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6 Super Routing Techniques Page 50

Lithium-ion Batteries

Are they right for your shop?

December 2006

8 Trim Routers: Your Best Buy!



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1000



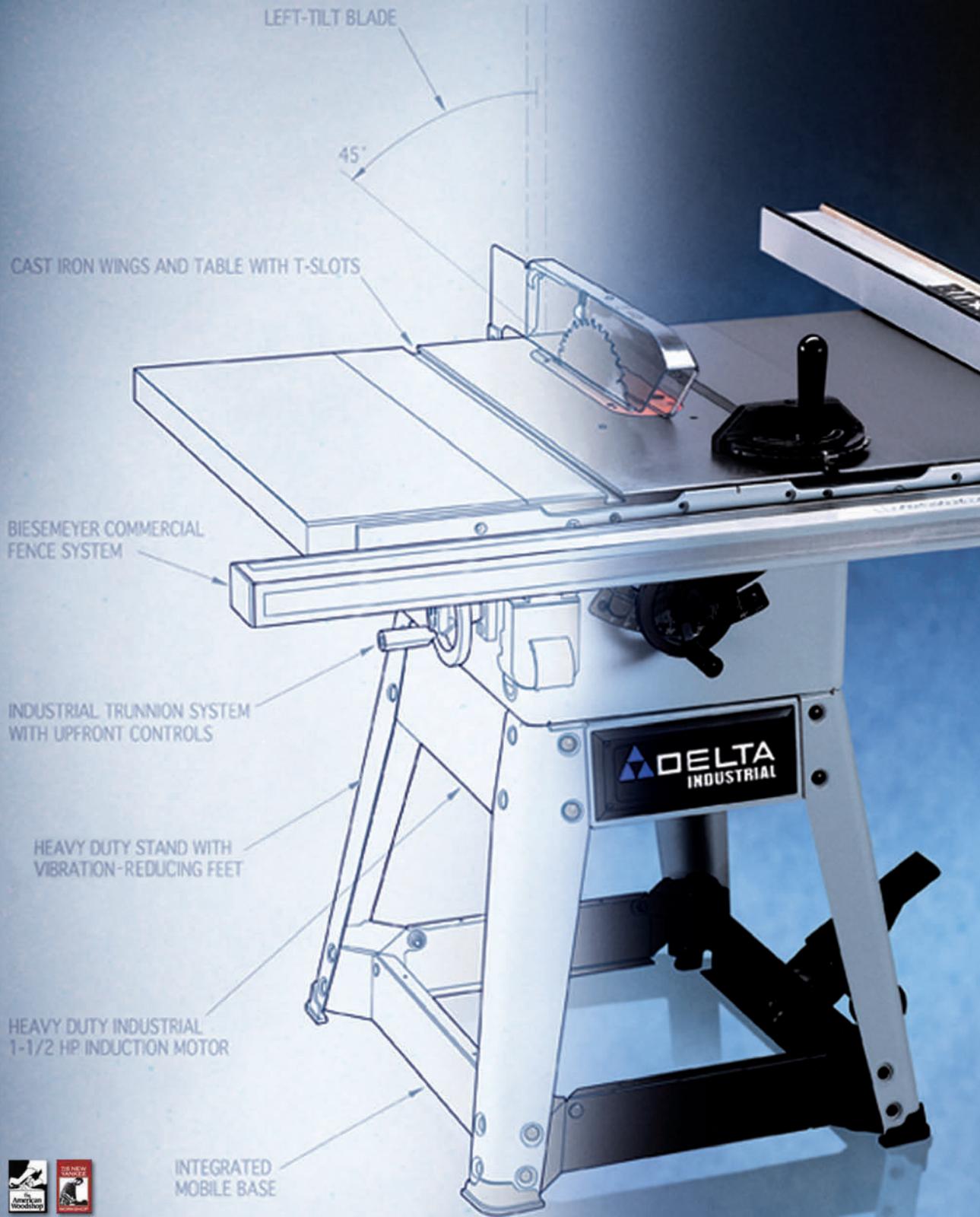


This year marks a century of PORTER-CABLE® helping woodworkers turn their imagination into reality. Over that time, we've had quite a few amazing creations of our own. Check out the impact our history has had on woodworking shops around the world at porter-cable.com/centennial.

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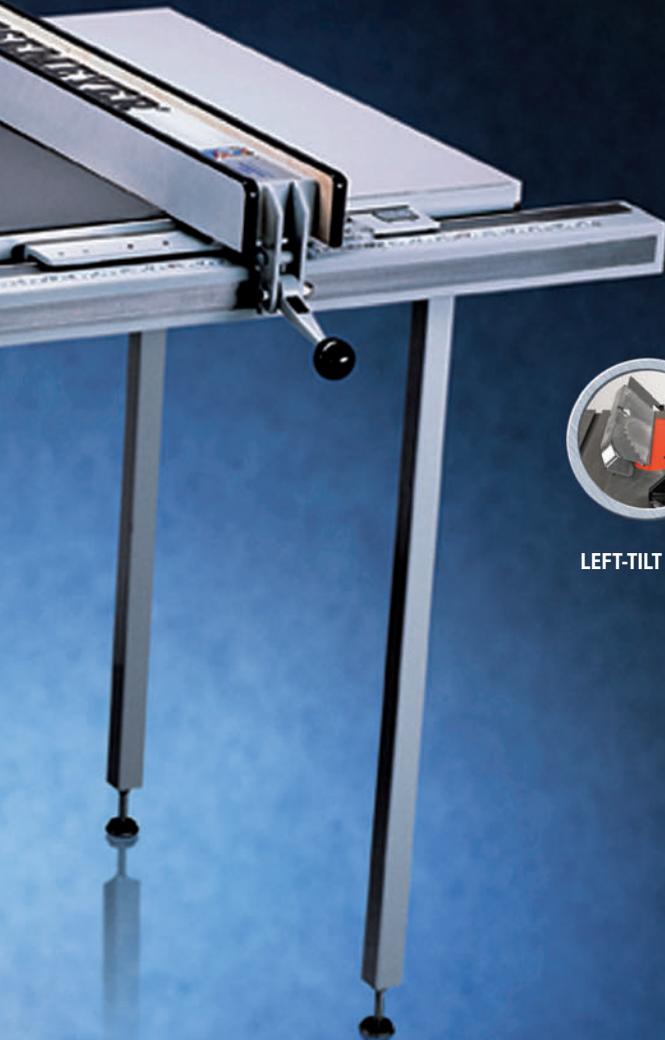
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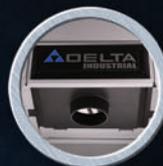
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LEFT-TILT BLADE



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Page 58

36 Birth of a Sofa Table

By Ian Kirby

Our master woodworker teaches you not only how to build a sofa table, but also how to design one to fit your own ideas.

44 Flat-screen TV Media Center

By Mike McGlynn

New flat-screen TVs call for a new woodworking project: a media center to hold them. Plus, tips on using ApplePly® and on vacuum bagging.

50 Six Router Techniques

By Bill Hylton

The author of the standard reference books on routing tells you what you can do with the tool — cutting dadoes and circles, duplicating parts, jointing edges and more — and how to do it.

58 Designing an Entertainment Center for the Ages

By Sandor Nagyszalanczy

Understanding all the hardware and electronic options available is the first step to creating an entertainment center that will outlast your current equipment.



Page 36



Page 44



Page 50

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Page 26



Page 30



Woodworkers

- 14 **Editor's Note**
We're not the only ones having an anniversary.
- 16 **Letters**
Math, saw blade info and Smokey's name.
- 20 **Tricks of the Trade**
Easy alignment for your rip fence.
- 22 **Questions & Answers**
Saw blade teeth and screw sizes.
- 26 **Shop Talk**
Ringing out the glory of woodworking.
- 34 **Stumpers**
A tool from the days of the Model T.



Techniques

- 30 **Woodturning**
Straight talk on techniques for cutting with a skew chisel.
- 104 **Finishing Hotline**
Michael Dresdner tackles your finishing questions.

Tools

- 66 **Tool Review**
Chris Marshall takes trim routers for a test drive.
- 84 **Today's Shop**
A.J. Hamler looks behind the scenes of new Lithium-ion battery technology.
- 98 **What's In Store**
Products to protect your tools and your hearing.

Page
66



It's not
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A Century of Toolmaking

I do enjoy milestone celebrations — as long as it's not my "milestone" birthday being celebrated. So this year, I'm in luck. Not only is 2006 the 30th anniversary of your favorite woodworking magazine, but it also marks the centennial of one of America's most enduring tool companies. Just think: the great-grandfathers of our very first subscribers might well have used a Porter-Cable tool (pencil sharpeners were among their first) to complete the hand-me-down rocking horses those same readers galloped upon in their youth. That's some real woodworking history!

When the *Journal* got together with P-C for a big birthday bash at the International Woodworking Fair in Atlanta, we agreed to show off their very latest offering (available in the first quarter of 2007). The brand-new *OmniJig Joinery System*[™] you see on this page is so new that when the *Journal* took pictures of it for our cover, Porter-Cable graciously sent along one of the senior design engineers who developed it, to make sure we knew how the prototype should be set up. It's that new ... and you saw it here first.

"Outfitted with some optional templates," Steve McDaniel told editor Rob Johnstone (*photo at left*) "the OmniJig will rout dovetails, box joints and mortise and tenon joints — and it will work with any router."

Elsewhere in this issue, you'll find articles that incorporate both the new and the "old." While an entertainment center project might have been cutting-edge 30 years ago, flat-screen TVs weren't even on the drawing board. Today, they're all the rage, so we asked Mike McGlynn to create a modernistic flat-screen TV media center, featuring a silent lift. His project starts on page 44. Or, if you'd prefer to design your own entertainment center, check out Sandor Nagyszalanczy's collection of clever design tips (*see page 58*).

Lithium-ion batteries are another example of what's new in woodworking and power tools, and we're glad to welcome A.J. Hamler to our pages with his article explaining this technology (*see page 84*). As for the router, your "traditional" favorite woodworking tool, we have more great information in store for you this issue with Chris Marshall's review of trim routers on page 66 and instructions on some great router techniques from Bill Hylton (author of the book *Woodworking with the Router*) starting on page 50.

Larry N. Stoiaken



We decided to wrap up this milestone year by giving you, our readers, some free holiday plans. Subscribers can download the plans by visiting www.woodworkersjournal.com and following the link. Look for more "More on the Web" offerings in the future (for instance, for this issue we're posting a plywood cutting list for the Mike McGlynn project described above). We hope you enjoy the free plans!



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New Math and the Digital Divide



confine or lock up.” The word Mr. Kieffer meant to use was interment, without the first “n.” I know, picky, picky ... Keep up the good work.

Joe McDonald
Sellersville, Pennsylvania

as he stated, then the three million remaining acres would be 3.33 percent of that amount, not .03 percent.

Jim Kirkwood
Muncie, Indiana

In the formula for adjusting dimensions to the Flag Case, you say if $X=10\frac{1}{4}"$, then $2X=21\frac{1}{2}"$. Does this mean that if $X=2$, then 2 times X does not equal 4? Wow! What am I missing?

Dick Vallett
Hockessin, Delaware

WJ Response: *Someone (not Mr. Kieffer) is clearly mathematically challenged. Read the next letter!*

See the Forest for the Trees

As a brand-new subscriber, I don't like to complain, but in the story, "Hunting up the Longleaf Pine," August 2006, if I built furniture with the math Rob Johnstone used, then I'd be making extremely miniature products. That is, if the pre-Columbian forest were 90 million acres,

I enjoyed your article on longleaf pine in the August 2006 issue, but I noticed a couple of small errors.

The first item that "bears" mentioning involves that very famous fire-fighting ursine, "Smokey Bear." You incorrectly identified him as "Smokey the Bear." Shame! You don't say "Yogi the Bear" or "Huckleberry the Hound"; why say "Smokey the Bear"?

Another item concerns the wood properties of longleaf pine. You reference "specific density." I believe that you meant "specific gravity." Wood can be described by its density or its specific gravity, but not its "specific density." Otherwise, it was a fine article on a fine species.

Michael G. Messina,
Professor
Forest Sciences,
Texas A&M
College Station, Texas

WJ Response: *Michael, I'm so pleased that Smokey Bear has friends in silviculture. Jim, I think you and Michael (and Dick) will agree that my personal "specific density" includes all things mathematical.*

— Rob Johnstone



Flagging Errors

It seems that I always learn something from the articles in this fine magazine, even after 30 years of teaching high school woodshop. As a former U.S. Navy Seabee, I was especially interested in the Memorial Flag Case article by Bruce Kieffer (August 2006). I've made a few in the past for friends and appreciated his technique for dealing with the angles and dimensions of the case.

However, there is a minor error in this article: The word "internment," used in the article to describe the type of flag used in burial ceremonies, is misspelled. "Internment" means "to

Smokey Bear has been around since 1944, but in 1952 a song was written about the famous fire-fighting bear. The songwriters added "the" (to fit the beat) creating an unofficial middle name. To set the record straight: our hero's name is Smokey Bear ... period.



Mail Call! Contact us by writing to "Letters", Woodworker's Journal, 4365 Willow Drive, Medina, Minnesota 55340, by fax at (763) 478-8396 or by e-mail: letters@woodworkersjournal.com

We ask that all letters, including e-mails, include a mailing address and phone number. We reserve the right to edit for length and clarity.



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Making the Cut

Thanks to Sandor Nagyszalanczy (*August 2006*) for the infinitely usable information about both the style and brand of blades most used on the most popular power tool in our workshops. Bravo! Finally, a comprehensive, reasonably “scientific” and objective look at 10" blades for EVERY woodworker, not just the moneyed few. And a gutsy move for your magazine, considering the amount of ad revenue you [could] receive from those companies whose products were tested.



Using this information, I can opt for the Forrest Woodworker II if I need to have a saw blade to display in my glass-fronted shop cabinets containing my Lie-Nielsen Planes, Lamello and Festool power tools and fine Japanese chisels. Or, since I don't have any of these, I can take this article with me to my local Home Depot™ or Lowe's® and buy a blade, knowing that I'll get nearly

the same performance as those more expensive ones. And it won't break my heart when I hit the staple I overlooked on that \$8-per-bd.-ft. barcoded red oak I purchased at the same store, the only “lumber” store available to many of us these days.

*John Lloyd
Herrin, Illinois*

continues on page 18 ...

Safety First: Learning how to operate power and hand tools is essential for developing safe woodworking practices. For purposes of clarity, necessary guards have been removed from equipment shown in our magazine. We in no way recommend using this equipment without safety guards and urge readers to strictly follow manufacturers' instructions and safety precautions.

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A Digital Underclass?

I am a subscriber to your magazine and, in order to subscribe, I wasn't required to have an e-mail address. It works great. Recently, I tried to order from a company that advertises in your magazine. I discovered that as a person without an e-mail address, I couldn't purchase

a product, contact the company or even register online as a customer. I guess if you don't have an e-mail address these days, then you may be treated as a second-class citizen. I can't be the only person in the world without an e-mail address. I think that some businesses should rethink their policies, and they might get more business. I do appreciate your magazine and hope you keep up the good work.

*Lee McCann
Bentonville, Arizona*

WJ Response: What about you? Have you chosen to stick with "snail-mail" for your communications? Do you feel that you're increasingly out of touch with the woodworking world as a result? Let us

know how the digital divide is affecting your favorite hobby.

Pull 'Em Off

I do NOT like the pullout sections. They ruin the magazine and make it difficult to thumb through the pages. And, while we're on the subject, I dislike pullouts slightly less than the inward-folding double center [spread] pages. They drive me batty and make me want to toss the magazine. They're really hard to read and never fold back up into the magazine neatly. Please, please, get rid of that idiotic feature and keep all the pages the same. Other than that, your magazine is great!

*Terry Weller
Huntington Beach, California*



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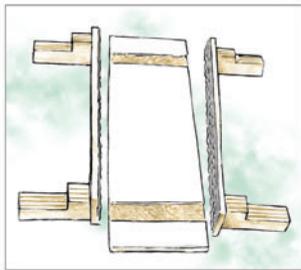
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Jigging Up for Shop Success

Three jig components are clamped in place to form an edge-planing "tunnel."



Edge-jointing with a Planer

I find it a great convenience to be able to machine-plane boards on edge, and all you need is this simple three-piece jig. I use melamine-faced particleboard to make the side walls and base of the jig because it stays flat and is slippery smooth. Clamp both sides of the jig as shown (adjusted to the thickness of your stock) to the planer table on both the infeed and outfeed side. The walls of the jig form a tunnel through the planer to keep narrow boards standing correctly as you feed them through.

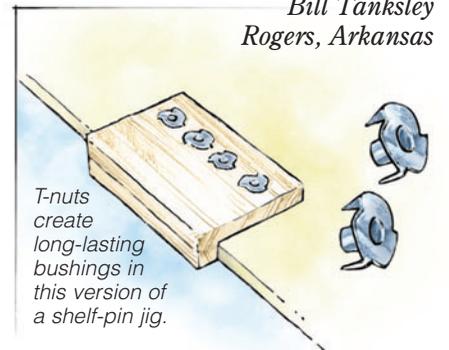
*Stephanie Bourque
Gracefield, Quebec*



T-nut Shelf-Pin Jig

Drilling evenly spaced shelf-pin holes in your cabinet projects is much easier with my shelf-pin jig. I make mine from a couple of pieces of scrap — a large piece that forms the actual drilling jig and a second strip screwed underneath to serve as an edge guide. I insert 5/16" T-nuts into holes in my jig to act like bushings for guiding the drill bit. Just pound them in and drill out the inner threads with a 1/4" twist bit. If you ever need to change the hole spacing, just tap out the bushings and insert them into new holes.

*Bill Tanksley
Rogers, Arkansas*



Rip Fence Alignment Jig

To minimize binding and kickback, it's important that the rip fence and saw blade on your table saw line up with the miter slots and blade. I made this simple adjustable jig so I can check their alignment from time to time. It looks very much like an oversized marking gauge.

