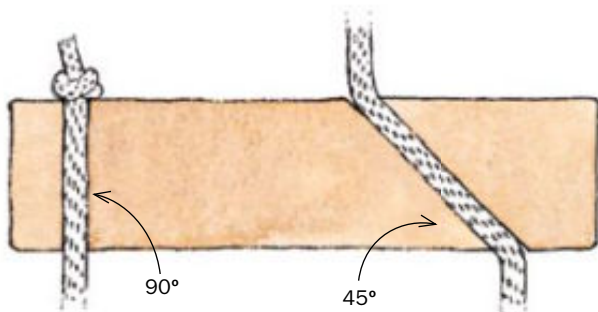
Recently I needed to drill precise holes in 10-ft.-long posts. The drill-press table was about 52 in. high, and I needed to support the post at the same height. My roller stand extends only to a height of 44 in., so I needed another way. My solution was to suspend the opposite end of the board on an adjustable sling hung from the ceiling of my workshop.

The sling is a simple loop made of braided cord and a small block of wood with two holes. One hole is at 90°, the other at 45°. The angled hole helps keep the block horizontal under load. The holes must be just big enough to run the cord through.

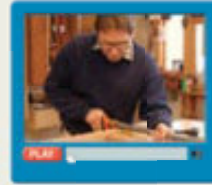
The sling is easily adjusted, even while holding a board; it is fast and convenient to set up; and it eliminates the need for a bulky stand. Size the sling (length of rope) to accommodate a substantial beam. The block makes it easy to adjust for smaller pieces.

One potential disadvantage is the tendency of the workpiece to swing back and forth on the sling end. This is easily remedied by clamping or firmly holding the workpiece to a fence on the drill press. This technique has worked so well that I have set up support slings for other tools in the workshop.

—BOB ROGERS, Newhall, Calif.



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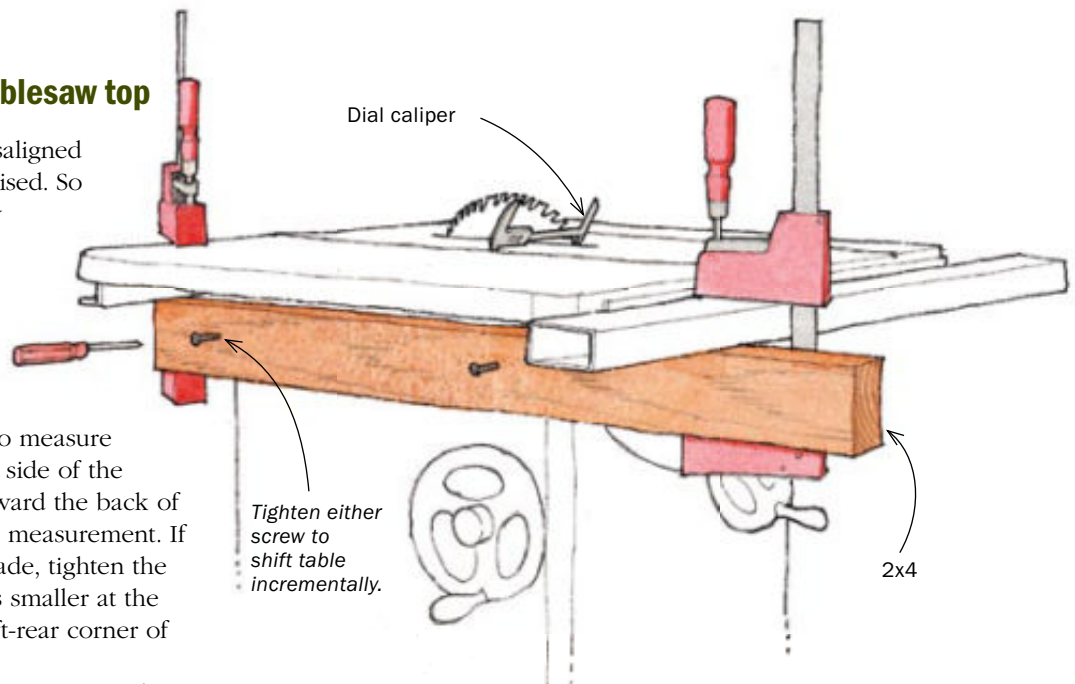
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Micro-adjuster for a misaligned tablesaw top

If you have a cabinet saw whose table is misaligned with the blade, cutting accuracy is compromised. So it's important to correct any misalignment by adjusting the tabletop.

To adjust a saw's table, first unplug the machine and loosen all four bolts that secure the table to the cabinet. Make a pencil mark in the space between two sawblade teeth. Rotate the blade toward the front of the saw and use a dial caliper to measure the distance between the miter slot and the side of the blade at the mark. Now rotate the blade toward the back of the saw, measure, and compare to the front measurement. If the distance is smaller at the front of the blade, tighten the bolt at the left-front corner of the saw; if it's smaller at the back of the blade, tighten the bolt at the left-rear corner of the saw. Leave the other three bolts loose.

Next, clamp a 2x4 to the guide rails as shown. Drive 2½-in. drywall screws into the board so that when tightened they will come in contact with the cabinet near the corners of the saw. Now recheck the blade-to-miter-slot measurement at the locked-down corner. Rotate the blade to the other position, and, holding the calipers with one hand, begin tightening the screw at that corner to move the table into alignment.



Before you arrive at the desired caliper reading, stop and recheck the reading on both sides of the blade because invariably the readings will change slightly. Keep turning the screw and making very subtle changes until the readings match.

Before unclamping the 2x4, tighten the rest of the tabletop bolts and recheck the blade-to-miter-slot gap one last time.

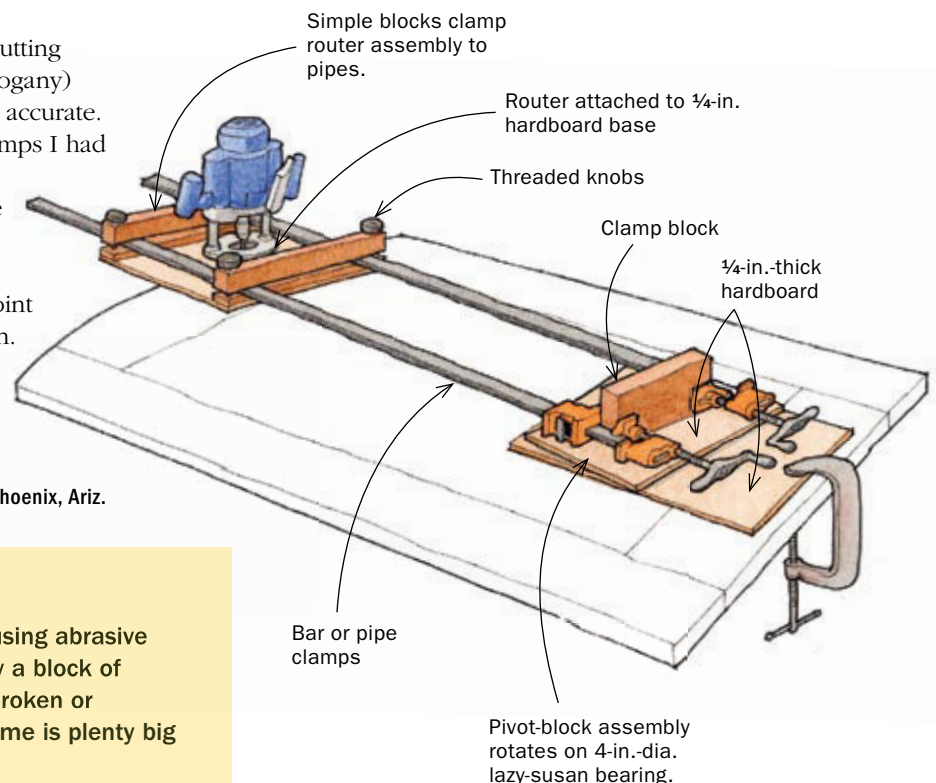
—PAUL COMI JR., San Gabriel, Calif.

Pipe-clamp fixture for routing large arcs

While building a gate, I was left with one major task—cutting an arch at the top. The thickness of the wood (8/4 mahogany) demanded a circle-cutting fixture that was very stiff and accurate. So I devised this fixture based on the 8-ft.-long pipe clamps I had used to glue up the gate. It consists of two bar or pipe clamps, a pivot-block assembly, and a router base. The clamp block on the pivot assembly is sized so that the pipes remain parallel from one end to the other.

To cut the arch, I determined the radius and pivot point and clamped the pivot block to the gate at this location. I then clamped the router base to the pipe at the other end and carefully cut the arch by rotating a plunge router through the curve, taking light cuts with multiple passes.

—RON BOE, Phoenix, Ariz.

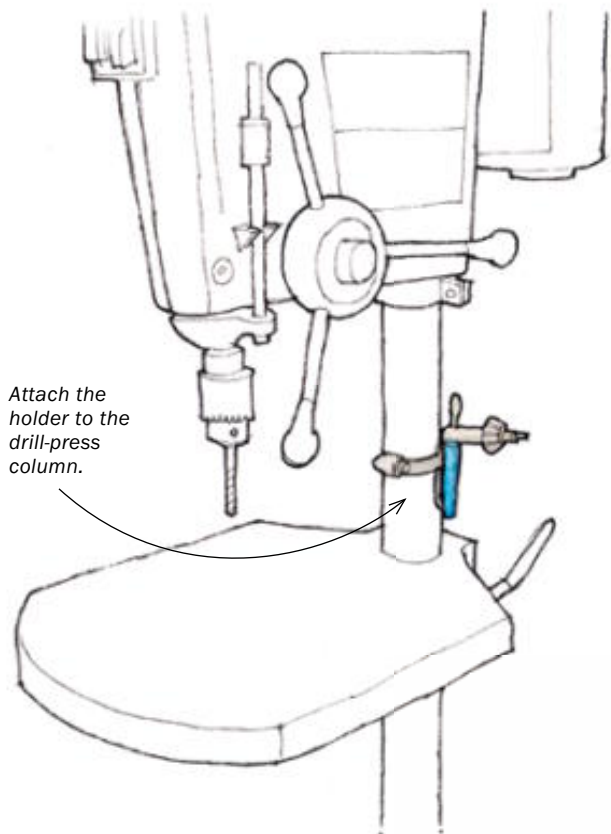


Quick Tip

I wanted to try sharpening chisels and plane irons using abrasive paper on granite. Not being flush with money to buy a block of granite, I asked a tombstone company for a small broken or misworded tombstone. The broken piece they gave me is plenty big and dead flat. It really works well for this purpose.

—RANDY JOHNS, Spencer, Tenn.

Drill-press chuck-key holder

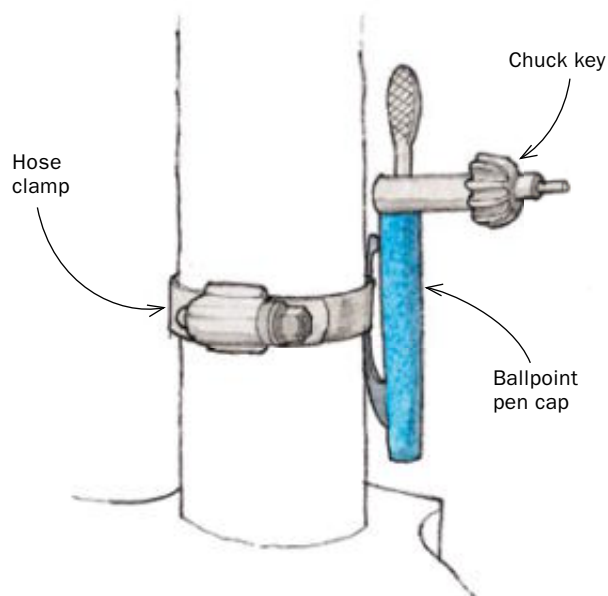


Attach the holder to the drill-press column.

When I finally tired of having to search for my drill-press chuck key every time I needed to change a bit, I made a little nest for it right on the drill-press column using a ballpoint pen cap and a hose clamp.

I placed the keeper high enough so that it doesn't disturb the travel of the table and low enough to clear the head assembly when I pull out the key from the cap.

—SERGE DUCLOS, Delson, Que., Canada



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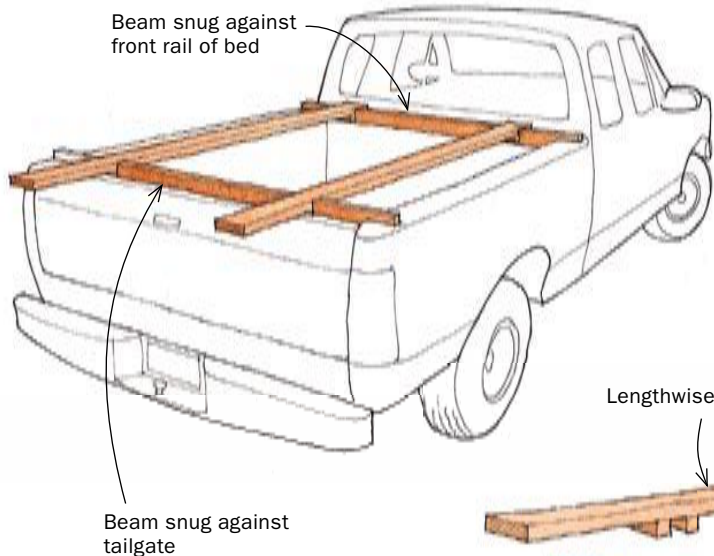
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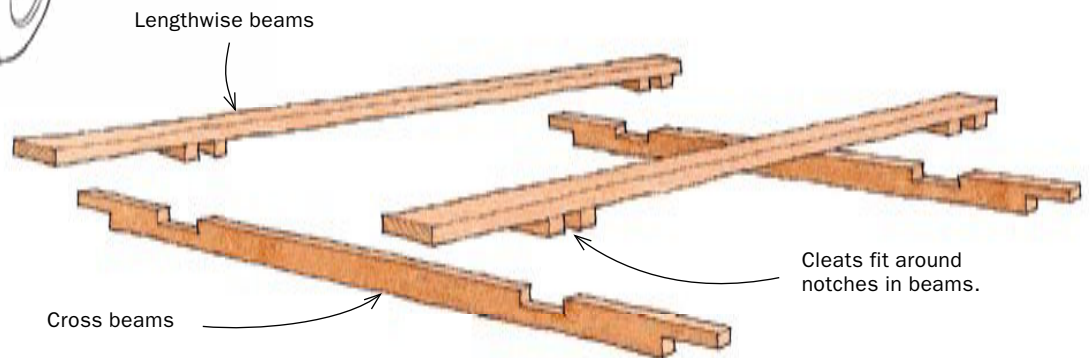


Transport sheet goods in a short-bed pickup

My extended-cab pickup has a short, narrow bed that won't carry a full sheet of plywood flat on the bed. So I built a rack that fits on top of the bed. It consists of two pairs of beams with cleats and notches that self-lock to control the location. Place the cleats so that the outboard pair bump against the bed rail at the front and the tailgate at the back.

To use, simply pop the rack in place and secure it to the bed of the truck (I use bungee cords to tie the lengthwise beams to cargo hooks in the bed). Put the load on the rack, and tie it all down either to hooks on the bed rails or inside the bed.

—JOHN WILLIAMS, Bellevue, Wash.



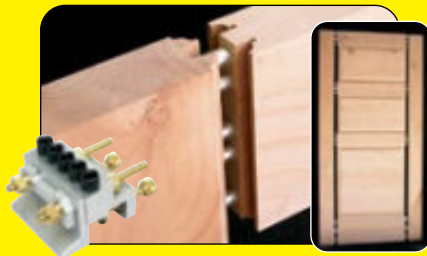
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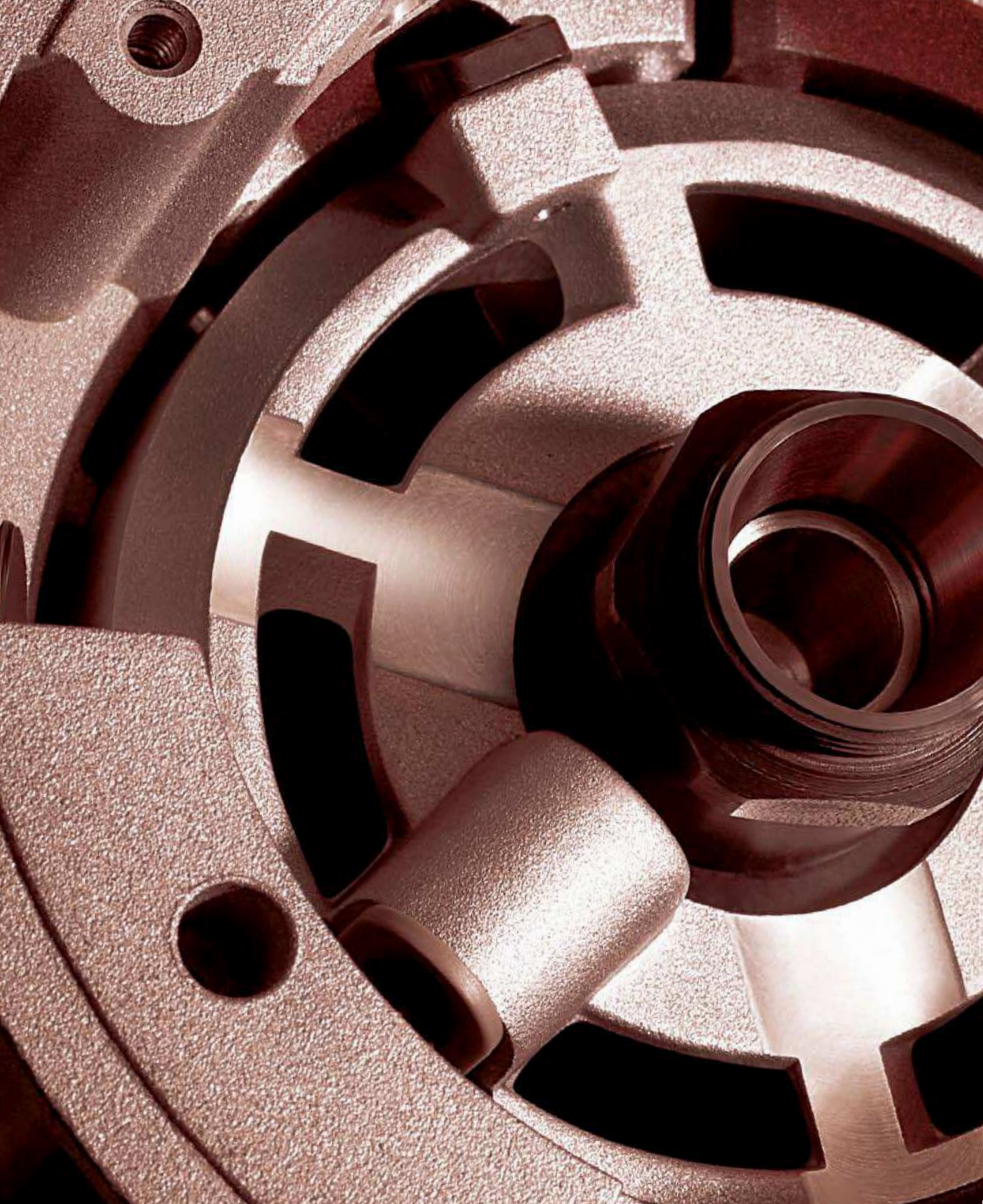
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■ CORDLESS TOOLS

Small impact driver may be the only drill you'll need

SINCE THE BEGINNING OF CORDLESS TIME, manufacturers gradually have been building bigger and more powerful drill/drivers. Early versions of the species boasted 9.6v. Now, some models have evolved into 36v titans. But extra power also means added size and weight, and that can be a disadvantage for furniture makers. A small, lightweight drill/driver is perfect for reaching inside a cabinet to install hardware. It also works fine for general construction at the workbench.

That's why the new Bosch PS40-2 impact driver caught my eye. It measures just 6½ in. long by 6 in. tall and weighs less than 2¼ lb. A 10.8v lithium-ion battery, combined with the impact function, provided plenty of power for furniture- and jig-making. It easily drives long or thick screws and is sensitive enough for smaller ones. A variable-speed

motor and a sensitive trigger mean you're less likely to overdrive screws.

The smallish battery provided plenty of power and held a charge surprisingly well. And the PS40-2 fit comfortably in the pocket of my shop

apron. This is a great little tool that could be my primary drill/driver. Its \$190 street price includes two batteries and a 30-minute charger. Go to www.boschtools.com; 800-267-2499.

—Roland Johnson works wood in Sauk Rapids, Minn.

▲ Online Extra

To post ratings and reviews of the tools you own and to browse our free archive of editor reviews from the last five years of *Fine Woodworking* magazine, go to FineWoodworking.com/ToolGuide.

■ HAND TOOLS

Handy router planes from Lie-Nielsen

I USE A ROUTER PLANE ALL THE TIME in my shop. Indeed, over the years, my antique Stanley No. 71½ has proven invaluable. The tool makes it easy to smooth the bottoms of dadoes, grooves, and rabbets. It's perfect for adjusting the fit of a hinge mortise and doing inlay work, too.

Lie-Nielsen recently introduced two new router planes, the No. 71 and the smaller No. 271. I gave both a good workout in my shop.

Despite my fondness for the old Stanley, the Lie-Nielsen No. 71 takes the tool to a new level. A square hole in the base accepts a massive O-1 steel blade. You adjust the blade with one knob, and then tighten it in position with another. The depth of cut can be changed quickly and precisely, a nice feature for “sneaking up” on a perfect fit. A depth stop is easily adjusted and locks securely.

The blade does not come prelapped. You'll need to lap and then sharpen it before cutting.

Like its bigger brother, the No. 271 is a precision tool, albeit a simpler one. It doesn't have an adjustment knob; you move the blade up and down by hand. The tool is comfortable to hold and capable of doing exacting work. It's best used on smaller parts, where a large router plane wouldn't fit or balance well. Of the two, I'd buy the No. 71 first, mainly because its larger size is better suited to general woodworking tasks. It sells for \$125; the No. 271 for \$75. For more information, go to 222.lie-nielsen.com; 800-327-2520.

—Jeff Miller builds furniture and teaches woodworking in Chicago.



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■ MACHINES

Steel City rolls out 14-in. bandsaw

WITH A 1½-HP MOTOR, THIS NEW BANDSAW from Steel City Toolworks (model 50100) has plenty of power. We immediately added an optional riser block, which gives the saw a generous 12 in. of resaw capacity. And there's plenty of cast iron—the frame, wheels, table, and trunnion supports—which adds heft and helps the saw absorb vibration.

The saw also has handy features such as a convenient paddle-type on-off switch, an integrated mobile base, and a quick-release blade-tension mechanism. Bearing-type guides offer tool-free adjustment, a big plus. But the guides are mounted to shafts that tended to stick a bit, making for some sudden overadjustments.

Performance-wise, the saw deftly cut all manner of curves, and resaw cuts were satisfactory. On the downside, the blade guards—both the regular-length guard that comes with the saw and the extralong version that comes with the accessory riser-block kit—sit unusually low, making it difficult to see the cut line in some cases. Unlike the long version, the standard guard has a plastic window to help make it easier to see, but the plastic distorted the view of the cut line, so the result was not ideal.

Also, no matter how much muscle I applied, the lock knobs for the table-tilt mechanism did not adequately lock the table in place. It wouldn't likely be a problem with medium-weight stock, but a heavy board just might cause the table to shift.

Overall, the Steel City 50100 14-in. bandsaw is a solid performer. It needs only a blade guard that allows for better viewing of the cut, and a better table lock. With those changes, it would have everything you could ask for in a midsize bandsaw, and at a great price.

—Tom McKenna is an associate editor.



STEEL CITY 50100

Street price: \$700 (rip fence: \$130)

Motor: 1½ hp, 115v

Fence height: 2¾ in.

Wheel alignment: top behind, 0.047 in.

Post misalignment: side, 0.006 in.;
back, 0.002 in.

Resaw capacity: 12 in.

Guides/thrust: double bearing/bearing

Guide adjustments: upper, easy;
lower, difficult

Blade changes: Easy

Quality of resaw cuts: Good

Timed resaw test: 5 lb., 2 min. 43 sec.;
7.5 lb., 1 min. 16 sec.

■ GADGETS

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BEFORE HANGING A WALL CABINET, you need to find the wall studs. Electronic stud finders are relatively inexpensive. Flashing LED lights and an audible beep are supposed to tell you where a stud is located, but you can get false readings. Your screws hit only thin air and leave holes to be patched. Recently, while installing a built-in cabinet, I tried a new gadget called the MagicStud Finder. To use it, you simply place a disk—a rare-earth magnet encased in plastic—in a holder. Then you slide the holder back and forth on the wall in search of a drywall screw. When the holder passes above a screw, the magnet attaches itself to the wall directly over the screw. No need to move slowly; the magnet pops out of the holder and onto the wall even if your hand is moving it pretty quickly. In short, it worked great.

MagicStud Finder comes with five targets, so you can locate several studs at once. It sells for \$15 plus \$6 shipping and handling. To learn more go to www.magicstudfinder.com.

—Tom Begnal is an associate editor.



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■ DRILLING

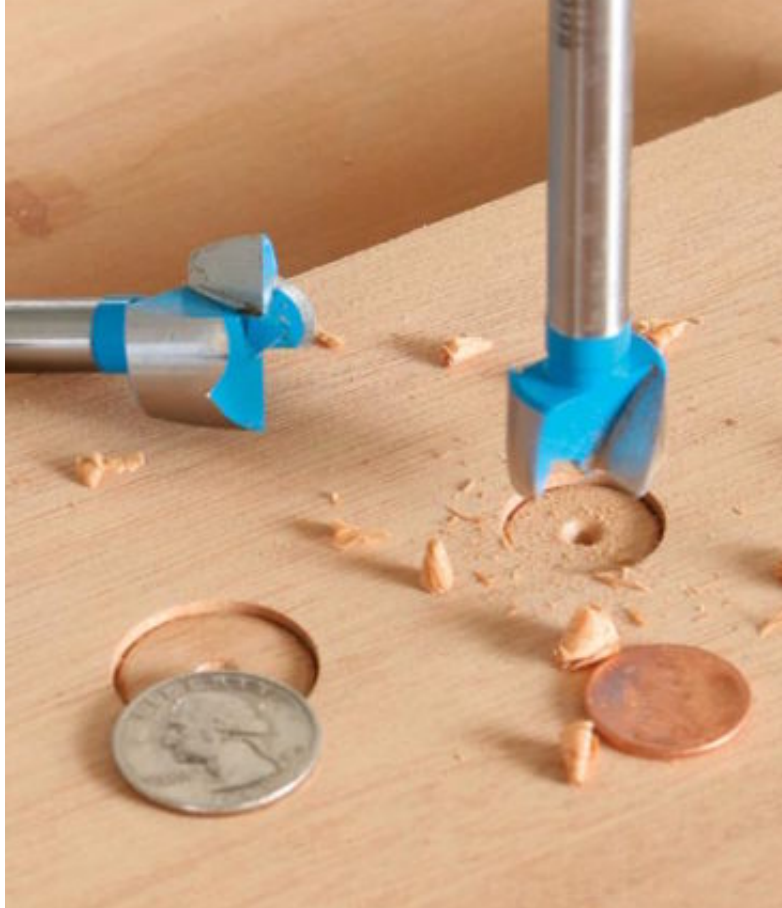
Bits drill coin-sized holes

SO YOU READ OUR ARTICLE on how woodworkers sign their work ("What's Your Sign?" *FWW* #193) and decided to try one of the methods—inlaying a coin. You measured the diameter of a penny, chucked a 3/4-in.-dia. Forstner bit in your drill press, and bored a shallow hole. But when you tried to insert the penny, the hole was a hair small. And when you tried a 1-in. bit for a quarter, it was a hair large.

Rockler has solved the problem by offering U.S. coin-sized high-speed-steel Forstner bits. We tried the penny (0.764 in.), quarter (0.955 in.) and half-dollar (1.219 in.) bits, and each one seated its coin perfectly. A dab of epoxy was all that was needed to secure the coin.

Prices vary from \$16 to \$18. More information can be had at www.rockler.com; 800-279-4441.

—Charlie Reina is an associate editor.



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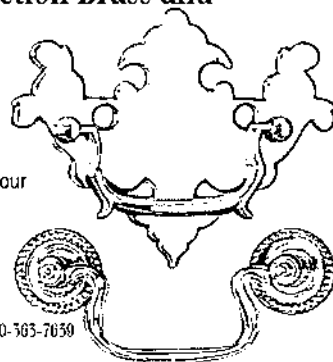
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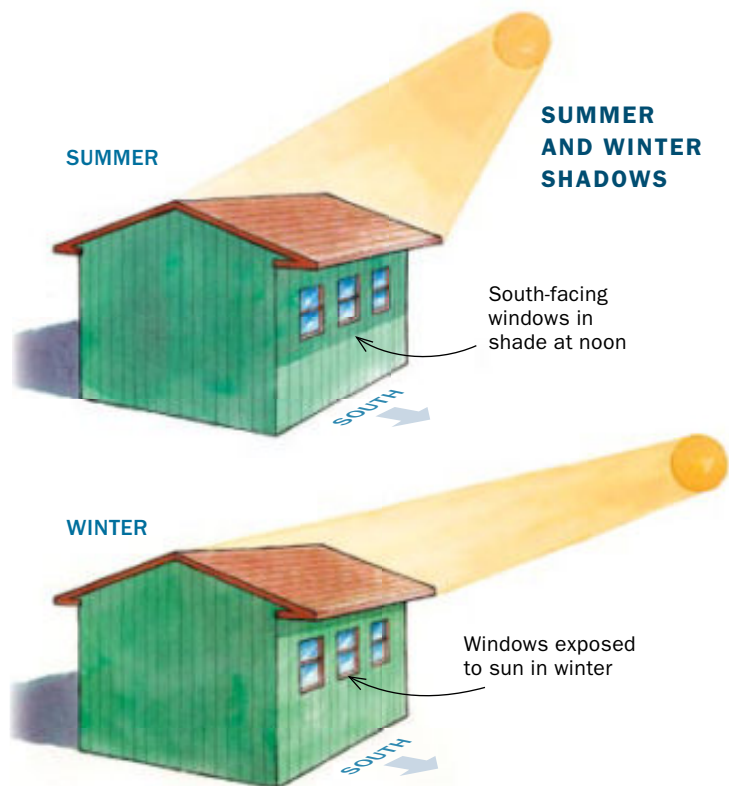
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Passive solar shop

USE SEASONAL SUN ANGLES TO LOWER YOUR HEATING AND AIR-CONDITIONING COSTS

BY STEVEN CHANT



In the summer, with the midday sun high in the sky, the south-facing windows are completely in shade (photo, left; drawing, top). Come winter, the sun is low in the sky, and the shop windows let in a full measure of warming sunshine (drawing, above).

After 25 years in a cramped, one-car garage workspace, the time finally arrived to construct a shop with some real elbow room. In addition to all the usual design considerations—work flow, machine locations, electrical-outlet placement, dust collection, and the like—I wanted to incorporate passive solar heating. Using energy from the sun to heat the shop offers two advantages. First, heating costs go down, no small advantage at a time when energy prices have soared. And second, it reduces—even if in a small way—our national dependence on oil.

Window size and placement are important

When designing a shop to take advantage of the sun's energy, the size of the windows is an important part of the story. In winter, you want windows to let in lots of warming sunshine. In summer, you want those same windows in the shade.

Before you can size and position the windows, you need to figure out where the shadow lines fall. To do that, here's a quick refresher in high-school science.

Sun 101—In the northern hemisphere, the sun arcs across the southern sky as it travels from sunrise to sunset. Viewed from the earth, the distance between the horizon and the sun, measured in degrees, is commonly called the angle of the

Use a story stick to determine roof overhang and window placement. At about noon on June 21, when the sun was at its highest mid-day point of the year, Chant mocked up the roof overhang and marked the shadow line. He repeated the task six months later.



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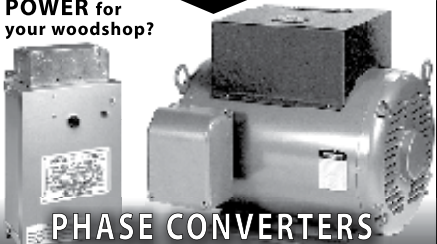
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Winter warmth



Winter sun is a welcome visitor. Sunlight and the free heat that comes with it bathe Chant's shop in early January.



Heat for cloudy days. On days when the sun doesn't shine, a woodstove keeps the shop at a comfortable temperature.

sun. The sun reaches its highest angle at midday—halfway between sunrise and sunset. In the winter, the sun angle is low. Come summer, the angle is much higher. Indeed, at midday in mid-June, the sun is almost directly overhead.

For me, that meant making sure one of the long walls of my planned 34-ft. by 64-ft. shop would face due south, where the sun always lives. Then it was necessary to determine where shadows would fall on the shop wall during the two seasons of temperature extremes—winter and summer.

Story stick measures angle of sun—Relatively inexpensive architectural design programs (SketchUp is a great one, and free at google.com) let you determine sun angles for any day, time, and latitude. If you know how to use one or are willing to learn, it is a good way to get the shadow information. But as a hands-on type who'd rather stay away from unfamiliar computer programs, I used a simple, low-tech method to obtain the solar angles and shadow lines needed to locate the windows. A kind of story stick allowed me to stand outside in the sun and measure the shadow-casting effect of various roof overhangs.

The stick is made from two 2x4s, a 10-footer to represent the upper portion of my shop wall, and a 4-footer that is clamped at a right angle to the longer piece to duplicate the various roof overhangs. My roof overhang is at an elevation of 10 ft.

The story-stick system requires two shadow readings, six months apart. One reading is made around June 21, the day that the sun reaches its highest point in the midday sky. The second reading is made around December 22, when the midday sun is at its lowest point in the sky. The plans called for

the bottom of the windows to be about 5 ft. from the ceiling, allowing wall space for floor cabinets.

At about noon on June 21, with the bottom end of the pole resting on the ground, I pointed the extension at the sun. At the same time, I held a level against the stick to help keep it plumb. I noted where the extension cast a shadow on the pole. After some trial and error, I had the overhang extending 28 in., just far enough to place the shadow line at the 5-ft. mark.

Six months later, I repeated the reading with the 28-in. extension. This time, of course, the shadow line was higher on the pole, about 1 ft. from the roof overhang.

Now I had all the data needed to determine the window height. A 4-ft.-tall window installed 1 ft. from the ceiling would have its bottom end 5 ft. below the extension. At midday, it would be in full sun in the winter and full shade in the summer.

Insulation is important, and trees help, too

No matter how carefully you've placed the windows, a poorly insulated shop won't hold heat for long in winter. In summer, that shop will absorb outside heat and transfer it inside. So make sure the walls, ceiling, doors, and windows are well insulated.

Also, I planted deciduous trees along the east, south, and west sides. In summer, their leaves help shade the shop. In winter, their bare branches allow warm sunlight in. If there is room on the property, consider a row of evergreens on the north side. In many areas, the prevailing winter winds come from the north. Evergreens located there won't shade the shop, but their year-round needles will catch the cold blast. □

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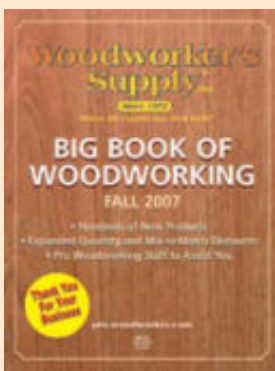
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Set up shop on a budget

HOW TO FIND BARGAINS AND WORK WITH FEWER TOOLS

BY MIKE BIELSKI

This article was inspired by editor Asa Christiana's piece in last year's *Tools & Shops* issue, titled "Set Up Shop for \$5,000."

That headline struck me as discouraging. As an entry fee, \$5,000 seems high enough to exclude a number of potential woodworkers, myself included. Christiana softened the blow by saying that used tools could cut the cost roughly in half. That figure seemed much closer to my experience, which involved buying a mix of new and used tools. Having said that, buying the right used tools is much more difficult than buying from a catalog or dealer who stocks everything needed to build a great shop. It requires a bit of guile and a good plan, but the payoff is worth it. Through careful choices and good fortune, I was able to outfit my shop with a blend of new and used tools for around \$2,000.

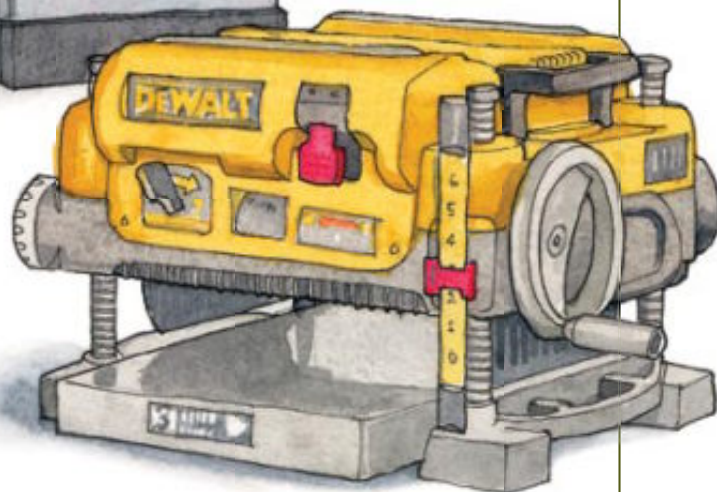
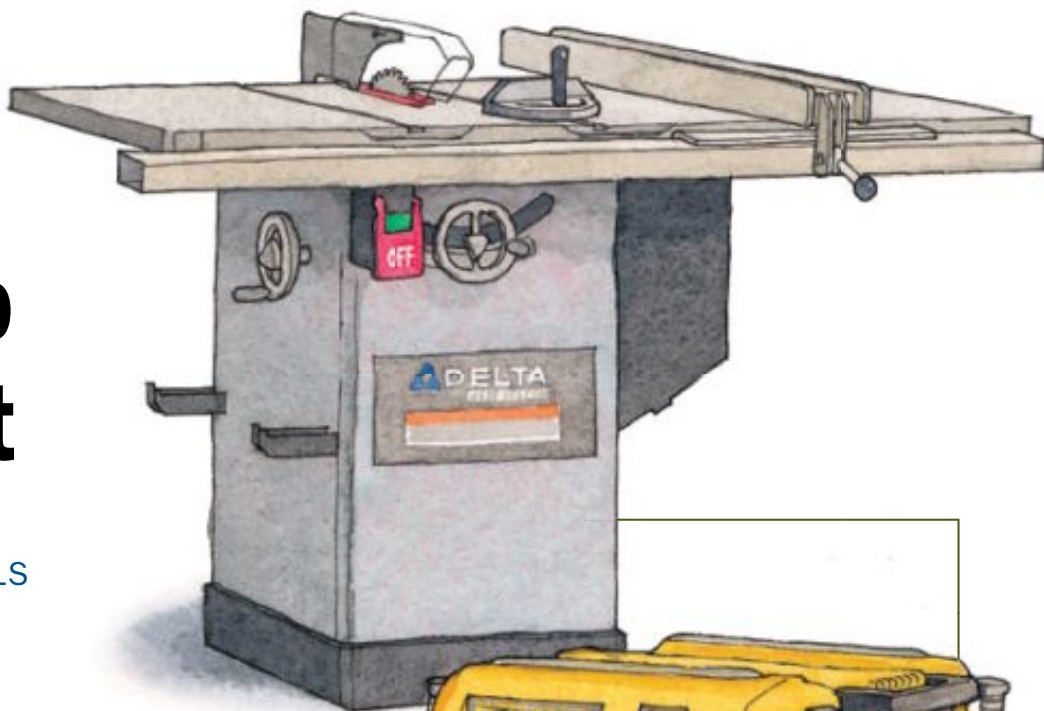
A shopping strategy: foundation before frills

My approach wasn't about buying cheap tools. Buying on price alone often costs more in the long run when a cheap tool doesn't perform or fails and must be replaced with one that works. The trick is finding quality tools at an affordable price, and knowing how to make the most of them.

My strategy was to buy the most basic and versatile tools before adding specialized ones, no matter how low the price. This led me to start with a tablesaw, a thickness planer, and a router.

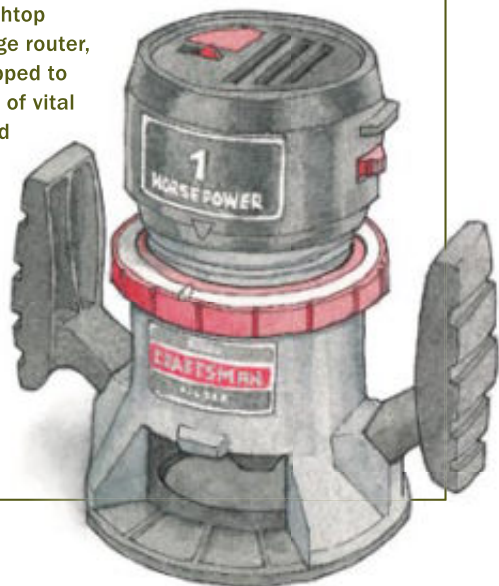
The tablesaw—This tool is the backbone of nearly every shop, and for good reason. It allows unmatched precision in ripping parallel edges and crosscutting at a variety of angles. Most woodworkers find it crucial for the basic milling of stock. It is also suited to many joinery tasks, easily producing tenons, box joints, and—with a reground blade—the tails for dovetail joints.

Through my cabinet-shop connections, I managed a snappy deal (\$200) on a used cabinet saw with a 54-in. commercial



A working shop has three hearts

Start woodworking with a tablesaw, a benchtop planer, and a plunge router, and you'll be equipped to perform a core set of vital milling, joinery, and shaping tasks. Plan on spending \$600 to \$1,200 for a used cabinet saw or new hybrid (see pp. 60-65), \$400 for a planer, and \$200 for a plunge router or router combo kit.



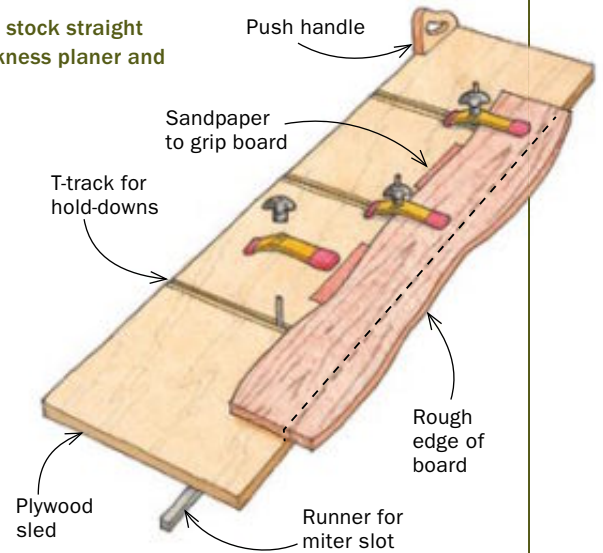
Jointing without a jointer



A pair of jigs lets you mill stock straight and flat using only a thickness planer and a tablesaw.

EDGE-JOINTING

Use the tablesaw to straighten a wavy edge. The jig's plywood sled rides on a long runner that sits in the miter slot. Make sure the blade is parallel to the slot. Secure the rough lumber with hold-downs so that the rough edge overhangs the sled slightly along its length.



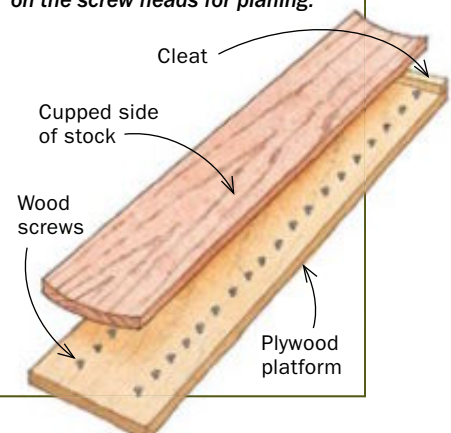
rip fence. That price would be hard to match, but it is possible to find a hybrid or used cabinet saw with a high-quality fence for \$600 to \$1,200. Some of them will run on 120v household current, meaning you won't have to rewire your shop for 240v service, but be sure to check for compatibility before you buy.

This style of saw will provide more power than a contractor-type saw and have the high-quality rip fence you need to do good work. However, because they are favored by professionals and serious amateurs, cabinet saws are harder to find on the used market. Scour the classifieds and online sales (be sure to check industrial auction sites as well), and do some networking. Check the bulletin board at your hardwood supplier and ask the proprietors if they know of anyone selling a saw. Also call local cabinet shops. They sometimes have a surplus tool sitting idle that they'd be willing to sell. Take your time in this step. A careful investment will pay dividends in the long run, but a well-intentioned compromise can cause long-term frustration.

The thickness planer—A thickness planer will significantly expand the creativity and craftsmanship of your work by allowing you to buy roughsawn stock and use wood of any thickness in your designs. Nowadays, a new planer often represents a

FACE-JOINTING

The thickness planer can joint a board's face. On this simple jig, the stock is supported by twin rows of wood screws driven into a platform and adjusted to meet the varying clearances on the underside of the board. The stock rides the sled cup side up. Slide the board slightly sideways to adjust the screws, then seat it firmly on the screw heads for planing.

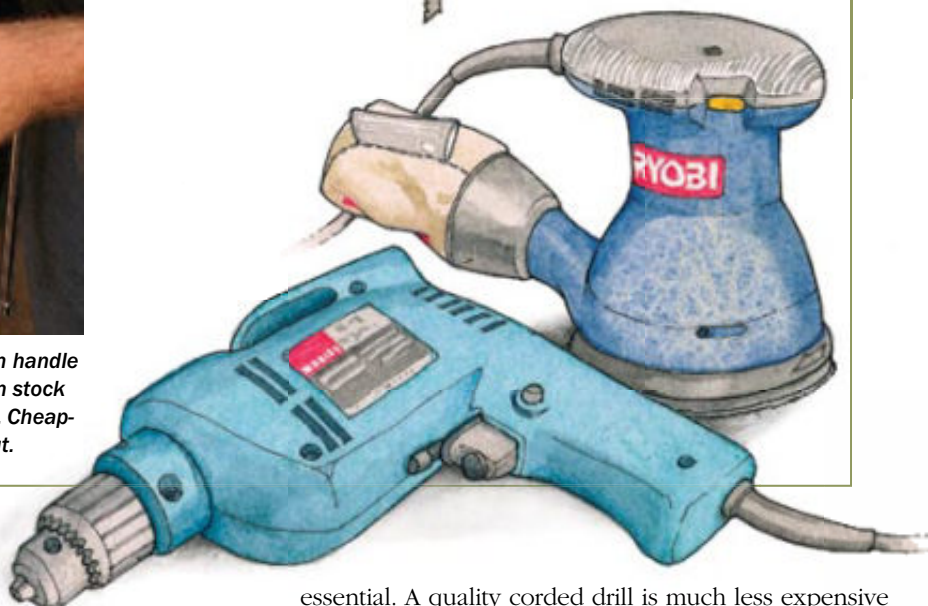
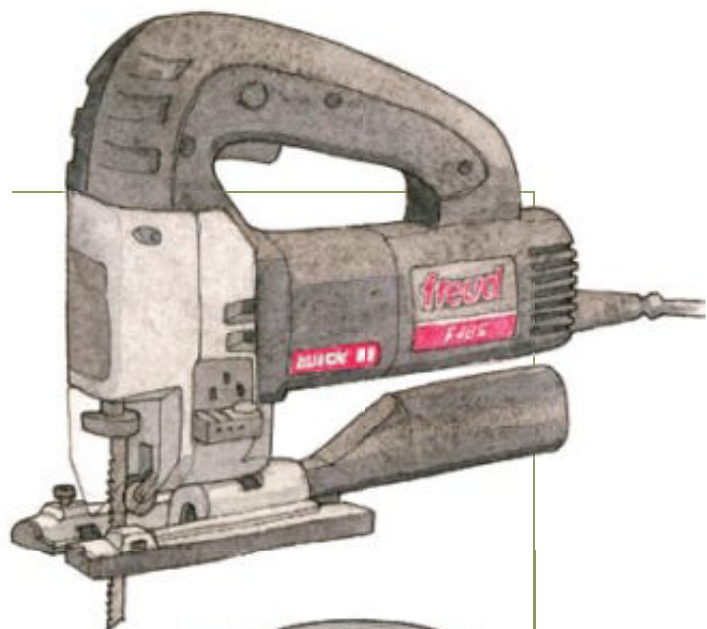


Put the right power in your hands



Cut curves without a bandsaw. A jigsaw can often handle the task, even on thick stock like this 8/4 maple. On stock this thick, premium blades are worth the extra cost. Cheaper versions can deflect, creating an out-of-square cut.

There's a universe of handheld power tools, but a handful pay the largest dividends. Start with a jigsaw, a corded drill, and a random-orbit sander. Reconditioned tools are often a bargain.



better value than a used model. In recent years, DeWalt and Ridgid have introduced portable planers with chip-ejection fans, which work as a built-in dust collector. Dust collection is important for all tools, but essential for thickness planers. This feature can help delay the expense of a dust collector and thus reduce the overall cost of a planer. Speaking of dust collection, I should mention that I don't use a dedicated dust collector in my shop. I use a shop vac with a small hose for my sanders and a larger-diameter hose for the tablesaw and router table, and I depend on the built-in chip-ejection fan for my thickness planer.

The router—The router is the master when it comes to flexibility. Its potential far exceeds trimming and decorative edge treatments. A router will cut mortises, rabbets, and dadoes, and adding a router table builds in even more versatility, including biscuit joinery and raised-panel doors. But where the router distinguishes itself from all other tools is in its ability to produce identical parts using a pattern.

Other important power tools—A good jigsaw will help get you through many tasks, particularly cutting curves, that would otherwise require a bandsaw. Look for one with blade guides that keep blade deflection to a minimum. A handheld drill is also

essential. A quality corded drill is much less expensive than a cordless one, and will never leave you without a charge. Also look for a quality random-orbit sander with a provision for dust collection.

One of the best deals on portable power tools, including routers and sometimes planers, comes in the form of factory-reconditioned tools. These are primarily tools that have been repaired at the factory after failing quality inspections or being returned by customers. While they cannot be sold as new, they are identical to new tools in quality and appearance and usually feature the same warranty (be sure to check). Typical savings are anywhere from 15% to 30%, though you sometimes can find even bigger bargains. These tools can be found at Amazon.com and other online tool sellers. It is also possible to buy them through retail stores and, in some cases, directly from the manufacturer's Web site.

Used hand tools are plentiful

Hand tools offer your best chance of finding a real bargain. Until the early 20th century, nearly all woodworking was done with hand tools, and their designs and uses have changed little. Most of the high-end planes on today's market, for example, are just

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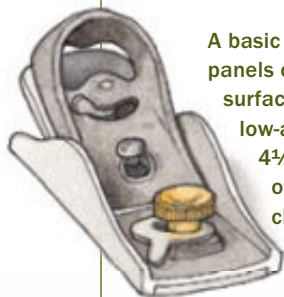
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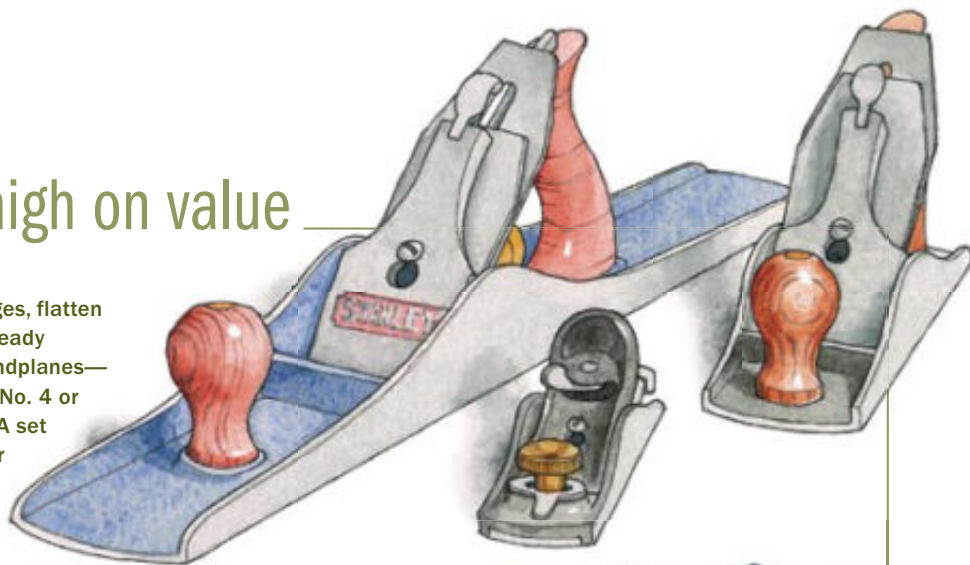
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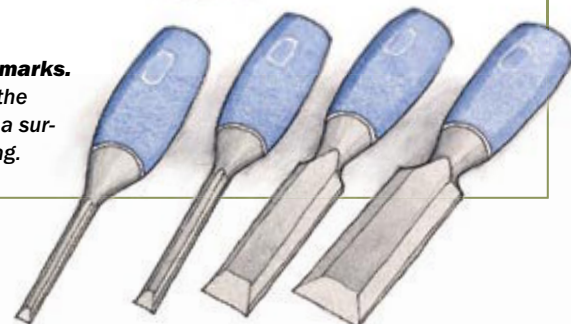
Low-tech tools are high on value



A basic set of handplanes lets you true edges, flatten panels or wide boards, and achieve finish-ready surfaces. Start with a small cluster of handplanes—low-angle and standard block planes, a No. 4 or 4½ bench plane, and a jointer plane. A set of inexpensive chisels is essential for chopping, paring, and trimming.



Clean up the sawmarks.
A few passes with the jointer plane leave a surface ready for gluing.



reproductions of the original designs. And because the originals were mass-produced, they are fairly easy to find at rummage sales and antiques stores. (For more information, refer to Matthew Teague's article, "Buying Old Tools," in *FWW* #180).

Plan to invest in a set of bench chisels, both standard and low-angle block planes, a No. 4 or 4½ smoothing plane, and a No. 6 jack or No. 7 jointer. Between them, these planes will true edges, flatten glue-ups that are wider than your thickness planer, and tame tricky grain that would tear out with a mechanized planer. They also do fine trimming better than any other tools. □

A FEW WORDS ABOUT AUCTIONS

For any auction, live or online, make sure you know the current retail price of tools like the one you are bidding on. Then set your price and stick to it.

Before you bid in an online auction, check the site's rules of operation. At some sites, a winning bid is a binding contract, which can be a problem if you can't inspect the tool before you purchase it. Don't forget shipping costs. In some cases they can exceed the cost of the tool. Also, make sure the tool you're buying will run on the power you have in your shop. Many former industrial tools run on 240v single-phase power. If your shop doesn't have 240v service, you'll need to factor in the cost of upgrading before deciding to buy. You don't want to saddle yourself with a tool you can't use, no matter how good the price.

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Smart Garage Workshop, From the Ground Up



From foundation to shop cabinets,
how to stretch your dollars and space

BY MATTHEW TEAGUE

When I left the staff of *Fine Woodworking* and headed south a few years ago, my wife and I bought a '50s ranch just east of downtown Nashville. I set up shop in the flat-roofed, one-car garage out back while we figured out if I could make a living building furniture and writing about the craft. Two years later, both careers were going well. The workshop, however, was growing smaller every day.

I didn't need an industrial shop for a big crew, but I did want a well-equipped workshop for a single pro, with plenty of bench space, versatile storage, adequate lighting, dust collection, and enough uncramped space to allow for tools and efficient workflow—the same requirements a serious hobbyist might have. I moved into

my new shop recently, and the lessons I learned should be valuable to anyone thinking about building a small, detached shop for woodworking. Many of these tips also will work for updating an existing garage.

An architect is a good value

If you're building a shop and you're concerned about either its look or resale value, hiring an architect is worth the relatively small outlay of money (ours charged \$560). In my case, he devised construction alternatives to raise the ceiling without raising the roof; he helped convince me—against the contractor's suggestion—to keep the bumped-out roof over the entry door; and he was available for last-minute phone calls to help solve the inevitable



One year, from dream to reality

Between April 2006 and March 2007, Teague chronicled the process of building this shop in a weekly blog, "The Smart Shop." Go to FineWoodworking.com/blogs for the whole story. Here are a few milestones from the construction process:



June 23, 2006 "They used only exterior forms for the foundation walls. As they worked their way around, they'd push the rock up against the concrete."



June 28, 2006 "At the end of the day, I'm left with a handsome shop floor. Around dusk I like to stand out there and pretend I'm looking out my windows."



July 28, 2006 "No matter how many times you've seen it, everyone wants to lend a hand raising the first wall."



Aug. 9, 2006 "A little sweat and a good push slide the trusses onto the top of the framing."



Aug. 21, 2006 "After the roof went on ... I was able to get both the electrician and the plumber to do their rough-in work while the building sat idle."



Sept. 1, 2006 "After all the trim was set in place, it took two days to wrap the building in Hardiplank siding with a 5-in. reveal."

snafus that pop up during construction. Also, at least in my county, having full renderings of the building plan helped us skate past an otherwise overbearing inspection department. In short, if I had to do it again, I'd probably ask more of the architect instead of less.

For resale reasons, we designed the building to serve as a two-car garage, though we'll never park a car in it ourselves. And even if codes had allowed for a larger shop, I'd have stayed near the 700-sq.-ft. limit (we ended up at 698). Even on paper, anything larger looked like a monstrosity alongside our humble home.

The architect helped to ensure that the design complements our brick ranch house: He drew in a low-slung (4/12 pitch) hip roof like the one on the house and then,



Oct. 26, 2006 "Having recently Sheetrocked a room's worth of ceiling in my own house, I had no hesitation hiring a crew to handle the shop."



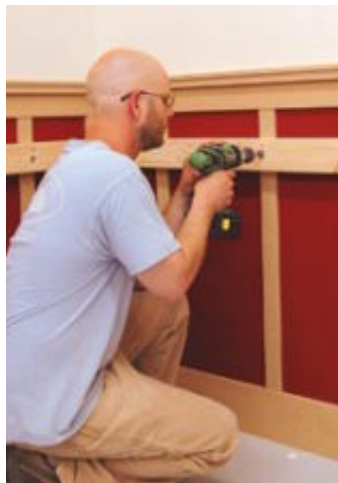
Nov. 19, 2006 "For months now, I've waited for the day to move out of my old shop and into the new one ... a short distance I must have walked a thousand times."

A well-designed workshop

Teague tapped all of his experience from past shops he owned and the articles and books he worked on as a writer and editor to build and equip a safe, comfortable, well-organized garage shop.

PLENTY OF ROOM TO WORK

Two workbenches team up with a long utility bench in the other corner to provide plenty of room for projects, and the center of the shop floor is wide open for assembly and finishing.



Shop wainscoting. To add character and impact resistance, and to leave less area for drywalling, Teague nailed simple MDF wainscoting onto the stud walls. The stiles mark the studs, making it easier to hang things like this ledger board for the long work surface in the right rear corner.

to prevent the building from looking like a box with a cap, he set the front door in a small bump-out under a cantilevered roof. Though the house is brick, we opted for Hardiplank siding on the shop and saved about \$5,000.

While the architect worried mostly about the exterior of the shop, I spent countless hours sketching the interior. I wanted plenty of natural light inside, a comfortable office space, and, for waterstones and general cleanup, the luxury of running water. I settled on a half-bath (a toilet and a mop sink), with room for later expansion, combined with a small office for books and a computer—together the two rooms take up only 96 sq. ft. of space, but they save countless trips to the house.