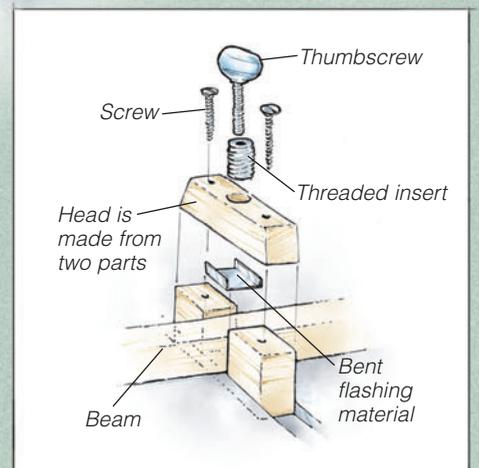
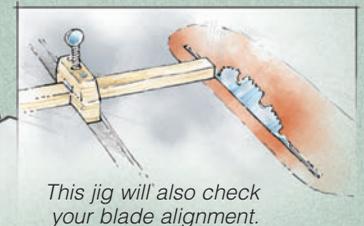
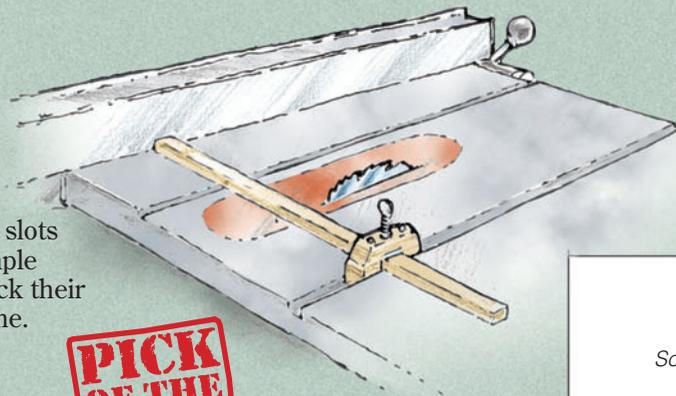
A thumbscrew, fitted to a threaded insert, holds the head in place anywhere along the beam.

To use the jig, slip the head into a miter slot (its thickness must match the slot width) near the front of the saw table. Slide the beam until it touches the fence, and lock the head. Remove the jig and set it in the same slot near the back of

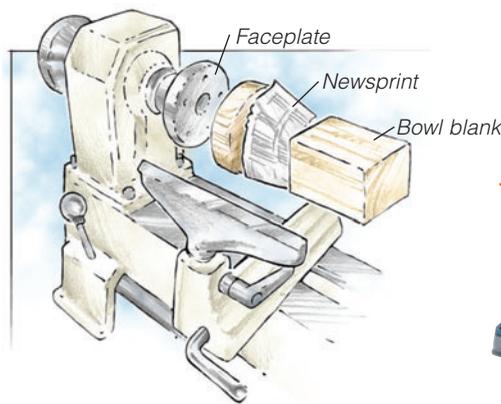
**PICK
OF THE
TRICKS**

the table. If the beam still touches the fence, you'll know the fence is parallel to the slot. It works the same way when checking your saw blade's alignment.

*Roland Romito
Broadview Heights, Ohio*



A new spin on a paper joint



New Angle on Old Power Plugs

My power tool cords always seem to pull free from extension cords during use. Tying the cords together just ruins them faster, and those cord connectors hang up on everything in sight. I solved the problem by replacing the standard plugs on my power tools with right-angle plugs. They're harder to pull out, because they aren't in line with the extension plug socket. They're inexpensive and come with or without a ground prong.

Mike Ruffalo
Columbia, Missouri

Quick-release Newspaper Seam

When I'm turning bowls using a faceplate, I mount the bowl blank to a piece of 3/4" scrap and screw

the faceplate to the scrap. An easy way to make a sturdy, yet breakable joint between the scrap and blank is to coat the scrap with Duco[®] Cement and apply a sheet of newspaper to it. Press the paper firmly to the blank. Then use more cement to glue the bowl blank to the newspaper facing, and let it dry overnight. After you've finished your turning, a couple sharp raps with a mallet and a paint scraper will split the paper joint easily to release the bowl. A little acetone cleans off any paper residue.

Monroe J. Mechling
Steubenville, Ohio



WINNER!

In addition to our standard payment (below) Roland Romito of Broadview Heights, Ohio,

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Advice for Taming Monster Lumber



Screw gauges (commonly known as sizes) standardize the diameters of screw shanks at their widest points. Not all gauges are readily available.



Q Over the years, I've seen the following screw sizes: 2, 3, 4, 5, 6, 8, 10 and 12. What happened to sizes 7, 9 and 11?

*Skip Tenney
Morgantown, West Virginia*

A Screw sizes — or more, accurately, screw gauges — are based on a numbering system that standardizes the thickness of the screw shank (not the threads) at its widest diameter. These numbers were established almost 60 years ago by the International Organization for Standardization (ISO). For instance, if a screw manufacturer follows ISO standards closely, a #4 screw will have a shank diameter of .112", and a #8 will have a .164"-thick shank. Manufacturers engineer screws within tolerances that may vary a few thousandths of an inch from ISO standards. As you know from buying screws, the higher the gauge, the thicker the shank. The gauges you've seen are those stocked most often in stores, but specifications for the more

obscure #7, #9 and #11 — as well as #0 and #1 — do exist. They just aren't commonly manufactured or sold. It's sort of like digging a foxhole with a teaspoon.

— *LiLi Jackson*

Q I recently purchased oak from a lumber mill that I plan to use for furniture. Some of the wood is more than 12" wide. Should this be ripped into narrower strips to glue up for panels in order to prevent cupping, or is it OK the way it is?

*Charles Jacobs
Canton, Ohio*

A Rip it into narrower pieces, but only when individual boards show signs of cupping. If not, take advantage of the luxury of your wide wood.

— *Rob Johnstone*

Q I am building a table out of pine lumber that is 2" thick by 12" wide. The table will be 12' long. What is the best way to joint this type of heavy lumber?

*Mickey Seale
Denham Springs,
Louisiana*

A Whew, Mickey, that's a big task! To properly prepare stock of that dimension, you must go through the same steps as you would with any other piece of lumber. Before you begin to glue it up, the top and bottom faces need to be flat and parallel to one

another, and the edges of the board must be at 90° to those faces and parallel to each other. To joint one face so that it's flat, you'll need a 12" jointer, and in this case, outfeed supports — in order to control those humongous pieces of wood. These outfeed supports must be perfectly aligned with the plane of the jointer's outfeed table. If they're not, trust me, your misery will know no bounds. Once you have a flat surface, you should use winding sticks to check that there's no twist. On one face of the stock, use a planer (minimum 12"-wide cutters) to create the parallel flat face. At this point, step to

continues on page 24 ...

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THIS ISSUE'S EXPERTS

Rob Johnstone is the editor of *Woodworker's Journal*.

Lili Jackson is a frequent contributor to *Woodworker's Journal*.

Cliff Paddock is the director of new product development—cutting tools at Freud America.

your table saw and cut the non-jointed edge so it's parallel with the jointed edge. Then, move back to the jointer and run that edge over the jointer as you did before. Again, because the stock is so long, you will need those well-aligned outfeed supports. Despite the size of these pieces, these jointing tasks are best done by one person. (You can have a buddy help steady and control the stock once it's clear of the cutter, if you wish.) That's because you need to shift the pressure — which holds the stock against both the fence and the tables — smoothly from the infeed table to the outfeed table. Two people

would work at odds to one another in this task.

— Rob Johnstone



Why don't saw blade manufacturers address blade plate materials in their blade specifications? A blade plate made of SAE 4340 steel should dampen vibration better than a blade plate made of SAE 1015.

R. C. May,
via Internet



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requirements of the plate when choosing the steel. The steels that you suggest might help reduce vibration, but they lack other properties needed to produce a strong, durable blade. Our steel has a much higher carbon content to provide the strength and mechanical properties required, therefore making Freud steel superior to SAE 4340. In addition, Freud blades incorporate other features to dampen vibration, including laser-cut, anti-vibration reeds, proprietary fillers for those reeds, computerized tensioning and thoroughly tested tooth geometries that reduce noise and harmonic vibration.

Cliff Paddock

Q Why are all of the saw blades on the market outfitted with an even number of teeth? It would seem to me that an

odd number of teeth would generate less sympathetic vibration, just like a three-blade boat propeller.

*R.C. May,
via Internet*

A That's an interesting question. Freud has completed numerous tests in our state-of-the-art testing facility in Italy over the past several years as part of our ongoing efforts to bring new technologies and designs to the market. In fact, we have tested saw blades with an odd number of teeth. Our results showed that the even number of teeth, as used on all Freud saw blades, reduces vibration, and an odd number of teeth actually increases vibration. As noted before, our full range of blade-dampening features allow Freud blades to offer the most vibration-free performance in the industry.

Cliff Paddock

SAFETY NOTICE!

A safety alert has been issued for the **Porter-Cable Cordless Brad Nailer Model BN200V12** for possible dangers that might result from a nail ejecting while the switch is in the "Off" position. To find more information, visit www.porter-cable.com or call 800-949-6348.

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A recall is in effect for all RA200 and RA202 **Ryobi Radial Arm Saws** (benchtop models with 8" blades) in which potential hazards could arise if the plastic motor housing cracks, causing the blade assembly to fall off. For more information, visit www.ryobi.com or call 800-525-2579.

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Inspiration Rings True



Woodworker Rick Carr says that wherever it's displayed, his liberty bell is a resounding success.

Working through his vacation and every spare moment of his time, he built a 7½'-tall by 5½'-wide by 5'-deep, full-scale wooden replica of the Liberty Bell, seated on an elegant, two-legged wooden base — in only eight weeks. The determined “duffer,” as he modestly calls himself, had constructed this massive wooden work of art just in time for festivities at Sagemont Church in Houston.

Ring in the Past

Woodworker Rick Carr Recreates the Liberty Bell

When woodworking hobbyist Rick Carr of Houston, Texas, first toured the Liberty Bell in 1999, he was awestruck. That's when Rick, an airline pilot and former Air National Guard pilot, began dreaming of building a full-scale wooden replica of this venerable icon of American freedom. His hope was to display it as the centerpiece of his church's July 4th celebration. Five years later, with the help of his daughter, graphic designer Julie Carr, and the support and encouragement of a host of others, including his church, Rockler Woodworking and Hardware, Ace Hardware, Boise Cascade and Continental Airlines, Rick realized his dream.

The wooden bell, yoke and elegant stand weigh in at a hefty 1,200 lbs. The bell is free-swinging and contains the same carved inscriptions found on the original Liberty Bell, first built in 1752 and later recast in 1753 because of cracks.

“I faced a lot of challenges,” he noted. “The size of the bell was so huge it was hard to work with. Friends suggested that I make it out



After creating rings, Carr stacked, glued and screwed them together to form the bell's core.



The bell was so heavy that Carr used a router on a moveable jig to form the shape, keeping the bell stationary as he worked around it.

of papier-mâché or cardboard. But to do the icon proud, I felt it had to be made of wood to capture the true grandeur and majesty of the original Liberty Bell.” Rick's bell is crafted from ¾" Baltic birch plywood and seated in a sturdy, graceful stand made of scrap 7" by 18" glued-up laminate beams.

Besides having to develop his own working plan to build from, Rick faced a series of other huge challenges — from figuring the exact dimensions of the original bell to determining the best ways to cut, rout, join, fasten, plane, inscribe and finish his masterpiece. For more info on Carr's inspiring journey, visit www.ringlibertyring.com.

Carr's bell was featured in a special July 4th display and ceremony at Newark Liberty International Airport this year.

Lounging on the furniture they built, these enthusiastic young woodworkers take a break to enjoy the fruits of their labors. Before taking the program, most of the girls had never picked up a hammer.



Girls at Work

Building Skills and Confidence

When New Hampshire woodworker Elaine Hamel, a general contractor by trade, began teaching basic woodworking classes in Girl Scout camps 14 years ago, she was so moved by the experience that she resolved to teach year-round to girls and women. "It's amazing to see how learning these trade skills really bolsters girls' self-confidence, self-esteem and spirits," she said, "especially with kids who come from disadvantaged or foster homes."



In the shop, GAW is committed to teaching up to 10 girls per class in a four-hour session.



"Girls learn that power tools are not just for boys. Besides skills, they learn confidence."

A remodeling contractor for the past 20 years, she built a large barn right on her property in New Hampshire to use as a shop where she could offer a full program of woodworking classes. The goal of "Girls at Work" (GAW) is "to help girls and women build confidence and independence in an open and supportive atmosphere while learning the craft of woodworking."

Elaine estimates that she's taught woodworking classes to nearly a thousand girls throughout New England.

Right now, Elaine still spends a lot of time on the road, lugging 400-600 lbs. of tools and equipment in her utility pickup to teach classes in camps all over New England. "Camps don't have the funds or the means to transport girls here," she explained. "So I go there instead."

Elaine emphasizes that her program is nonprofit because her aim is "to provide classes at a very low cost to girls and interested women."

"None of us in the program are paid for what we do," she explained. Elaine works days as a contractor and devotes nights, weekends and any spare time she has to the program. "We have to rely on the kindness, generosity and dedication of our board and volunteers to help us operate GAW," she said.

Although she's received a few grants and donations, her wish is to get enough funding to go full-time with help from a small, paid staff so that GAW can offer classes year-

round (instead of just summers) to girls through after-school programming, school vacation camps, weekends and more, as well as to interested women. "Unfortunately, we've been unable to offer classes to women interested in learning these skills. Many own their own homes and need to know how to take care of them," she said.



GAW can teach about 75 - 150 students per day, depending on the size of the group and the number of volunteers on hand to help out.

As to the girls, "It's amazing to see [them] discover that they can actually build something; then they have the results of their efforts as a constant reminder that they can do anything they set their minds to," Elaine said. "They feel empowered. Hopefully, this sense of accomplishment spills over into other areas of their lives... For me, seeing this is more rewarding than any paycheck could be." For more info, or to support the program or provide a scholarship to help put a girl through woodworking class, please visit www.girlswork.com.



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Tips for the Skew-Chisel Challenged

By Betty Scarpino



If you learn two skew-cutting techniques and a scraping method, you'll turn like a pro!

As I read through a variety of articles about using the skew chisel, I was struck by the significance, not only of what the authors were saying, but of who they were. Primarily they were old-guy production turners, noteworthy because there aren't that many of them left today. They were good turners — great in most cases! They were great turners because that's what they did for a living, day

in and day out. Most likely you don't do that, which is why you're probably skew chisel-challenged.

So let's begin with a simple premise: Anything you learn to do well, you do so by practicing. With just a few hours' practice, you will begin to feel in control of the various cuts that can be made with a skew. When you learn two of them, plus one method of scraping, you'll be well on your way!

One of the Old Guys

Years ago, I met one of the old-guy turners, Rude Osolnik. I was so stunned at his ability with turning that I probably didn't learn much from his demonstration, except to clearly understand that his tools were an extension of his hands and that he used short-handle tools. The most amazing thing he did (and there were many amazing things!) happened when he finished turning a spindle: He didn't shut off his lathe before he parted off the candleholder and inserted another piece of wood between centers! He must have retracted the quill of the tailstock, then retightened it — I don't recall — but he must have, otherwise how else did the second, same-size piece of wood fit?

Learning Some Technical Terms

Before we get started, I'll need to describe the skew chisel and its various parts.

- The toe is the sharp point where the skew-chisel edge is the longest.
- The heel is the other point.
- There are four "bevels." Really! There are four! The first two are obvious — they're the ones you sharpen on your grinding wheel. The other two bevels: one is under the toe and the other is under the heel. Remember them ... they're important! I call them the toe bevel and the heel bevel. They aren't really bevels in the traditional sense, but they act as a bevel and are important when using the toe or heel to make a cut.
- There are four cutting edges. These four opportunities for your skew chisel to make cuts in your wood, intended or otherwise, are: toe, heel, side one and side two. Of course the two sides share the same edge, but for purposes of discussion, I name them differently.

“You will get dig-ins as you learn to use the skew chisel. We all do and it’s a jolt!

Rarely is it serious, though, especially if you take a light cut and use sharp tools. Good luck!”

— Betty Scarpino

- The shape of the profile on the end of your skew is somewhat of a preference, but you need to know why you decide one shape over the other. If you want to have the cutting edge rounded, heel-to-toe, that’s fine. Some people swear by it, but for me, it doesn’t work. The argument is that the rounded profile helps keep the toe or heel from digging in when you don’t want it to. I prefer a flat profile, which helps me see the toe and heel more clearly. You decide — or try both shapes.

- Oval skews are ones where the bar of tool steel is oval rather than flat. I gave my oval skew away years ago (it just wasn’t for me). I borrowed the one in the photo from my friend Jennifer. I don’t

like oval skews because the tool doesn’t rest flat on the toolrest when I’m scraping.

Start with a Sharp Skew

Sharp is better than dull — you’ll cut easier and with less pressure. Remember that for every action there’s an equal and opposite reaction. If your tool is dull, you have to push harder. When you get a dig-in, it’ll be super deep!

For the bevels on the sides — the ones you sharpen on the grinder — you can make them either long or short or somewhere in between. Long bevels make the cutting action a bit more aggressive and difficult (at first) to control. If the bevels are short, the cut is less aggressive; however, you won’t be able to make cuts in narrow gaps between tight elements. Make sure the side bevels are concave or flat. If they end up being convex, that causes problems with cutting.

Bridging the Gap

Let’s bridge the gap between someone like Rude Osolnik and us lesser mortals. The skew chisel has an undeserved reputation for being difficult to use, so begin with a different thought: “It’s exciting to learn how to use the skew chisel, and I’m up to the challenge!”

Now that your skew is sharp and your mind is ready, go to your lathe and put a piece of wood between centers, the best kind being green wood. Choose something you don’t treasure. Try for a chunk no larger in diameter than about 5" and about 12" long. Make sure it is solid wood with no large defects or cracks.

Using a roughing gouge, make the wood round, then turn off your lathe. Holding your skew chisel in one hand, apply it to the wood, rotating the wood by hand, as shown in photo 3 at left. Note how each cutting edge of the skew reacts when it meets the wood. If you’re having trouble rotating the



1



2



3



4

Woodturning continues on page 32 ...

In this sequence the author roughs out a blank (photos 1 and 2) and then moves on to her planing cut (photos 3 and 4). For the planing cut, Betty likes to turn the work by hand, adjusting the toolrest until she finds the proper angle between her chisel and rest.

Toe cut



Heel cut



Planing cut



Scraping cut



Four skew-chisel cuts

Growing your woodturning skills is similar to increasing your vocabulary. If you know more words, you can express yourself more easily. If you master all four of these cutting techniques, you will be able to express yourself more fully in wood.

wood, call a friend to help. He or she may think you're a bit crazy, but go for it anyway.

Adjust the lathe to a fairly low speed (800 to 1,000 RPM) and make light cuts. The skew chisel is not meant for heavy cuts, at least not from a beginner.

Here's a brief explanation of how to use a skew chisel to avoid catches: When you are using one of the cutting edges, stay off the rest of them! Remember that there are four parts of the skew that will make a cut. The same goes for the bevel. Use the bevel that corresponds to the cutting edge, and let the bevel support the cut.

Making the Essential Cuts

To start with, practice two cuts: the V-groove (toe or heel) and the planing cut. They are the ones you will use most often. Once you master them, you will be able to figure out the others.

The V-groove cut is made with either the toe or the heel of the skew. I prefer using the toe, but try both and decide which is best for you. There are advantages to both. Use an arching motion when you first put the toe into the wood — don't just stick the point into the wood. Slightly angle your skew chisel to one side, but leave a bit of clearance on that side, too. If you don't leave that clearance, then you will unintentionally connect that side's cutting edge and a catch will happen. Cut one side of the V-groove, then the other side, taking light cuts. To get the feel for it, pretend there's a bevel under the toe or heel.

The planing cut is made with either of the long edges. It's similar to taking a hand plane and shaving the wood. Lightly rest the skew chisel's side bevel

on the wood, then slowly lift the handle and advance the cutting edge into the wood, moving the skew forward. Take a light cut. Don't let the toe or the heel touch the wood. And did I mention, take a light cut? The part of the edge that is the safest to use is about two-thirds down from the toe.

You will discover it is easier for you to let the tool travel left-to-right or right-to-left, depending on which hand is dominant. Practice both postures.

Scraping with a Skew Chisel

This is where I bring the old-guy turners back into the conversation. They probably would never scrape with the skew chisel. Remember, though, we're not one of them. My assumption is that most of us want to be able to use the skew chisel occasionally and have some success with it.

So, hold the skew chisel horizontally on the toolrest. Use the long cutting edge and keep the toe from digging into any protruding element that's not being scraped. The only time you will get a catch is if you let the point of the tool accidentally dig into an element close to where you're scraping. This scraping cut is handy for smoothing out those small bumps left by a gouge or by a previous cut with the skew; however, don't expect it to make a clean cut on already-torn wood grain. This cut is also the best choice for areas of your turning that contain end grain.

Betty Scarpino first learned to use a skew chisel from a pattern maker who taught the scraping method only.

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Just Tooling Around

What's This?

Joseph (Jody) Schultz, from International Falls, Minnesota, sent in this true mystery tool. With each turn of the crank handle, the shaft rotates clockwise till it makes a 3/4 turn, then switches direction to make a 1/4 turn counter-clockwise.

Know what it is? Send in your answer for a chance to win a prize!



If you have your own woodworking mystery tool (or the answer to this issue's entry), send it to Stumpers, c/o Woodworker's Journal, P.O. Box 261, Medina, Minnesota 55340. Or send us an e-mail: stumpers@woodworkersjournal.com

Motor Skills

This tool [from "Stumpers," *August, 2006*] has no connection to woodworking. It is used to lap [seal] the intake and exhaust valves on a gasoline engine [in antique cars dating back to the '20s, '30s and '40s]... Lapping compound was used to create a ground seal between the valve and seat ... I used a similar one on my Model A Ford many years ago.

John Bracken, Milledgeville, Illinois

While John might have had his own Model A, many of our readers remembered their grandfathers using the tool submitted by **Richard Lehman** from Upper Lake, California. **John Cunningham** from Las Vegas, New Mexico, for example, remembered that, "The reversible tip on the end of the tool swivels to fit either a slotted valve head or one with two small holes on top." **Jim Jacobs** from Nevada City, California, added, "I remember my grandpa using one on the old 'hit and miss' single-cylinder engines we had on our farm." **Bill Scott** of Kewanee, Illinois, said, "It's an easy identification for old car nuts." He owns a similar tool — not surprising for a man with six Model T's in his family and "a barnful of these curious oddities." Another oddity, sent in by **Charles Wood** from Clovis,



Pump handle to spin shaft.

Car nuts had no trouble identifying this valve-grinding tool. The arrows show the area to be lapped.



New Mexico, is his claim that the "valve grinder was sometimes used with toothpaste to lap it." **Ross Barna** of Orlando, Florida, informed us that a "new, updated" valve grinder can be bought online today from any small engine tool supplier, while **Jim Armstrong** from Normal, Illinois, sent in a how-to article from a 1924 edition of the *Auto Repairman's Handbook* with instructions for making a handmade valve grinder from an old hand drill.

Wrong Turns, Wild Rides

Although many were able to identify the valve grinder, there were a number of responders who veered off course. As a kid, **Jack Early** of Red Wing, Minnesota, found a similar tool in his grandmother's basement. "It was great for making holes in the dirt, but my uncle gave me a good lecture about proper use of tools." Jack's uncle called it a "shovel bit drill and used it for cutting holes in wood."

Audley "Ozzie" Barnacoat of Cincinnati said it was "an early attempt to find an easy way for shipbuilders to drill large holes in the planks of ships to insert dowel rods." Another inventive answer from **George Ulrich, Jr.** of DeWitt, Nebraska, said it was "used to drill holes for the pegs at the top of old barns and houses before they used many nails." **Wes Newswanger** of Lancaster, Pennsylvania, called it a "pre-electric drill version of the paint stirrer." One of the most imaginative guesses was from **Peter N. Williams** of Kingsville, Texas, who said he saw a similar tool while visiting a pottery factory in Okinawa, Japan, where "an old man was using it to drill holes in the base of ceramic vases." A long ride from motor world!

—Liz Sela



WINNER! A. David Buse, of Lee's Summit, Missouri, wins this Porter-Cable 895PK Multi-base Router Kit. We toss all the Stumpers letters into a hat to select a winner.

A Woodworking Revolution!

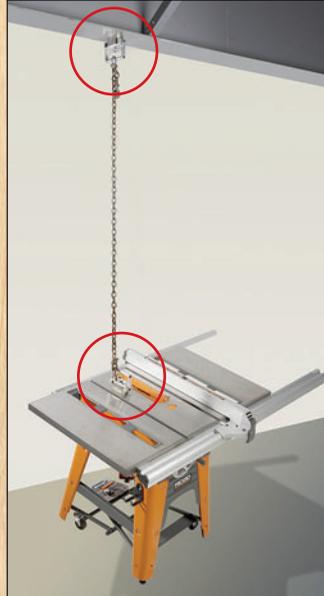
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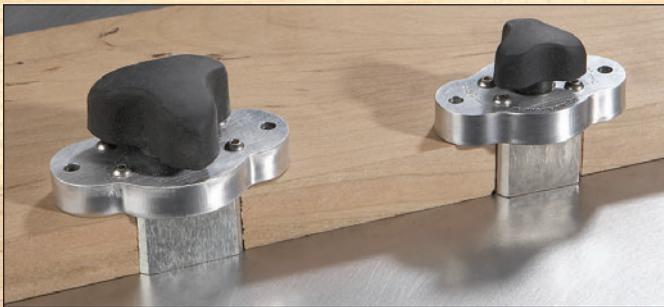
Magswitch featherboards allow for control on wider pieces.



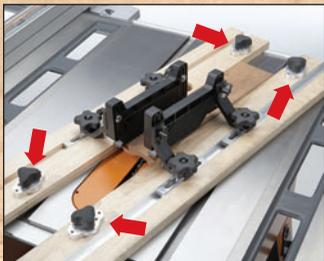
A dual-hold vertical attachment holds wood snugly and safely!

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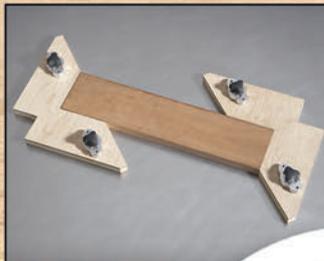
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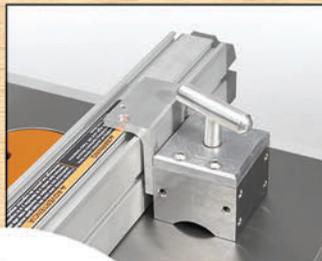
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Using his own methods and machines, our author designs and makes a sofa table and then invites you to make your own, using methods and machines appropriate to your skills and shop.



Birth of a Sofa Table

From Concept to Prototype

By Ian Kirby

This article departs considerably from my previous work on design and furniture making for *Woodworker's Journal*. It reflects more closely my work as a professional furniture designer.

The design problem explored here was to create a sofa table for small-quantity production intended for sale in specialty furniture stores. It would show no allegiance to a particular style while being lighthearted and fanciful rather than overly serious. The design problem is relatively simple because the dimensions are fairly standard and the table comprises only three elements: the leg, the top rails and the top.

I immediately determined that the underframe — legs and rails — would be “dematerialized.” That’s a fancy designer word for “painted.” It means that the material used for the structural element is disguised by the painted finish. This obliges the viewer to focus on the shapes of the parts and the relationship of one part to another because there is no wood grain, wood color or joinery to distract your attention.

Furniture is a collection of forms and spaces. What most people fail to realize is that spaces are usually more interesting shapes than forms. This piece illustrates the point well. If you look at the original drawing of the leg and piece of rail (on the following page), you will note that I emphasized the space between leg and rail by shading. If you were to look at the real thing, you would find that that space is often the most dramatic part of the assembly. One reason why it attracts your attention is that the space changes radically when viewed from different angles. On the other hand, the leg, which is the form, doesn’t change — no matter from what angle you look at it.

Marble or sand-blasted glass would work well as a top, but we are woodworkers, after all, so the question arises: What wood would work best with such an underframe?

To avoid the visual conflict that would certainly occur with a piece of highly-figured material, a species with an homogenous tonal value is called for. That admittedly leaves little to choose from: holly or quartersawn English sycamore are both white and plain, yet not easily attainable. I chose the ubiquitous bird’s-eye maple.

Design Beginnings

I began with the leg. From this came a full-size drawing so that the joint and rail relationship could be better determined. It proved good enough to make a full-size leg in order to walk around it and reassess the worth of the idea. Following slight adjustments, I made a working drawing and added the rails and top.

It’s at this point that the departure referred to at the outset really gets underway. I showed the drawings to a friend whose computer skills far exceed his furniture making. He quickly turned my orthographic drawings into the colored perspective image shown in the box below.

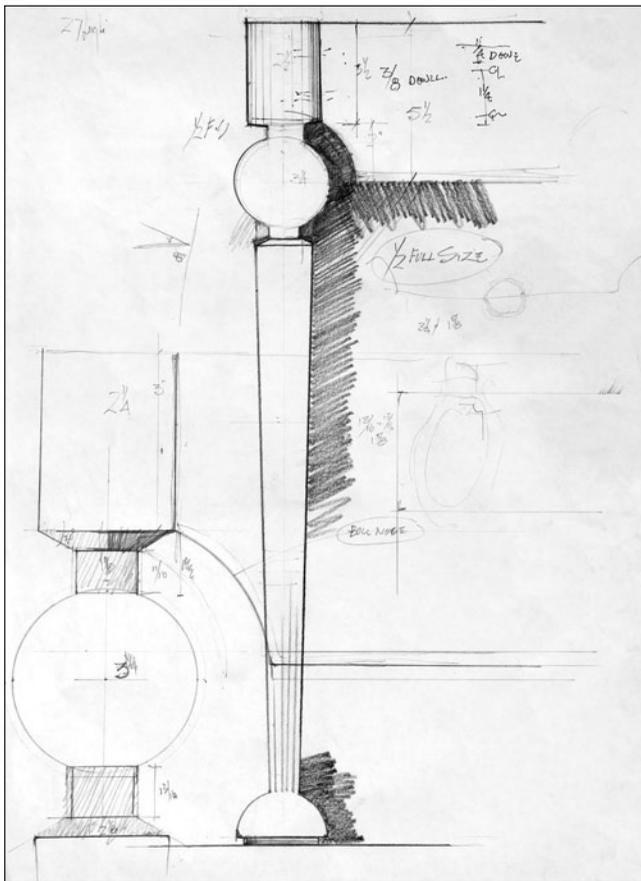


My CAD-savvy friend, Kirk Kelsey, added a molding around the edge of the rails. A few clicks and mouse moves at the center of the long rail produced a medallion or, if desired, a hole. The world of click-click adds a new dimension to furniture design.

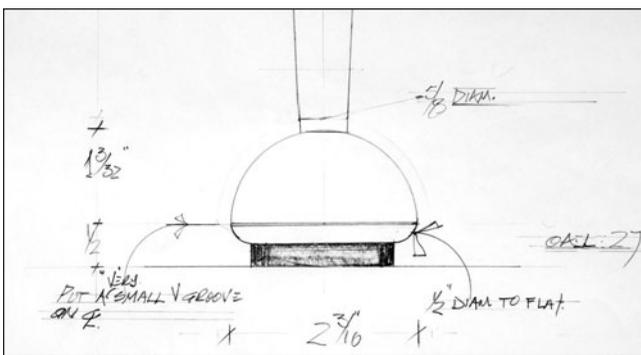
Working Methods

I will describe how I completed each task. However, there are many ways to achieve the same end — depending on your skill set, tools and machines, contacts and resources, and predilection. My construction methods were typical of work on a prototype — a word which correctly describes most of our one-of-a-kind work. From hand tools to CNC machinery, I called upon a wide variety of tools and working methods.

Where you lack a particular skill or immediate access to machinery, I suggest that you prevail on friends or professionals for help. Possibly an even more heretical suggestion is that you have a part made in a shop equipped with the machinery to do it. It’s called outsourcing: we do it when we buy wood instead of cutting down a tree, so don’t feel you need apologize for following this route.



The leg is simply a collection of solid geometric shapes: a cylinder, a sphere and an inverted cone. The author's aim was to make the rail connect to the leg literally at the jointed top half and visually at the bottom half, where negative space mimics the shape of the ball.



After the leg was turned, the author made small adjustments to the cylinders, above and below the ball, and to the foot.



The templates, after they have been shaped by a band saw or its like, must have their shapes refined (here with a drum sander) to the marked lines.

Making the Patterns

The top, the long rails and the short rails are all shaped as shown in the *Drawings* on page 41. I can't imagine anyone wanting to shape them with spokeshave, surform and rasp, but you could. Most will use a router or a shaper. All three shapes need a pattern to guide the cutter. I used 1/2" MDF. Its thickness provides plenty of surface for the guide bearing of the cutting tool, while its density holds the pattern shape well. The shapes can be rough cut with a band saw, a jigsaw or a coping saw. The sawn face needs refining to the line, and the commonest way is by sanding. Possible tools include a spindle sander, edge sander or pneumatic drum sander mounted in a drill press. Yet another alternative — and the one I used — is a CNC machine. Depending on the system, it may need a scanned drawing or a computer-generated drawing. When fed to the CNC machine, the outcome is a pattern exactly as drawn. Chances are high that you don't own one but, as suggested earlier, outsourcing is an acceptable consideration.

Making the Legs

The sphere on the leg is 3" in diameter, which means you'll need a leg blank 3" x 3" x 29". I glued up 1 3/4" thick poplar, then milled it to final dimension. The rails are 3/4" poplar.

The joint connecting a square leg and a rail would ordinarily be a mortise and tenon. It would work here as well where one of the parts is cylindrical. An alternative is the BeadLock® system shown in the sidebar at right. I chose twin 1/2" x 1 1/2" dowels. (For more on dowel joinery, see "Gluing the Underframe" on page 42.) Once your joints are made and fitted, rail to square leg, it's time to turn the leg.



All the required templates are made and refined. In addition to providing accuracy as you shape your stock, these patterns can be used repeatedly.

Turn and Turn Again:

There are several ways to skin a cat ...

The popularity of turning has prompted an abundance of writing and classes on the subject, albeit mostly about face plate turning. In practice, furniture turnings are mostly between centers. Again, we will likely part ways on methodology. I used a lathe that had been upgraded to CNC capability. But these legs can be turned on a traditional lathe without too much difficulty. If you own a lathe, this leg design presents two problems: turning an accurate sphere and preventing chatter at the lower end of the leg. The solution to sphere accuracy is practice, and the solution to chatter is a back steady. The tough guys steady the revolving workpiece with one hand pressing from the back while the other hand continues the cut from the front. For the rest of us, it's OK to hold a folded leather glove or some such similar pad at the back to protect fingers from the heat. If you don't own a lathe, then you may prevail on a friend or outsource the job.

Because of the vagaries of wood density along with tailstock pressure, when the leg blank is mounted in the lathe the "joint cylinder" at the top of the leg can vary in length when made using this method. This makes a good case for cutting all the cylinders to the same dead length after turning, followed by making the joint. This detail is typical of how problems differ between one-of-a-kind and multiple manufacture.



This converted Wadkins lathe has a lead screw and a stepper motor. This means that if you can electronically tell the cutter where to move in space, it will cut (turn) a leg for you — the power of CNC!



Regardless whether you turn by hand and compare your leg's shape to a template or shadow drawing, or use a manual duplicator, you are making methodology and technology choices. Here, the author checks the tolerance of the leg blank as it comes off his CNC lathe.

BeadLock ... Strong and Simple Joinery

As pointed out, each builder makes joinery decisions based on the tools and products at their disposal. Journeyman Tools' BeadLock®, a unique loose tenon system, provides a sturdy joint without time-consuming setup or additional jigs. With it, you drill a series of overlapping holes using a guide block clamped to the workpiece. 3/8" or 1/2" bead stock is provided, which can be cut to length to make what amounts to a loose tenon.