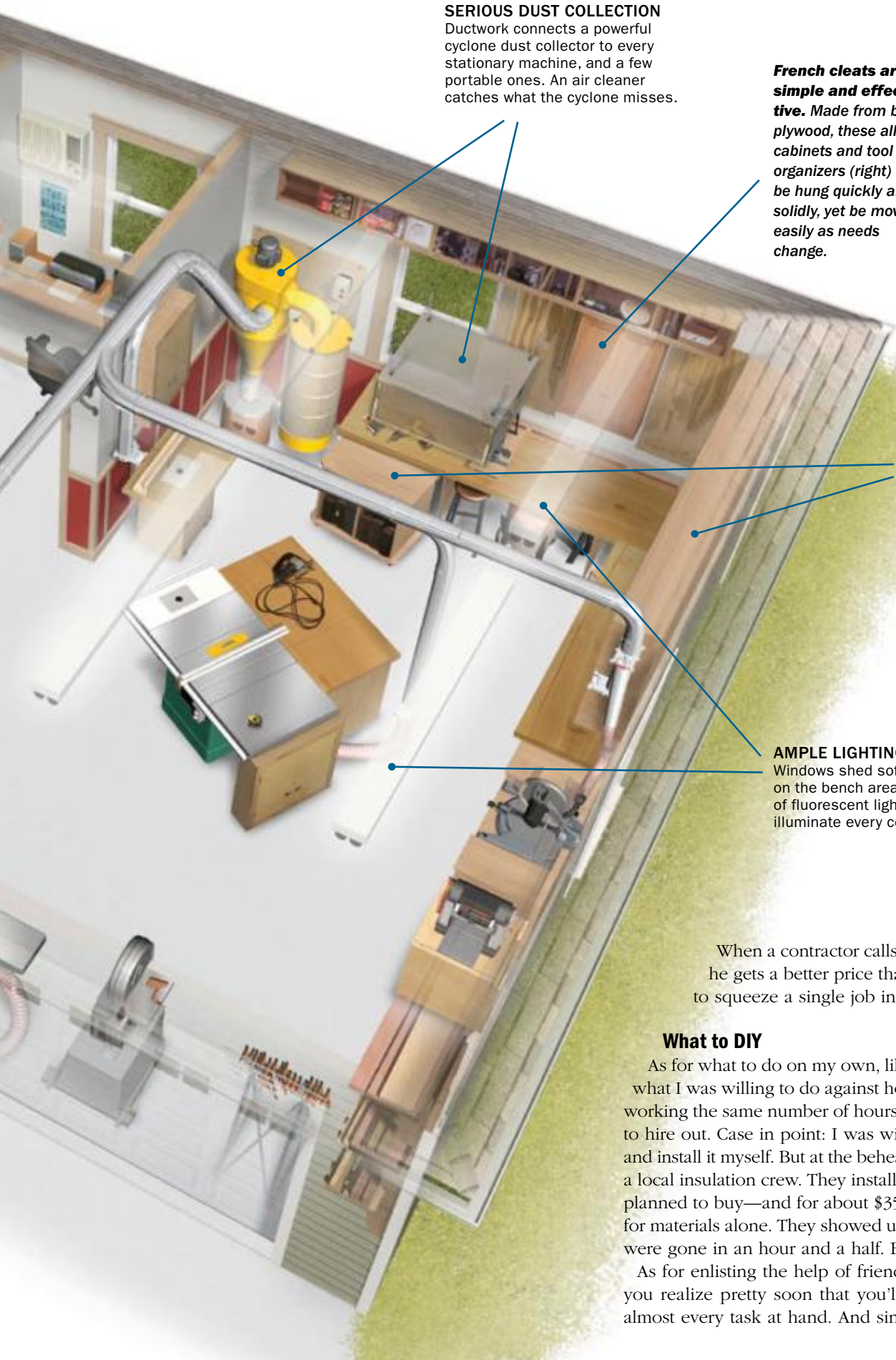
With the office and bath in the back corner of the shop, I was left with a generous 600 sq. ft. of L-shaped shop space. Once we had a working drawing, I made scaled cutouts of all my tools and set them in place. Before we broke ground, I needed to know that everything would fit.



Shop around for a builder

Construction bids from general contractors were at least \$50,000. We then called a contractor who builds garages exclusively. His bid came in at just over half that of the cheapest general contractor. I checked out some of his work, called his references, and signed on.

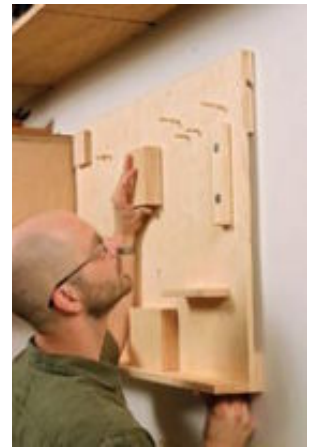
The builder would be responsible for pouring the foundation, framing, roofing, and installing the windows and doors. I opted to subcontract the plumbing, electrical, insulation, drywall, and exterior painting myself. Being a nice guy, the builder even helped me negotiate lower prices with a few of the subs. In retrospect, I don't think I saved much money by subbing out work myself.



SERIOUS DUST COLLECTION

Ductwork connects a powerful cyclone dust collector to every stationary machine, and a few portable ones. An air cleaner catches what the cyclone misses.

French cleats are simple and effective. Made from birch plywood, these allow cabinets and tool organizers (right) to be hung quickly and solidly, yet be moved easily as needs change.



ENOUGH STORAGE TO KILL CLUTTER

Teague fit storage into every square foot of wall and floor space. The bench area has a wall cabinet, cubbyholes, and tool boards over the benches, with drawer units below. The machine area has more of the same, with rolling carts and cabinets tucked under the L-shaped work surface. The office and bathroom have shelves built in.

AMPLE LIGHTING

Windows shed soft, natural light on the bench area, while 48 feet of fluorescent light fixtures can illuminate every corner.

When a contractor calls a sub he deals with every day, he gets a better price than you do when you ask them to squeeze a single job into a busy schedule.

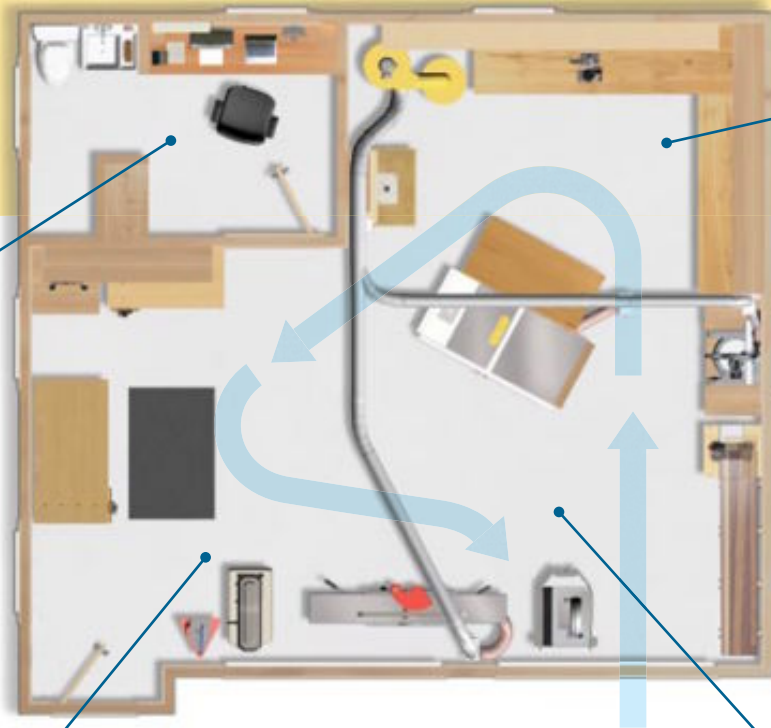
What to DIY

As for what to do on my own, like many of you I had to weigh what I was willing to do against how much money I could make working the same number of hours. In most cases, it was cheaper to hire out. Case in point: I was willing to buy rolls of insulation and install it myself. But at the behest of my builder I checked with a local insulation crew. They installed better insulation than I had planned to buy—and for about \$350 less than I would have paid for materials alone. They showed up a day after I called them and were gone in an hour and a half. Better yet, I didn't itch at all.

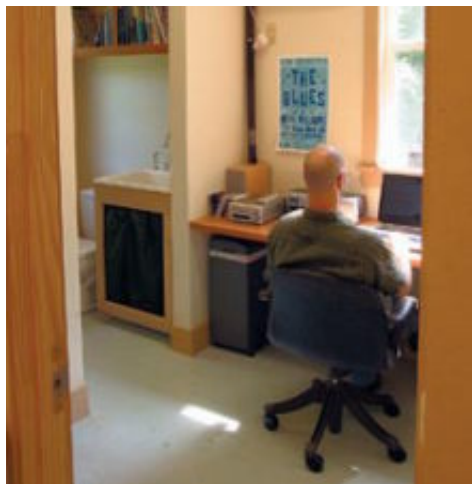
As for enlisting the help of friends, on large construction jobs, you realize pretty soon that you'll need a crew of buddies for almost every task at hand. And since you can call on them only

Let the work flow

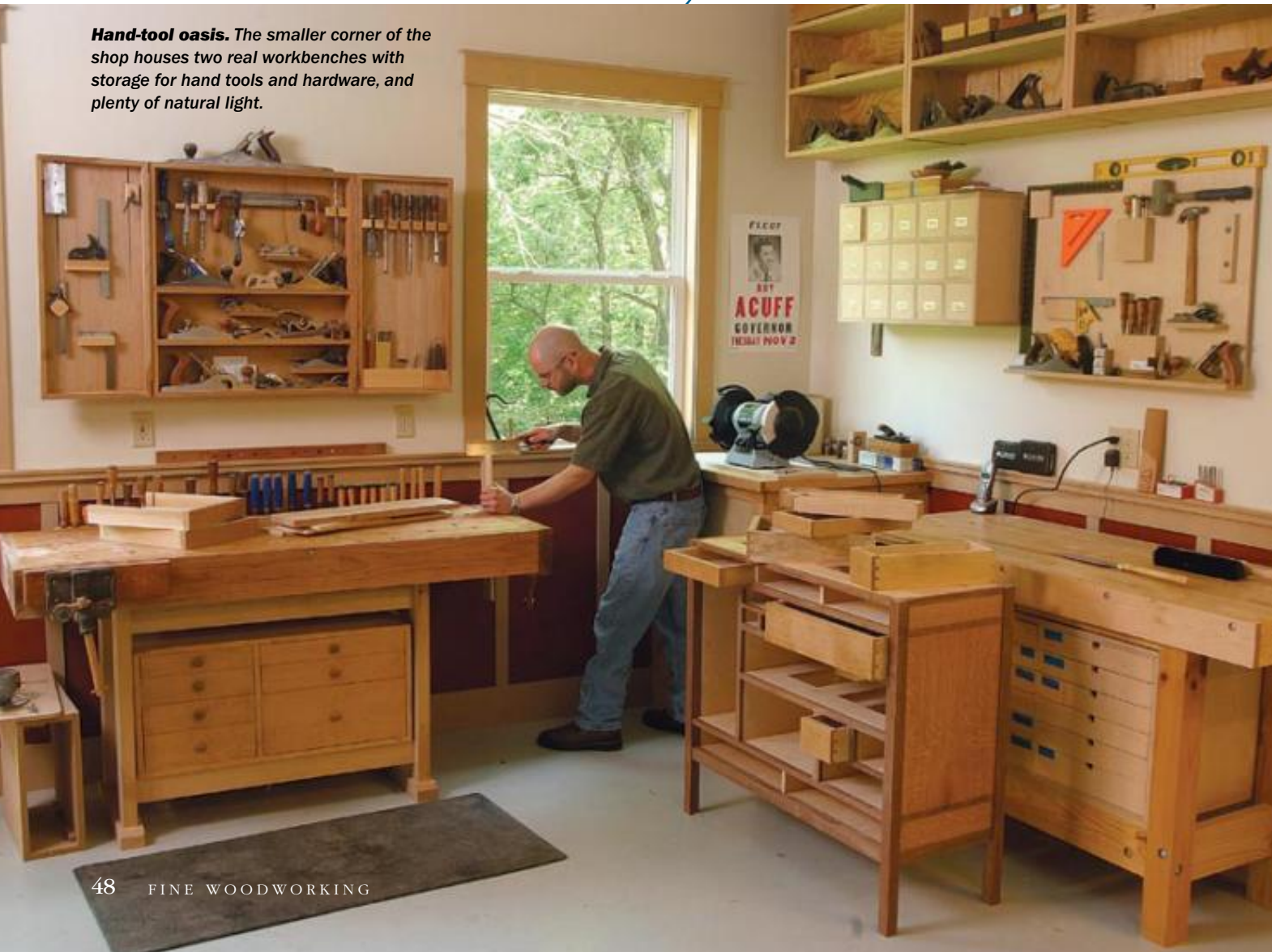
The office/bathroom shortens one end of the shop, creating distinct areas for machine and bench work. Materials flow in the garage door, onto the lumber rack; through the nearby milling machines; onto the bandsaw, drill press, and router table; and then into the bench area for joinery, assembly, and finishing before heading out the way they came in.



Comfort and self-sufficiency. An office for computer, stereo, and books, along with a small bathroom, keeps Teague on task all day long.



Hand-tool oasis. The smaller corner of the shop houses two real workbenches with storage for hand tools and hardware, and plenty of natural light.





Power central. The larger portion of the shop consolidates the machines and dust-collection ducting, with plenty of lumber storage and all-purpose benchtop space around the outside.



Materials and milling. With the lumber rack built next to the garage door (left), Teague can move materials easily into the shop. The jointer and tablesaw are nearby (below) for milling, and a planer cart and lumber cart roll between them to complete an efficient array.



so often, you have to pick your battles. Consider this, too: If you can't get to a task immediately, it puts off all the subcontractors in line behind you (you can't drywall until you install insulation, etc.). Even with all I subbed out, there were plenty of construction concerns to keep me busy.

In cases where the work was relaxing or really mattered to me, I did it myself. I built the cabinetry and storage units and did all of the trim work. I also installed the dust collector and ducting.

A great option for heating and cooling

I've worked in shops that aren't climate-controlled, and neither 20°F nor 100°F is very inspiring. Installing central heating and air seemed like a no-brainer. However, for a fraction of the price, a number of HVAC guys told me, an electric 15,000-Btu packaged terminal air conditioner (PTAC) would work as well. PTACs essentially are small heat pumps and are common in hotel rooms.

The framers left an opening for the unit, and the electrician ran an extra 220v outlet on a dedicated circuit. All I had to do was set the unit in the wall and plug it in. I spent an extra \$50 to add a thermostat—a good decision. After paying the bills through a harsh winter and a Nashville summer, the PTAC seems just as efficient as the central heat-pump system we put in the house.

Electrical: More is more

My builder led me to an electrician who called back promptly, showed up when he said he would, and actually seemed to like what he does for a living. To boot, his prices were reasonable. He re-routed a 100-amp panel from the old shop and installed both 220v and 110v outlets everywhere I might want to place a tool; adding an outlet during construction costs only a few extra



ROLLING CARTS DO DOUBLE DUTY

Storage and work space. Teague prefers an open-based bench with room for rolling carts below (above). One unit has simple drawers (right) that bring the tools to the job, with a hinged top that can flip onto another storage cart (below) to create a larger surface for assembly or finishing.



bucks but doing so later is both pricey and a hassle. For convenience, we located all of the outlets 42 in. off the floor—above bench height. He also supplied and installed six 8-ft. strips of fluorescent lighting.

Walls made for woodworking

Once the shell of the building was up, I did the bulk of the interior work, beginning with the extrahigh walls. If I went with drywall from floor to ceiling, I worried that I'd punch countless holes in the walls as I moved boards around the shop. So I designed and installed medium-density fiberboard (MDF) wainscoting around the lower 40 in. of the walls—to just above bench height. I milled all of the trim pieces for windows, doors, and wainscoting from a few sheets of MDF, at a fraction of what off-the-shelf molding would have cost. I centered each wainscoting stile on a stud—when I hang cabinets on the wall, I don't need a stud finder.

Once the drywall contractors were done (I'm no fan of that job), I painted the top of the walls a light tan color; it masks dust and it's less bland than stark white. I painted the wainscoting panels red, but left the MDF trim natural with just a shellac finish.

As much as I'd prefer wood floors—they're much easier on your back and dropped tools—I had to draw the line somewhere. I sealed the concrete floor with a durable epoxy paint. In front of my workbenches and tablesaw I rolled out anti-fatigue floor mats.

Work flow: From machines to benches

In any efficient shop, work flow determines the tool layout. In my shop, raw lumber comes in the garage door and goes straight onto the lumber racks. With only slight tweaks, I used the lumber-rack design outlined by Andy Beasley in *FWW* #181. Boards slide easily off the racks and onto the chopsaw, where I cut them to rough length. I then stack them on a mobile cart near the jointer, the planer, and the tablesaw. By the time I'm toting workpieces to the workbench, router table, or one of the work areas along the back and side walls, they're already milled to a manageable size.

Big tools first—To accommodate long boards, I set the tablesaw at an angle in the center of the shop, and behind it I put my old outfeed table that doubles as a storage unit. The tablesaw is also outfitted with a router table on the left extension wing. Having two router tables comes in handy when I'm using paired router bits. My main router table is located along the short wall opposite the office. It's built to the height of the tablesaw, and rolls out to provide extra outfeed support.

I left both garage doors operable but realized that I'd only need access to one. A new 12-in. jointer (a shop-warming gift to myself) sits against the garage door I seldom use.

The bench area is an oasis—I didn't get into woodworking because I like heavy, loud machines. What I enjoy most is time at the workbench with hand tools. For that, I placed my two real workbenches in the smaller section of the shop. When I walk in the door, seeing the two walls of benches and hand tools makes me feel like I'm walking into a woodshop instead of a factory.

Storage and more storage

Whenever possible, I try to design storage into my workstations. My chopsaw stand, seen in *FWW* #160, is outfitted with shallow metal drawers available from Lee Valley (www.leevalley.com) that slide on grooves cut directly into cabinet sides. The outfeed table

Rolling, rotating planer cart



Planers require a lot of infeed and outfeed space, so I've always stored my benchtop planer on a cart under the right wing of my tablesaw, pulling it out when I needed it. But that meant either lifting the heavy planer onto a benchtop or working crouched over. In this shop I've found a better way.

A pivoting-top tool station is not a new idea, but this one works especially well and is easy to build. The planer is bolted to a top that spins on a ½-in. steel rod.

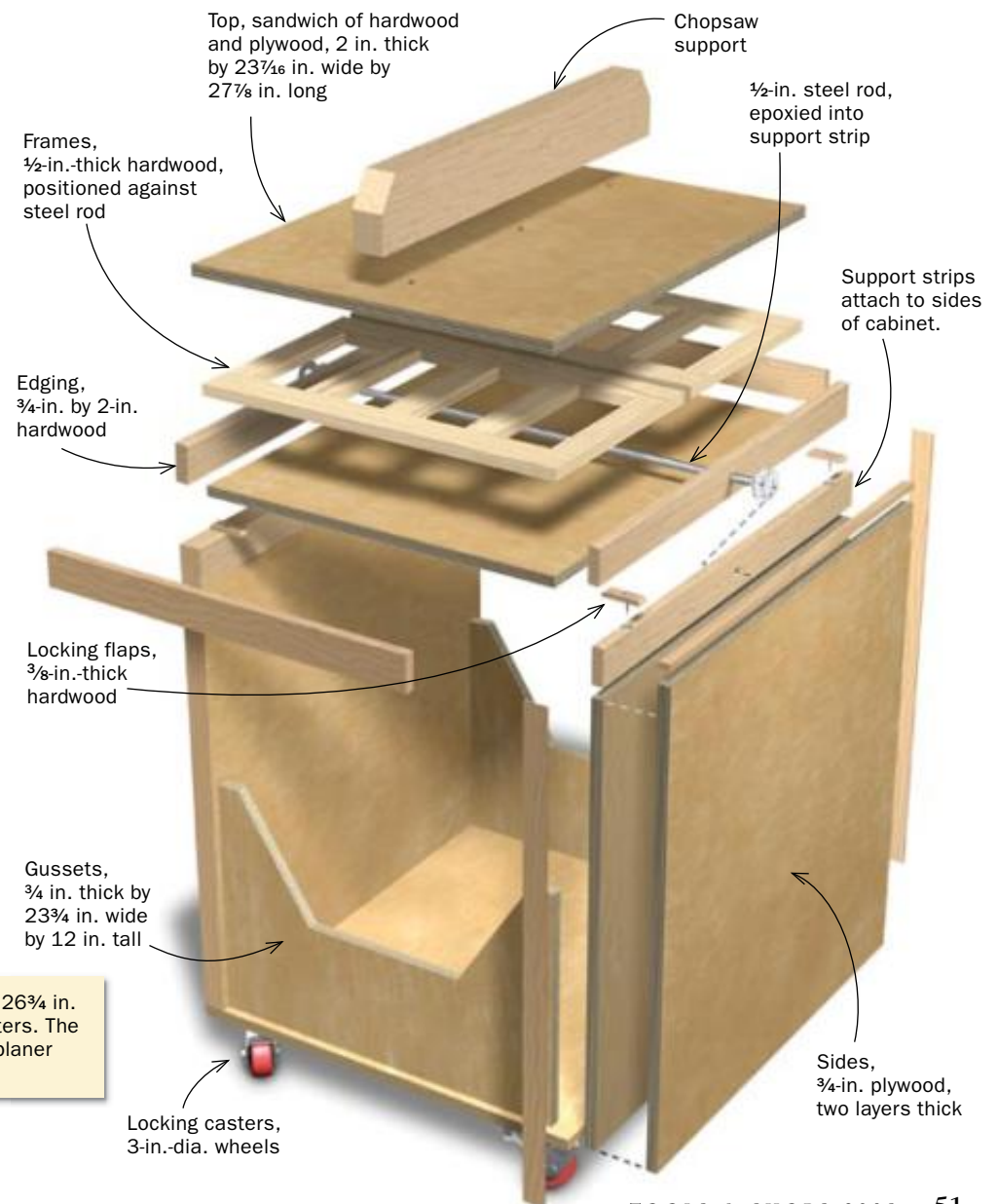
For support at the chopsaw, I simply screwed a length of hard maple to the other side of the top. A more versatile option would be to install an adjustable roller on the side of the cabinet. Then I could use the other side of the top for another tool, such as a disk/belt sander combination.

The secret is to start by building the top, and then size the cabinet parts to fit it. The top is two ¾-in.-thick pieces of birch plywood glued onto an inner hardwood frame, creating a torsion box of sorts. The frame is the exact thickness of the steel rod, and its two halves are positioned snugly against the rod so it is supported on four sides. The pivot mechanism is deceptively simple: The top is edged with maple, and the rod passes through that edging, ending in two support strips that sit atop the cabinet sides. Before attaching the side edging to the top, drill a ½-in. hole through its center points. Then glue on the edging with the rod in place. Now slide two washers onto each end of the steel rod, and epoxy the rod into the outer support strips.



Another innovative cart. The pivoting-top planer cart spends most of its life as an outfeed support for the chopsaw (top), with the planer lying in wait. When needed, the planer pivots upward (center), where it uses the top of the tablesaw for outfeed support (above).

NOTE: The cabinet is 27⅞ in. deep by 26¾ in. wide by 27⅞ in. tall, not including casters. The overall height, 32⅞ in., positions the planer bed at tablesaw height.



DIY DUCTING IN A DAY

It's a snap. Teague spent a lot more to get Nordfab ducting, which goes together in a toolless snap and can be dismantled and rearranged just as easily. Oneida, the cyclone manufacturer, eased the process further by producing a ductwork diagram and parts list, based on a drawing of the floor plan.



for the tablesaw holds my handheld power tools, and the auxiliary table sits on a cabinet for tablesaw accessories. All of the wall-storage units—including cabinets and tool boards—are hung on French cleats, making it easy to move or rearrange them later.

Long workbench accommodates roll-out carts—One of the best moves I made was to build a long work surface that starts at the chopsaw station, turns the corner at the back wall, and extends to the dust collector. The surface is simply two thicknesses of plywood glued and screwed together, and it's supported by ¾-in.-thick plywood panels instead of cabinet bases. Underneath I keep a low, rolling assembly table, as well as storage cabinets of various designs. I also keep my pancake-style compressor there, on its own rolling base.

At last, real dust collection

Because the shop shares space with my office, I wanted to keep dust to an absolute minimum. I could have gotten away with a



few smaller mobile units for dust collection, but not only do they take up more space, they also have to be wrangled around the shop constantly. After consulting numerous experts and manufacturers, I went with a 3-hp, 2-stage cyclone collector from Oneida (www.oneida-air.com). I provided them with a drawing of the shop's floor plan, and they gave me a parts list and a drawing of the ductwork layout.

For the ductwork itself, I spent about twice the price of traditional materials in favor of quick-release ducting from Nordfab (www.nordfab.com). This ducting snaps together without tools and goes up in a fraction of the time it takes to rivet and route traditional ductwork. Better still, it can be disassembled and rearranged easily should my tooling or layout change.

Even with a great dust-collection system, a little bit of dust is inevitable. To help manage airborne dust, I hung an air cleaner over the tablesaw. The cost was minimal, but it makes a noticeable difference.

Now that the shop is done and I've spent a few months building furniture there, I don't miss the few corners I cut, but I do appreciate all the extras I insisted on. The floor paint, wainscoting, half-bath, top-flight dust collection, and smart storage solutions all work together to create a comfortable and inspiring workspace. When I walk through the door each morning, I know I'm set up to build almost anything that pops into my mind. It's become my home a few feet away from home. □

Matthew Teague is a woodworker and freelance writer in Nashville.

Bottom line: under \$40K



Not counting what I spent on tools and dust collection, which will move with me to my next shop, I came in under the \$40,000 budget. It's worth noting that the shop is built on a pretty steep slope, which added a few thousand to the cost of the foundation.

Builder	\$27,700
Foundation, framing, siding, roofing, windows, and doors	
Architect	\$560
Plumbing	\$4,040
Drain lines, water lines, and fixtures	
Electrical	\$3,440
100-amp panel, wiring, outlets, lighting	
Insulation	\$650
R-30 in the ceiling, R-19 in the walls	
Drywall	\$850
Exterior painting	\$1,200
Climate control	\$700
PTAC unit	
Trim and wainscoting materials	\$300

Total: \$39,440



Use Screws Like a Pro

Get maximum holding power in every situation

BY ROBERT J. SETTICH

Some purists will tell you there's no place for screws in woodworking. If they mean that screws can't replace a snug mortise-and-tenon or a seamless dovetail joint ... OK. But the fact is, screws do the job—and do it well—in many woodworking applications. The trick is to select the right screw for the job, and to understand how to get the most holding power from it.

The basics

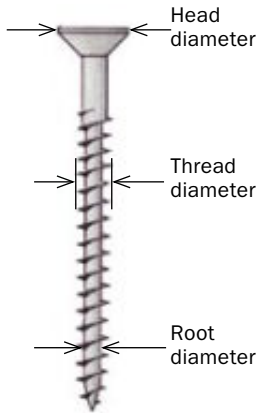
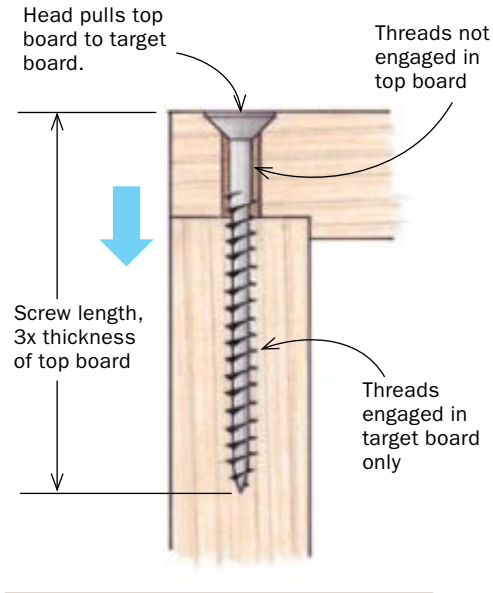
Most crucial to a screw's holding power is its resistance to being pulled out. The more thread surface in contact with the wood, the more resistance. So, to muscle up holding power, use a longer or thicker screw, one with a deeper thread pattern, or any combination of those properties.

A thicker root (around which the threads are wound) also beefs up a screw's torsional strength, or resistance to twisting forces that can snap it, usually after its head hits the wood. To avoid this, choose the right screw, drill the right-size pilot hole, and don't overdrive. Set the power driver's clutch to a lower setting or make the last few turns by hand. Overdriving also spins the screw after it reaches full depth, reducing the wood fibers to a fluff and leaving the screw with no holding power.

Pilot holes—In woodworking, *always* drill pilot holes. Without them, screws simply push the wood

ANATOMY OF A SCREW JOINT

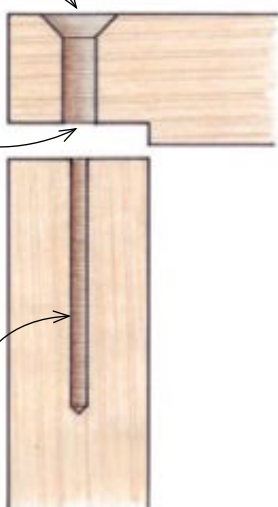
Drill with the right bits, in the right sequence, and the screw will bring the boards tightly together.



Countersink is equal to or greater than head diameter.

Clearance hole equals thread diameter.

Pilot hole equals root diameter.



1



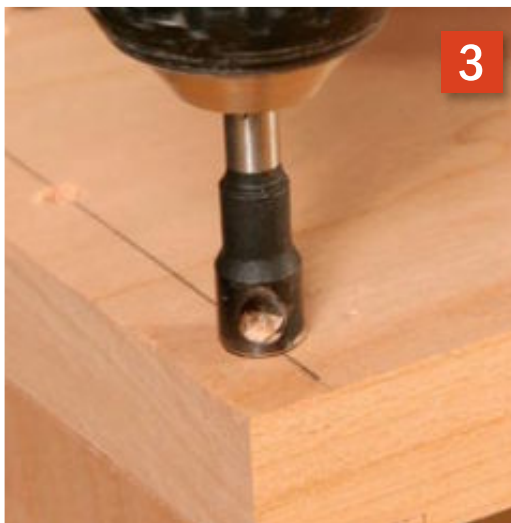
Start with the pilot hole. With the workpieces clamped tightly together, drill the pilot hole to the depth of the screw's length. The drill bit is the same diameter as the root of the screw.

-sizing the Pilot and Clearance Holes

A caliper zeroes in on the screw's root and outside-thread diameters. You'll need both measurements in order to choose the proper bits for the drilling sequence.



Clearance hole is next. After switching to a bit matching the screw's outside thread diameter, drill the clearance hole through the top board only. Flagging the bit with tape keeps you from drilling too deeply.

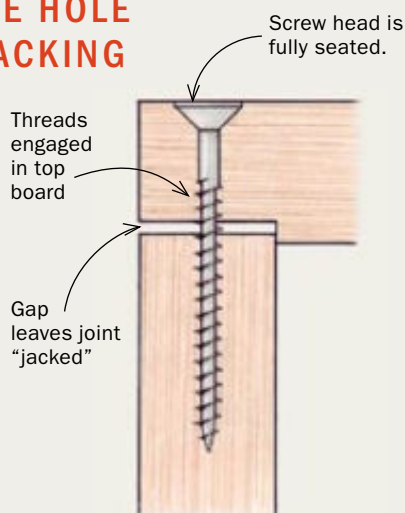


Then make headroom. A countersink bit makes the tapered hole that will fit the head of the screw. This single-cutter type creates chatter-free results.



A CLEARANCE HOLE PREVENTS JACKING

With no clearance hole, the screw threads engage the top board. If the joint is not clamped, the top board can lift and stay separated from the target board, especially if the screw raises a bump of wood as it enters the target board.



Bring it home. Drive the screw all the way, so it seats firmly in the countersink. This draws the boards together and keeps the screw head at or below the top surface.

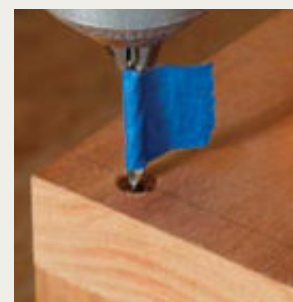
fibers aside. This is OK in carpentry, but with the harder woods and often thinner pieces used in making furniture, it's a recipe for splitting. The general rule is to drill a pilot hole in the target piece that's the size of the screw's root. This is easy when using a rolled-thread screw, in which the root diameter is consistent throughout the length of the screw, tapering only at the tip. For a cut-thread screw, in which the root diameter gradually tapers toward the tip, optimal drilling requires a tapered drill bit.

Clearance holes—Another critical element in a successful screw joint is the head of the screw. No matter how great a screw's holding power, the joint won't hold tight if the pieces being fastened are "jacked," or not drawn tightly together. That's where clearance holes come in. These are drilled through the top board (or piece to be fastened), allowing the head of the screw to pull that piece fast against the target board. To achieve this in most cases, the clearance hole should be as wide as the outer diameter of the screw's widest threads.

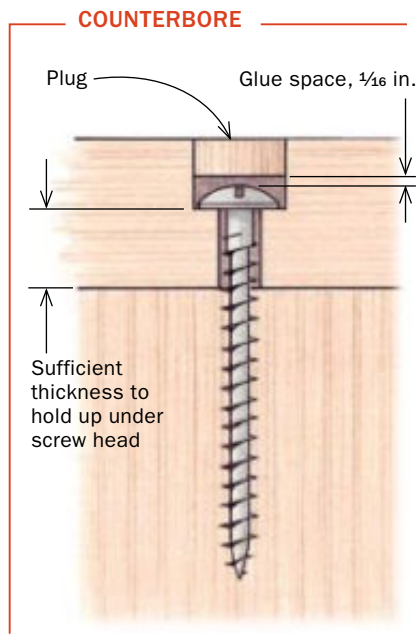
Dialing in a precise screw fit—Here's an easy way to confirm the pilot-hole and clearance-hole sizes for a batch of screws. This works for all screws and woods, but you need dial calipers (\$16 for a 6-in. version from Grizzly; www.grizzly.com; product No. G9256)

COMBO BITS

Using an appropriate-size combo bit saves steps, letting you make the clearance hole and countersink in one drilling (left). Before or after this step, use a smaller bit to drill the pilot hole (below).



Counterboring

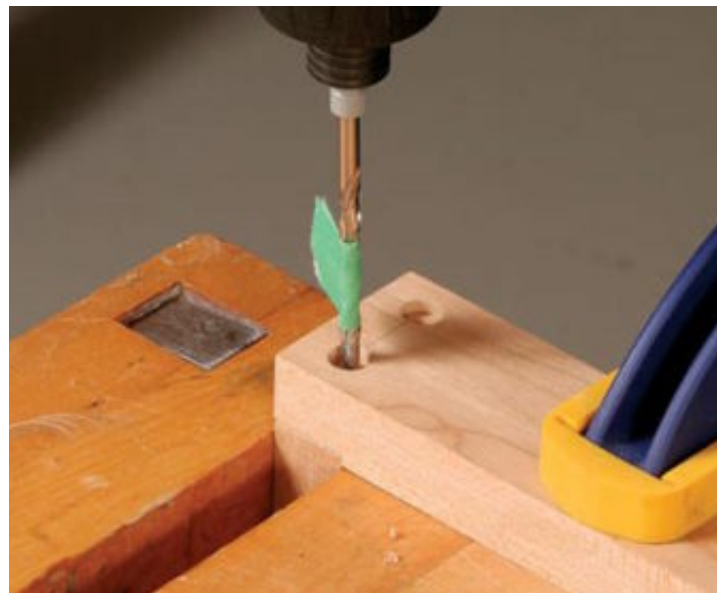


Use the counterbore bit first. Drill deep enough for the plug plus 1/16 in. for glue buildup, but leave enough top board beneath the plug hole to support the screw head. Using a Forstner bit and masking tape helps ensure a straight-walled plug hole with a round, sharp rim.

and a full set of drill bits, graduated by 64ths of an inch.

First, measure the root diameter of the screw by reaching into the space between threads. This is the diameter of the pilot hole. For very soft woods like pine, go down one bit size; for very hard woods like maple, go up a size. Next, measure the outside of the threads. This is the diameter of the clearance hole. And if you need a counterbore (see next section), use a bit that matches the screw's head diameter—or the diameter of the plug that will cover the screw head.

Countersinking and counterboring—Beginners sometimes use the terms “countersinking” and “counterboring” interchangeably, but they are distinctly different processes. Countersinking chamfers the rim of a hole so that a flathead screw seats flush to, or slightly below, the surface of the wood.



Two twist bits are next. Drill the narrow pilot hole through both pieces, and then use the larger bit to widen the hole in the top board for clearance (above). Bring the joint home with screws, and tap in the glued-up plugs (right).



My favorite countersink bits are the single-cutter design (created by drilling a hole through the bit) because the cone point positively engages the hole and the cutter slices the wood instead of grinding it. Countersinks usually have an 82° angle to match the underside of flathead screws.

Another countersink is attached to a drill bit. For woodworking, this bit should be sized to make the clearance hole. These combination tools are often sold in sets to accommodate a wide range of screw gauges. The countersinks also match various plug sizes, so if the bit is driven deeper into the wood, the countersink also makes a counterbore for plugging.

A counterbore is a hole with parallel sides, stopped partway through the top board. Sometimes you'll make one simply to extend the reach of a screw, but it's more commonly used to create a home for a plug to conceal the screw head.

The drilling sequence—In furniture making, where accuracy is essential, the order in which you drill your holes can be critical. If you're not careful, you can get into a situation in which a subsequent bit can't pick up the center of an earlier hole.

To attach two pieces of wood with a countersunk screw, clamp the pieces together first. Next, drill the pilot hole through the top board and into the bottom board. Then, using a twist bit (which, because of its tapered tip, centers itself over the pilot hole), drill the clearance hole in the top board.

To create a plugged screw joint, clamp the boards together and drill the counterbore in the top board. Make the counterbore about 1/16 in. deeper than the penetration of the plug. Drill the pilot hole next, driving the bit through the center dimple left by the first bit. Then make the clearance hole with a twist bit.

Screws in solid wood

Now the question becomes which screws—and what fastening techniques—work best in which situations. Let's begin with the most common application in making furniture: fastening solid wood to solid wood. Here are a few general rules:

Slotted holes



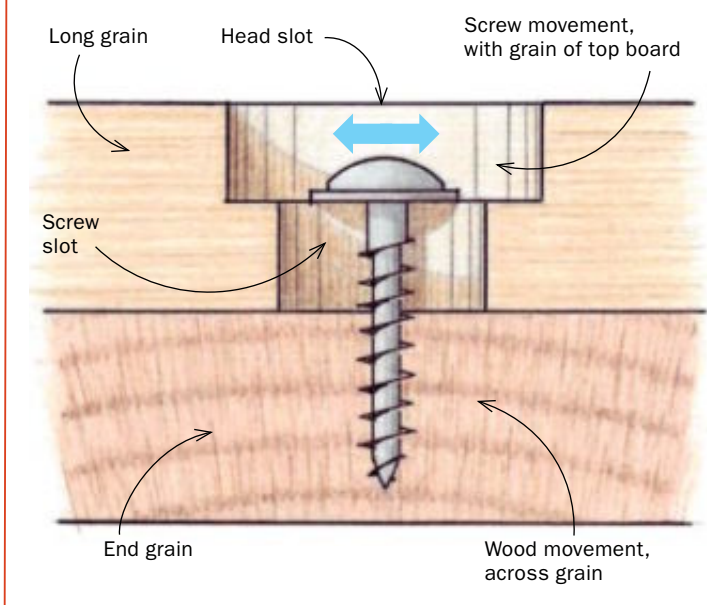
FLAT-BOTTOM BITS

The flat-bottom slot not only accommodates any screw with a flat-bottomed head, but it also allows you to add a washer, further ensuring freedom of movement over the wood surface.



Route the slot. With a screw-slot bit in his router, Settich plunges it into a bracket for a solid-wood cabinet top (top). The resulting slot (bottom) leaves ample room for the top to expand and contract.

CROSS-GRAIN FASTENING



1. Drive the screw through the thinner piece of wood into the thicker one.

2. Avoid “jacked” joints by making sure the threads aren’t engaging the top board, and also by clamping parts together tightly before driving screws. Otherwise, the screw entering the target board can raise a tiny eruption of wood that can permanently separate the two pieces of wood.

3. Another cure for jacked joints is to countersink the pilot hole on the bottom of the board you’re fastening. This creates a clearance zone for the raised wood fibers.

4. If you must drive a screw into end grain, a cross-dowel in the target board will boost strength.

Slotted holes allow movement—Solid wood’s seasonal expansion and contraction is a concern that arises most often when fastening the tops of tables or cases. One common solution is to drill slotted screw holes in the cleats used to attach them. The slots allow the top to expand and contract

TAPERED BITS

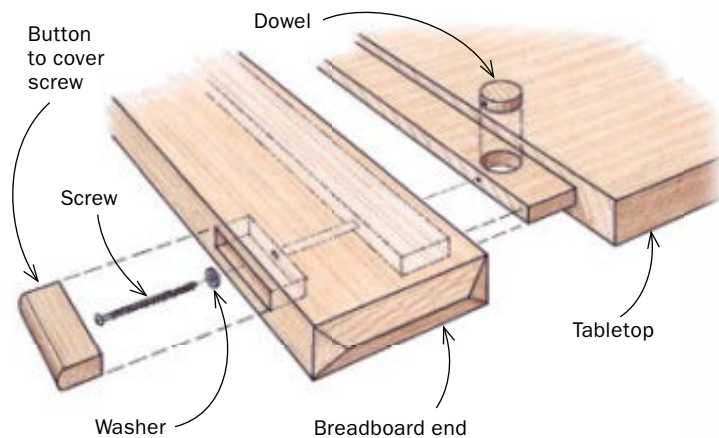
The tapered-bottom screw-slot bit matches the design of the flathead screw, as with this mounting slot for a solid-wood drawer bottom.



End grain



Use a dowel for grip. Screwing into end grain, as when applying a breadboard end, is risky because the threads don't grip the wood fibers well. Solve this problem by inserting a dowel near (but not too close to) the edge of the target board and screwing into the dowel.



across its grain while being held flat by the screws. Slotted holes work similarly for screws attaching solid-wood drawer bottoms.

Another common solid-wood screw application involves breadboard ends for table and casework tops. Screws in slotted holes hold the breadboard to the tongue but permit the top to freely change in width. (A screw-slot router bit is the perfect tool for most slotting applications. Lee Valley offers styles for either flat-head or roundhead screws.)

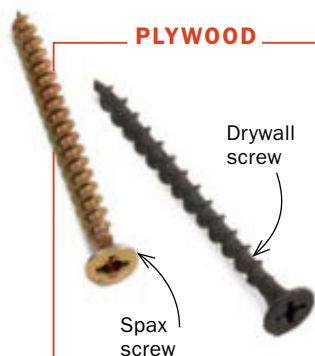
Joining plywood and MDF

Building cabinets, jigs, and other items with sheet goods such as plywood and medium-density fiberboard (MDF) poses other fastening challenges. Though wood movement is not a major concern, these materials are especially prone to end- and edge-splitting. This can leave the screws that fasten them with very little holding power.

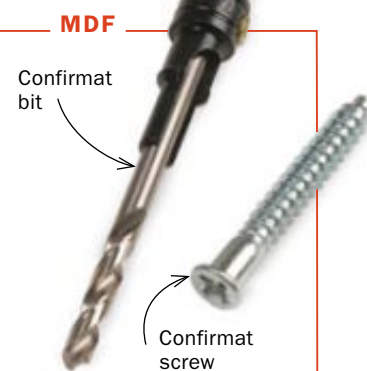
Plywood—You can achieve decent strength screwing into the face of a plywood panel because you're working into face-grain wood fibers. But screwing into a plywood end or edge offers no more than thin layers of edge and side grain, and it takes more thread surface to get a good bite. With conventional screw designs, this means moving to a larger gauge—for example, a #10 screw instead of a #8. But edge-driving a thicker screw also increases the risk of splitting the plywood by separating its layers. So your best bet is to use a fastener that has a deeper thread circling a slimmer shank. That includes Spax screws and Type W drywall screws.

Medium-density fiberboard—Unlike plywood, MDF lacks the structural advantages of continuous wood fibers. As a result, it's

Sheet goods



Use deep, sharp threads in plywood. Most screws won't hold well in the cross-layered fibers of plywood. The solution: Use deep-threaded fasteners such as Spax screws and Type-W drywall screws, especially when fastening into an edge such as a plywood cabinet shelf (right).



Special screws for MDF. Getting a good grip in medium-density fiberboard requires a shallow-threaded fastener with a substantial root diameter such as the Confirmat screw. A special bit allows you to drill the matching pilot hole, clearance hole, and countersink.

Hardware

HINGE BIT

Hinges require extra precision. Drill pilot holes with a self-centering hinge bit. It's best to have two or three different sizes of these bits, to match the most common hinge-screw sizes.



SWITCHEROO

Steel first, brass later. Brass screws are soft and often wind up with scratched or stripped heads when driven into hardwood. To avoid that, drive a steel screw into the pilot hole first, then replace it with its brass twin.



even more prone to splitting and causing spinout. The best solution is to use a low thread design, as seen in the Conformat screw.

Fastening hardware

You rarely have to deal with seasonal movement or edge-grain liabilities when fastening hardware to wood. Yet this job is not as easy as it seems. Many hardware items, such as hinges, have countersunk holes and include mounting screws. While convenient, this does not ensure that the screws will fit properly or hold well. So, begin by test-fitting each screw into its countersink to be sure that the head is flush with the surface of the leaf. If the head stands proud, and it's the only type of screw available, modify the hinge with a countersink bit, preferably chucked into a drill press.

Start with the right bit. A special self-centering drill bit takes the frustration and guesswork out of drilling precisely positioned pilot holes for hardware. Many such bits (including the most common brand, the Vix bit) enable you to replace the twist drill component of the assembly to extend the life of the tool.

Then, go with the right fastener. Use the screws that come with the hinge, or substitute special hinge screws. When you drive screws, the threads typically raise a tiny curl of wood that can become trapped under the head of an ordinary screw and prevent it from fully seating. The undercut head of the hinge screw provides room for the curl, so you can drive the head flush.

If the hinges are brass, the hinge screws should be brass, too. But brass screws are soft, and their heads are easily marred by a struggling screwdriver tip. Avoid problems by first driving an identical steel screw into the pilot hole. This will cut the threads into the wood, reducing the strain on the brass. If you still meet resistance, enlarge the diameter of the pilot hole. □

Robert J. Setlich is a writer, photographer, and woodworker in Gladstone, Mo. He is the author of Taunton's Complete Illustrated Guide to Choosing and Installing Hardware (The Taunton Press, 2003).

AVOID WRONG-HEADEDNESS

If the tapers of a screw head and hinge hole don't match (top), the screw might seat proud and prevent the hinge from closing fully. If you don't have the right screw on hand, reshape the hinge hole with a countersink (center). With the hole reshaped, you can re-seat the screw at its proper depth (bottom).



Hybrid Tablesaws

Do serious woodworking without springing for a cabinet saw

BY TOM BEGNAL



Until relatively recently, a home woodworker looking to buy a floor-standing tablesaw had just two choices—a contractor's saw or a cabinet saw. Now there's a third choice, commonly called a hybrid saw, that fits between the two in price and performance.

When it comes to power, hybrids generally have between 1¾ hp and 2 hp. Cabinet saws begin at 3 hp. But if you work with very thick stock only occasionally, a 3-hp motor isn't a must. A 1¾-hp to 2-hp

motor will cut just fine through the thickest hard maple—you just have to cut a bit slower. Also, hybrid saws, like contractor's saws, have 110v motors. That means there is no need for special wiring; you can plug them into any household grounded outlet. On the other hand, cabinet saws run on 220v.

Choosing a favorite

All these saws cut ¾-in.-thick stock without strain. And, with the exception of the

Hitachi, all could cut 2¾-in.-thick maple simply by slowing the feed rate. Also, all had good rip fences, a very important component in a tablesaw.

That said, the Woodtek had the most power, the widest rip capacity, a roll-around stand (that worked wonderfully), and a low price. I felt it was the best overall saw in the bunch. And, because it comes at a low price, it's the best value, too.

Tom Begnal is an associate editor.

What's the difference?

In terms of overall features, hybrids generally fall between contractor's saws and cabinet saws. But on the important points—smoothness of cut, dust collection, rip fence—hybrids have more in common with the big guys.

Contractor's saws

- Price range: \$550 to \$900
- 1½ hp, 110v
- Motor outside of cabinet
- Trunnion assembly mounted to underside of table
- Generally have stamped-steel wings (cast-iron wings optional)



Hybrid saws

- Price range: \$700 to \$1,100
- 1¾ hp to 2 hp, 110v
- Motor inside cabinet
- Trunnion assembly mounted to underside of table or cabinet
- Beefier trunnions than on contractor's saws
- Good-quality rip fence
- Cast-iron wings (optional on the DeWalt)



Cabinet saws

- Price range: \$975 to \$2,100
- 3 hp to 5 hp, 220v
- Motor inside cabinet
- Trunnion assembly mounted to cabinet, making for easier adjustment
- Beefiest trunnions
- Cast-iron wings



15-point inspection

What makes a good tablesaw? When evaluating the overall quality of a tablesaw, I take into consideration a number of categories—15, to be exact. A saw that does well in all 15 areas is an excellent tool.



1 Miter slots

For smooth, safe cuts, the tablesaw blade must be parallel to the miter slots at any blade angle. I measured blade/miter-slot parallelism with a 10-in.-dia. testing plate at 0° and then took a reading to see how different the alignment was with the plate at 45° (see chart, pp. 64-65). A difference of more than 0.007 or 0.008 means you'll have to shim the trunnions, a tedious process of trial and error on most saws. Anything less can be solved with a side-to-side shift, which is easier. It's important to check your saw when it arrives. Any of them can be bumped out of whack during shipping.

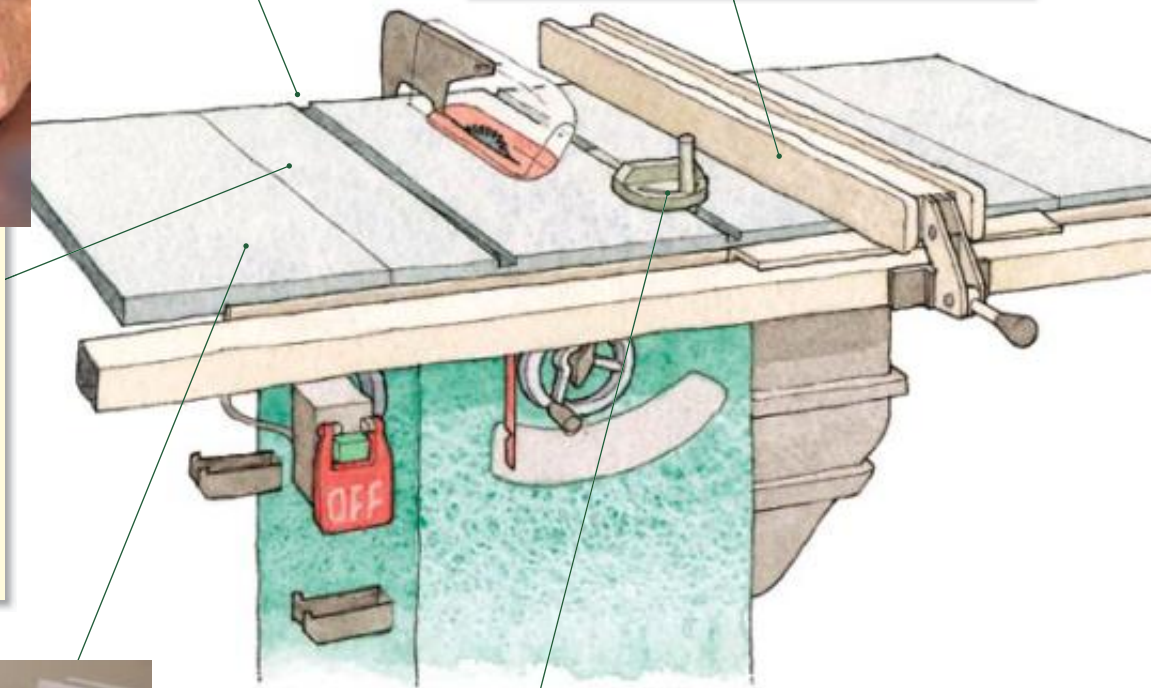
2 Rip fence

The importance of a good rip fence is hard to overstate. A good one is sturdy, straight, square to the table, and parallel to the sawblade. If not parallel or square, the fence should be easy to adjust so. It should slide smoothly and lock securely with little effort. When side pressure is applied, fence deflection at the back of the saw should be minimal. All these hybrids had good rip fences. Some needed tweaking to get them parallel or square, but that took only a minute or two. To get a sense of how much each fence might deflect, I used a push-pull gauge to apply 6 lb. of force to the back end. None deflected more than 0.006 in., an acceptable number.



3 Flat table

A tabletop with one or more severe dips or crowns, depending on their location, could affect whether the blade makes a square cut. Using a test-quality straightedge and feeler gauges, I made 12 measurements on each top, then averaged them. All the tops were satisfactorily flat, with the average deviations ranging from under 0.001 in. to 0.002 in.



4 Wings

Like the table, the wings should be flat and installed flush to the table; if not, your boards might not be square to the blade. All the wings were flat enough.

5 Miter gauge

A miter gauge should slide smoothly in its slots with no noticeable wobble in the bar, and it should allow you to set accurate stops at 0° (90°) and 45°. I also like a comfortable handle. All the miter gauges in this group were adequate, but those of the Grizzly, Shop Fox, and Delta stood out as especially sturdy and comfortable.

15-point inspection (continued)

INSIDE THE CABINET

A look under the hood can tell you a lot about how a tablesaw will perform when the blade meets the wood.

6 Vibration and cut quality

A saw that vibrates a lot is more likely to produce rough cuts. Plus, it will be noisy and generally annoying to use. I didn't test for vibration, as all the saws ran smoothly after adjusting for misalignment.

7 Trunnion

The trunnion houses the arbor, the spinning horizontal rod to which the blade is attached. It allows the blade to rise up and down and to tilt from 0° to 45°. The Craftsman and Steel City saws have cabinet-mounted trunnions, which means the table can be easily and independently adjusted if it isn't parallel to the blade either at 0° or 45°. If the trunnions must be shimmed, they can be accessed easily by removing the saw table. On the other eight hybrids, the trunnions are attached to the underside of the table, where they are much harder to access. The good news is that any adjustment should be a once-in-a-lifetime event.



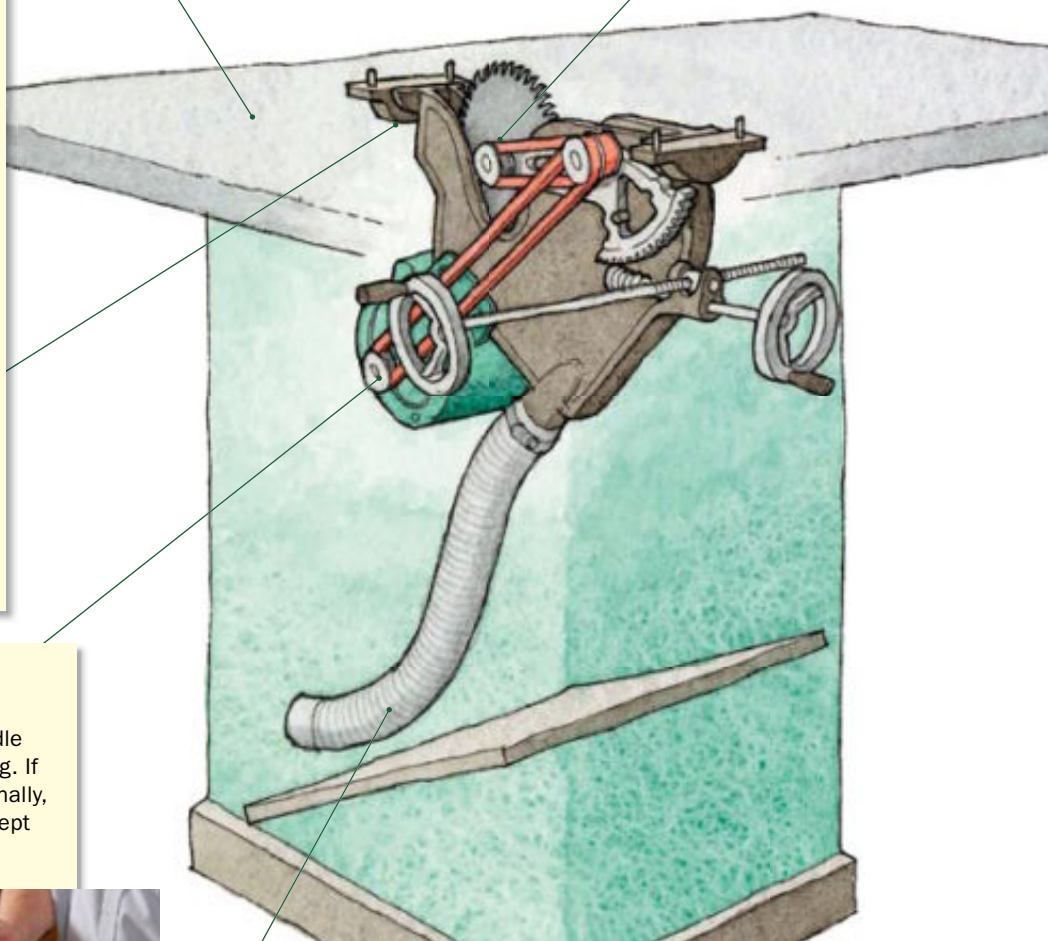
9 Motor

You want a motor that has the horsepower to handle your cutting needs without bogging down or stalling. If you rip thick stock (1½ in. to 2½ in.) only occasionally, horsepower is not a big issue; just cut slower. Except for the Hitachi, all the saws did fine when ripping 1⅞-in.-thick stock at a reasonable feed rate of about 5 ft. per minute (fpm). On the Hitachi, the thermal-overload breaker popped and shut off the saw a couple of times during each cut. When the saws were pushed to a fairly aggressive 7½ fpm, the Woodtek was the only one that didn't bog down.



8 Arbor-flange runout

The sawblade mounts directly to the arbor flange, so any runout on the flange is increased several times at the outside edge of the blade. Wobble creates a wider kerf and a rougher cut. Manufacturers try to keep this runout to a maximum of 0.001 in. Only the Craftsman, with a runout of 0.002 in., exceeded the limit, but it cut as smoothly as the others.



10 Dust collection

Wood dust is bad for your lungs. A saw that removes at least 90% of the dust it generates is about the best we can hope for, especially since some is certain to escape at the throat plate and will be thrown toward the operator by the spinning blade. All the hybrid saws did an adequate job collecting dust with a 2½-hp, 220v dust collector attached to the dust ports.

ON THE OUTSIDE

Several features on the outside of the cabinet affect safety and convenience; be sure to give them adequate consideration.



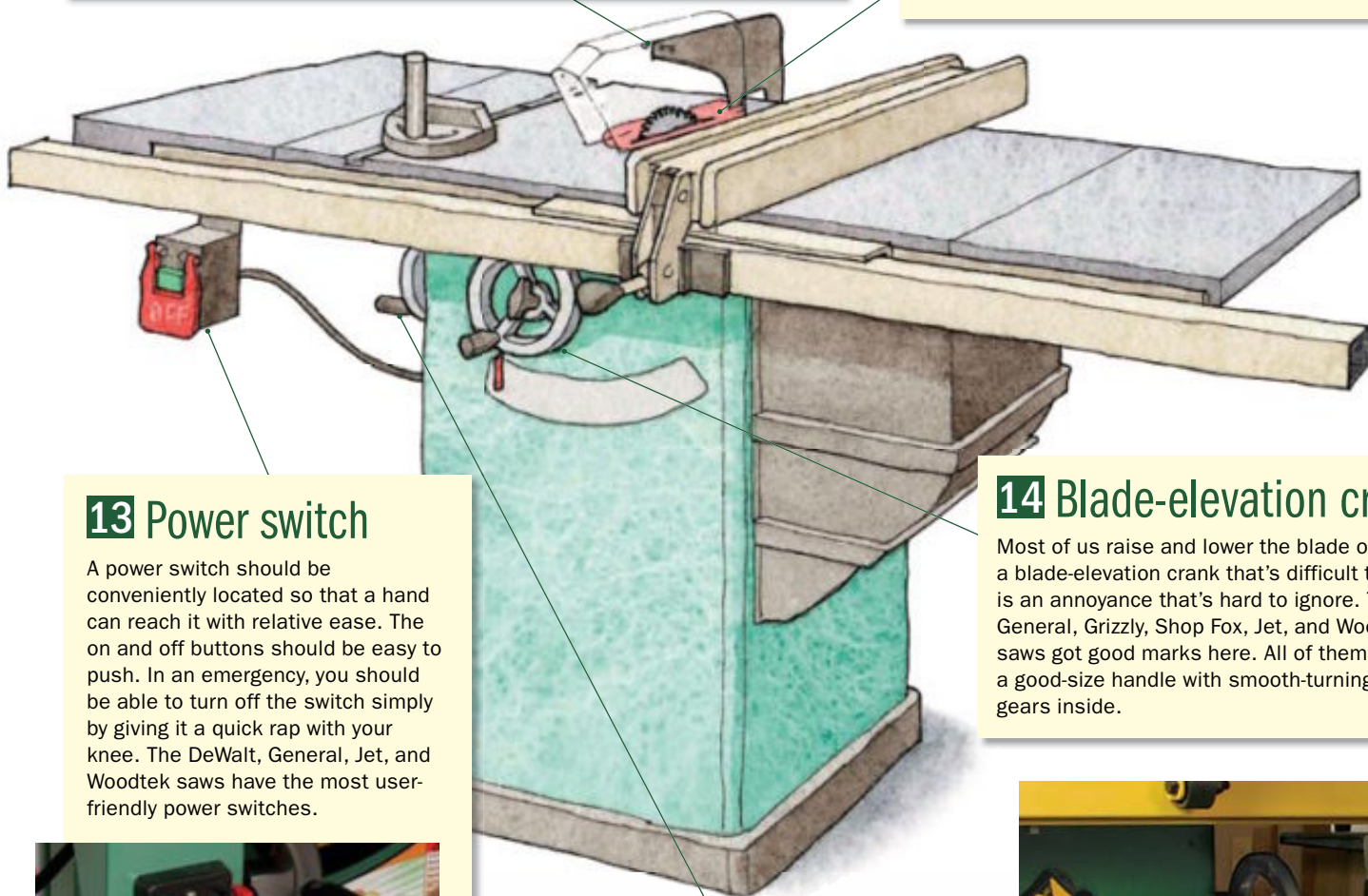
11 Blade cover and splitter

None of the saws have exceptional blade covers and splitters. Only the Craftsman and Steel City saws make them relatively easy to remove and replace—simply loosen a locking knob and slip the unit from a toolless locking bracket. All but the Delta and the Hitachi have covers that remain tilted up when placed in that position to align the blade with a mark on a workpiece, although the DeWalt requires a long reach to do so.