The holes and bead stock form a tight interface and, when glued, form a strong and durable joint. Simple and smart. While our author chose basic dowel joints to connect the legs and aprons, he tested the BeadLock system and found it suitable to the task.

— WJ Staff



Our author checked out the BeadLock system and found that it results in a strong and durable joint.





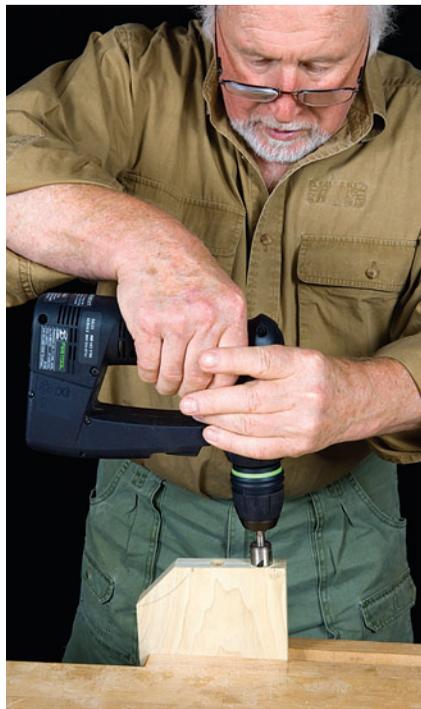
Start the process by marking the end of the rail with a center line, using a marking gauge.



Using a wide chisel and horizontal paring, cut the V to within 1/16" of the edge of the wood. The poplar cuts easily.



Leave the smallest of flats on the edges of the V-groove — say, 1/32". Refine the angle as shown in the photo at right.



Chamfer the edges of the dowel holes with a countersink bit to prevent the chisel from breaking out the end grain.



With the V formed, get to the desired angle by chiseling from the face of the rail down the slope of the V.

a sliding table past a tilted table saw blade or past a dovetail router bit set to half the thickness of the rail. For the eight pieces involved, I found paring with a chisel was a quick and easy way to advance completion of the prototype.

Clamping Blocks

You should use clamping blocks for any assembly, but clamping a cylindrical leg requires special treatment because a flat block will damage the workpiece. A concave clamping block, unless it fits perfectly, can be equally damaging. The solution is a V-block. Use a soft wood — I used Spanish cedar — and, for strength, make sure the grain runs across the V. The surface contact on two sides is enough to spread the pressure and avoid compressing the leg. It's also easy to move the clamp so that you can direct pressure exactly where you want it to close the joint and square the assembly.

You may have read my exhortations in past articles about the evils of undercutting shoulder lines, but here I am apparently recommending

the practice. However, the previous situations concerned typical square stock mortise-and-tenon or dovetail joints in which the joint line would be cleaned up by planing. If you plane an undercut shoulder line where the parts are flush, what was a tight shoulder line becomes a gapped shoulder line as the undercut is revealed. In this case, the joint will not be planed.

Shaping the Rails

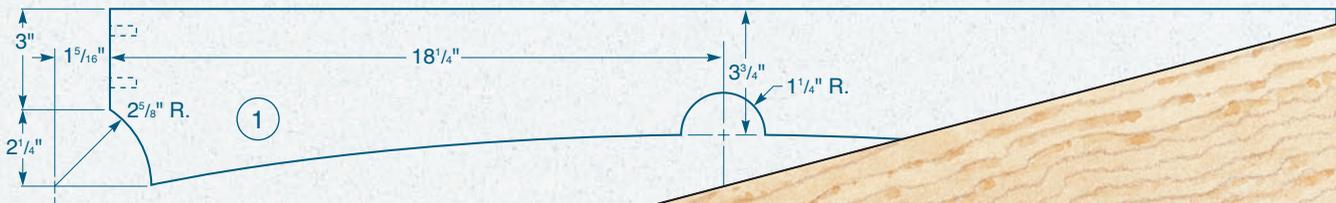
Once the shape has been drawn on the workpiece from the pattern, it's sawn out much like the pattern itself. However, the finish cut to the line is accomplished using a router or shaper guided by the pattern. You can guide a router on top of the workpiece or guide the workpiece over a router table. Your choice determines whether the pattern faces up or down and whether you use an end- or shank-bearing bit. Whichever method you choose, it's important to get the sawn line as close to the finish as possible because the typical bit with two

Making Shoulders Fit

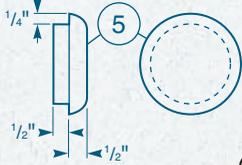
Whatever joinery method you choose, you must resolve the problem of a square-ended rail meeting a cylindrical leg. You could leave the rail shoulder square and flatten the contact area on the cylinder. Or you could scribe the shoulder and hollow it to the curve of the leg. Both ways are doable but more complicated than the method I chose. But first, guided by the pattern, mark the curve on the 5/8" wide rail and cut the corner off at 45° on the chop saw. This step is necessary because the cylinder diameter is smaller than the sphere diameter, making it impossible to check the joint because the rail would contact the sphere before the joint line closes.

Using a chisel, I formed a V-groove on the shoulder, the narrow edges of which made tight contact with the cylindrical leg. The angle of each side of the V-groove is about 18°. The V-groove could be made by running

Long Rail
(Front View)

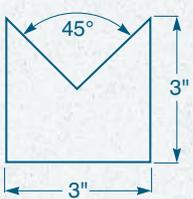


Disk
(Side and Front View)



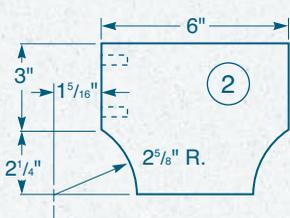
The author created three different decorative disk designs. Select one of his, or create your own.

Clamping Block
(Top View)

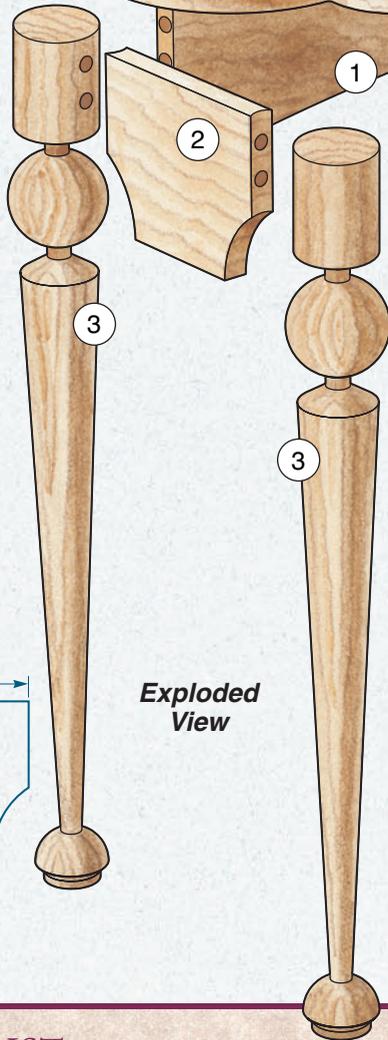


Clamping block is a 3" x 3" x 3" cube.

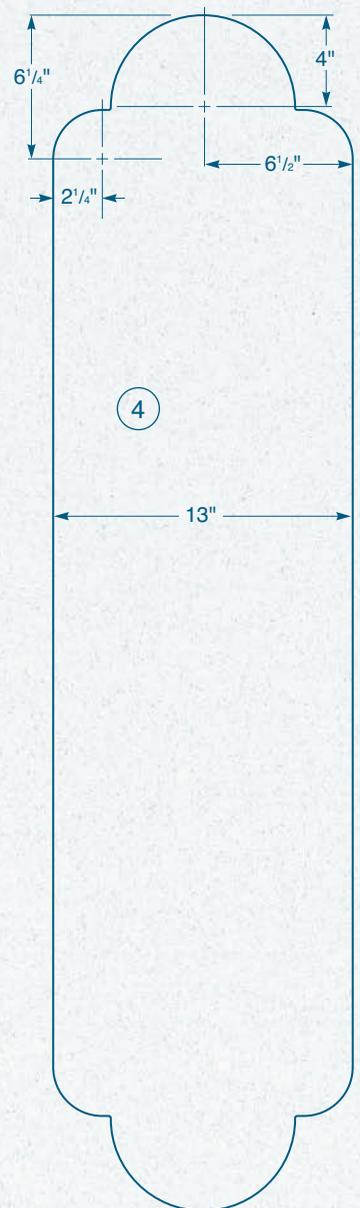
Short Rail
(Front View)



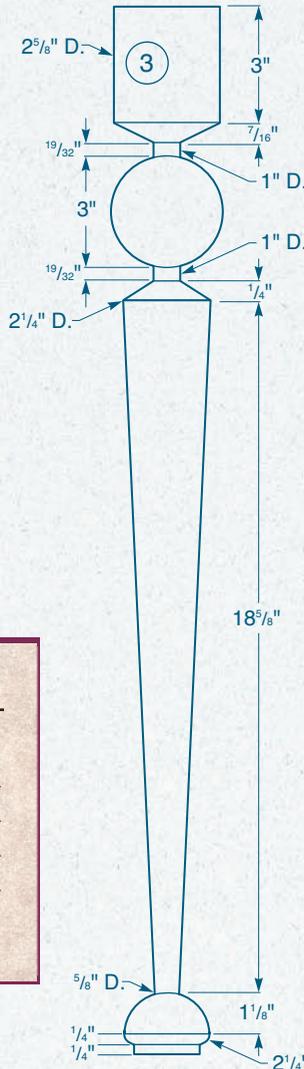
Exploded View



Top
(Top View)



Leg
(Front View)



MATERIAL LIST

	T x W x L
1 Long Rails (2)	3/4" x 5 1/4" x 36 1/2"
2 Short Rails (2)	3/4" x 5 1/4" x 6"
3 Legs (4)	2 7/8" x 2 7/8" x 28 1/8"
4 Top (1)	3/4" x 13" x 52"
5 Disks (2)	1" x 3"



A V-shaped clamping block prevents damage to the cylindrical leg and allows you to apply pressure where needed.



This image clearly shows the quality of the shoulder line and the V-groove that promotes tight contact.



Using an upcut spiral bit, the author was able to remove the excess as shavings, leaving a smooth, clean-cut top rail.



Check for twist with winding strips, the same way as you would for a square stock assembly.

Dry Fit and Check for Accuracy

Conduct the usual checks, but with a slight difference. Use the lathe centers to check for parallel: the bottom reading should be the same as the top. You can spread the legs or toe them in by moving the clamp up or down on the V-block. To check for twist, balance and sight winding strips the same way as you would for a square stock assembly.

Gluing the Underframe

I used dowel joints, a joinery method I shunned when I first started woodworking. I've changed because dowel joints have changed. First, the holes are made with a multi-spindle head, so whether you use two, three or four, they will be exactly spaced and in line. Second, the accurately machined drill revolves faster, leaving a perfectly cylindrical hole with smooth sides. Finally, the splined dowels are accurately made, and the splines increase the

straight cutters tends to turn the excess into dust, and excessive overhang is prone to tearout.

I used a router table and a Freud 1/2" two-start upcut spiral bit with an end bearing. Spiral bits cut cleaner, producing shavings rather than dust, and I was able to make the cut from end to end, in spite of some challenging end grain in the center semicircle.

effectiveness of the glue. Add all this together and you have a very effective joint — effective, that is, if you take time to properly glue the parts (see the sidebar below). I readily admit that a dowel joint glue-up is somewhat more tedious than other joint glue-ups.

Once the glue-up is in clamps, repeat the accuracy checks made during the dry fit and adjust if necessary.

Dowel Joints: The Key is Proper Application of your Glue



Thoroughly wet the dowel hole. A splurt of glue randomly squirted into the dowel hole will result in dry areas, causing a weaker joint.



Next, wet half the dowel before inserting it in the hole. But don't apply excessive amounts of glue. "Wet" does not mean "dripping."



Insert the dowel and then wet the other half of the dowel. The author uses a paddle as the applicator for the glue. A 1/4" dowel works as well.

Making the Top

In the past, I've stressed the necessity of carefully composing the parts to make the top: it's especially necessary for this table, because it has to sit in harmony with the underframe. Making the top follows the traditional route that would be followed for any solid wood piece of furniture:

- select and compose the pieces,
- joint the edges to be glued,
- glue up,
- plane one side flat, and then plane to thickness.

At this point, the route differs a little because the top has shapes other than rectangular. The next steps are to

- mark the top shape from the pattern,
- saw to 1/16" of the line,
- rout to the line using bearing bits,
- plane/sand and finish.

Once again, each maker has the option of completing a task by a different method.

Here's a short version of the route I followed: after glue-up, I flattened one side on a jointer, thickened on a planer and sanded on a wide belt sander, sawed close to the pattern line with a band saw, and pattern-cut to the finished edge with a router. The edges were softened top and bottom by a 1/8" radius bit to complement the soft feel and curved lines of the whole table.

Finishing Up Those Last Details

Do as you wish with color — satin or gloss, spray or brush. I brushed on a good primer coat because of the intensity of the top color. It gets thoroughly sanded flat in preparation for spraying the final color.

Attaching a tabletop or a chest to its base is traditionally done using buttons and holes formed to allow the top or chest to shrink and expand. Done right, this hidden work is time-consuming and demanding. A more common solution is to run a saw kerf into which fits an offset clip. The clips are thick enough to fit nicely into the 1/8" saw kerf, and their design mirrors the design of a wooden button in that the screw arm is not parallel to the kerf arm, as shown in the photo above. Use a panhead screw for a neat and effective detail.

Ian Kirby is a master woodworker and designer and a frequent contributor to Woodworker's Journal. His next article will be on making and understanding drawings.



Saw close to the layout to line to help prevent chipout or tearout when you template rout to the line. Get within 1/16" or less.



Because the kerf and screw arms of the clip are not parallel, the clip levers off the back of the screw plate. When the screw is driven home, it pulls the top and base together tightly.



The Freud spiral bit left a very smooth edge. With a shank-bearing bit and an end-bearing bit, you can shape the top in fine style.



After sizing the metallic parts, the author applied silver and gold leaf for a quick and handsome finish. You can also mask and spray, or carve or sculpt your own design.



In his three-step painting process, the author used a gray primer to prepare the wood for its dark final burgundy coat. Sanding between those coats is an essential step for a successful painted finish.

Flat-screen TV Media Center

By Mike McGlynn

When the Journal asked me to come up with a flat-screen TV media center, I had a bit of a struggle with the design. My normal leaning toward the Greene & Greene brothers wasn't helping much. Ultimately, I found the answer with a clean, modern look, focusing on simple straight lines and exposed edges of built-up ApplePly® sheet stock.



ApplePly is available in several thicknesses with maple faces and comes in standard 4' x 8' sheets. Although it is a very high-grade product, ApplePly has a couple of quirks that annoy the tar out of me, especially considering that it costs around \$100 for a 1/2"-thick sheet. The first and most annoying problem is that the sheets are rarely flat — in fact, I've yet to see a flat sheet of ApplePly in 20 years of woodworking. Every sheet seems to have a "potato chip" quality to it. Years ago, I gave up trying to fight this annoyance and instead just glue two sheets together using a vacuum bag system to get the thickness I need. This results in a dead-flat panel.

The second little annoyance is that ApplePly isn't truly void-free. A much better description would be "99% void-free."

This isn't that big of a deal; just keep in mind that those voids are going to require some edge filling in places.

Sheet Stock Construction

The upside of this cabinet being made entirely of sheet stock is that the layout and prep is greatly simplified. For a set of cutting diagrams for this project, go to our web site at www.woodworkersjournal.com. When making sheet stock cabinets, I make a parts list and then lay out the parts on scale drawings of 4' x 8' sheets. While laying out the parts, there were three things I kept in mind:

1. All parts, with the exception of the middle divider, are 1" finished thickness and are thus actually two pieces of 1/2" material glued together — two sets of everything.

2. Related to #1: All the pieces need to be cut 1" oversize to allow for trimming after vacuum bagging.

3. Most sheets of ApplePly have a slight taper around the edge of the panel. You'll probably take care of it in the previously mentioned trim step, but keep it in mind.

Cutting veneered sheet stock, especially cross grain, is a pain in the neck. If you are not lucky enough to own a table saw with a scoring blade, you'll need to use an extremely sharp blade. Score the bottom-side cut line with a knife, and tape the bottom cut line with masking tape. Or, you can cut close to the line with a circular saw and then trim to the line with a router and straightedge.

Vacuum Bag Gluing

Once I had all my panels cut up, it was time for an adventure in Vacuum Bagging Land. I have done a lot of this work over the years, so I have some hard-earned information that I can pass on. My first tip is to use Titebond® Cold Press for Veneer glue. I like it because it has a fairly long open time — very good when working with large panels. In addition, it dries quickly and doesn't bleed through when working with veneer. My second piece of advice is to have a dead-flat platen on which to do the bagging. I have a 4' x 8' bench that is absolutely flat. I put the bag on top of this bench and use a 3/4" melamine platen inside the bag. I scored the melamine with a shallow 2" x 2" gridwork of saw kerfs to allow for air evacuation. After I glue the panels and put them together, I tape them tightly with blue 3M masking tape. This prevents a sliding mess as the panels go into the bag. Practically everything you read about vacuum bagging will tell you not to use masking tape, as it supposedly will get so firmly stuck that it won't come off without damaging the panel. Truth be told, this is a big load of #\$\$%! Even after 24 hours in a vacuum bag, the blue tape comes right off with absolutely no problem at all.

A remote control activates the cabinet lift mechanism and lowers the TV (and its "lid") into a compartment at the back of the unit.



“I’ve yet to see a flat sheet of ApplePly in 20 years of woodworking. Every sheet seems to have a ‘potato chip’ quality to it.”

Prior to putting the taped-together panels in the bag, I lay a piece of “breather” fabric over the top and lightly tape it down at the corners. Breather fabric is nothing more than thin polyester batting that allows the air to evacuate quickly and evenly. Sometimes it ends up getting glued to the panel, but you can rip it right off. My last suggestion for vacuum bagging is to get a reservoir tank, if possible. I have a 50-gallon tank salvaged from an old air compressor that I use for my reservoir tank. It is hooked up in-line between the pump and the bag. With a reservoir tank, the pump only cycles about every 30 minutes or so; without it, the pump will probably cycle once a minute.

Working with the Panels

Once the panels come out of the vacuum bag, you can begin to cut them into the proper size parts. This is not quite as easy as it might seem. Despite taping the panels together, there is always a bit of shifting that goes on in the bag, which leaves the panel edges uneven. It’s a pretty elementary thing, but in order to create a square panel, you have to start out with at least one straight edge. On my sliding-top saw, this is easy to accomplish. Alternately, you could use a long straightedge and trim the panel with a router.

The top, which has a hole for the TV lift, is made by what I call the “saw it apart and then glue it back together” method. After straightening one long edge on the top panel, I ripped it into three pieces, as shown in the Drawings. To minimize the effect of the saw cuts, I used the thinnest thin-kerf saw blade that I have. Sliding these strips together, I marked a centerline across all three, and then cut out the lift opening (retaining the drop to make the “lid”). Next, I used biscuits and glue to reassemble the top. When it dried, I trimmed the top to size the same way as the rest of the panels, and then repeated this step for the interior top — except you can toss the drop this time.

Smoothing the Edges

One of the unexpected things you will encounter, if you have never used exposed-edge plywood before, is how long and painstaking it is to finish all those exposed edges! From my experience, it doesn’t matter how careful you are, there will still be saw marks to remove. The logical choice to do this job would seem to be sandpaper, but this just isn’t so — unless you want to have a good shoulder workout. What I found works the fastest is to take a *very* thin cut with a *very* sharp low-angle block plane, followed by sanding with a hard block and 220-grit paper. As with any plywood edge, it’s important to not chip out the corners. I prevent chipping by stopping just short of the corner and then planing from the other direction. The glues in plywood dull plane blades quickly, and even a even slightly dull blade makes a rough cut, so I found myself honing the cutting edge frequently as I went along.

The 1/4" x 1/4" rabbet on the top and bottom panels is a subtle detail that nicely breaks up the faces of the cabinet. I made quick work of these rabbets using a router and a rabbeting bit. Just as with planing the edges, I was careful to not chip out the corners while routing. When I finished routing the reveal, I used a hard block and 220-grit paper to detail the rabbets.

I also had to rout rabbets and dadoes in four other panels. I started by routing the 1/4" deep x 1/2" dadoes in the two front-to-back dividers for the false back. This was easily accomplished on a router table with a fence. I then routed rabbets in the two side panels, to accept the back.

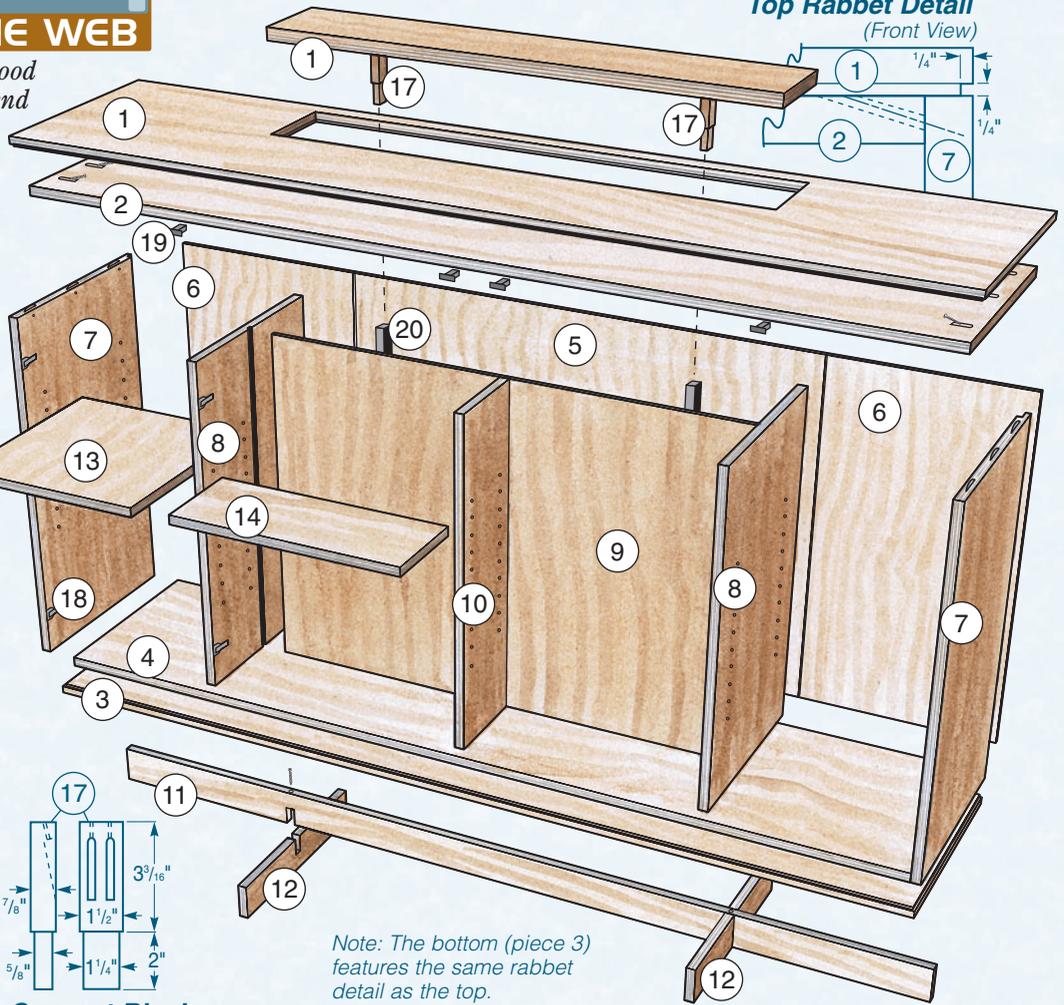
The short and long members of the base are connected with half-lap joints. The author cut the slots to width first on the table saw, then nibbled away the waste in between.



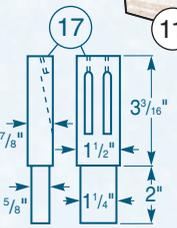
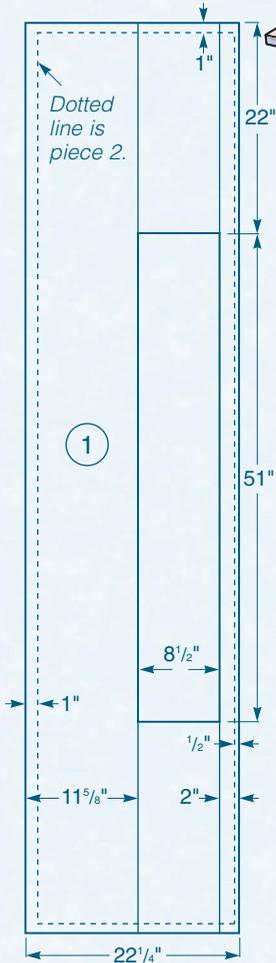
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Top Rabbet Detail
(Front View)



Top (Top View)



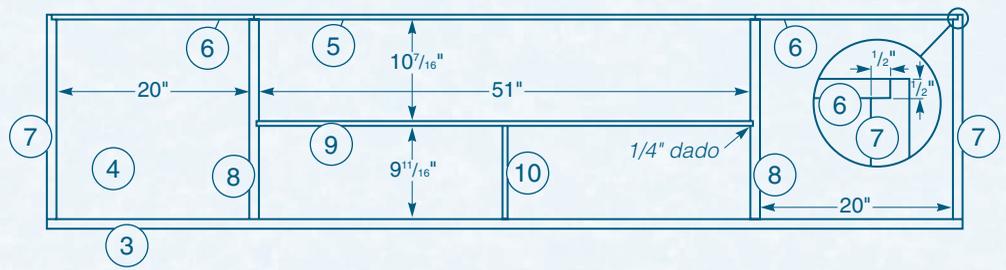
Support Block
(Front and Side View)

Note: The bottom (piece 3) features the same rabbet detail as the top.

Base - Long (Front View)



Carcass (Top View)



MATERIAL LIST

	T x W x L		T x W x L
1 Top (1)	1" x 22 1/4" x 95"	11 Base - Long (1)	1" x 4" x 95"
2 Interior Top (1)	1" x 20 3/4" x 93"	12 Bases - Short (2)	1" x 4" x 22 1/4"
3 Bottom (1)	1" x 22 1/4" x 95"	13 Side Shelves (8)	1" x 19 7/8" x 20 3/4"
4 Interior Bottom (1)	1" x 20 3/4" x 93"	14 Middle Shelves (8)	1" x 9 5/8" x 24 7/8"
5 Middle Back (1)	1/2" x 52" x 38"	15 Outer Doors (2)	1" x 21 7/8" x 38"
6 Outer Backs (2)	1/2" x 21" x 38"	16 Inner Doors (2)	1" x 25 5/16" x 38"
7 Sides (2)	1" x 21 1/4" x 38"	17 Support Block (2)	7/8" x 1 1/2" x 5 13/16"
8 Front to Back Dividers (2)	1" x 20 3/4" x 36"	18 Hinges (4 sets)	European & Soss
9 False Back (1)	1/2" x 51 1/2" x 36"	19 Door Catches (4)	Hafele
10 Partial Divider (1)	1" x 9 11/16" x 36"	20 TV Lift (1)	(see page 49)



There's no way around it: shelf-pin holes are tedious to drill. A drilling jig at least ensures they'll all be evenly spaced when you're done.

For me, sanding a furniture project is a two-step affair. I do all the sanding I can before I assemble the pieces, and then I do a detail/touchup sanding on the assembled piece before finishing. This is especially true on a project that has a lot of flat panels. I sanded all the panels with a random orbit sander, starting with 120-grit paper and finishing with 220.



Use a sharp block plane, followed by careful sanding, to clean up saw marks on the exposed plywood edges.

“The glues in plywood dull plane blades quickly ... I found myself honing the cutting edge frequently as I went along.”

Center-out Assembly

Assembling this cabinet was a matter of starting at the center and working outward. I began by attaching the short partial divider to the false back with screws and glue. I then attached that assembly to the longer front-to-back dividers using glue and screws. Prior to attaching the interior bottom panel and interior top panel, I laid out and cut a series of pocket holes on the ends of the hidden face of each piece. I then attached these panels to the center assembly with glue and screws. I made sure to lay everything out and drill pilot holes for all the screws. I laid out biscuit joints on the ends of the bottom panel and top panel and their corresponding side panels. Using pocket screws, biscuit joints and glue, I then attached the side panels.

The “foot” on this cabinet consists of three pieces that are joined together with a half-lap joint. I attached the three pieces with a single long screw driven into each joint. Once assembled, I fastened the foot to the bottom with multiple screws and glue. I love it when something is hidden like this: I can screw parts together to my heart's content — and none of them show.

I attached the top to the assembled center section using screws through the interior top. The bottom and foot

subassembly was attached to the center section with screws.

Tricking Out the Lift

The TV lift I chose for this project is a “forklift” style available from Rockler Woodworking & Hardware. The directions for this lift showed the top cover being hinged and the lift pushing it open as it raised. I found this to be a completely ludicrous idea. For starters, the cover would either flop back out of the way or ride against the lift as it rose. I found both options unacceptable. With a little “Rube Goldberg”-style engineering, I was able to figure out how to have the cover rise with the lift. My solution was to take the caps off the top of the rectangular steel tubes that support the back of the TV and make a wood plug to fit in them. I could then attach the cover to the plugs with pocket screws. To make sure the TV would be completely visible when the lift was up, I blocked up the base of the lift about three inches. Once the lift was in place, I was able to fine-tune the height of my top mounting blocks until the cover sat perfectly flush with the cabinet top when closed.

Installing the Hinges

This cabinet has two different types of hinges on it: Soss hinges for the outside doors and Euro-style hinges for the inside doors. I would have preferred to use Euro hinges throughout, but you can't get Euro hinges that will *completely* overlay a 1" edge. This is regrettable as Euro hinges are so much easier to install and adjust. My desire to have full overlay doors without seeing the hinges pretty much limited me to

The author used a motor-driven, “forklift” style lift from Rockler Woodworking and Hardware to raise and lower the television in the cabinet. He turned to a combination of Soss and Euro hinges to hang the thick doors.



Soss hinges. Installing the Euro hinges on the center doors was a simple matter of drilling the appropriate holes and mounting the hinges. Installing the Soss hinges was quite another matter. You can buy templates for routing Soss hinges. I prefer to use my own shop-built jig. In any case, be extremely careful as you rout out the mortises for these hinges. You basically have one shot to do it right ... practice on some scrape wood!

After installing the hinges, I hung the doors and did whatever adjusting and trimming was necessary to have them all line up properly.

There are an amazing number of shelf support holes in this cabinet. It is much easier to drill them with the back off and prior to finishing, rather than afterward. I used a shelf-pin drilling template, clamped it in place with a couple of spring clamps and methodically drilled all the holes with a brad-point bit. A simple masking tape stop controlled the hole depths.

The next thing to do was to fit the back. I chose to make the back in three pieces, so that if you only need access to one section, you don't have to remove the whole back. After fitting the three pieces, I drilled them all for attachment screws. I have found that it is almost always better to attach cabinet backs with screws rather than nails. You just never know when you will have to take the back off a cabinet for some reason. When attached with screws, removal is a piece of cake; with nails, it is a major pain in the neck.

The shelves were the last thing to do before finishing. Because they are 1" thick and have an exposed edge, these were probably the easiest shelves I have ever made.

Applying the Finish

When you reach this stage, the cabinet is now complete except for finishing. Prior to finishing, I disassembled the entire cabinet. I made sure to mark all the hinges and their corresponding pockets to ease reassembly. I then went over the entire cabinet methodically and touched up any scuffs or sharp edges with 220-grit sandpaper. Three coats of sprayed synthetic, catalyzed lacquer were my choice of finish.

Once I was done finishing, I reassembled the cabinet. For door catches, I used item #245.50.301 from Hafele. These are touch-latch catches that use a ball system instead of magnets. I have always hated the way that magnetic touch latches barely have the strength to hold a fly; on the other hand, you could probably pull a truck with these catches without them opening. They are really great in an application like this, where there is potential for a large door to warp a little bit and get out of alignment.

Good Old 20/20 Hindsight ...

If you read this magazine on a regular basis, you know that I have a great love of Arts & Crafts furniture, especially the designs of Charles and Henry Greene. What you most likely don't know is that I'm also a huge fan of Modernist architecture and design. I have a really great appreciation for a clean, modern piece that is simple and aesthetically pleasing. In some ways, this is a more difficult thing to pull off than the more traditional designs. I'm relatively pleased with how this

project turned out. I like the simplicity of the lines, but I don't think the exposed edges were worth the trouble. I'm inclined to think that it would have been just as successful if it had been made out of MDF-veneered sheet stock with veneered edges.

So, from here forward, if editor Rob Johnstone ever hears me suggesting making a project with exposed plywood edges, he has my permission to smack me in the head with a carving mallet until I change my mind ... really!

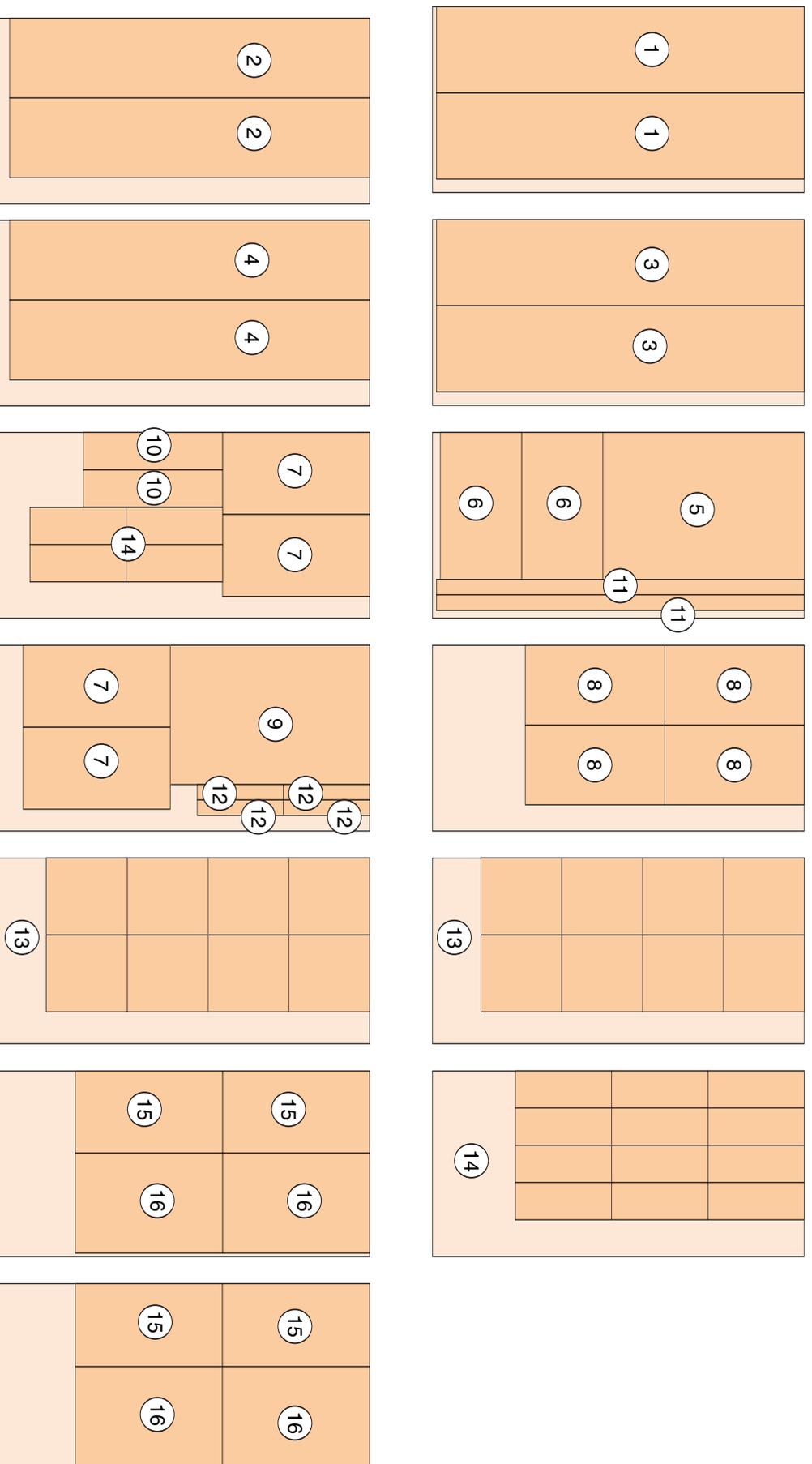
Mike McGlynn is a long-time Journal contributing editor.