12 Table insert

Most of the inserts were less than flat, making it about impossible to get them level with the table. And because they are relatively thin, all tended to deflect under moderate downward pressure. Craftsman, Delta, DeWalt, Jet, and Steel City made an effort to add stiffness by including ribs on the underside of the inserts. They helped, but not enough to eliminate the problem. You're better off making your own zero-clearance insert (see *FWW* #169, p. 51).



13 Power switch

A power switch should be conveniently located so that a hand can reach it with relative ease. The on and off buttons should be easy to push. In an emergency, you should be able to turn off the switch simply by giving it a quick rap with your knee. The DeWalt, General, Jet, and Woodtek saws have the most user-friendly power switches.



14 Blade-elevation crank

Most of us raise and lower the blade often, so a blade-elevation crank that's difficult to turn is an annoyance that's hard to ignore. The General, Grizzly, Shop Fox, Jet, and Woodtek saws got good marks here. All of them had a good-size handle with smooth-turning gears inside.

15 Blade-tilt crank

Like the blade-elevation crank, the blade-tilt crank should be easy to turn. The blade should move smoothly as it pivots, with accurate stops at 0° (90°) and 45°. All the cranks worked acceptably well.



Head to head

Consider all factors, from price to power to setup, when choosing a saw.

MODEL	SOURCE	STREET PRICE	MOTOR	TABLE SIZE (INCLUDING WINGS)
Craftsman 22124	www.craftsman.com	\$1,100	1¾ hp/ 15 amps	27 in. by 44 in.
Delta 36-717	www.deltaportercable.com	\$1,000	1¾ hp/ 15 amps	27 in. by 40½ in.
DeWalt DW746X	www.dewalt.com	\$1,100	1¾ hp/ 15 amps	27 in. by 40¾ in.
General 50-220C M1	www.general.ca	\$990	2 hp/ 13 amps	27 in. by 44 in.
Grizzly G0478	www.grizzly.com	\$725	2 hp/ 20 amps	27 in. by 39¾ in.
Hitachi C10LA	www.hitachipowertools.com	\$925	1½ hp/ 15 amps	27 in. by 40¾ in.
Jet JPS-10TS (No. 708481)	www.jettools.com	\$700	1¾ hp/ 17.5 amps	27 in. by 41¾ in.
Shop Fox W1748	www.woodstockint.com	\$980	2 hp/ 20 amps	27 in. by 39¾ in.
Steel City 35601	www.steelcitytoolworks.com	\$980	1¾ hp/ 15 amps	27 in. by 44 in.
Woodtek 148-271	www.woodworker.com	\$760	2 hp/ 18 amps	27 in. by 44 in.

AUTHOR'S CHOICE
BEST OVERALL
AUTHOR'S CHOICE
BEST VALUE



CRAFTSMAN 22124

Includes outfeed table and 12-in.-wide side table; blade guard and splitter easy to remove and replace; poor parallelism but adjustment isn't difficult on this saw.



DELTA 36-717

Includes 14-in.-wide side table with support legs; fair parallelism (needed simple trunnion adjustment, covered in manual).



DEWALT DW746X

Stamped steel wings; sliding table available as option; fair parallelism (needed simple trunnion adjustment).



GENERAL 50-220C M1

Digital angle readout; blade-elevation crank among the easiest to turn; difference in parallelism at 45° required difficult adjustment.



GRIZZLY G0478

Sawblade and power-cord plug not included; blade-elevation crank among easiest to turn; best overall parallelism (needed no adjustment).

RIP CAPACITY	ARBOR-FLANGE RUNOUT	BLADE-TO-SLOT PARALLELISM		RIP-FENCE DEFLECTION	CUTTING POWER
		@ 0°	Difference @ 45°		
30 in.	0.002 in.	0.001 in.	0.010 in.	0.001 in.	Good
30 in.	0.001 in.	0.008 in.	0.008 in.	0.001 in.	Good
28 in.	0.000 in.	0.001 in.	0.006 in.	0.003 in.	Good
30 in.	0.001 in.	0.002 in.	0.014 in.	0.003 in.	Good
27½ in.	0.000 in.	0.005 in.	0.002 in.	0.003 in.	Good
25½ in.	0.000 in.	0.007 in.	0.022 in.	0.001 in.	Fair
32 in.	0.000 in.	0.003 in.	0.008 in.	0.005 in.	Good
27½ in.	0.000 in.	0.008 in.	0.022 in.	0.003 in.	Good
31 in.	0.001 in.	0.011 in.	0.002 in.	0.006 in.	Good
36 in.	0.000 in.	0.002 in.	0.008 in.	0.003 in.	Very good

Online Extra

The DeWalt hybrid offers an optional sliding crosscut table. For a video, go to FineWoodworking.com/extras.



WOODTEK 148-271

Digital angle readout; built-in rolling stand; widest rip capacity; most cutting power; blade-elevation crank among easiest to turn; fair parallelism (needed simple trunnion adjustment).



STEEL CITY 35601

Includes 10-in.-wide side table; blade guard and splitter are easy to remove and replace. Good overall parallelism (easy adjustment needed, covered in manual).



HITACHI C10LA

Includes small outfeed table; blade-angle scale is in tabletop; poor parallelism (required difficult adjustment).



JET JPS-10TS

Includes blade lock for one-wrench blade changing; blade-elevation crank among easiest to turn; fair parallelism (needed simple trunnion adjustment, covered in manual).



SHOP FOX W1748

Blade and power-cord plug not included; blade-elevation crank easy to turn; poor parallelism (required difficult adjustment, but manual covers it).

Rock-Solid Router Table

Easy to build, this workhorse can handle any routing task

BY J. PETER SCHLEBECKER



PANEL RAISING



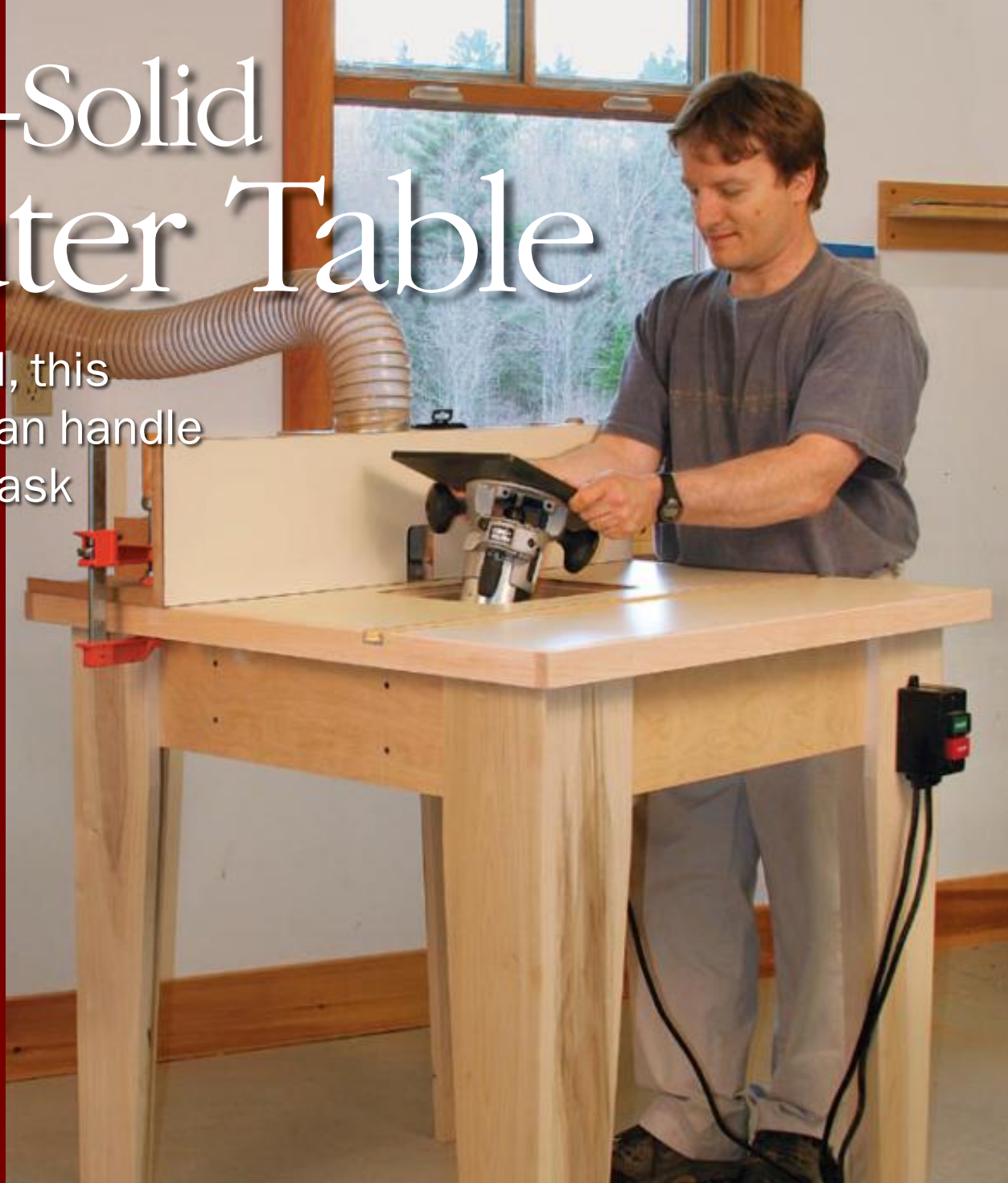
TEMPLATE ROUTING



ROUTER JOINERY

READY TO WORK

The high fence fully supports tall workpieces as they pass the bit. The large surface accommodates small workpieces as well as tabletops, and the T-slide can be useful in creating joinery.



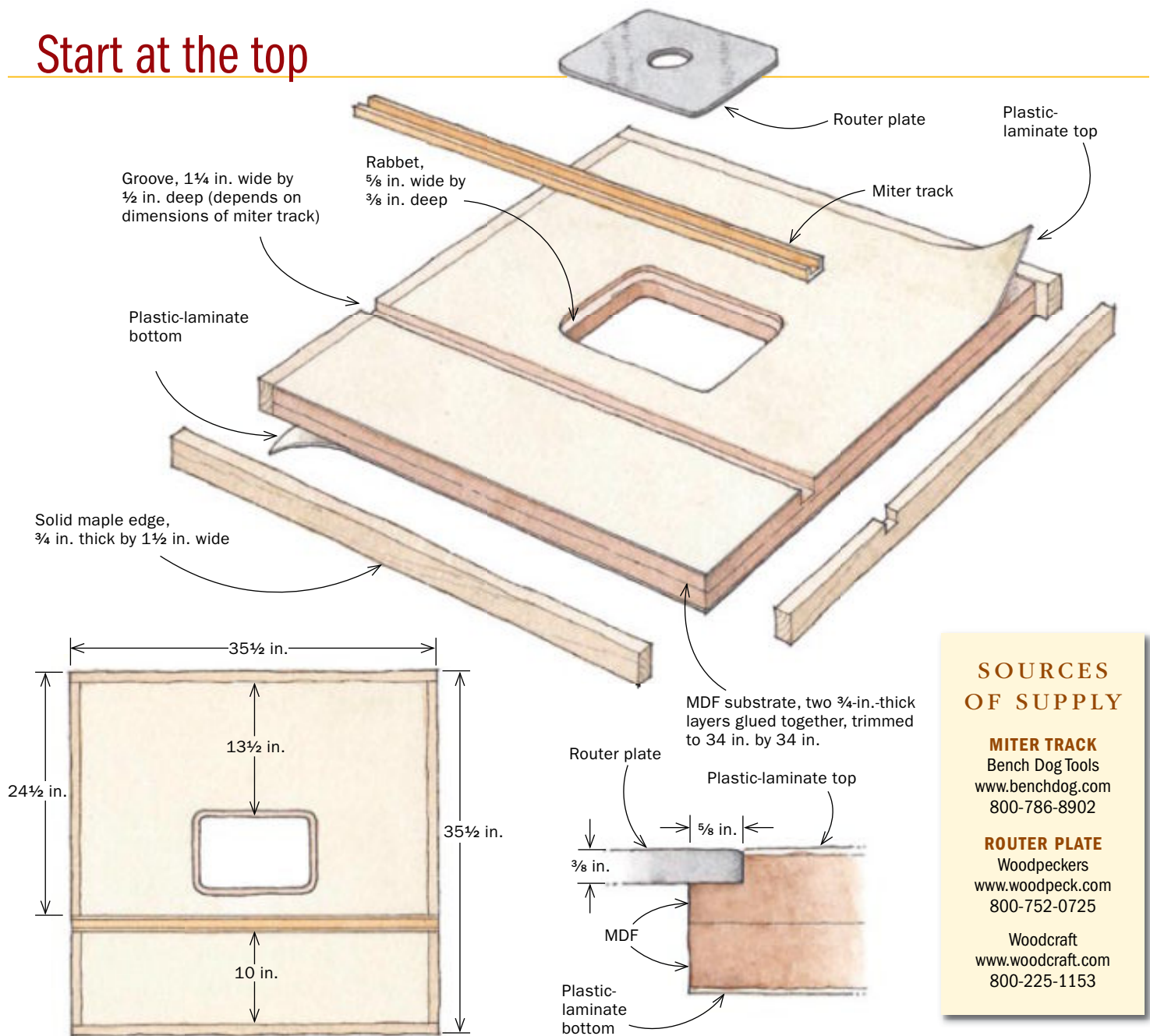
One of the first assignments I was given as the new facilities manager at the Center for Furniture Craftmanship was to design and build the best router table I could using common woodworking materials. I started by coming up with a list of must-have features.

First, the table surface had to be big enough to accommodate large workpieces such as pattern templates for bending forms, angle-cutting sleds, frame-and-panel rails on the miter gauge, longer lengths of stock requiring featherboards, and inside curves. It had to be wide enough to resist tipping and shimmying when subjected to

sideways forces. Also, the tabletop had to be extremely flat as a reference surface, and it could not respond to the extreme changes in humidity that we get in Maine. It had to remain flat and could not deflect over the years or when heavy downward pressure was applied.

The top needed a durable, smooth, low-friction surface that would withstand the vagaries of student use. And I wanted the table-edge overhang large enough to support a clamp, without any deviations in thickness that would make it hard to get a clamp to hold properly. My list of basic considerations went

Start at the top



SOURCES OF SUPPLY

MITER TRACK
Bench Dog Tools
www.benchdog.com
800-786-8902

ROUTER PLATE
Woodpeckers
www.woodpeck.com
800-752-0725

Woodcraft
www.woodcraft.com
800-225-1153

Glue two over-size MDF pieces together. Curved cauls help distribute pressure to the center while clamping at the ends. Trim this substrate square and to size afterward.



Make an opening for the router. Drill starter holes in the corners and use a jigsaw to cut to a layout line. Make the opening 1 1/4 in. smaller than your router plate in both directions.



1

Laminate the top

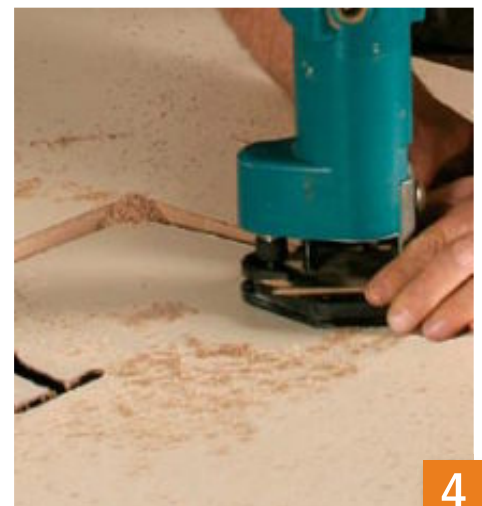
Apply the laminate top and trim all the edges. Dowels or narrow strips of wood (1) prevent the laminate from inadvertently sticking to the contact cement. Working from one end to the other, pull the strips out one at a time (2) while you smooth the laminate onto the MDF. Use a rubber roller (3) to apply even pressure across the top. The adhesive sets almost immediately, so make sure you have pressed the entire surface. Using a laminate trimmer (4), go around the outside edges, and use a starter hole to trim around the router opening.



2



3



4

on: The table had to be a good work height, and it had to be easy to change bits in the router and make fine adjustments. The fence needed to be flat and rigid, stay at 90° to the table, be easy to set and remove, have good dust collection, and be large enough to support large workpieces and the attachment of jigs and featherboards. The on/off switch had to be large and easily accessible for emergency shutoff, and the whole table had to be easy to clean, especially underneath.

We have had three of these router tables under nonstop use by students at the school for three years, and other than the routers being dropped occasionally, the tables have proved extremely durable.

Common materials, used wisely

The materials list for this router table is short: ¾-in. medium-density fiberboard (MDF), plastic laminate, plywood, maple, and poplar. For the tabletop substrate, I used a double layer of ¾-in. MDF because it is flat and strong. The MDF is sandwiched between two layers of horizontal grade (thick) plastic laminate, which is extremely durable and seals the MDF from moisture. Using a light color makes it possible to draw pencil lines for reference marks that are easily washed off.

The aprons and cross-braces make up a torsion box that supports the top and legs, and are made out of cabinet-grade birch plywood for strength, dimensional stability, and the ability to hold screws well. The legs are solid poplar for strength and nice edge appearance, and the design resists racking without stretchers.

I recommend a ⅜-in.-thick aluminum router plate that does not flex and has variable throat-size inserts to accommodate large and small bits. With an aluminum plate, you can be sure that the mounting screws won't pull through the mounting material. I use a router that can be adjusted through the base, thereby eliminat-

Recess the router plate

Make a template. Surround the plate with four pieces of MDF and glue them together. Make sure the template is large enough to reach the edges of the tabletop for clamping.



Cut a rabbet to hold the router plate. Choose the correct bit. With a $\frac{3}{4}$ -in.-thick template, you'll need a short flush-trimming bit. Practice on some scrap first to set the bit depth to the exact depth of the plate. Then center the template on the opening and cut the rabbet.

ing the need for a router-lift base (see “Routers for Router Tables,” *FWW* #189, pp. 54-59). On the other hand, router-lift bases can accommodate a router you already have, and are very accurate (see “Router Lifts,” *FWW* #155, pp. 56-61).

A simple top solidifies the table

Constructing the top is easy. You simply glue the two pieces of MDF together, add the laminate, create a rabbet to hold the router plate, and rout a groove for the miter track. First, cut the two layers of MDF about $\frac{1}{4}$ in. oversize so you can trim the whole thing once it is glued up. Use a few small nails in the MDF to prevent slippage (the nails can stay in as long as the heads are set), and clamp it in a vacuum press or with clamps and cauls. After the glue is set (yellow glue is fine) trim the top to size, maintaining squareness. Lay out the position of the router plate in the center of the top. Measure $\frac{5}{8}$ in. inside this line to lay out the hole through the top. Now drill starter holes at the corners and use a jigsaw to cut along the inner line.

Next, cut two pieces of plastic laminate about $\frac{1}{4}$ in. oversize all around. Use two coats of contact adhesive on each surface to glue the top and bottom, letting the first coat dry until it is no longer tacky to the touch but moving quickly once the second coat is applied. Trim all the edges, including the opening.

Router plate needs a perfect rabbet—Make a template from $\frac{3}{4}$ -in. MDF to cut the rabbet for the router plate. Surround the actual plate with four pieces, making sure the final template is wide enough to clamp to the tabletop. Using a plunge router and a top-bearing flush-trimming bit with the same radius as the corners of the plate, cut the rabbet for the router plate. But first do test cuts, using the template over scrap MDF, until you get the plate just flush.

Edging the top with $\frac{3}{4}$ -in.-thick solid maple seals the edges and provides a durable, softened edge. After applying the edging, the final step is routing the groove for the miter track. This can be done with a fence clamped to the top and a router

Add a miter track

Cut a groove for the miter track. The miter track should fit snugly in the groove and sit flush with the tabletop. Various tracks call for epoxy or screws to keep them in place.



Assemble the base



Glue and screw the sides and cross braces together. It's helpful to tack the pieces in place with brads first so they don't shift.



Add corner blocks. These provide strength and a solid place to attach the top with screws.



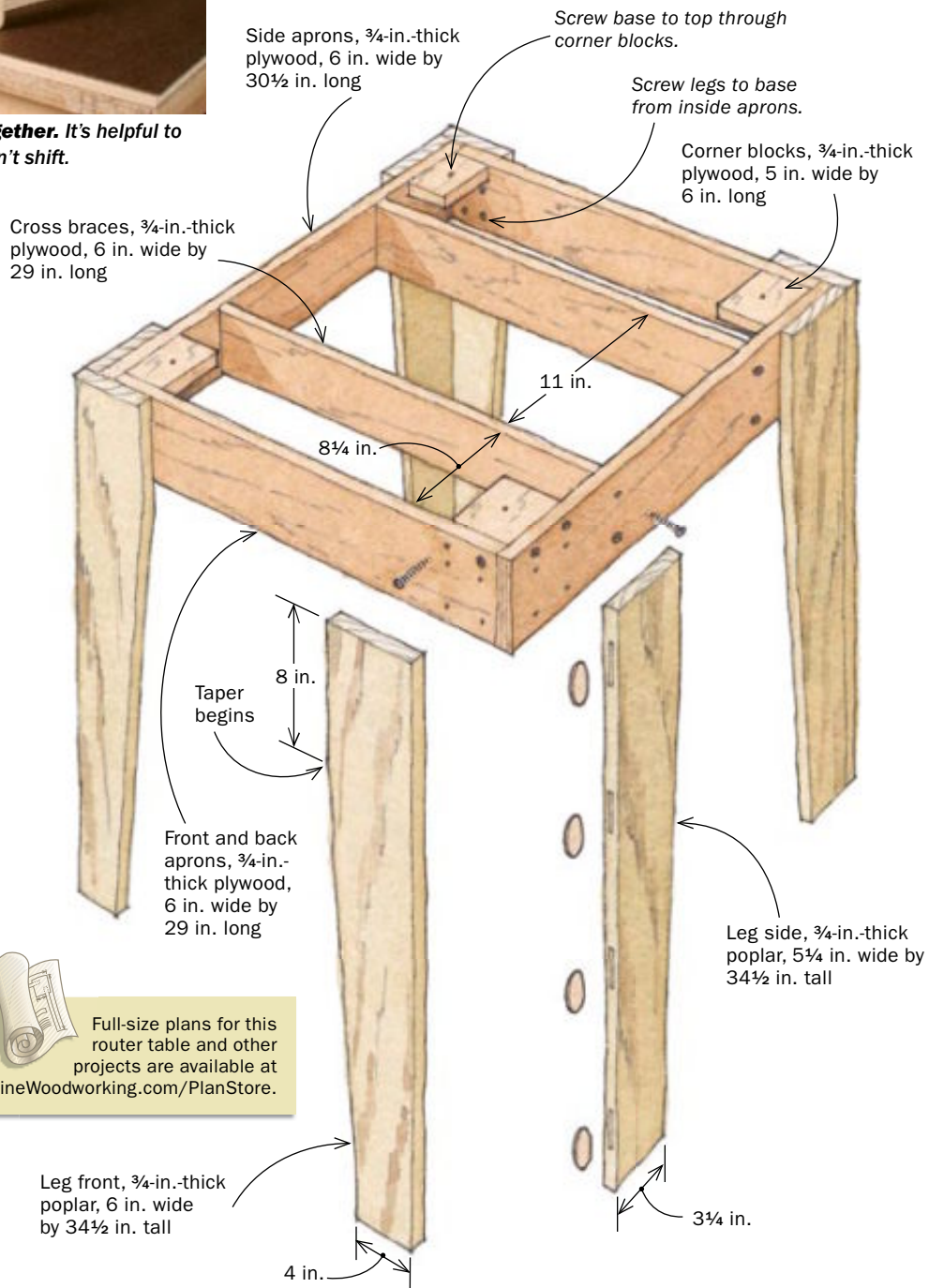
Attach the legs. Glue and clamp the legs in place before screwing them to the base from the inside.

with a straight bit. The width and depth of the groove depend on the track you purchase.

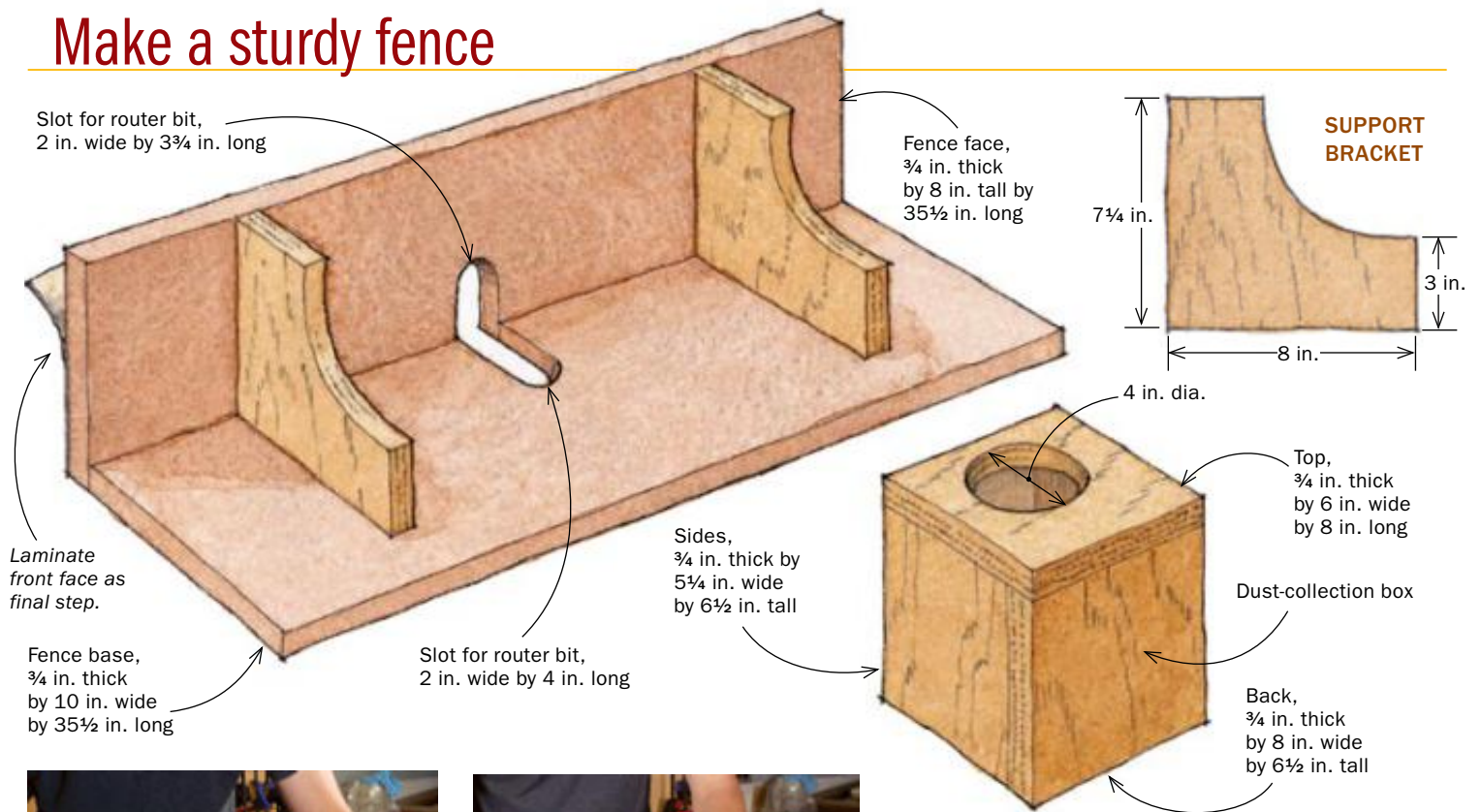
The apron and legs are basic and strong

The plywood for the apron-and-cross-brace box should be cut very straight and square to create a level, flat torsion-box frame. I just glue and screw this together. It helps to use a pneumatic nailer to pin the pieces in place to prevent misalignment before the screws are piloted and sunk. Glue and screw in corner blocks for bracing and to provide a place to anchor the top with screws.

Mill up $\frac{3}{4}$ -in. poplar for the legs. For visual appeal, I like to do a taper cut on the inside of the legs. We use this leg design on many of our worktables at the school, and it is very strong. Use biscuits to join the leg sections, and then glue and screw the legs to the apron from the inside to hide the screws.



Make a sturdy fence



Start with the bottom and face. Glue and screws are a fast, strong, and easy way to secure the face to the bottom. Squareness is vital to the fence's function, so check for square as you secure the buttresses.



Simple dust collection. Four pieces of 3/4-in. plywood make up the dust-collection system. A hole in the top piece allows you to connect a dust hose.

When you attach the tabletop to the base, screwing through the corner blocks from below, make sure that the pilot holes through the lower layer of plastic laminate are chamfered; otherwise, it will crack. Now mount the router to the plate and install the external switch.

A high, square fence with good dust collection

A good fence is essential. It should be carefully constructed of MDF to be straight and square. I cut the bottom and face pieces out of 3/4-in. MDF, and the buttresses out of 3/4-in.-thick plywood. Bandsaw openings for the largest bit you expect to use. You can always reduce the size of the opening with a zero-clearance auxiliary fence made of 1/4-in.-thick material. The top of the dust-collection box should have a hole cut into it to accept the fitting for the dust hose.

Glue and screw the bottom and face together, and then attach the buttresses in the same way, making sure they force the bottom and face into a perfect 90° angle. Now add the pieces for the box using glue and a nail gun or screws. Be sure to drill pilot holes for screws to avoid splitting. The final step is to glue a piece of plastic laminate to the face using contact adhesive. The fence clamps to the table, so dedicate a couple of good clamps to it.