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Plywood cutting layout diagram



Numbers refer to parts listed in Material List for Flat-screen TV
 Entertainment Center in November/December 2006 issue of
Woodworker's Journal.



Six Super

There's no question that a router is woodworking's most versatile power tool. All the new routers, bits and accessories that flood the market every year make it clear. But if you only pull out a router for knocking off edges, you're missing out on a bunch of other great things it can do. A router is perfect for cutting dadoes, duplicating



By Bill Hylton

Router Tricks

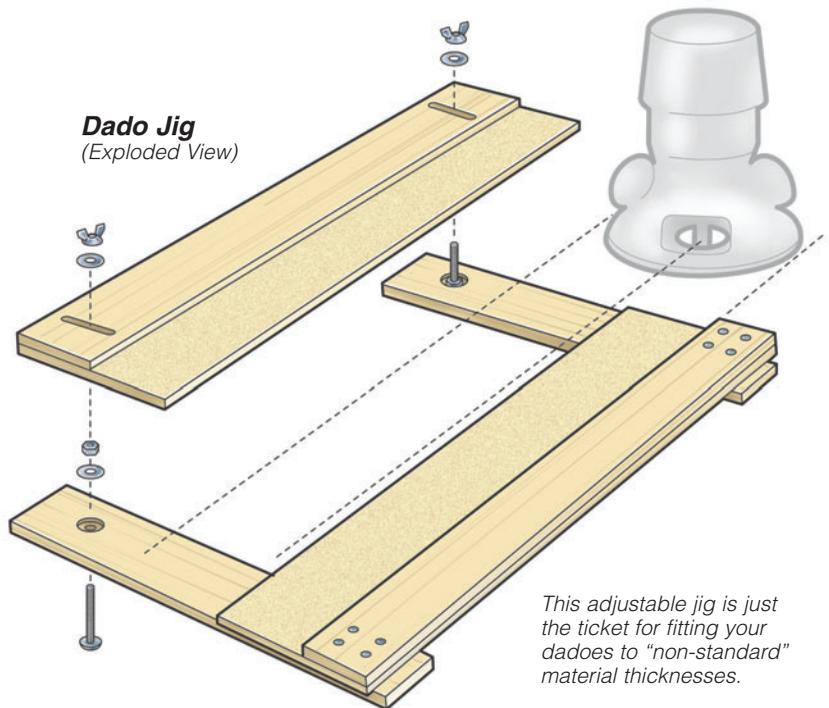
parts, cutting circles and more. It will joint edges on par with the best jointer out there and can even surface boards your planer can't touch. All it takes is the right technique and a few simple jigs. Here are six of my favorite, tried-and-true techniques you just plain have to try for yourself. You'll love these, trust me!

Milling Custom-width Dadoes

The dado joint is excellent for casework: simple, strong and easy to cut (especially with a router).

The chip in the glue, so to speak, is properly matching a dado's width to the stock thickness it's intended to fit. Plywood is notoriously variable in thickness, and solid wood continually expands and contracts. But each straight bit cuts a set groove width. So you rout with what you've got and hope you get a snug fit.

Here's a simple-to-make jig that resolves the problem. It has two fences to trap the router: One is fixed and the other is adjustable. The bit can only cut in the gap between the fences. If the fences are just far enough apart to accommo-



This adjustable jig is just the ticket for fitting your dadoes to "non-standard" material thicknesses.



Set the router on the jig with the bit in the gap and clear of the work. Pull the router along one fence, then push it back along the other to mill the dado. The fences keep the router from wandering off course so it cuts the dado to the exact width you require. It doesn't get much easier.



The critical step to building the jig is trimming the fence bases with the router and bit you'll always use with the assembled jig.



Slip a couple of scraps as thick as the dado you want to cut between the fences. Squeeze the fences tight, then tighten the knobs on the adjustable fence. You'll get a perfect, snug fit.

date the router base with no side-to-side play, then the cut matches the bit diameter perfectly. Introduce some additional space between the fences, and you get a controlled cut that's wider than the bit. This allows you to adjust the jig for any dado width you want to cut.

While you can set the gap, and thus the dado width, by measuring, it's easiest to use scraps as gauges.

Set scraps of the working material between the fence bases. Slide the movable fence so the scraps are pinched tight, and lock down the fence knobs. Yank out the scraps, and the jig is ready to be positioned on the work. Simply line up and clamp the fence base right on the layout line.

When you cut, the router can't veer off course, regardless of feed direction, because it's trapped. Just

run the router along one fence and back along the other to cut the dado.

Construction of the jig is pretty easy, and it should be evident from the *Exploded Drawing* at left. The key step is trimming the fence bases (see *photo*, above left). Guide the one router and bit you've chosen to use exclusively for this jig along each fence to trim both base sections to their exact final sizes.



As you guide the router along one fence, the cut is immediately adjacent to that fence's base. The cut is completed to the full desired width on the return pass.



Regardless of stock thickness, you can produce perfectly fitted dados. Here are dados fitted to 7/8" solid wood, 3/4" plywood, 5/8" solid wood and 1/2" plywood, all cut with a 3/8" straight bit.

2 Routing Perfect Edge Joints Every Time

The router is a terrific tool for jointing the edges of boards for an edge-to-edge glue-up. All you need is a 1½ to 2 HP router, a fairly large-diameter straight bit and several long pieces of plywood.

To start, place one of the plywood pieces on the workbench and lay the first of the boards to be jointed on top of it. The plywood elevates the work so the router bit doesn't cut the benchtop. Position a fence carefully atop this board. Here's how: Subtract the radius of the bit from the radius of the router base. From the remainder, subtract 1/16", which is all you want to joint off the board edge. Place the fence that distance from the board's edge.

Clamp all three pieces — plywood spacer, workpiece and fence — to the bench with large clamps.

Rout the edge. If the first pass doesn't completely smooth the edge, shift the fence a nudge and make another pass.

Now set a second plywood piece on the benchtop, with a second workpiece on top of it. The gap between the second workpiece and the just-routed edge of the first one should be about 1/16" less than the bit diameter. Clamp this workpiece to the bench. Guide the router along the fence, moving it in the opposite direction of the initial cut to trim the second workpiece.

Check the joint by unclamping the second workpiece and butting it against the first. (Never move the first workpiece or the fence until you are all done and the joint passes muster.) If the first pass doesn't smooth the whole edge, shift the workpiece and rout the edge again.

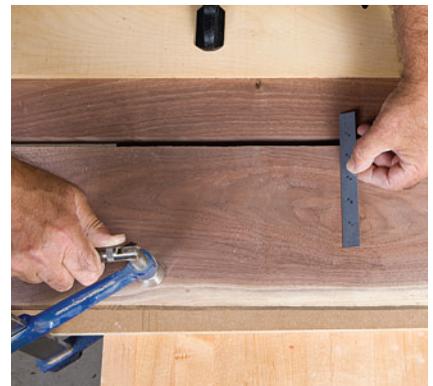
The result is a tight glue joint without using a jointer. Simple and very sweet.



Here's a simple setup that converts your router and straight bit into a "jointer." With a couple pieces of plywood and two straightedges, you can create a tight glue joint in jiffy.



Determine where to clamp the straightedge by measuring from its edge to a reference line drawn on the workpiece.



Bring the mating board into position, and adjust the gap, with a rule, to 1/16" less than the bit's diameter. This is the amount the bit will remove from the second board.



Guide the router along the fence, in the correct left-to-right direction, to mill it clean, square and straight.



These router-jointed edges are as square, smooth and chip-free as you could make on a jointer. As you can see, the glued joint is virtually invisible.

3 Surfacing Stock with a Router and Sled Jig

Surfacing a board or panel's face, like jointing its edges, is commonly regarded as a job for a jointer. But it's a job a router can accomplish, and there are times when the router might be a better choice than the jointer. Make no mistake here; you'd be nuts to habitually prepare lumber using the router. You can't beat the jointer/planer/table saw ensemble to dress roughsawn boards.

But every once in a while, there's a special project where router surfacing is appropriate. Maybe you have a gnarly grained board that's beautiful but difficult to face-joint or plane without tearout. Perhaps you've glued up a thick, heavy, wide solid-wood countertop or benchtop and need to flatten and smooth its uneven, glue-blotched surface.

Here're the basics of how to surface with a router:

Make two expendable "tracks" about 3/4" higher and 6" to 8" longer than the stock. Plant a track on either side of the work; the tops of the tracks must be in the same plane if



Make up a pair of support tracks and fasten or clamp them on either side of the blank. Attach a narrower ledge to the inner face of each track to provide clearance so you can mill to the blank's edges without hitting the tracks.



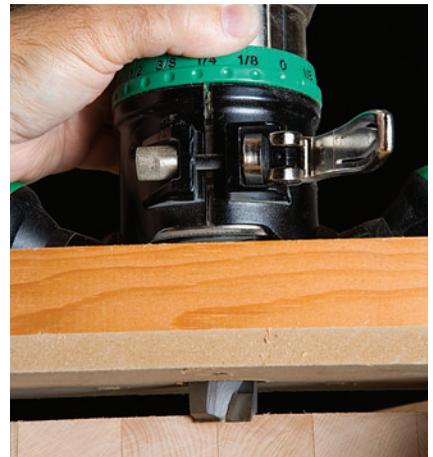
Router surfacing will require a sled that's more than twice as long as the workpiece is wide so there's plenty of overhang on the tracks. Milling the surface involves moving the router and sled back and forth along the tracks, methodically widening the surfaced area.

the finished surface is to be flat. Clamp or fasten them securely so nothing shifts out of alignment.

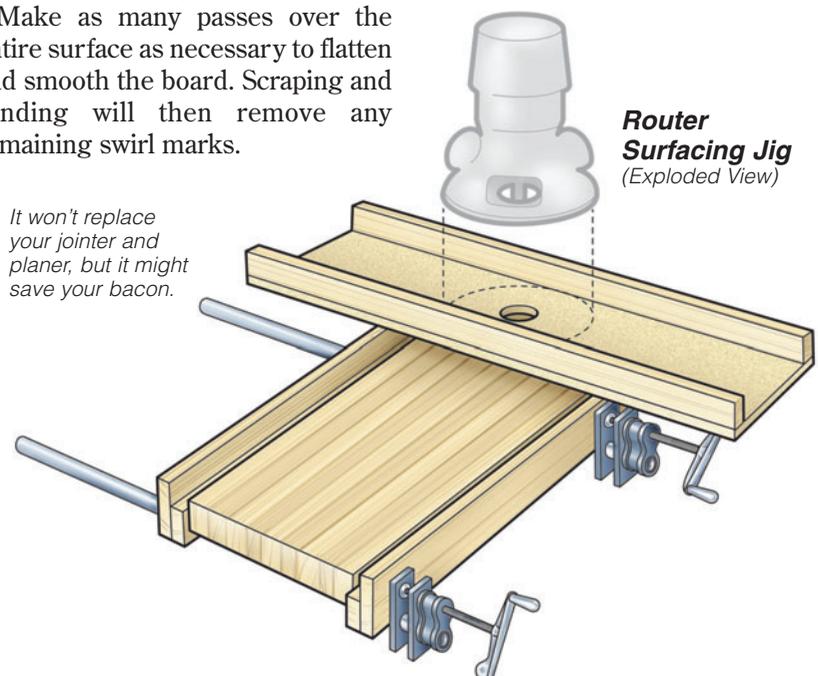
Make a sled and mount the router in the middle. The sled must be flat, true and rigid. Fasten the router to the sled, set it on the tracks and adjust a large-diameter bottom-cleaning bit to remove no more than 1/8" to 3/16" from the high spots. Spot-check the bit depth.

Then rout. Whether you work side to side or end to end, be an automaton. Sweep on one axis, milling a path as wide as the cutter. Click over a notch and sweep again, widening the path. Repeat the same process all the way across.

Make as many passes over the entire surface as necessary to flatten and smooth the board. Scraping and sanding will then remove any remaining swirl marks.



Though a straight bit works, a bottom-cleaning or planer bit cuts a wider swath and often produces a smoother surface.



It won't replace your jointer and planer, but it might save your bacon.

Router Surfacing Jig
(Exploded View)

4 Routing Curves the Easy Way with a Trammel

“Going in circles” often is a way of saying you’re wasting time. In woodworking, cutting circles or arcs is sometimes done in time-consuming ways. So a practical technique for cutting good, clean circles (or arcs) is invaluable.

To cut circles or arcs with the router, use a trammel. Your router may have one among its accessories. If you don’t have one, it’s easy to cut out an oversized plywood baseplate, mounting the router on one end and driving a screw for a pivot point to set the circle’s center. You can make fancier, adjustable versions as well.

Cutting circles is the natural turf of the plunge router. The plunger makes it easy to get the bit into the work and then deepen the cut after each lap. If you are routing completely through the stock, set the plunge depth to the stock thickness plus no more than 1/16".

Setting the cutting radius is where you account for the diameter of the



Measure from the bit and mark the pivot point. Drill a hole at the spot for a pivot nail or screw. The bit is outside the radius if you want a disk, inside it if you want a hole.

bit. If you are cutting a disk, exclude the bit from the radius; for hole cutouts, include the bit in the radius. Typically, you measure from the bit out, either adjusting the pivot point or marking on the trammel where the pivot must be.

Next, you need to secure the workpiece and, at the same time,



Power up, plunge the bit, and swing the router counterclockwise around the trammel’s pivot. (The shop-made trammel shown above left is adjustable.) Plunge a little deeper with the next and additional passes until the bit cuts all the way through. You can use a plywood scrap to make a trammel that pivots on a screw (right) to cut large arcs or circles.

protect the surface beneath it. Attach the work to some expendable material, such as 1/4" plywood, and clamp the backup to the workbench.

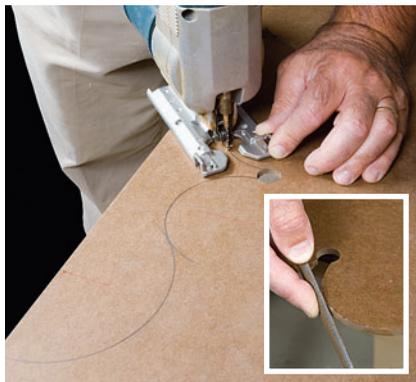
You’re all set. Switch on the router, plunge the bit into the work, and swing the machine around the pivot. Cut your way through in several deepening passes.

5 Duplicating a Workpiece with Templates

A template provides a quick and easy way to produce multiples of parts with contours, like a leg with a kink in it, a curved rail for a chair or a cutout apron for a table or shelf. A template can also be used to make identical joinery cuts.

Template routing can be a smart approach even when you only have one or two tricky parts to make. The materials best suited for templates — MDF, hardboard and thin plywood — are inexpensive and easily worked. If you botch a cheap template when you make it, it’s still better than trashing a \$20 board.

This simplest form of template-guided routing is done with either a flush-trimming bit or a pattern bit. Both have pilot bearings that are



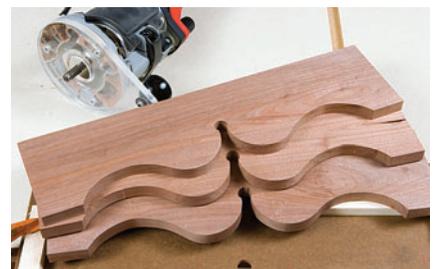
Cut out your template just proud of the layout line, then smooth and refine the sawn edges with files and sandpaper, fairing any transitions.

exactly the same size as the bit’s cutting diameter. The bearing rides along the template, and the bit cuts the workpiece to match.

Make the template exactly the shape you want, using files or sandpaper to smooth the edges carefully. Even little imperfections will telegraph directly into the work.

Draw the template shape on the work and cut it about 1/16" oversize. Mount the template on the blank with double-sided carpet tape, hot-melt glue or clamps. This way the router only has to shave off a sliver of material to bring the workpiece to final size. Works like a charm.

Now, check out the router table on the next page, and you’ll have added six easy techniques that should help turn your router into the wonder tool it’s meant to be.



Identical parts, produced with remarkable ease, demonstrate the benefit of templates. All you need is a piloted flush-trim or pattern bit.

6 How to Set Up a Super Simple Router Table

One of the most productive things you can do with a router is mount it, inverted, under a table. This turns it into a precision stationary tool. You'll be able to rout small or oddly proportioned workpieces, cut joinery and even raise panels safely. Router tables also instill confidence if you're a newbie, because you don't have to hold the router.

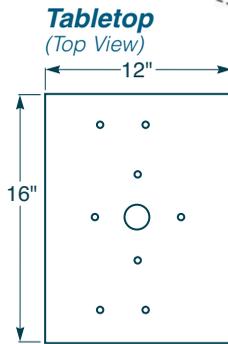
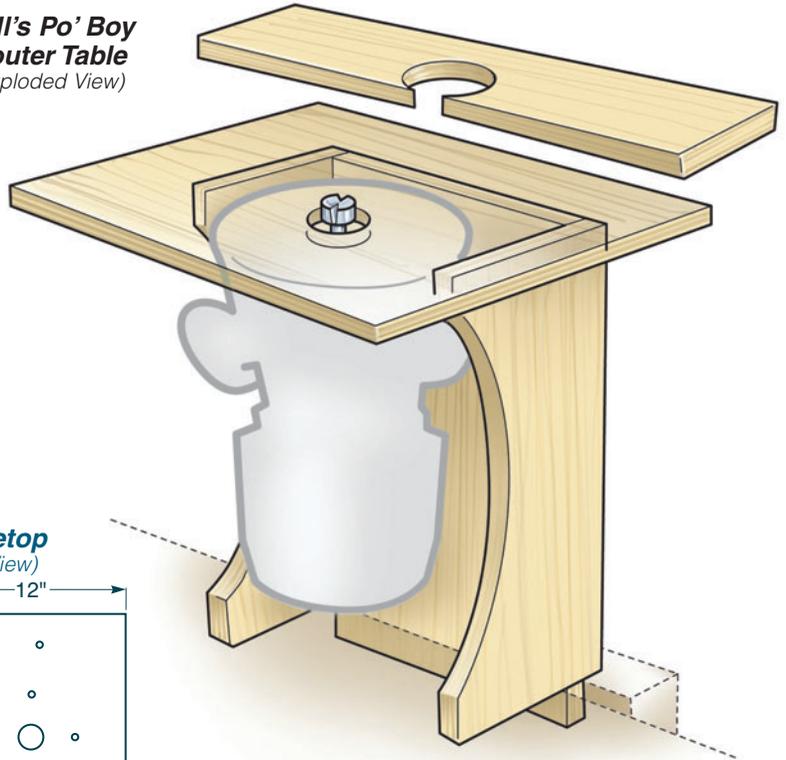
Building a router table is really no big deal. A quick trip to the local home center and a couple of hours in the shop is all it takes to build a basic table for whatever router you own. I call this design the "Po' Boy." When you shop, buy a quarter-sheet of 3/4" plywood (be extravagant and get birch plywood!) and a handful of 2 1/2" drywall screws. Also, buy longer screws to replace the ones that attach the baseplate to your router. All the supplies won't cost you more than about 15 bucks.

Cut the plywood into a 12" by 16" top, two 6" by 14" sides and an 11" by 16" back. You'll have more than half the plywood left, so you'll be able to make a suitable fence. Screw the sides to the edges of the back. You want the back to hang below the sides so you can clamp it securely in a bench vise. Set the top in place and screw it to the base. Now mount your router base to the top using the baseplate as a pattern for drilling mounting-screw holes. To make the bit opening, chuck a big straight bit in the router and plunge the bit through the top.

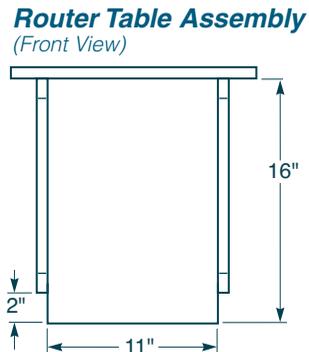
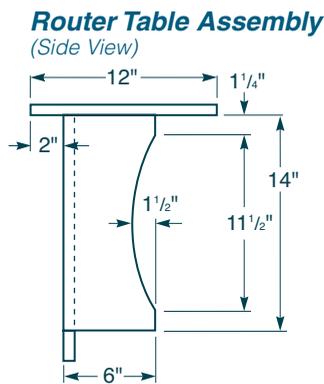
Bingo! You've got a router table. With the plywood you have left, you can make a low fence — just a straightedge, perhaps with a notch for the bit — and a tall L-shaped model with dust pickup. Secure either fence style to the tabletop with clamps.

Bill Hylton, a frequent contributor to Woodworker's Journal, is author of "Woodworking with the Router" and many articles on router techniques.

Bill's Po' Boy Router Table
(Exploded View)



The extra-long back is designed to be held securely by a bench vise or clamps.



A router table will cut dadoes and grooves (left), shape edge profiles (center) and even raise panels for cabinet doors with a vertical panel-raising bit. All it takes is a little plywood, a couple of hours' time and Bill's "Po' Boy" plan.

Designing an Entertainment Center

By Sandor Nagyszalanczy





Home entertainment used to be really easy: You sat down at the piano and played a song or two while your aunt Gertie strummed along on her ukulele. But for most folks, that kind of entertainment long ago went the way of vaudeville, the Model T and red flannel underwear.

Today's hub of domestic amusement is the home entertainment center, a place where we can watch a movie or television show, listen to jazz or bluegrass tunes, play video games or even surf the Internet. But all that pleasure requires a passel of electronic componentry — TVs, amplifiers, speakers, CD, DVD, tape and game players — that all must be housed and wired together. Many of these require easy access, for changing a DVD or game card, or for adjusting the volume ... directly or remotely.

Besides the style and proportion of the woodwork, many practical and technical requirements must be taken into consideration when designing a good home entertainment center. Among other things, these include how to mount a television screen, locate speakers and wire, ventilate electronic components and store media. While this article won't go into the details of actually building the cabinetry, it will give you a good idea how to plan your cabinet's layout and choose the right hardware to accommodate all your electronic gadgets and make your entertainment center easier to use.

Locating the Television

The first step in designing an entertainment center should be planning the location and layout of its most prominent component: usually the

television. While the overall style and design of your cabinet may dictate the location of the television set, for most comfortable viewing, try to locate approximately at eye-level, relative to the viewer's seating height. Also consider the television's orientation relative to windows and lights, which may cause annoying glare on its glass screen. Sometimes, angling the screen in the cabinet by just a few degrees can reduce glare and make the picture much easier to see.

The huge, dark screen of any mega-size television tends to



Locating the television is often the prime consideration when designing an entertainment center. Consider not only where and how it will be placed in the cabinet, but how sunlight and other light sources will affect the screen (glare).



Highly accessible pull-out media storage shelves (above) can be tucked neatly beside other components and then pushed out of sight when closed behind this entertainment center's inset doors, as shown in the photo at right.

overwhelm the décor of a room, so you may wish to design your cabinet to hide the TV when it's not in use. A pair of tambour or sliding doors, as shown in the *photos* on the previous page, work well for this purpose when there's adequate room on either side of the television. If cabinet space is more limited, flipper-type doors are an elegant choice. This mechanical hardware works with either flat veneered or frame-and-panel doors, allowing the doors to open, then slide completely back into recesses located beside the TV (see *photos*, above). On the downside, flipper door hardware can be quite challenging to install and adjust, so be sure to read ALL of the instructions before finalizing the dimensions of your cabinet.

When sizing the cabinet space for a television, it's always best to measure the actual set you're going to install, instead of relying on

dimensions found in a brochure or online. The size of any given model may change without notice from the manufacturer, leaving you with a too-small space for a too-big TV. Don't size the space to fit the TV too tightly; always leave a couple of inches of clearance above and to the sides of the set, for ventilation.

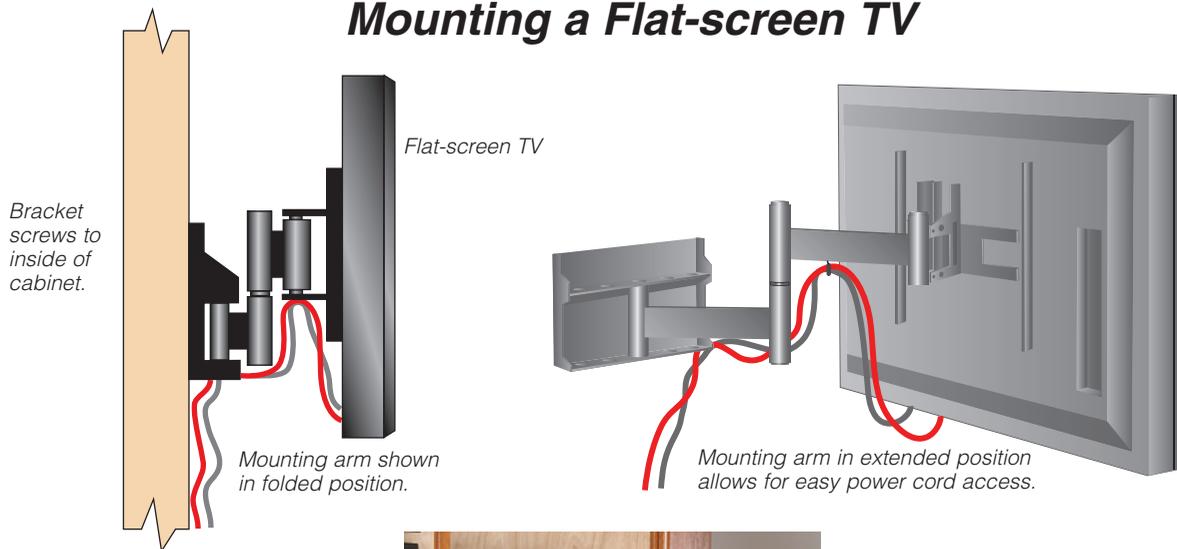
Larger (32" and up) picture-tube and projection televisions can be enormously heavy, so be sure to build your casework accordingly, adding support and beefing up carcass components as necessary to support the weight. If you decide to mount the TV atop pull-out-and-swivel hardware, make sure it's rated to handle your TV's weight and size.

Flat-screen plasma and LCD televisions are much lighter and take up far less cabinet space than picture-tube TVs or DLP and other projection televisions. A flat-screen is easy to mount in a relatively shallow



cabinet recess. But instead of mounting the screen the same way you would hang it on a wall, mounting it on an articulated arm or retractable mount allows you to tilt or angle the screen for optimal viewing (see the web site at the URL www.ergoindemand.com/plasma-tv-furniture.htm). A retractable mount also allows the screen to be pulled out for access to wiring. Just make sure to factor in the 6" or more of additional cabinet depth you'll need to accommodate the hardware.

Mounting a Flat-screen TV



Planning for Other Components

No entertainment center would be complete without a host of audio- and video-playing electronic components. A cabinet for even the most basic home system may contain a half dozen or more devices, including stereo receivers, pre-amps and amplifiers, disc and tape players and recorders, satellite boxes and more.

When planning each component's place in the cabinetry, it's a good idea to put the most often-accessed components, such as CD changers and tape players, at a height that won't force you to stoop or stand on your tiptoes when changing discs or tapes. Also, locate disc and game players no higher than about chest level, so you can read the label on a disc while it's still in the player. Components with lighted displays should be positioned where they're easy to see. Other components, like AC power filter/conditioners and audio amplifiers, need not be seen at all and may be placed inside lower cabinets. If you're a dinosaur like me and still own a record player, mount it atop a pull-out platform set on full-extension drawer slides. The player resides inside the cabinet, yet pulls out when you want to play a record.

Unfortunately, there are few standards for the dimensions of consumer audio/visual components, and individual devices can vary greatly in size, particularly in height. If you do build a custom-sized



The author keeps his prehistoric turntable on a pull-out shelf mounted on full-extension slides (above). Adjustable shelves (below) allow you to change components without building a new cabinet.



compartment for each component, it's unlikely that future replacements will fit. For that reason, adjustable shelves are a great choice for housing multiple components. By creating a bank of shelves inside a cabinet compartment (at least 18" wide), you can set the height of each shelf to suit the height of a component as well as provide ventilation space between them. Because component depth varies, too, make your shelves as deep as your deepest component plus 2", to leave clearance for connecting audio plugs and wires.

Options for Hiding Components

If you don't care for the "techno" look of electronic components sitting in plain sight, you may wish to hide them behind hinged doors, sliding panels or tambours. Such treatments not only give a cabinet a cleaner look, but also reduce dust that can cause problems with the electronics (scratchy sounds when turning audio controls and so forth). The problem is, the infrared (IR) signal from a remote control won't pass through a solid wood door to operate hidden components. One possible solution is to use glass sliding doors or glass-paneled hinged doors. Tinted glass will partially hide components, yet it allows most IR signals to pass through, and you can read a component's lighted display easily through the glass.



The clutter of gadgetry and other media are out of sight and out of mind when this entertainment center's doors are closed. It's a transformation from "media central" to handsome cabinetry.

Keeping Everything Cool

Most electronic components (especially audio amplifiers and picture-tube televisions) create surprising amounts of heat when they operate. To prevent damage to sensitive electronics, heat must be allowed to escape. This isn't much of a problem with open-backed cabinets, provided there's adequate open space left above components (see the device's manual for recommendations). On closed-back cabinets, you can provide a path for heat to escape by drilling a row of large holes near the top of each enclosed space.

seems to come from the screen itself. If the left and right front stereo speakers are also housed in the cabinet, it's best to center them relative to the screen and space them to form an approximate equilateral triangle between speakers and the user's listening position (see *Illustration*, next page).

A more elegant, albeit expensive, solution is to install an IR remote relay system in your cabinet: A small, eye-like receiver, mounted somewhere on the face of the cabinet, collects the IR signal from your remote control and sends it through wires to a connecting block. The block then relays the IR signals to your hidden components via a series of wired emitters stuck to the front of each component, as shown in the *photo* below.



Mounting an IR receiver on the cabinet face allows infrared receivers to operate when the cabinet doors are closed.

Positioning Audio Speakers

Putting speakers for stereo systems and home theater inside the cabinetry can create a cleaner look for your entertainment system. Just be sure to choose speakers with shielded cabinets (designed specifically for home theater systems); otherwise, the powerful magnet can, in close proximity, distort colors of picture-tube TV screens and monitors and ruin magnetic media.

In a multiple-speaker home theater setup, it's advantageous to locate the center-channel speaker close to and above (or below) the television screen. This way, spoken dialogue, predominant in the center channel of a movie sound track,



Pass-through holes are the easiest way to keep wires organized and tangle-free. Drill holes large enough to fit the cord plugs. You'll also need to drill ventilation holes through the back to keep components from overheating.

Cubbies and compartments for speakers housed in cabinets should be sized slightly larger than the speaker itself. To reduce distortion caused by sound reflecting and diffracting, the front of each speaker should be flush with the front of the cabinet. You can prevent annoying rattles and buzzes (due to sound vibration) by fitting each speaker with vibration-isolating feet or setting it on a layer of dense foam. Because of the ultra-low-frequency audio produced by subwoofers (think of the thunderous T. Rex footsteps in *Jurassic Park*), never locate them inside a cabinet, but rather somewhere in the middle of the room. Because low-frequency sounds aren't directional, it's OK to place them off-center, or even behind the couch.



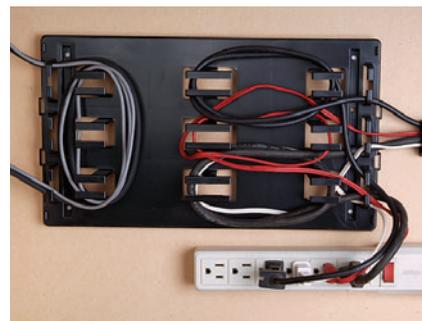
Use cloth-covered frames to conceal speakers that don't match the style or colors of your entertainment center.

Rotating cabinet hardware makes it easy to gain access to the backs of components whenever you want to rearrange or service them. This Accuride hardware and many of the other products in this article are available from Rockler Woodworking and Hardware at rockler.com.



Adding Surge-protected Outlets

Most home theater or entertainment center setups have a plethora of power cords to plug in (say that 10 times fast!). A multiple-outlet power strip, preferably with surge protection and RF filtering, is perfect for this task. Get one large enough to feed future components and accessories, and mount it inside your cabinet wherever it's convenient to reach. This allows you to turn electricity off to all components with one switch, say when there's



Stick-on wire channels and wire organizers are a few economical ways to tame the "snake pit" of audio, video and power cords. Mount a surge-protected power strip nearby to power everything down during storms.

If the appearance of the speakers doesn't match the style of your entertainment center cabinetry, you can fit a cloth-covered panel to the front of each cabinet opening, using speaker cloth that's the color and texture you prefer. To provide access to speakers and give the installation a clean, custom look, staple the cloth to a wood frame that's sized to fit the cubby (see *photo*, facing page). Use hook-and-loop tabs or magnetic fasteners to secure the frame.

Taming all that Wire

Despite the inroads that wireless technology has made with our home office setups, home entertainment equipment is still primarily wire-based, requiring a staggering array of different wires and cables — power cords, audio hookups, speaker wires, video cables and more. If you don't manage and organize your wiring, the back of your entertainment cabinet is likely to resemble a snake pit.

One way to tame the snakes is to use plastic wire channels and organizers. Stuck in place with double-stick tape, channels guide

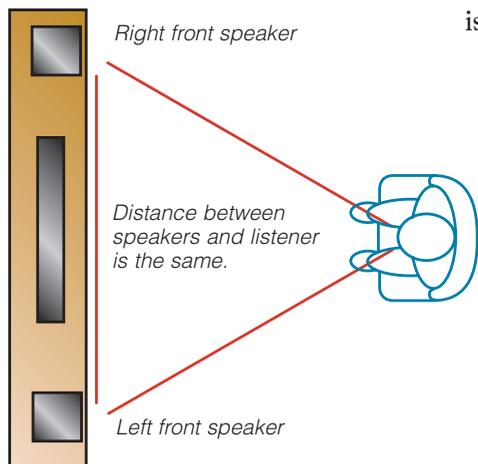
audio wires along cabinet surfaces between components, keeping them neatly out of sight. Wire organizers are great for tidying up excessively long wires and cords (see right bottom *photos*, this page).

The simplest way to allow wires to pass through cabinet bulkheads is to drill holes in them and pull the wires through. Make sure to bore holes large enough to pass the plugs on the ends of the wires (power cord plugs are especially large). It's best to make holes bigger than you think you need, to accommodate future wiring additions. Rounding over the edges of each hole with a router makes wires easier to pull through. To finish off holes that will show on the outside of the cabinet, fit them with decorative cord grommets (see www.rockler.com).

One big problem with electronics housed in cabinetry is that all major wiring connections are on the back of each component. Even if you connect all the wires in your system before attaching the cabinet back (or installing a built-in in its enclosure), it's still a big hassle whenever you need to reconfigure your system or remove components for repair.