It's a good idea to add some useful jigs to go with the table: featherboards for narrow or long pieces, a corner dust chute for collecting dust when cutting an inside radius, an overhead pin guide for templates mounted to the top of a workpiece, and an angle sled for presenting the work at various angles. □

J. Peter Schlebecker teaches at the Center for Furniture Craftsmanship in Rockport, Maine.



Handplanes I Can't Live Without

Do better work with these 8 vital tools

BY GARRETT HACK

Every shop—even one that relies heavily on power tools—needs handplanes.

For some tasks, such as smoothing a surface or fitting a joint perfectly, handplanes fine-tune work that was begun on a machine. In other instances, they handle jobs that machines can't do as quickly or nimbly. Handplanes are quiet, safe, and clean. They encourage working at a slower pace that is less prone to mistakes. And did I mention enjoyment? The swish of a plane across a surface and the smell of fresh shavings are reason enough to pick up a handplane.

To reap these rewards, though, you first have to spend some effort in learning to handle the tools and, most importantly, in learning to keep them sharp. A good guide for sharpening plane irons and other hand tools is David Charlesworth's "A User's Guide to Waterstones" (*FWW* #169, pp. 30-35).

The planes on this list are tools that I use day after day. Most do a variety of things very well; a few are the best tools for specialized tasks. I've listed them in rough order of importance.

Garrett Hack is a contributing editor.



Bench plane

Best at: Flattening and smoothing surfaces

Model shown: Old Stanley Bedrock No. 604 fitted with a thick replacement blade

Available new: Contemporary versions by Lie-Nielsen, Veritas, Clifton, and others feature unbreakable castings and thick alloy blades (good for chatter-free cutting).

If you have just one plane in your shop, make sure it's a No. 4 bench plane. I use mine all the time to flatten and smooth surfaces or to joint and trim edges in ways that power tools and sandpaper can't.

If you're fitting a drawer front, for instance, the plane lets you dial it in carefully, one 0.001-in.-thick shaving at a time. In contrast, a single mistake on the tablesaw can render the workpiece useless. You'll also find that, with practice, you can use a No. 4 to smooth a fairly large drawer face with a few passes in less than a minute. Unlike a sander, the plane leaves a smooth surface that has deep clarity and is flat right to the edges.

The No. 4 also is great for cutting bevels in a profiled edge and does a respectable job smoothing end grain, like that on the edge of a tabletop. It even works well for shaping convex curves such as a bowed drawer front.

The key to the No. 4's versatility lies in its middle-of-the-road size. It takes a two-handed grip that delivers enough power to flatten and smooth large parts, yet it's small enough to use in tight places or for more delicate work. The blade can be adjusted to take a coarse shaving, or a very fine one that leaves a beautifully smooth surface.

You can tackle both tasks with a single No. 4 plane by opening the throat wide for the rough work, then narrowing the opening for the smoothing passes. For some No. 4s with a "Bedrock" frog, this adjustment takes 15 seconds; with others, the blade must be removed in order to adjust the frog forward and tighten the mouth.



Working a surface. The No. 4's size makes it ideal for flattening or smoothing a small panel.



Cleaning up small parts. A few passes clean up machine marks and put a finish-ready surface on a stile.



Make fine adjustments. The No. 4's throat can be closed to take very fine shavings, perfect for precisely fitting parts such as a drawer face.

2



Adjustable block plane

Best at: Shaping curves and chamfers, smoothing small surfaces, trimming dovetails, and cutting end grain

Model shown: Lie-Nielsen No. 60½

Also available new: Veritas makes a nice version of this low-angle, adjustable-throat plane. Stanley continues to make the classic 60½.



A champ at profiling. The block plane's small size gives it great flexibility in cutting chamfers or custom rounded profiles.

This plane, patterned after the Stanley No. 60½, is another tool to keep within easy reach. Like the No. 4, it can be adjusted for rough or fine work, and it does a multitude of things well.

I like this plane for the precise trimming of small surfaces, such as where stile and rail meet on a frame. In similar fashion, I keep the No. 60½ handy when sizing small parts because it can take fine shavings from edges too narrow for larger planes.

For these reasons, the 60½ is perfect for the very exact business of sizing inlays and trimming them flush after glue-up, where the grain might be going in many

directions. For the smoothest cutting in these situations, you need a plane with a throat that can be adjusted to the thickness of a piece of thin paper.

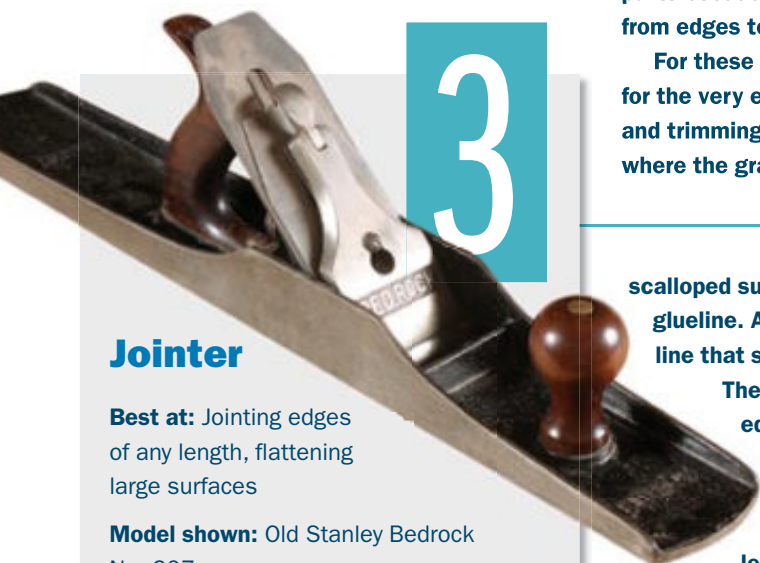
The block plane is also the best tool for trimming dovetail pins flush after glue-up. Because the plane cuts at a low angle, much like a paring chisel, it is ideal for cutting end grain smoothly.

This plane is also great for shaping wood, giving you great flexibility when cutting tapered chamfers or rounded edges. In contrast to a router setup, the block plane lets you refine or alter a profile easily as you go.



Trim dovetails perfectly flush. A low-angle block plane can bring the end grain of the pins flush with the surface of a drawer side.

3



Jointer

Best at: Jointing edges of any length, flattening large surfaces

Model shown: Old Stanley Bedrock No. 607

Available new: Clifton, Stanley, and Lie-Nielsen all make a No. 7.

I rely on the mechanical jointer in my shop every day, but I wouldn't be without my jointer plane. The No. 7 is ideal for jointing edges on boards that are too long, heavy, or awkward to handle on the jointer. I often use it to clean up machine-jointed edges, especially those that will be glued. This is because jointer knives that are slightly dull or improperly set can create a

scalloped surface that leaves gaps in the glue-line. And that could mean a glue-line that shows or a joint that fails.

The No. 7 perfectly trues the edge and cuts a clean glue surface. I also can use the plane to make an edge slightly concave along its length for a sprung joint.

This plane and its beefier sibling, the No. 8, also are hefty and long enough to make quick work of flattening large surfaces or cutting a set of tapered legs dead straight. The long sole bridges valleys that a No. 4 would follow, making the jointer plane a better choice for flattening.

The accuracy of a jointer plane depends on a sole that is flat from end to end. These planes cost more to make and thus are considerably more expensive than a No. 4. Otherwise, look for the same basic characteristics: comfortable handles, a thick blade, and easy throat adjustment.



Flatten big surfaces. A jointer, with its long, heavy sole, is perfect for taking heavy shavings needed to flatten wide, roughsawn stock or a glued-up panel.

4

I like to say that a perfectly fitted mortise-and-tenon joint looks like it grew together. Even with precise tablesaw tenoning jigs and hollow-chisel mortisers, though, it's hard to get this sort of fit straight from the machines.

So many things can prevent a joint from fitting perfectly. A table-saw blade, even with stabilizers, can wobble and cut a shoulder that's not perfectly straight. Or you could wobble when cutting the cheeks (even using a jig). You might have a joint ever so slightly out of square in either plane, in which case one shoulder hits before the other or the bottom hits before the top. The longer the shoulder (breadboard ends being the extreme), the more likely or more obvious the problems.

The shoulder plane fixes these slight imperfections, leaving you with a perfectly fitting joint. It can take a fine shaving precisely where you need it, whether on a shoulder or cheek. For slightly angled joints, a shoulder plane is safer than trying to use jigs, where it is very easy to get something backward and cut at the wrong angle.

I regularly use my Stanley No. 93 for adjusting rabbets cut by machine, such as on the meeting rails of two cabinet doors or when fitting a rabbeted panel. It also works respectably across the grain in other situations, such as sizing the bottom of a wide dado.

Earning its name. The shoulder plane's full-width blade and sides that are square to the sole allow it to accurately true up a tenon shoulder.

Slimming a fat tenon. The same attributes make it useful for trimming a tenon cheek for a precise fit.



Ready for a finish. A well-tuned smoothing plane will leave a glasslike surface that doesn't need sanding.

5

Smoothing plane

Best at: Cutting a smooth, highly polished surface that is ready for a finish

Model shown:

Lie-Nielsen No. 4½

Also available new: Clifton, Lie-Nielsen, and Stanley make a Bailey pattern No. 4½. Ray Iles makes an infill smoother reproduction. Vintage Norris or Spiers infill smoothers can be found. Sauer and Steiner make infill planes superior to many originals.

Woodworkers smooth lots of surfaces. A smoothing plane is amazingly efficient at this, cutting flat surfaces so polished they shine with deep clarity. A No. 4 is an OK smoother, but it is a little light for really difficult grain. It's more efficient to have a plane dedicated to smoothing. It should have some mass, a super-fine throat, and a solidly supported, thick blade. That No. 4 is still very useful as a pre-smoother, flattening a surface and doing the bulk of the work. That way, the smoothing plane need cut just a few gossamer shavings and stays at peak sharpness longer.

A good smoother may be the most expensive plane on this list, but it's worth it. Among the best designs are heavy British planes such as those made by Norris and Spiers, with steel bodies infilled with dense rosewood, and very thick blades. A number of contemporary versions are available, some better than the originals. The heavy body and wide blade of the No. 4½ make it a very good smoother, especially with a 50° cutting angle (frog). Length is not important for a smoother, but some like the mass of a No. 7, No. 6, or No. 5½ for this work.

6

Spokeshave



Best at: Shaping, smoothing, and refining curves

Model shown: Old Stanley No. 52

Available new: Contemporary versions by Veritas, Lie-Nielsen, Woodjoy, and others



Smoothing an inside curve. A spokeshave can easily navigate curves like those on this chest apron.

For the most part, all of the planes listed so far work well to make wood flat, smooth, and square. But what about curves?

For shaping or smoothing curves, nothing beats a spokeshave. The spokeshave, with its narrow sole and winglike handles, doesn't look like a handplane, but it works like one. It holds a relatively wide iron at a fixed angle and depth. It registers the cut against a sole, and it takes a shaving. The spokeshave's long handles and narrow sole are ideal for steering around curves and working into tight places. They help maintain a consistent angle easily when cutting chamfers where a block plane won't reach, such as along a concave curve. The narrow sole allows the tool to work both inside and outside curves. Soles come in a variety of shapes, including rounded for tighter curves. The spokeshave is a great tool for shaping the profile on the edge of a curved tabletop or an arched apron, or for smoothing the bandsawn profile of a cabriole leg.



Chamfering along a curve. The tool also can be used to cut a chamfer along a tight curve, a tall order for an ordinary handplane.

A second block plane

7



Best at: Roughing out curves, wide bevels, or simple molding profiles.

Model shown: Lie-Nielsen No. 102

Available new: Your second block plane could be another No. 60½, adjusted to take rougher cuts. Lie-Nielsen's No. 102 fits a large palm well, and its open throat is suited to aggressive work and big shavings.

If you already have a No. 60½ tuned for precise work, you'll find you can work more quickly if you set up a second block plane to make coarser cuts. Having twin block planes ensures that each is tuned precisely the way I want it for the work and spares me the hassle and variation of adjusting a single plane back and forth.

I use this second plane to rough out a wide chamfer or bevel, or to shape a bullnose profile for a cabinet molding. The plane offers good control despite making aggressive cuts. I also use my second block plane, set for a light cut, to remove freshly dried glue from a panel, a far safer bet than risking tearout by scraping it off.

Chamfering a tenon end. A block plane adjusted for rough cuts makes quick work of many simple tasks.



Small router plane

8



Best at: Cutting and cleaning up small grooves, cleaning up hinge mortises

Model shown: Old Stanley No. 271

Available new: Lie-Nielsen makes a small router plane based on this design. It offers a ¼-in. blade as well as pointed- and square-tipped ⅜-in. blades for inlay work.

When working on just a few parts, I often find that to set up a machine to do 100% of a task takes far more time (what with test cuts and jigs) than to do 95% of the job quickly and the rest by hand. A stopped groove for a box bottom is a good example. I can set up a tablesaw with a dado blade in a minute, but it leaves curved ends to be cleaned out. A small router plane is just the tool, with its right-angled blade projecting below the sole and working as a paring chisel. The blade can be locked to cut consistently at any depth. For a long time this was a shopmade tool, with a simple wooden body and a bent chisel blade.

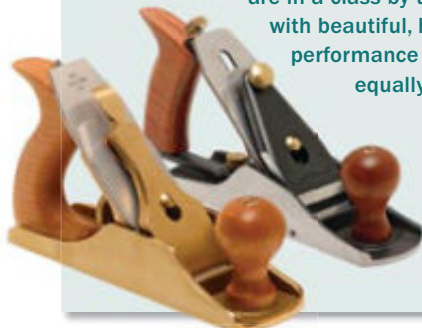
The No. 271 router plane, the pint-sized sibling to the No. 71 router plane, is one of those planes that can make your life a lot easier. It can work in a groove or dado as narrow as ¼ in. wide, and it can work along a curve as easily as a flat surface. For leveling the bottom of an inlay recess, a router plane is far easier to use than a chisel, and less apt to damage the walls. It's also useful for installing drawer locks that mortise into the back of the face, and for cutting hinge mortises at a consistent depth. The No. 271 is worth having for cleaning up stopped dadoses and sliding dovetails alone.



A small job done quickly. A router plane cuts a hinge mortise to an even depth. Note the strip clamped on for support.

NEW

Modern woodworkers are enjoying something of a plane-making renaissance, with many toolmakers building quality planes. Naturally there are differences in cost, quality, and characteristics of each tool. Generally, Lie-Nielsen planes are the priciest, with a high level of precision and finish on every aspect of the tool. Veritas focuses on performance and innovation, less on a classic look. Clifton's planes are better-made versions of traditional Stanleys, with some tuning required. Specialty makers are in a class by themselves, with beautiful, high-performance tools for an equally high price.



SOURCES OF SUPPLY

USED

HIGHLAND HARDWARE
800-241-6748
www.highlandwoodworking.com
Anant, Clifton, Lie-Nielsen, Stanley

LIE-NIELSEN
800-327-2520
www.lie-nielsen.com

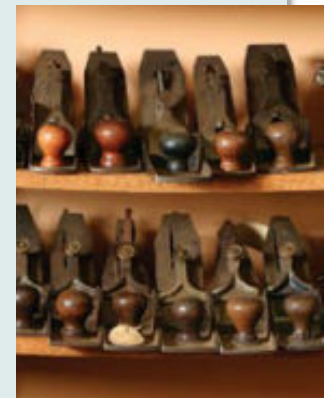
SAUER & STEINER TOOLWORKS
519-568-8159
www.sauerandsteiner.com

TOOLS FOR WORKING WOOD
800-426-4613
www.toolsforworkingwood.com
Clifton, Ray Iles

VERITAS
800-871-8158
www.leevalley.com

Used tools are another choice, often the least expensive and needing plenty of tuning, but usually worth it—especially for the frugal among us. And there is no denying the special satisfaction that comes from reviving an old tool.

If you have the time and energy, flea markets and yard sales can yield a great many tools for far less than the cost of new ones. Used-tool dealers, online auctions, and tool collectors' meets are other good venues for scouting out a bargain. For a great guide to evaluating and buying used tools, including a list of sources, look at "Buying Old Tools" by Matthew Teague in *FWW* #180.



Benchtop Planers

Small machines offer big performance

BY ROLAND JOHNSON

A thickness planer, used in conjunction with a jointer, is a necessary addition to a wood-working shop. While a jointer flattens one side of a board, it's the planer that makes the other side parallel and customizes the thickness.

Planers allow you to mill rough lumber, so there is no need to rely on more expensive presurfaced lumber. Processing rough-sawn lumber also optimizes the yield from each board because you can work around warped or twisted wood. In addition to saving you money when buying lumber, a planer offers you



CRAFTSMAN 21759

AUTHOR'S
BEST OVERALL
CHOICE



This Craftsman is a strong machine that leaves an excellent surface. It has a consistent, repeatable digital depth gauge and impressive dust collection. The turret-style depth stop broke on the first model we tested, but Craftsman provided us with another planer, and the stop didn't break on that one (we tried). In any case, the stops on all the machines were less than accurate, and the Craftsman includes a digital depth gauge, which is very accurate.

DEWALT 735

AUTHOR'S
BEST OVERALL
CHOICE



This powerful planer has a compact, low-profile design and leaves a great finish surface. It had no problem cutting $\frac{3}{32}$ in. off an 8-in.-wide white-oak board. The side crank handle for height adjustment is awkward compared to the top-mounted models. There is good access to the knives for changing. Dust collection is quite good, but the hose attaches directly above the center of the outfeed table, which is slightly inconvenient if the hose isn't rigged out of the way.

Snipe



Too much snipe? If snipe is just a couple of thousandths of an inch deep, it can be worked out by sanding and scraping and is not a concern.



Managing snipe. When snipe is too extensive, it can't be corrected with sanding or scraping and must be cut off the end of the board. Some machines, like the DeWalt 734, have cutterhead locks built into the design. These locking devices reduce the amount of snipe.

the flexibility to work with custom thicknesses, which has dozens of benefits, from avoiding factory thicknesses and giving more design flexibility to making tight joints.

What you should expect from a planer

Over the years, benchtop planers have evolved from crude job-site workhorses to tools that can fill the needs of exacting furniture makers. Nowadays, ergonomics plays a role in planer design, blade changes are becoming far easier, innovative dust-collection systems are incorporated, and added gadgets let you preset a depth stop.

RYOBI AP1301

AUTHOR'S
BEST VALUE
CHOICE



Considering the low price, the Ryobi has an impressive amount of power. The lack of extension tables could lead to more snipe than the other machines, but I didn't find excessive snipe while planing an 8-in.-wide by 40-in.-long board. Add reasonably good dust collection (adjusts to blow chips out the back or hooks to a dust collector on the side) and the package becomes a great value for any shop.

Regardless of amenities, a good planer should perform a few tasks well. It should minimize snipe and give you acceptable surface quality, side-to-side uniformity in terms of parallelism, and easy depth-of-cut control. I took a look at the current crop of planers to see how all these features add up.

How much power is enough?

With the exception of the Craftsman 21758 with 12 amps, all of these benchtop machines have motors rated at 15 amps or 2 hp. These machines are designed to run on 120v household current and most are rated at a maximum draw of 15 amps, so they are not designed to take deep cuts on wide boards.

I tested all of the machines by planing 40-in.-long white-oak boards, 5½ in. wide and 8 in. wide, making passes at 1/32 in. and 3/32 in. deep. I measured the amp draw of the motor and the length of time for each pass. Several machines had stops cast into the front edge of the cutterhead carriage that would not allow a 3/32-in. pass on the 8-in.-wide oak; I suppose this is self-preservation.

All of the machines performed well at 1/32-in. depth of cut, and all showed a significant increase in amp draw at 3/32 in. The DeWalt 735, the Makita 2012NB, the Ridgid R4330, and the Steel City 40200 allow full-width passes at the full 3/32-in. depth of cut, but this is abusing the machine. There is no reason to put small motors such as these to such excessive use. A bit more time spent making repeat passes to remove large quantities of wood will result in a longer life for the tool.

Surface quality is important

Obviously, sharp blades are a big part of surface quality, but cuts per inch (cpi) is important, too. Three things factor into cpi: the feed rate of the board past the cutterhead (measured in feet per minute or fpm), the number of knives, and the speed of the rotation of the blade (rpm).

As a board passes the spinning cutterhead, each knife takes a shallow cut, producing a slight scallop with its radius matching the diameter of the cutterhead. The closer these shallow scallops are to each other, the more they overlap and the less obvious they

Quality of cut

Speed settings. The Craftsman 21759, DeWalt 735, Delta, and Steel City planers all feature two feed speeds, which significantly increases the cuts per inch on the lower feed speed, creating a better surface.



become on the surface of the board. Cuts per inch determines how close these cuts are.

To test surface quality, I put a fresh set of blades on each machine and ran a board through at 1/32 in. None of the machines produced a surface that could forgo further cleanup with a sander, handplane, or scraper, although a few came close. In order to assess surface quality, I brought the ridges left by the cutterhead into view by marking across the surface of the boards with the side of a lumber crayon, making it easy to see how much would be taken off with a single swipe of a handplane. Even the poorest surfaces were smoothed in one shallow pass.

Snipe, the big issue

One of the most common complaints about thickness planers is their propensity to produce snipe on either end of a board. Snipe occurs when the board is held down by only one feed roller on either entry or exit and the force of the cutters lifts the end of the board, causing a slightly deeper cut.

Snipe can be exacerbated by not adequately supporting long boards as they move into and out of the machine, creating a lever-and-fulcrum effect that levers the board off the table and into the cutterhead. Long infeed and outfeed tables can help minimize snipe, but the best solution combines stock support with infeed and outfeed roller pressure pinning the stock to the feed table.

Four machines in this test rely on head locks to help minimize snipe. Locking the cutterhead/feed roller assembly prevents upward movement and can help eliminate snipe. A few of the machines have no locking device; one has down-pressured feed rollers, a system used in big commercial planers.

Also, to help eliminate or lessen snipe, many manufacturers recommend that the tables tilt

up slightly at the outboard ends. The tables will flex just enough to allow the material to be secured to the table by the feed rollers yet provide enough upward pressure on the board to help overcome the leverage and reduce snipe.

The DeWalt 735 excelled at reducing snipe. Without a locking cutterhead, springs located at each corner post supply constant downward pressure, eliminating any mechanical clearance movement in the cutterhead assembly. Other machines that controlled snipe were the Makita, the Steel City, the Delta, and the DeWalt 734.

How deep is your cut?

The Craftsman 21759, Delta, both DeWalts, Ridgid, Steel City, Sun-hill, and Woodtek planers have depth-of-cut indicators, a bonus for quickly setting the cutterhead height to the material and seeing how deep the cut will be. Simply crank the cutterhead assembly onto the end of the stock until the depth gauge starts to move and you instantly know how much you will remove with the pass. Makita has a simple indicator that relies on gravity to find the top of the board and give a visual indication of cut depth (see photo, facing page). The Delta has a Blade Zero device. It doesn't give a measurement, but it allows accurate setting of the cutterhead to the thickness of the board; from there you can control the depth of cut by cranking the cutterhead adjustment. On planers without indicators, like the Ryobi and the Craftsman 21758, you must rely on feel, setting the board in the planer and gently cranking the cutterhead onto the board, then lifting it to remove the board only to drop it again for the cut.

How thick is your stock?

Depth-stop devices indicate the thickness of the material (the distance between the blades and bed), not the depth of the cut.

Dust collection



Helpful new features. The chute on the Delta (above) flips to allow the hose to connect to either side. The Craftsman 21759 (right) and DeWalt 735 blow their own chips into almost any container, without a dust collector attached.



Photos, facing page (top left two): Roland Johnson

Depth of cut



How big a bite? There are different ways to determine how much material will be removed. Delta's "Blade-Zero" device (left) pops up when the cutterhead is even with the top surface of the board; from there the depth of cut is set by turning the crank a measurable amount. On the Makita (center) a loose pin moves with the cutterhead against the top of the stock, giving a visual idea of how deep the cut will be. Other models have depth-of-cut indicators that give an exact measurement (right).

Depth stops are included on the Craftsman 21759, DeWalt 735, Ridgid, Steel City, Sunhill, Woodtek, Delta, and Makita planers, while the Craftsman 21758, DeWalt 734, and Ryobi machines make do without one. After testing the accuracy and repeatability of the stops, the DeWalt 735 had the most consistent results with the Makita and Delta close behind. However, none of these devices would prompt me to go without calipers for critical dimensions.

Knife changes are easy to manage

These days, most machines come equipped with disposable, double-sided knives that are easy to change. The average change-out requires about 10 minutes for a two-knife head, 15 minutes for a three-knife head. I tested only planers that have moved into this realm of user-friendly blade changes. These knives are indexed, can be side-shifted slightly to eliminate planer lines, and cost no more to replace than a couple sharpenings of reusable knives.

The Delta, Ridgid, and Steel City planers have spring-loaded cover plates that allow the screws to remain in the cutterhead during knife changes while the springs automatically lift the plates free of the knife. The Ryobi uses gibs with its disposable blades, and all the other planers require removal of the screws and plates. Incidentally, all the machines have their own easily accessible way of storing blade-changing paraphernalia.

Dust-collection methods vary

Benchtop planers are noisy, messy machines. Not much can be done about the noise, but manufacturers handle the dust in different ways. Typically, a machine can be hooked up to a shop vacuum or dust-collection system, but some planers blow their own chips and hook up to a canister for collection. Two of the planers tested, the Craftsman 21759 and the DeWalt 735, have these built-in blowers, eliminating the need for separate dust collection.

All of these planers come supplied with a chute that allows the machines to be connected to either

a shop vacuum with a 2¼-in. hose or a 4-in. dust-collector hose.

Online Extra

To watch Johnson demonstrate how to get your planer to cut safely and smoothly, go to FineWoodworking.com/extras.

Thickness of material



Digital display, mechanical stops, or a simple scale. All these devices indicate the thickness of the material. The Craftsman 21759 (right) has a digital readout that is extremely accurate. Scales (above) and stops are much less precise.



The standouts

My two picks for best overall are the DeWalt 735 and the Craftsman 21759. Performance results on these two planers were so similar that it was impossible to choose one as the overall champ. Both produce excellent finish surfaces and have lots of power, great dust control, and an overall feeling of robustness. The Delta and Steel City planers were just behind these two leaders.

The best-value award falls to the Ryobi. It's simple, light (easy to stow), has good power and dust collection, and a low price. This planer can fit into nearly every woodworker's budget. □

Roland Johnson is a contributing editor.

CRAFTSMAN 21758



This is a lightweight, entry-level, no-frills planer. No cutterhead lock and short tables are most likely the reasons for some exit snipe. Dust collection is fair on this machine.

DELTA 22-580



The Delta is a good, solid machine with lots of power. It leaves an excellent finish surface, and blade changes are easy.

DEWALT 734



The DeWalt 734 has decent power and a nice, simple depth-of-cut gauge that doubles as an initial thickness indicator for easy setup. Dust collection is good.

MODEL/SOURCE	STREET PRICE	# OF BLADES	BLADE SIZE	TIMED BLADE CHANGE (MINUTES)	HP/AMPS	INFEED SNIPE (1/32-IN. CUT)	OUTFEED SNIPE (1/32-IN. CUT)
Craftsman 21758 www.craftsman.com	\$250	2	12½ in.	8:16	12 amp	0.006	0.001
AUTHOR'S BEST OVERALL CHOICE Craftsman 21759 www.craftsman.com	\$530	3	13 in.	13:02	15 amp	0.004	0.003
Delta 22-580 www.deltaportercable.com	\$430	3	13 in.	13:06	15 amp	0.002	0.002
DeWalt 734 www.dewalt.com	\$400	3	12½ in.	11:29	15 amp	0.002	0.001
AUTHOR'S BEST OVERALL CHOICE DeWalt 735 www.dewalt.com	\$550	3	13 in.	13:37	15 amp	0.001	less than 0.001
Makita 2012NB www.makita.com	\$470	2	12 in.	9:17	15 amp	0.003	less than 0.001
Ridgid R4330 www.ridgid.com	\$350	2	13 in.	11:38	15 amp	0.003	0.003
AUTHOR'S BEST VALUE CHOICE Ryobi AP1301 www.ryobitools.com	\$280	2	13 in.	8:29	15 amp	0.008	0.005
Steel City 40200 www.steelcitytoolworks.com	\$420	3	13 in.	10:25	15 amp	0.001	0.003
Sunhill SM-346 www.sunhillmachinery.com	\$350	2	13 in.	9:35	2 hp	0.003	0.003
Woodtek 115-946 www.woodworker.com	\$350	2	13 in.	8:33	2 hp	0.003	0.002

MAKITA 2021NB



The Makita is a good performer with a lot of power. Blade changes are simple. Unlike the rest of the machines, one revolution of the crank handle does not move the cutterhead $\frac{1}{16}$ in., making it awkward to intuitively change the depth of cut.

RIDGID R4330



The Ridgid is a good machine with a reasonable price tag. Dust collection is adequate and can work with or without a dust collector. Blade changes were fussy because the small gap between the frame and cutterhead made lifting the blade away from the cutterhead difficult.

STEEL CITY 40200



The Steel City planer offers two feed speeds, a three-knife cutterhead, good power, good dust collection, fast and easy knife changes, and moderate weight. All this adds up to a solid performer.

OUT OF PARALLEL	SURFACE QUALITY RATING
0.005	Good
0.002	Excellent
0.001	Excellent
0.001	Good
0.002	Excellent
0.002	Good
0.002	Good
0.002	Good
0.001	Very good
0.010	Good
0.002	Good

SUNHILL SM 346



I can't vouch for the internals such as motor windings and bearings, but other than color, these machines appeared identical. Both have plenty of power, provide a good surface finish, and allow easy knife changes. The crank handle for depth-of-cut control can be located on the left or right, and dust collection is good. These machines rely on a headlock for snipe control. Rollers on the leading edge of the infeed and trailing edge of the outfeed table add some convenience, but the feed tables are lower than the planer bed where they meet and can't be adjusted flush with the bed although they can be adjusted for tilt. These are a good value, though the Sunhill was too far out of parallel.

WOODTEK 115-946



Silence Your Shop Vac

Most vacuums are screaming banshees. A simple box stops the madness

BY THOMAS R. SCHRUNK

Standing used to give me the choice of two evils: I could use the sander's onboard dust bag and let my lungs be the final filter, or I could attach a shop vacuum and replace dust pollution with noise pollution. To solve both problems, I built a particleboard box and lined it with acoustic padding. With the vacuum inside, the noise reduction was so great that I had it tested by a sound engineer. He registered an amazing 25-decibel reduction (see chart) to a level below that of an average conversation.

The vacuum can be switched on and off from outside the box, it will work with

tool-activated vacuums, and I can now sand at will without creating either air or noise pollution.

Make the box in a morning

The concept and the design are simple. Acoustic panels absorb 50% or more of the sound that strikes them; the sound not absorbed is bounced into other parts of the box, gradually reducing the noise. The internal surfaces of the walls and top are lined with acoustic padding, and the exhaust from the vacuum passes through a baffle to extend its contact with the padding before exiting at the rear of the box.

Noise-containment box

The box is built of ¾-in.-thick particleboard and lined with acoustic padding. The dados are all ¼ in. deep. The parts are joined using yellow glue and reinforced with 16-ga. nails. The dimensions shown give an internal space of 20 in. deep by 20 in. wide by 24 in. tall, suitable for a Ridgid 5-hp vacuum. The box can be sized to fit any vacuum.

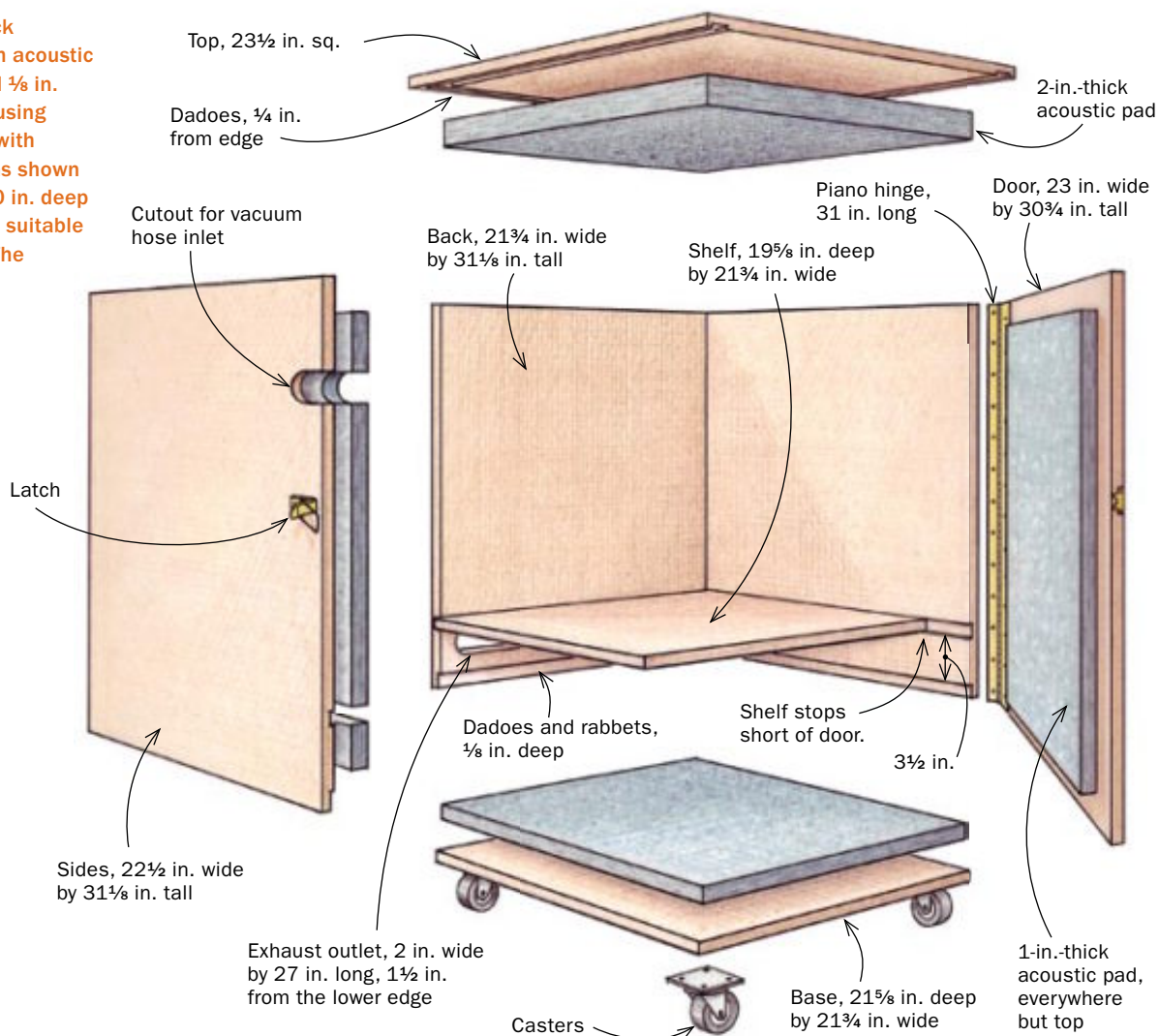
SOURCES OF SUPPLY

Acoustic padding

Acoustical Surfaces Inc. (www.acousticalsurfaces.com; 800-527-6253) sells 2-ft. by 4-ft. batts of 1-in.-thick acoustic padding with a noise-reduction coefficient (NRC) of 0.80 for \$18, and 2-in.-thick pads (NRC 1.15) for \$32.

Ceiling tiles

You also can use ceiling tile from home centers. Many have labels giving the NRC. Look for an NRC of at least 0.50, which absorbs 50% of the sound.



The box shown here holds a 5-hp Ridgid vacuum, but the size can be adjusted to fit any machine. You'll need the internal dimensions of the box to be at least 4 in. greater than the dimensions of the vacuum to allow space for the padding and for easy removal of the vacuum for emptying. For this size box, you'll need a sheet and a half of 3/4-in.-thick particleboard or medium-density fiberboard (MDF). The greater density of MDF gives it slightly better sound-dampening properties, but it weighs and costs more.

Use a router to cut 1/8-in.-deep rabbets and dados to help align the sections. Use yellow glue and a 16-ga. nail gun to assemble the back, sides, and shelf. Then use construction adhesive to apply padding to the underside of the shelf and the thin strips at the bottom of the sides. Apply the

MEASURING THE NOISE REDUCTION

Ridgid vacuum outside the box 83 db.

Normal conversation 60 db.

Ridgid vacuum inside the containment box 58 db.

Schrunk had a sound engineer measure the noise reduction after putting the vacuum in the noise-containment box. 83 decibels (db.) is on the threshold of needing hearing protection, while 58 db. is quieter than the average conversation.

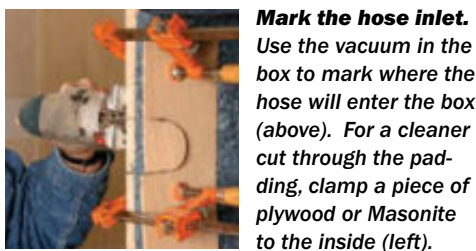
padding to the bottom before you attach it to the box. Apply padding to the rest of the inside, including the door. For extra noise suppression, use 2-in.-thick padding on the inside of the top, right above where the noisy exhaust exits the vacuum.

Cut out the hole for the hose inlet, attach the door hinge and latch, and screw on the casters. Feed the vacuum's electrical cord through the exhaust outlet, but don't plug it in. Turn on the vacuum's switch, place the vacuum in the box, and close the door. Plug the vacuum into an extension cord with a switch. Throw the switch on the extension cord and enter a whole new world of peaceful vacuuming. □

Thomas R. Schrunk, a veneer specialist in Minneapolis, prefers listening to music rather than his shop vac.



Apply the acoustic padding. The inside of the box is lined with acoustic padding stuck to the particleboard using construction adhesive.



Mark the hose inlet. Use the vacuum in the box to mark where the hose will enter the box (above). For a cleaner cut through the padding, clamp a piece of plywood or Masonite to the inside (left).



Online Extra

To listen to the reduction in noise when the shop vacuum is placed inside the box, go to FineWoodworking.com/extras.

Consider a Shaper

Even if you have a good router table, you may need this powerful machine

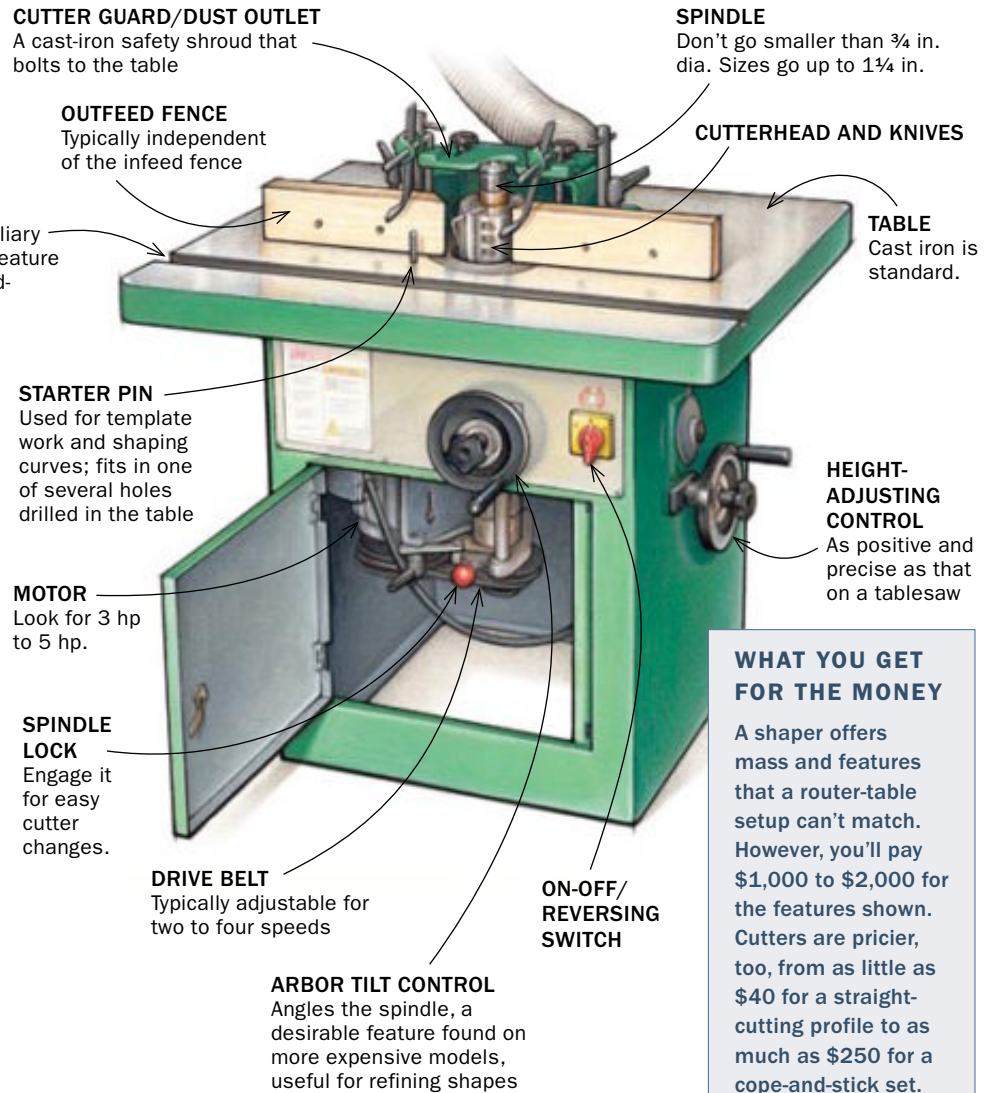
BY J. SPEETJENS



Beyond the router. A shaper will quickly and cleanly cut big profiles in thick stock, such as the cove shown here. With a shaft that's much thicker and stronger than a router spindle, shapers can accept much larger cutters, such as this cutterhead with interchangeable knives. Bearing collars also fit over the shaft.

Stripped to their essentials, a router mounted in a router table and a shaper are the same—a machine with a vertical, motorized spindle holding cutters to mill wood. As a professional woodworker, I consider both router and shaper indispensable. Sometimes, I choose one machine over the other simply because of the cutters I have available. But often only one of the machines can handle the task at hand. Even though routers and shapers perform the same basic functions, there are some critical differences.

Routers have taken over the hobbyist market, largely because of cost and partly because shapers have a reputation for being dangerous. An antiquated cutterhead system was notorious for firing shaper knives across shops at ballistic speeds. But these cutters, commonly termed slick-back



WHAT YOU GET FOR THE MONEY

A shaper offers mass and features that a router-table setup can't match. However, you'll pay \$1,000 to \$2,000 for the features shown. Cutters are pricier, too, from as little as \$40 for a straight-cutting profile to as much as \$250 for a cope-and-stick set.

Shaper cutters and heads

STACKABLE CUTTERS



Mix and match. Some cutters, like this cope-and-stick set, consist of separate components that slip over the shaper spindle. You can rearrange components for custom profiles.

REMOVABLE KNIVES



Corrugations and gibs. Some cutterheads and knives have corrugations that mate like gear teeth. Gibs and setscrews hold things tight. The corrugations let you move knives in or out in even increments.

CUSTOM GRINDS



One-of-a-kind shapes. The tool steel for a shaper knife costs only \$10 to \$20. You can easily create a template for a custom profile (top), then profile each knife on a bench grinder.



Cut large moldings

A shaper lets you make large runs of large moldings. A tilting arbor gives you the ability to modify standard profiles.



Keeping the stock in line. Hold-downs above the fence and bolted to the table (above) apply even pressure to the work. A shaper's power and large-diameter cutters let you make deep cuts (right). For safety's sake, though, don't try to do everything in one pass. A final light pass also cleans up the surface.



TILTING CAN CHANGE PROFILES

Deliberately out of line. Some shapers have a tilting arbor, which lets you quickly and easily create custom bevels with a standard cutter.



One cutter, two shapes. Tilting the arbor changes the profile, in this case creating a taller, thinner ogee.



STRAIGHT CUT



TILTED CUT



knives, have been replaced by better, safer designs. In my experience, shapers are no more or less dangerous than jointers, planers, routers, or even drill presses.

If you're setting up a new shop or upgrading the machines you already have, you may want to consider adding a shaper to expand the range of profiles you can create. In general, a shaper can make heavier cuts, and can make them much cleaner. A shaper easily handles large runs of moldings, cutting larger profiles than a router as well as a wider range of curves. I'll even use the shaper for small moldings if I want a profile I can't get from router bits. A shaper's miter slot or sliding table makes it easier to cut tenons and cope-and-stick joints. And if your shaper has a reversible motor, you can do template work without worrying about cutting against the grain; the ability to flip some cutters adds to the shaper's flexibility.

Size and heft make for smooth cuts

A shaper rated at 3 hp is a much more substantial machine than a 3-hp router. Routers hold their bits with a collet and nut attached to the motor shaft. Shapers are designed so that cutters, bearings, spacers,

Stack cutters for common joints

STILES AND RAILS

Matched sets of stacking cutters and spacers let you make cope-and-stick joints in a range of sizes.



One cutter set, many frames. Stackable cutters let you resize, reposition, or delete the panel groove for solid panels, glass panes, or no panel at all.

and guards slip directly onto the motor shaft, held fast with a nut on the top. Where the router has a 1/2-in. collet, the shaper has a 3/4-in. or 1-in.-dia. shaft. The drawing on p. 87 highlights the features that give a shaper its muscle.

The shaper's larger spindle dictates that a cutter with the same profile as a router bit will have an inherently larger diameter. The larger diameter means that the leading edge of the tool enters and exits the cut at a shallower angle, greatly reducing tearout in woods like hard maple. Also, there are much larger gullets between knives for clearing chips.

Larger cutters also mean that shapers can run slower than a router to achieve the same tool speed. Where router speeds



Cutting the joint. To make end-milling easy and safe, the workpiece is held against a fence that slides in the slot in the table (left). Once you've set the cutter height for one half of the joint, you can change cutters for the mating half without tweaking the fence or height settings (right).

TENONS

Quick tenons. Stacked cutters mill tenons in one pass. The crossed-arm stance looks awkward, but actually helps press the work into the cutter.



Raise panels

You often can use one cutter, different orientations, and different cutting depths to create complementary profiles—for example, a raised panel and a drawer front.



REVERSING CUTTER AND MOTOR

Take advantage of the ability to reverse the shaper's motor rotation and to re-stack cutters and bearings.



Cutter on bottom. To shape a drawer front, the cutter and bearing collar are stacked so that the work rides above the cutter.



Cutter on top. To give a raised panel a consistent edge thickness, the cutter is flipped to ride above the work, with a bearing collar below. To support the work for the length of the cuts, a single fence replaces the split fence.

typically range from 8,000 rpm to 25,000 rpm, shaper speeds range from only 3,500 rpm to about 10,000 rpm.

A shaper's substantial mass means less vibration and more consistent power, which yields a cleaner, more efficient cut. To understand how this works, joint the edge of a board using a jack plane and then a block plane. The inertia built up in the heavier plane actually drives the iron through the wood more efficiently. The same is true with larger shaper cutters.

Once they get up to speed, their momentum helps power them through the cut.

A wide range of profiles

There's an array of cutters available for shapers, just as for routers. But shapers give you a much greater variety. You can stack multiple cutters on the shaper shaft to create custom profiles. You also can grind your own knives or have them ground, so you can match specific profiles or create unique ones. I pay \$75 to \$175

to have knives ground. A blank that I can grind myself costs \$10 to \$20, depending on type and size.

Some shapers are equipped with a tilting arbor, which in effect gives you custom shapes from a stock cutter.

Because you can flip cutters and reverse the motor on a shaper, you often have more than one way to configure the tool setup. For example, a single cutter can shape both the edge of a raised panel and the edge on a drawer face (see photos, left).

Versatile table, fence, accessories

A shaper has a more substantial, durable, and adjustable fence and hold-down system, made from cast iron, steel, and wood. This enhances the shaper's safety, versatility, and quality of cut.

Shapers typically have independent in-feed and outfeed fences. That means the outfeed fence can be adjusted to support a fully shaped edge. Hold-downs are typically made from a piece of spring steel bent into a curve that presses against the work. They keep the workpiece steady and help prevent kickback.

A sliding table, optional on most shapers, makes it easy and safe to work on the ends of narrow pieces (for tenoning or cope-and-stick joints, for example) and to back up the cut to prevent blowout.

Another option, the power-feeder, easily mounts to the shaper's cast-iron table, making it easy to run raised panels or cut large runs of molding. However, the feeder's cost and setup time don't make it worthwhile for short runs or occasional use.

Shaping curves and patterns

The benefits that a shaper brings to straight cutting—custom profiles, the ability to profile thick stock in one pass—it also brings to non-linear milling. I've used my shaper to make rails for bow-front chests, arched door casings and raised panels, rocking-chair runners, and curved seat slats.

Template work with a shaper is very similar to template work with a router. In both cases, a bearing ensures that the cut is flush with the template. There are two important differences, though.

First, unlike a router, a shaper allows you to reverse the cutter rotation to deal with contrary grain or to minimize tearout when the grain changes direction. There's no need to make a climb-cut or turn the workpiece and template upside down, as

Shape curves

you would to avoid cutting against the grain with a router. You only have to flip the cutterhead over and move the stock from left to right to take advantage of the shaper's reverse rotation.

Second, the use of a starter pin is much more commonplace with a shaper than a router. The pin, which fits into one of several holes drilled in the shaper table, serves as a fulcrum to support curved stock as you pass it over the cutter. A bearing collar over the cutter also supports the stock. You press the workpiece against the pin, then pivot it into the bearing and move it past the cutter. □

J. Speetjens makes custom and gallery furniture in Greensboro, N.C.

You can use a shaper and templates to make curved edges. The shaper's reversible motor and cutters allow you to work from two directions, minimizing tearout where the grain direction changes.



Starter pin and bearings guide the work. A starter pin (a bolt works just fine) is essential for starting bearing-guided cuts without the workpiece diving into the cutter.

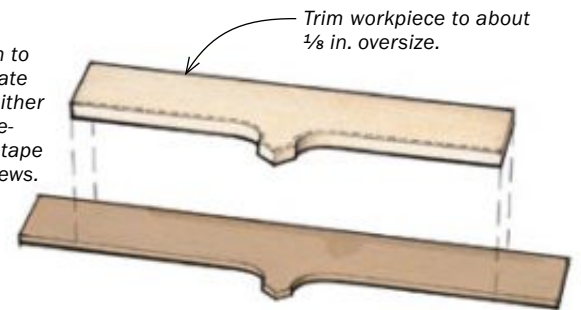
Make the pattern long. Allowing an extra 3 in. to 4 in. at each end of the template is another way to enter and exit bearing-guided cuts cleanly and safely.



ADD A TEMPLATE

For pattern shaping, bandsaw the workpiece fairly close to the finished shape, leaving no more than $\frac{1}{8}$ in. of waste.

Attach to template with either double-sided tape or screws.



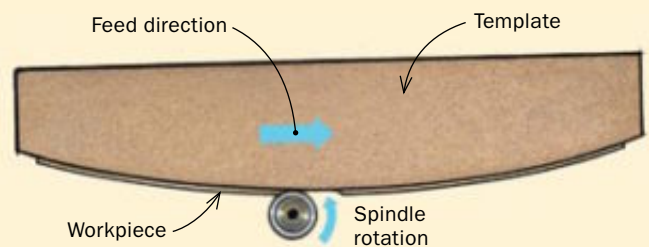
FLIP AND REVERSE TO AVOID TEAROUT

When shaping curves, work from the middle of the curve toward the edge, flipping the cutter and reversing the motor after shaping half the curve. That way, you're always working with the grain.

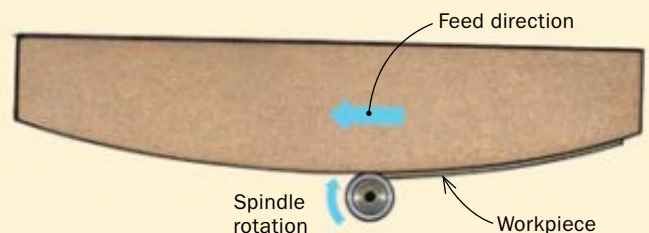


Start from the right. When shaping curves with a template, begin by moving the workpiece from right to left, starting at the center of the curve. Then reverse the motor's rotation and flip the cutter to shape the rest of the curve.

FIRST CUT STARTS AT THE MIDDLE OR HIGH POINT



THEN REVERSE THE CUTTER AND ROTATION



readers gallery

Tools

This *Tools & Shops* gallery includes handcrafted tools and tool chests made with the same care and precision as the finest furniture.



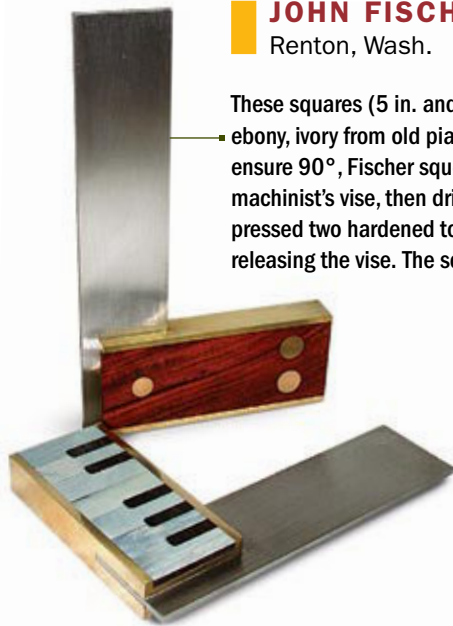
GREGG NOVOSAD
Palatine, Ill.

Novosad estimates it took 310 hours to complete this “furniture-style tool chest,” which was based on Lonnie Bird’s drop-lid secretary design. He finished the mahogany, maple, tulipwood, and padauk with polyurethane. The chest is 24 in. deep by 44 in. wide by 85 in. tall and holds approximately 215 tools.



JOHN FISCHER
Renton, Wash.

These squares (5 in. and 6 in.) are made of cocobolo, ebony, ivory from old piano keys, brass, and steel. To ensure 90°, Fischer squeezed the blade and body in a machinist’s vise, then drilled two holes through both and pressed two hardened tool pins into the holes before releasing the vise. The squares are finished with wax.



JONATHAN THORNTON
Buffalo, N.Y.

Inspired by the tool-making traditions of northeastern Native Americans and the people of the South Pacific, Thornton makes these crooked knife tools, called “mocotaugan,” and uses them for carving. The handles, finished with wipe-on polyurethane, are (from left) pear, apple, degame, and lilac. To make the fiddlehead-fern knife (left in photo), Thornton employed an Iroquois technique, casting a pewter inlay to hold the blade in the handle.

JOSEPH E. WHITMAN
Ferndale, Wash.

This low-angle block plane was Whitman’s first attempt at plane making. His inspiration came from *Tools & Shops* 2006 (*FWW* #181; “Build a Plane from a Kit”). In addition to brass and steel, he used a highly figured piece of katalox and finished it with Danish oil. The plane is 1½ in. wide by 6¼ in. long by 1½ in. tall.



CHRISTOPHER MARTYN

Winchester, Hampshire, England

Martyn constructs these miniature planes for use in making violins. Most of the soles are slightly curved in both directions. The planes vary slightly in size, but are about $\frac{7}{8}$ in. wide by $1\frac{1}{2}$ in. long by $\frac{9}{16}$ in. tall. The woods also vary and include cherry, elder, and boxwood. The two planes on the far right have an applied lignum vitae sole. Martyn acquires most of the blades from secondhand-tool shops but sometimes uses old chisel blades.



NICK BOGEN

Durham, N.C.

Bogen has been turning wood for five years, and has never purchased a turning tool. Instead, he forges his own steel using a triple tempering method developed for knives by Ed Fowler (the tool-making books of Alexander Weygers and Ray Larsen were the initial inspiration). These tools—from top, a $\frac{3}{8}$ -in. gouge, a skew chisel, and a straight scraper—have oak, orangeheart, and cherry handles finished with polyurethane.



BOB VERGETTE

Pender Island, B.C., Canada

Vergette made this canarywood smoothing plane (9 in. long) specifically to handplane the concave curves of a bed he was commissioned to build. He likes the idea of making the tools to complete projects because “it harkens back to a previous era when furniture makers commonly made specialized tools as a part of their work.”



STEVE EFTIMIADES

Floral Park, N.Y.

The obvious influence for this tool chest is the H.O. Studley tool chest (FWW #71), but Eftimiades credits Michael Dunbar for instilling in him an appreciation for hand tools during his Windsor chairmaking class. The chest, 9 in. deep by 20 in. wide (when closed) by 40 in. tall, holds 185 tools. Eftimiades built the right half of the chest in 2005, but didn't finish the left half until early 2007. The combination of cherry, quilted maple, rock maple, and ebony is finished with Danish oil.

Shops

Tools & Shops typically features a shop on the back cover, but since this issue doesn't, we decided to include some interesting shops here. These one-man shops, built by woodworkers from around the country, are as individual as their owners.

JIM BUDLONG Comptche, Calif.

Since Budlong's home and shop are located miles from accessible utilities, they are completely off the grid, powered by a solar/generator combination and heated with woodstoves. Budlong, who has been teaching woodworking for the last 18 years at the College of the Redwoods and producing commission pieces at the same time, spent almost three years building this shop with the aid of former students Eric Owen and Richard Haak. All the redwood lumber (not old growth, of course) was milled from the site. Budlong carefully chose 25 logs (20–36 in. dia. by 16 ft. long) from the surrounding wooded area, keeping the lower logs and selling off the tops to help fund the project, which he financed paycheck to paycheck. The 1,200-sq.-ft. lower level houses a small bench room, a storage area, and a machine room. A 400-sq.-ft. loft overlooks the machine room and serves as guest quarters. PHOTOS: DAVID WELTER



CHARLES DICK Comfort, Texas

No longer working in the world of computers, Dick thinks of himself as “re-phased” rather than retired. He has already spent a great deal of his “re-phasing” building this shop, where he plans to hone his amateur woodworking skills. The shop is divided into two workspaces, a main work area of 400 sq. ft. and a 135-sq.-ft. loft in the center section that is used for storage and as a design area. Barn doors on either end of the shop allow Dick to expand his workspace outside if need be.



ROSS TIEKEN
Shiner, Texas

Tieken designed and built this shop to blend with the surrounding prairie. He decided to use the footprint of his grandfather's old cement works business. This locked him into a 2,500-sq.-ft. shop, so he had to be very cost conscious. To reduce costs, Tieken did the construction himself with help from family and friends, a process that took three years. To keep ties to the history of the site, he salvaged as much lumber as possible from the original building. The rest (10-in.-wide cypress) was purchased rough and shiplapped by Tieken. All the windows were rescued from a scrap pile, and most of the machinery was purchased secondhand. Without heat, it's too cold to work here for about three weeks each winter. In the summer, Tieken cools the shop with a large fan that used to cool a chicken house down the road.

ROB HARE
Ulster Park, N.Y.

Because Hare works alone in both wood and metal, he needed a shop to accommodate both. The solution was this round shop that took Hare about eight months to construct. A crane, suspended from the ceiling and running on a track that travels the shop perimeter, can access the entire space and perform all the heavy lifting. Hare also figured out that a round space uses 15% less building materials than a square space of the same size. The main floor (1,900 sq. ft.) affords enough room for bench space, a machine area, and a place to work metal. A balcony (about one-third of the floor space) holds the office and storage area. PHOTOS: CHRIS KENDALL





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Sharpening services

THEY MAKE BITS AND BLADES CUT LIKE NEW,
BUT ARE THEY WORTH THE COST?

BY TOM BEGNAL

Woodworkers use all sorts of cutting tools, some powered by hand, others by electric motors. Either way, it's important that every edge is sharp. Otherwise, the tools don't work as designed.

Typical hand tools, like chisels and plane blades, sharpen relatively easily in minutes, right in the shop. But motor-powered cutting tools are a different story. Tablesaw blades, dado blades, jointer knives, planer knives, and router bits are best sharpened by a professional. A good one will have the sophisticated equipment needed to sharpen these very long, complex, or multiple edges, many of them hard tungsten carbide. Most



Sharpen or replace?

TOOL	AVG. COST NEW	AVG. MAIL-ORDER SHIPPING COST*	TOTAL AVG. COST NEW
10-in., 40-tooth blade	\$29 to \$105	\$10	\$39 to \$115
8-in., 24-tooth dado blade	\$95 to \$300	\$15	\$110 to \$315
Router bit	\$3 to \$140	\$9	\$12 to \$149
6-in. jointer blade	\$14	\$7	\$21
12-in. jointer blade	\$22	\$10	\$32

will ship the tool back to you within two to four days after it shows up in their shop.

Sharpening changes the size of a tool

Be aware that the size of a cutting tool changes slightly after sharpening. The diameter of a sawblade or dado cutter becomes slightly smaller. So, too, does the diameter of a straight router bit. The cutting radius of a round-over bit gets bigger, while the radius of a cove bit gets smaller. Planer and jointer blades end up narrower.

Whether or not a smaller tool is an issue depends on the tool itself and, to some extent, on how you plan to use it. It won't really make a difference when the diameter of a sawblade measures a few thousandths of an inch smaller after sharpening. A larger radius usually won't be an issue either, unless it's a matched set of router bits for cutting a rule joint on a drop-leaf table. When installed, planer and jointer knives can be adjusted to account for any change in width.

But if a bit is bearing-guided, and the bearing is intended to create a flush cut, the cut might not be flush after a sharpening (see "Trouble with bearing bits," p. 100). The result may be a slight step along the routed edge.

Matched rail-and-stile bits (also called cope-and-stick bits) are designed to make mirror-image cuts that fit together perfectly. Most users find that the bits can accept at least one sharpening before the fit becomes less than perfect. Check with your sharpener before sending along a set of these bits. Other types of cutters usually can be resharpened several times. Sawblades



BEFORE

Telltale sign of a dull blade.
When surfaces start to burn, despite proper setup and a healthy feed rate, the blade needs sharpening.



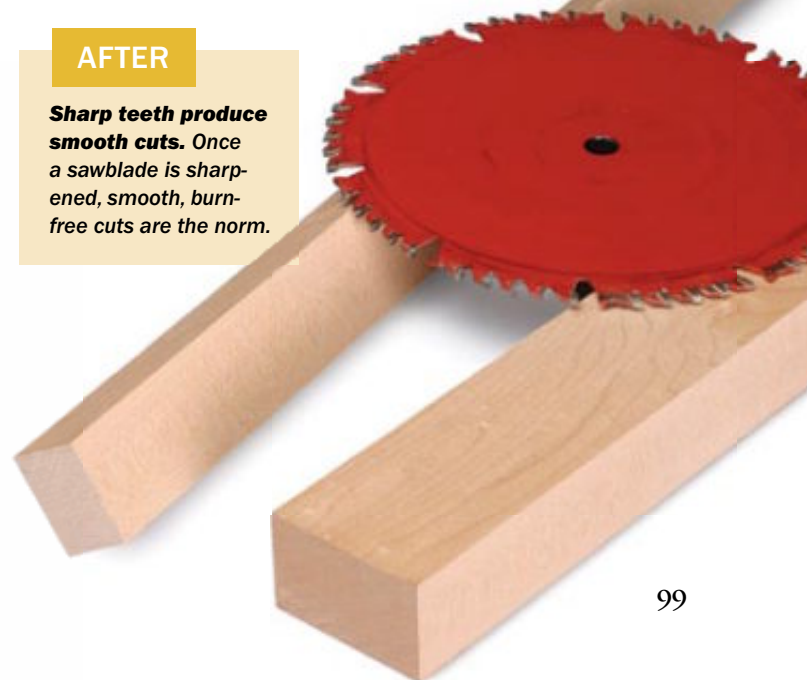
Sawblades

Sharpening at the shop. Professional sharpening services have the specialized equipment and know-how to turn dull bits and blades into sharp ones (above). Most sharpening services also can replace chipped or broken carbide teeth (right).



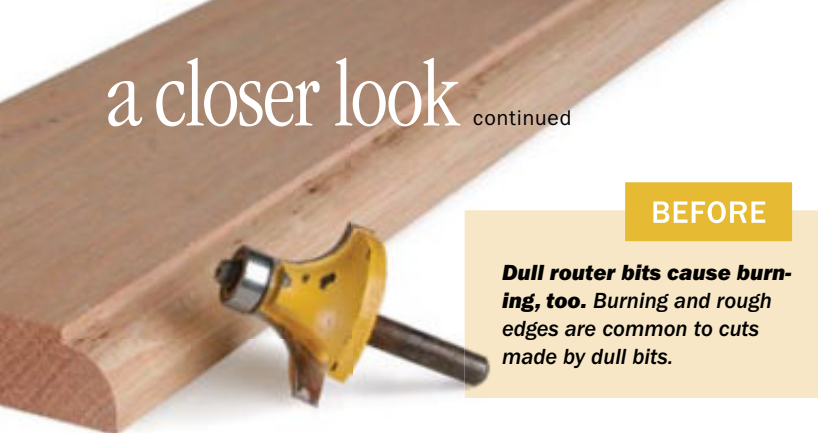
AFTER

Sharp teeth produce smooth cuts. Once a sawblade is sharpened, smooth, burn-free cuts are the norm.



AVG. COST TO SHARPEN	AVG. COST TO SHIP OUT AND BACK*	TOTAL AVG. SHARPENING COST	AMOUNT SAVED BY SHARPENING
\$16	\$16	\$32	\$7 to \$83
\$40	\$25	\$65	\$30 to \$235
\$5	\$14	\$19	-\$16 to \$102
\$4	\$14	\$18	\$3
\$8	\$20	\$28	\$4

*Finding a local store to do your buying or sharpening will save you the shipping costs and change the math.



BEFORE

Dull router bits cause burning, too. Burning and rough edges are common to cuts made by dull bits.



Router bits

Like new again. In the hands of a good sharpener, it takes just minutes to turn a dull router bit into a sharp one.



AFTER

Clean cutter. Expect burning and tearout to disappear once a router bit is sharp.

and bits that come with relatively large carbide tips typically get you a few more sharpenings than blades with smaller tips, something to consider when buying.

Cost: resharpen vs. replace

Before shipping out your favorite cutting tool for sharpening, find out if it will be worth the expense. That means comparing all the costs of buying a new tool to all the costs associated with having the dull one sharpened. The chart on pp. 98-99 offers guidance.

Most sharpening services make it easy to get prices. Many list prices online. If not, you usually can get a quick quote by phone or email. The prices shown are based on a survey of eight sharpeners located across the United States.

When getting prices, be sure to factor in the cost of shipping the tool to and from the sharpener. Sometimes, especially when the tool to be sharpened sells for a bargain price, it's cheaper to buy a new tool than to pay the cost of sharpening, plus shipping, plus taxes if applicable.

If possible, try to ship several tools at once. It's a good way to reduce the shipping cost.

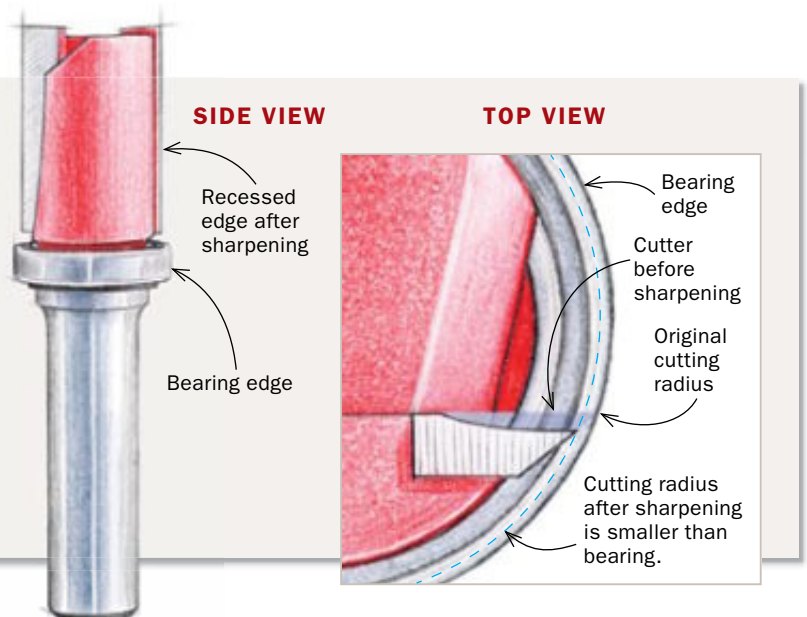
10-in.-dia. carbide-tipped sawblades—You can expect to pay around \$12 to sharpen a 10-in.-dia., 24-tooth carbide-tipped blade, \$14 for a 40-tooth blade, \$17 for a 60-tooth blade, and \$4 per tooth should any need replacement. Some sharpeners automatically replace sawblade tips that look cracked, chipped, or otherwise damaged. A few don't replace tips at all.

Others won't replace damaged tips unless their number exceeds 10% of the total number of teeth. That means if you send them a 60-tooth blade with six chipped teeth, they won't replace any unless you tell them to. But if that same blade has eight chipped tips, they will replace two tips to keep the number at or below 10%. The thinking here is that when 9 out of 10 teeth are fine, the blade can still cut effectively.

Router bits—On average, a straight router bit under 1 in. dia. can be sharpened for about \$4 per flute (per cutter edge, basically). Cove

Trouble with bearing bits

Invariably, sharpening a tool removes material from a cutting edge. That means each sharpening slightly reduces the cutting diameter of the tool. For some tools, like tablesaw blades, the size change doesn't make a real difference. However, on cutting tools like flush-trimming router bits, where the cutting diameter and bearing diameter need to be just about the same, the reduced cutting diameter can result in a bit that trims less than perfectly flush.



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Jointer and planer blades

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BEFORE

Unwelcome ridges. Thanks to two nicks in these planer blades, boards leave the planer with a couple of ridges.



AFTER

Ridge-free. Sharpening the planer blades removes the nicks, so the planed surface is glassy smooth.

bits and roundover bits with a radius less than about 1 in. will cost you about the same. Rail-and-stile bits and raised-panel bits run \$3 to \$4 per flute.

If your bit has a bearing, be aware that some manufacturers insist that you remove it before shipping. If a bearing is attached, they'll add an extra buck or two to the order. And they won't be responsible if a bearing gets damaged or lost.

Also, many services won't sharpen spiral bits. So check first before sending one out.

Most sharpeners also won't replace a damaged carbide tip on a router bit, mainly because the fix is more expensive than buying a new bit.

Jointer and planer blades—The average price for sharpening steel jointer and planer blades is around 67¢ per cutting inch. Carbide blades run about \$1.50 per inch. Several sharpeners have minimum rates, but all I looked at were less than \$5. Some add on a \$2 to \$4 charge to cover extra grinding time if the blade has nicks or chips deeper than 1/16 in.

Dado sets—Prices for sharpening carbide-tipped stacked dado sets range from about \$20 to over \$50, averaging around \$38. You get all the chippers sharpened, and both outside blades. The cost to replace a damaged tip is about \$4, the same as you'd pay to replace a tip on a tablesaw blade. Adjustable dado sets and steel dado sets can be sharpened, too. But based on my narrow survey, only about half of the sharpeners offer that service.

Finding a sharpener

Several months ago, I posted a question on FineWoodworking.com's Knots woodworking forum and asked members to recommend a sharpening service. I received about a dozen names, and added another half-dozen of my own. To see the list or add a name, go to www.finewoodworking.com/extras. To comment on your experience with a particular service, go to <http://forums.taunton.com/fw-knots>, and post your entry in the "Magazine Feedback" area. In time, we should have a good resource to call on when cutting tools go dull. □

How to keep edges sharper, longer

Carbide cutting tools can dull for any of several reasons.

Abrasion is one cause. The cutting edge simply wears away, and in the process, changes a sharp angle to a rounded one.

Resin buildup on the teeth can cause problems in a couple of ways. Chemicals in the resin can react with the binder that holds all the tiny bits of carbide together. When that happens, the carbide bits begin

to break away. Also, resin buildup can cause the blade to cut hotter, and a hot-running blade can cause the binder to weaken.

A blade that encounters a board with a hidden nail or screw will come away from the meeting with a few chipped teeth.

You can maximize time between sharpenings simply by following a couple of simple rules. Keep resin buildup under control



Resin is double trouble. Resin buildup on carbide teeth creates corrosion and extra heat, and both are bad news.

by cleaning the blade regularly. (A product called Simple Green works well, and it's available at most supermarkets.) Beyond that, it's just a matter of keeping the blade a safe distance from any nails and screws.

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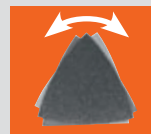
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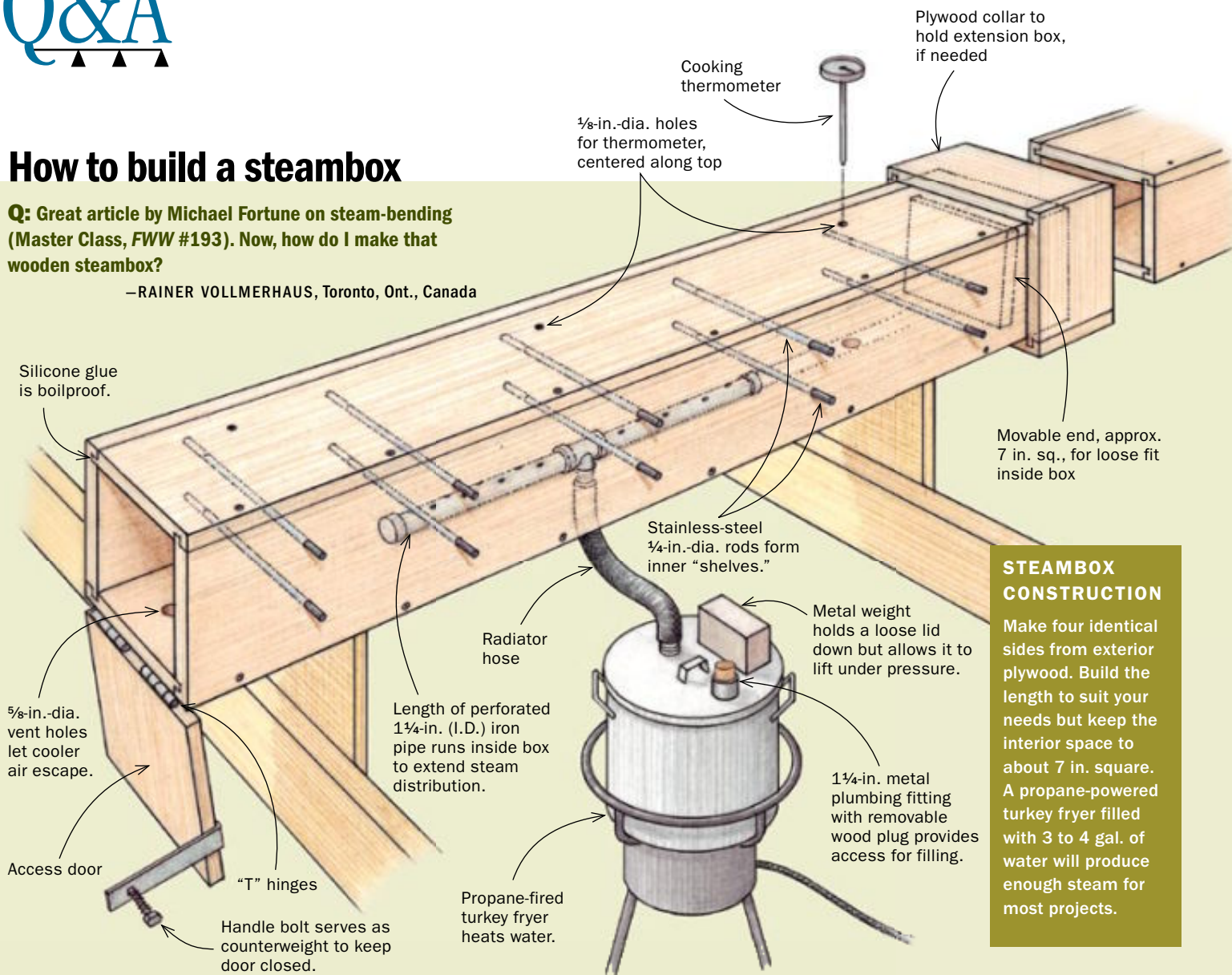
READER SERVICE NO. 95

TOOLS & SHOPS 2008 105

How to build a steambox

Q: Great article by Michael Fortune on steam-bending (Master Class, FWW #193). Now, how do I make that wooden steambox?

—RAINER VOLLMERHAUS, Toronto, Ont., Canada



STEAMBOX CONSTRUCTION

Make four identical sides from exterior plywood. Build the length to suit your needs but keep the interior space to about 7 in. square. A propane-powered turkey fryer filled with 3 to 4 gal. of water will produce enough steam for most projects.

A: MAKE THE BOX from 3/4-in. exterior plywood. Unlike interior ply, it will withstand the steam and last for years. Don't paint or line the wood, or dampness will lie against the surface, promoting rot. The length of the box is up to you. Mine is 48 in. long, but it's made to accept extensions (see drawing).

Keep the interior of the box to roughly 7 in. wide by 7 in. tall. That's large enough for several good-size blanks, and compact enough to easily maintain the necessary 200°F temperature. Holes drilled in the top let you check the temperature with a probed cooking thermometer throughout the steaming process.

Attach a hinged access door to one end of the box. A 7-in.-sq. piece of plywood fits loosely into the other end. Sliding it up close to the blanks minimizes the space to be steamed.

Pins inserted horizontally form two "racks" for the wood blanks. In use, the top rack should be loaded first to take advantage of the hottest steam.

The most reliable steam-maker I've

found is a propane-powered turkey fryer, available at hardware stores. With this setup, 3 to 4 gal. of water will generate all the steam you'll need for most bending projects. However, until you're accustomed to the timing of your specific setup, check the water level every 20 minutes. Lifting the lid briefly to check will not affect the steaming process. Nor will adding water when the level is low.

Pressurized steam is very dangerous, so the entire system must have outlets. Vent the box along the bottom so the cooler steam slips out. Use a loose lid on the steam source, with a weight on top that's light enough to let the lid lift open under high pressure.

When you're done steaming, leave both ends open and let the air dry out the box.

—Michael Fortune is a furniture maker in Lakefield, Ont., Canada, and teaches classes throughout North America.

Ask a question

Do you have a question you'd like us to consider for the column? Send it to Q&A, *Fine Woodworking*, 63 S. Main St., Newtown, CT 06470, or email fwqa@taunton.com.

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Cutting veneer with a knife

Q: I would like to try veneering, but I'm put off by how difficult cutting veneer seems to be. Most articles describe techniques that involve special veneer saws, jigs, and fixtures. Must it be that complicated?

—GEORGE WILSON, Brooklyn, N.Y.

A: ABSOLUTELY NOT. In fact, the process is simple.

First, you need a fence. I use a machinist's straightedge (Starrett makes one; it's sold by GarrettWade, www.garrettwade.com), but any flat and straight length of steel will do, if it's heavy enough to hold the veneer down flat for the cut.

Clamp the straightedge ends to the table, making sure that the veneer extends under both clamps (so the straightedge won't bow up in the middle). If a clamp can't reach the middle of the straightedge, hold that section down with a heavy weight.

The knife must be beveled on one side only, giving you a flat side to ride against the fence. This produces a square edge on the veneer that will butt tightly against the square edge of the adjacent piece. (One source for single-bevel knives is www.rockler.com.)

To begin, place the fence over the veneer so that the waste side is exposed.

Make a shallow scoring cut along the entire length of the veneer, going "down" the grain—that is, in the direction that takes the grain toward the fence. This might require switching hands, but it will force the knife against the fence during the cut.

Then, starting a few inches from the exit end of the score, make a through-cut down to the exit end. Work your way up through the rest of the cut the same way. This lessens the chance of splitting the veneer if the knife snags a tough spot.

To crosscut the veneer, start by establishing one straight edge along the grain. Now, using a square, make a scoring cut across the width of the veneer.

Next, as before, work back toward the beginning of the score. However, because you're cutting across the grain, you need to start delicately. Place the edge of the knife into the last ¼ in. of the score, and with a rocking, paring motion, cut down through the veneer. With the exit end severed, you can make the rest of the cuts without fear of tearout.


—Stuart Lipp is a frequent contributor.




Cut with the grain first. Start with a shallow score down the length of the veneer, keeping the flat side of the knife against the straightedge fence (above). A steel weight holds the middle of the fence down, while clamps secure the ends. Finish the cut in stages. Starting a few inches from the back end of the score, push the knife through the veneer (left). Then cut through in a series of short cuts, working up to the front.



Square up for the crosscut. With one edge of a carpenter's square on the newly cut edge, the other serves as the fence for the crosscut score. Next, keeping the square in place, cut gently through the veneer at the back end of the line. Then follow the same procedure used to cut with the grain.



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Plywood workbench top

Q: I would like to build a top for my workbench with layers of plywood. I'd also like to install benchdogs. What type of plywood will work best for this situation?

—JIM SIEFKEN,
Fort Collins, Colo.

A. THREE LAYERS OF 3/4-IN.-THICK plywood are a good choice for a strong, stable benchtop. Choose a plywood with no voids and as many layers as possible, such as Baltic birch. Place the top sheet upside down, and glue and screw the middle sheet to it using lines of 1 1/4-in. Spax or deep-threaded drywall screws sunk flush with the surface. Locate these screws carefully to allow the third sheet to be screwed down and the dog holes to be drilled.

Surround the top with a maple or other solid-wood edge, at least 3/4 in. thick and fastened to the plywood with the same type of screws. Miter the ends of the edging



Triple-thick plywood top. Three layers of 3/4-in. Baltic birch make a hefty workbench top. Maple strips attached with coarse-threaded screws give the top a splinter-free, solid-wood edge. Holes for round benchdogs are drilled, then chamfered at the top.

to give it a crisper, more professional look.

Making square holes in plywood is difficult, so I suggest using cylindrical benchdogs (www.hartvilletool.com). The

most common sizes require 3/4-in. or 1-in. holes. Chamfer the holes at the top to minimize the risk of chipping.

—Mark Schofield is the managing editor.

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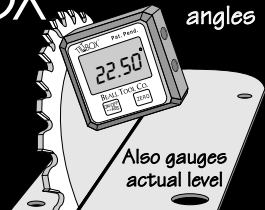
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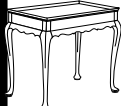


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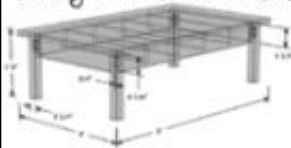
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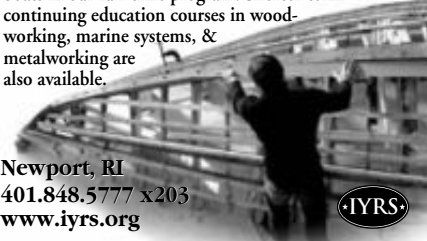
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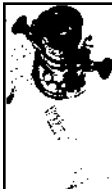
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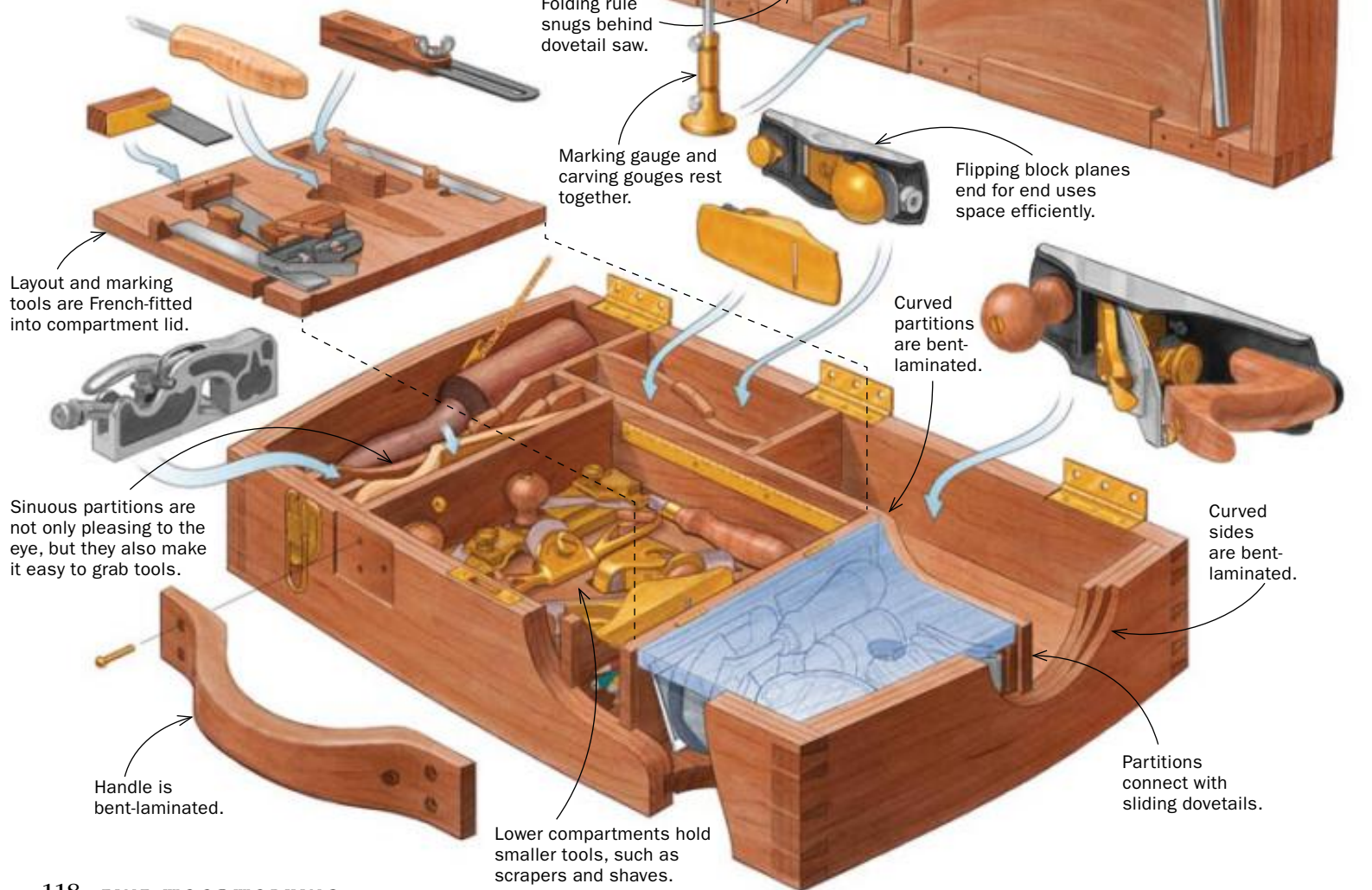
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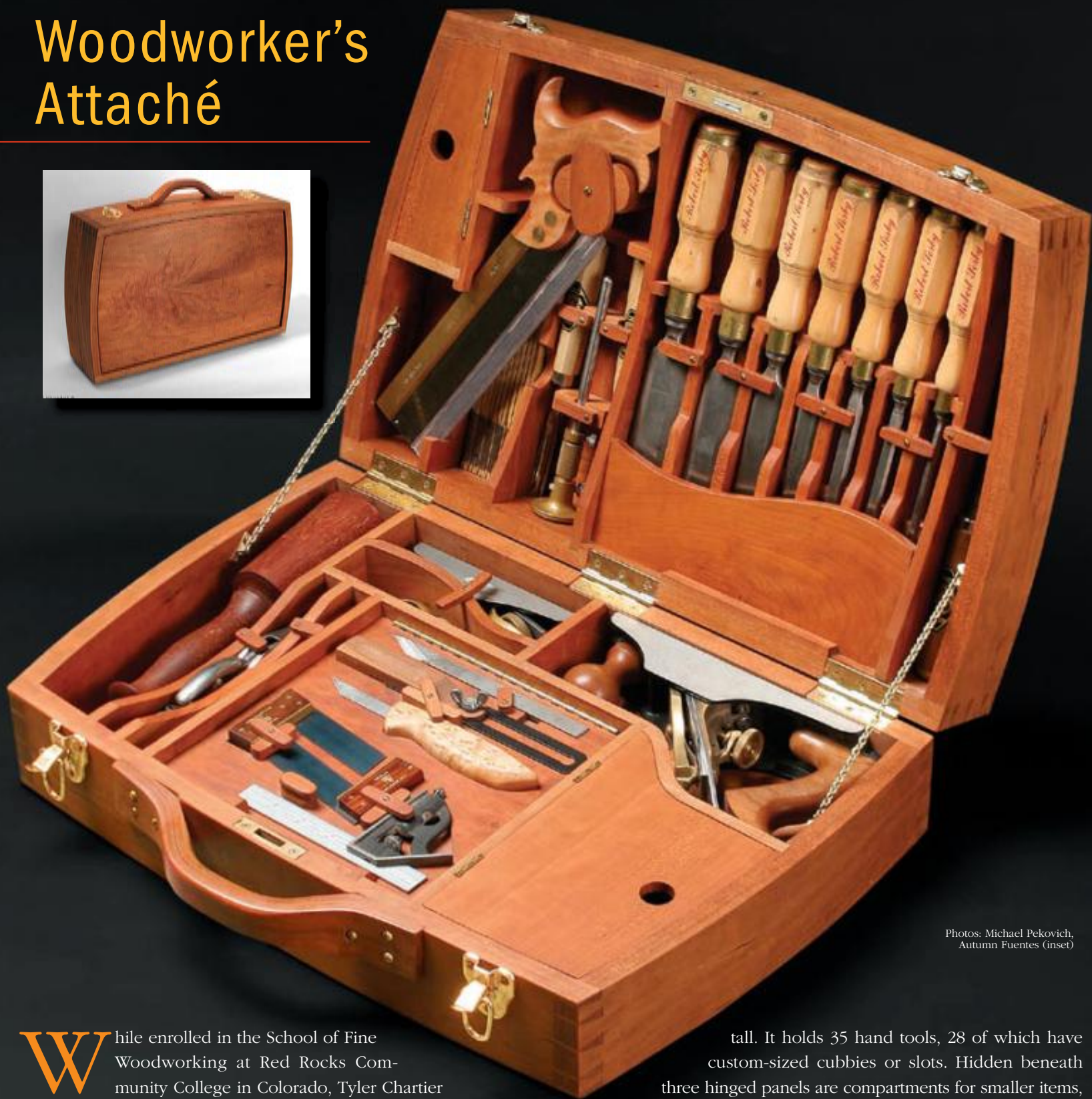
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Woodworker's Attaché



Photos: Michael Pekovich,
Autumn Fuentes (inset)

While enrolled in the School of Fine Woodworking at Red Rocks Community College in Colorado, Tyler Chartier needed to bring the requisite hand tools to class. Not wanting to lug his collection haphazardly in a bucket or a lunchbox-type case, and inspired by a poster of the H.O. Studley tool chest (available at www.taunton.com), Chartier designed and built this sophisticated attaché case to transport his tools comfortably and with style. Made of cherry, the case is 6 in. deep by 22 in. wide by 17 in.

tall. It holds 35 hand tools, 28 of which have custom-sized cubbies or slots. Hidden beneath three hinged panels are compartments for smaller items, such as utility knives, pencils, and notebooks. The interior partitions are connected with sliding dovetails—34 in all—and the sides, top, and bottom of the case are joined with hand-cut dovetails.

Chartier, 31, who lives in Cobb, Calif., is now a full-time woodworker. To see more of his work, go to www.chartiercustomfurniture.com.
—Thomas McKenna

How They Did It Turn to p. 118 for an exploded view of the design and construction.

Pro Portfolio For a narrated slide show of the features, go to FineWoodworking.com/extras.