The easiest (but most expensive) solution to gaining wiring access is to use special rotating cabinet hardware, such as the Accuride Media Access Center (MAC) system (see *top photo*). The MAC's hardware allows the entire component cabinet to pull out and rotate around, providing ready access to the wiring at the rear. A more economical solution is to leave enough slack in your wiring to allow each component to be slid forward and clear of the cabinet.

The Speaker Triangle





Drawers can become a dumping ground for media unless you organize them. Commercial trays or shop-made dividers solve the problem.

or adjustable shelves are the easiest option, and they are the

A couple of final caveats for media storage: Never locate media in shelves or drawers above amplifiers and other components that produce lots of heat, as this can damage them. And never store magnetic tapes and media near unshielded speakers or picture-tube televisions, as they're likely to be ruined. Also, some plastic media organizers hold only one type of media, while others handle several different kinds; plastic CD racks usually won't hold double-disc CDs.

Sandor Nagyszalanczy is a furniture designer/craftsman who wrote the New Built-Ins Idea Book, available from a variety of online booksellers.



Commercial plastic racks turn those narrow, underused cubby spaces into functional storage bays for tapes, CDs and DVDs.

a thunderstorm or you're leaving on vacation. To avoid AC power from electrically disturbing audio signals, rout power cords apart from audio cables whenever possible (note how the two types of cords are run separately in the wire organizer pictured on the previous page).

Organizing Media Storage

The best CD player in the world is worthless without something to play in it. Even if your iPod is brimming with tunes, you're likely to have lots of other media — CDs, DVDs, VHS tapes, audio- and videocassettes that need storage and organization.

Where you store media depends in great part on the design of your entertainment center. Simple, fixed

best choice for storing record albums (remember those big, round, black discs?). If your cabinet includes drawers, it's easy to keep media neatly arranged by adding either shop-made dividers or a commercially made storage tray (see *photo*, above). Narrow vertical spaces (often left over at the outer edges of your cabinet or on either side of a large-screen TV) are a great place for CD, DVD and VHS tape storage. Commercial plastic racks and holders are easy to mount, and they provide ready access to your media (left *photo*).

If your entertainment cabinet is 14" to 16" or more deep, you'll get the greatest amount of storage in a narrow space by creating a multi-tiered pull-out. The DVD/VHS tape storage pull-outs shown in the *photo* at right are made from 1/2" birch plywood. A pair of full-extension, heavy-duty drawer slides on the back of each pull-out allow it to glide out of the cabinet like a tall drawer. Depending on your design, you may also be able to use bottom-mounted drawer slides and hide them behind cabinet doors.

Clever planning can transform all of the otherwise unused areas of an entertainment center into useful, easy-to-access storage for all your media.



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Trim Router Rally

By Chris Marshall

These little dynamos prove that big things really can come in small packages

Up till just a few years ago, I was a trim router skeptic. How could a little laminate trimmer compare to the performance and versatility of my other mid-size routers? Boy, was I in for an eye-opener. A couple of hours' time with a trim router was all it took to change my mind. These days, I reach for my trim router every chance I get.

While it's true that a trim router only packs about 1 HP max, one pony is enough to deliver a lot of punch in a conveniently small package. It will accept any 1/4"-shank profiling bit with an overall cutting diameter up to an inch or a little more for shaping edges or adding



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TOP 10 REASONS TO OWN A TRIM ROUTER

1. Trims laminates and veneer with ease
2. Shaves solid-wood edging flush with shelving
3. Profiles, chamfers and rounds over edges
4. Excavates inlay mortises
5. Template routs with a guide collar or flush-trim bit
6. Cuts hinge mortises on narrow door stiles
7. Mills rabbets, tenons and other joinery
8. Follows letter templates for sign-making
9. Accepts optional tilting and offset bases
10. Micro-sized to go where no other router will fit

Tool Review continues on page 70 ...

decorative beading. Switch to a flush-trim bit and you can use it for trimming veneer or doing moderate template routing. Add a guide collar, and you've got a perfect inlay cutter. Or, chuck a straight bit to cut dadoes and grooves. It'll ride the edge of a cabinet door for routing hinge mortises and even tackle dovetails, tenons and rabbets. In short, it's really a fixed-base router that fits in your pocket.

In my opinion, a "good" trim router should be comfortable in hand and small enough to navigate a board edge, easy to change bits, have a base capable of fine depth adjustment and — last but not least — deliver lots of power. How well did these test routers meet the criteria? Well, my cutting challenges were tough: milling large roundovers and deep dadoes in hard maple. While there are no really bad apples in this bushel of trimmers, some are definitely sweeter than others. Here's my take on them all and which tool earns our "Best Bet" accolade.

Bosch PR20EVSNK Colt

Sometimes a tool is so well designed that it sets the standard for its category. I think this Bosch Colt could become the trim router benchmark. Here's why: Starting at the top, the contoured motor housing fits a palm like a hand in a glove. Bosch adds a soft wraparound overmold to provide even more comfort.

The standard base is also a pleasure to use. Flip the buckle lock open, and the motor slides right out of the base with just a quarter turn. Not all trim routers provide a means for making both coarse and fine depth adjustments, but both functions are easy to do here. Twist the motor to the "unlock" position and it slides up and down, then engage the lock and use a knurled knob to micro-adjust the cutting depth. A graduated scale helps track your depth changes.

The Colt's large subbase provides enough footprint so the



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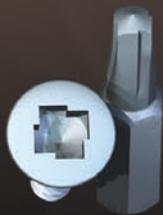


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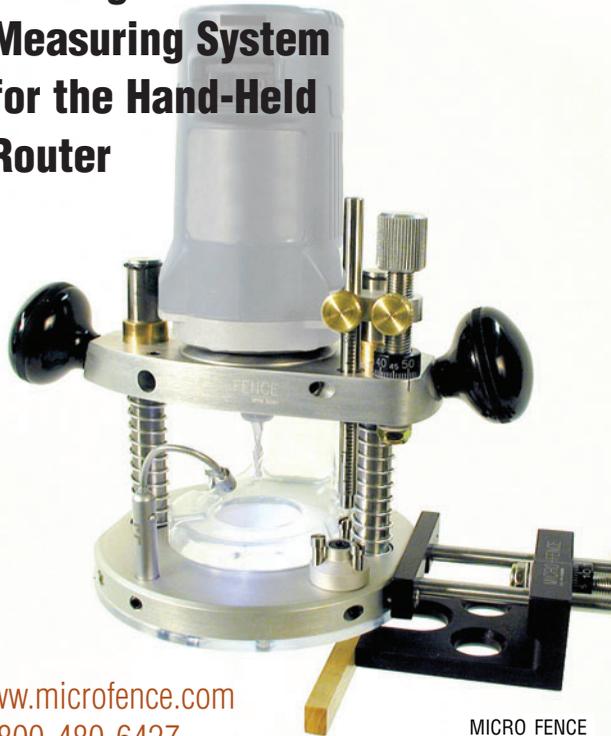
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Creature comforts, soft start and loads of power make the Colt an excellent trim router.

BOSCH

Model: PR20EVSNK Colt

Price: \$199

Phone: 877-267-2499

Amps/Speed (rpm): 5.7; 16,000 - 35,000

Soft start: Yes

Base size: 3³/₈" x 3⁵/₈"

Weight (lbs): 3.3

Height: 7¹/₂"

Noise (dB): 95

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tool is easy to steer around corners or balance on the edge of 3/4" stock without feeling tippy. I also like the pair of "finger support pockets" on the base that let you get a second hand safely on the base to guide those delicate cuts. The 1¹/₂" bit opening is also the largest in this test group. It's still tough to see what the bit is up to at times inside a tiny base, but the oversized hole makes viewing a little easier and allows the use of larger bits. Bosch guide collars fit the opening for template routing.

Bit changing is a one-wrench operation, thanks to a spindle lock, but the switch was a little finicky to manipulate, and sometimes it slipped out of engagement.

In testing, the variable-speed motor powered up gently and zipped right through hard maple, making 3/8"-radius roundovers and cutting 1/4"-deep dadoes in a single pass with a 1/2" bit. Power delivery was unwavering, thanks to Constant Feedback Circuitry™ that controls motor speed under load. Vibration was a non-issue, and the motor ran nice and cool.

Long story short: All the desirable standard features are here. The kit I was sent includes roller and straight edge guides, tilting and offset bases and a laminate seaming base. If you don't need the extras, you can also buy the Colt with just a straight edge guide for around \$119. Either way, this is a dandy machine.



Compact and powerful, the 27715 trim router is up to task for general home woodworking.

CRAFTSMAN

Model: 27715 Professional

Price: \$100

Phone: 800-932-3188

Amps/Speed (rpm): 4.5; 25,000

Soft start: No

Base size: 3¹/₂" x 3¹/₂"

Weight (lbs): 3

Height: 7"

Noise (dB): 84

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Craftsman 27715 Professional

Aside from a few cosmetic differences in color and motor cap shape, the Craftsman and Ryobi trim routers in this test are identical. Straightaway, I liked their compact height at just under 7", although the petite sizing might make for a cramped grip if you have really big hands.

Craftsman and Ryobi provide large plastic bases with a tool-free buckle lock that makes it easy to pull the motors out. Ryobi's amber base is a little easier to see through than the smoky-colored Craftsman base. One concern I have about the design is that the motors are held in place by friction alone; there's no secondary restraint to prevent the motor from shifting during a heavy cut. This wasn't a problem during testing, but keep the buckle adjusted tightly to avoid slippage.

I also wish the base had a micro-adjust feature for better depth control. The only way to tweak cutting depth is to unlock the buckle and slide the motor up or down — it's a crude operation that could use refinement. The bit opening is a bit too large to accept standard 1³/₁₆" guide collars.

The collet style also leaves something to be desired. The other test routers have "nut and sleeve" collets like larger routers. Here, the inner sleeve is actually an integral part of the motor shaft. If a bit slips and scores the sleeve, it could ruin the shaft.

On the upside, both machines run quietly and smoothly, and the tiny 4.5-amp motors were impressively powerful. This pair easily routed 3/8" roundovers. Same story when I plowed 1/4"-deep dadoes: no problems in the power category.

Choosing between the two, you'll save around \$20 buying the Ryobi and get the same extras: a two-

Tool Review continues on page 72 ...

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DEWALT

Model: DW670

Price: \$99

Phone: 800-433-9258

Amps/Speed (rpm): 5.6; 30,000

Soft start: No

Base size: 3 1/2" x 3 1/2"

Weight (lbs): 3

Height: 8 1/2"

Noise (dB): 98

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out of your way while giving your other hand a safe little perch to help guide the cut. This base has a tiny micro-adjust knob that works OK, but there's no way to make coarse height adjustments. A second large knob locks the depth setting. The bit opening in the subbase is standardized to accept 1 3/16" guide collars.

Changing bits is a one-wrench job, thanks to a spindle lock that engages without issue. It's good that the base comes off easily; it obstructs most of the spindle lock.

All in all, around \$99 buys a muscle car of a trim router with all the promise of being durable and hard-

working over the long haul. It comes with a roller edge guide, but DeWalt doesn't provide a carry case, which would be helpful. A variety of optional bases are also available as accessories.

Freud FT750T

Freud's FT750T trimmer generally fell short of the mark for me. At 4.4 lbs., it's the heaviest trimmer in this test and the tallest at just shy of 10 1/2". Large proportions don't help its handling characteristics. The standard base is narrower than other machines, and the smaller footprint makes this router harder to guide along the edge of 1x stock.

Overall, the base is a mixed blessing. It has a nice wide opening around the collet, which makes it easier to use two wrenches for changing bits. Switching bits isn't a problem with the base installed, and that's a good thing: You'll need a Torx screwdriver to remove it from the motor. A two-knob micro-adjust system works well for fine-tuning depth settings, but there's no provision for coarse depth adjustment. Its 1 3/8" bit opening is too small for standard guide collars. You can buy other base styles for this tool, including a plunge base.

Freud outfits this trimmer with a large 6.5-amp motor, which should have provided plenty of power for

handled woodworking base and piloted laminate bit. But, if you plan to use your trim router every day or for precision work, I'd pick a trimmer with a heavy-duty, replaceable collet and better depth adjustment.

DeWalt DW670

Without question, DeWalt earns the checkered flag in this rally for power. No matter how hard I pushed the 670 during cutting tests, its motor never faded or caused the bit to chatter. Cuts were crisp, and the motor drove the bit through maple like a hot knife through butter. Speaking of heat, it didn't take long for the lower metal housing to heat up uncomfortably, which could be a real nuisance if you're routing for long spells.

Other features on the DeWalt were decent but not as impressive as its power. The motor housing diameter feels large, and there's nothing special about the grip. It's the second tallest router at just under 9", yet the proportions are still controllable with one hand.

The standard base design is sturdy and serviceable. Loosening a long locking lever releases the base from the motor for changing bits. A chip guard helps deflect debris



Freud's FT750T is priced competitively with other trim routers, but demanding cutting tests posed a stiff challenge for this machine.

FREUD

Model: FT750T

Price: \$100

Phone: 800-334-4107

Amps/Speed (rpm): 6.5; 27,000

Soft start: No

Base size: 3 1/2" x 3 1/2"

Weight (lbs): 4.4

Height: 10 1/2"

Noise (dB): 94

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Tool Review continues on page 74 ...



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TOOL REVIEW



Makita offers a lightweight, respectable trimmer here. LED lights and a clear base are nice pluses, but it should also come with a tool case.

MAKITA

Model: 3707FC

Price: \$139

Phone: 800-462-5482

Amps/Speed (rpm): 4.4; 26,000

Soft start: Yes

Base size: 3 1/2" x 3 1/2"

Weight (lbs): 2.6

Height: 8"

Noise (dB): 88

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keep that buckle tight when it's locked. Only friction keeps the motor from moving up and down. Makita provides a rubber thumb roller above the buckle for micro-adjusting bit depth. It's definitely not as refined as the rack-and-pinion gear on RIDGID's R2400. The base accepts a guide collar that comes with the kit, but the hole is too big for 1 3/16" collars.

Power this little router up, and it runs quietly without a hint of vibration. A 3/8"-radius roundover knocked off maple edges without issue. Dadoing was a stiffer challenge. Despite electronic feedback control to help regulate torque, plowing dados still caused the Makita to surge under heavy load. The bit chattered and the router became "grabby."

Makita outfits the 3707FC with a pair of LED lights that help brighten up the cutting area — a thoughtful detail. It also comes with a roller edge guide. However, \$139 should also cover the cost of a carry case for this tool, which would make it a better deal.

Porter-Cable 7310

If you like your coffee black and your conversations short, Porter-Cable's no-frills 7310 might be ideal. Its features are straightforward and serviceable, with decent power for general routing tasks.

The 7310's motor will fill the average palm but may be a smidge large for smaller hands. At 3.75 lbs.

my cutting tasks. Unfortunately, it underperformed. It was up to task for milling 1/4"-dia. roundovers, but the motor really labored when plowing dados. The bit chattered, and surges of torque made the router lurch along erratically.

To be fair, I made test cuts on the same piece of maple with the DeWalt; it was an easy feat for that machine. So, the wood was not the source of the problem here.

For around \$100, this tool just doesn't offer the same value as its similarly priced competition with better features and power delivery.

Makita 3707FC

The strengths of this little Makita outshine its weaknesses, which generally made it enjoyable to use. At 2.6 lbs., it's the featherweight of the bunch and reasonably sized for the average hand. The tool is nicely balanced with a large footprint.

Makita is the only machine with a clear plastic base — an excellent feature. Seeing through the base makes it easy to keep an eye on your progress. I like the buckle-lock feature as well. The motor slips out in a jiffy, and a pin in back prevents the motor from twisting if you hit a knot. However, be sure to

it's heftier than some trimmers, but the tool is short enough with a large base to still feel balanced and controllable.

Both coarse and fine depth adjustments are possible using a two-knob system. The lock knob is spring-loaded, and loosening it a few turns allows you to pull the base away from the motor to slide it up and down. Bit changes aren't difficult, thanks to a spindle lock and a fairly wide opening around the collet. I'd suggest keeping the base on the tool when you switch bits. Re-threading the knob on the motor is a tricky job because of the spring.

The plastic subbase opening is sized to fit standard guide collars, but the thickness of the metal base makes it hard to tighten a guide collar's threaded ring securely. I'd use a piloted flush-trim bit instead and skip the collar.

PORTER-CABLE

Model: 7310

Price: \$239

Phone: 888-848-5175

Amps/Speed (rpm): 5.6; 30,000

Soft start: No

Base size: 3³/₈" x 3⁵/₈"

Weight (lbs): 3.75

Height: 7¹/₂"

Noise (dB): 96

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Porter-Cable's 7310 is a no-fuss router that fared well in testing. It should provide good service and will accept many specialized base styles.



Under power, this 5.6-amp tool fared as well as others, zipping through 1/4" roundovers but chattering now and then on the dadoes. Oddly, if you are a right-handed user, the On/Off switch ends up facing away from you, which was a little inconvenient.

My test kit came with a carry case, three bases and a roller edge guide. You can buy the 7310 with only the standard base for around \$99.

Tool Review continues on page 76 ...

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A nice mix of features and power make the R2400 worth a close look when you're ready to buy. This little tool really satisfies.

RIDGID R2400

This tool is just plain fun to hold. The motor housing is smaller than others, so your grip is secure and comfortable even without an overmold. Weight is nicely balanced from top to bottom.

RIDGID

Model: R2400

Price: \$100

Phone: 800-474-3443

Amps/Speed (rpm): 6;
20,000 - 30,000

Soft start: Yes

Base size: 3 1/2" Dia.

Weight (lbs): 3

Height: 7 3/8"

Noise (dB): 91

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RIDGID gives the R2400 a rack-and-pinion style thumb roller for moving the motor up and down. A wingnut tightens the setting. This base provides a fairly small window for gaining access to the collet. Changing bits is definitely easier if you remove the motor. In order to do that, you have to loosen the

wingnut almost all the way and push on it to disengage the motor. After many attempts, the motor never pulled out easily. It was the only feature that didn't quite shine.

This trim router has a round base style. I like to hold the corners of a square base to help guide the tool along during a cut, so I missed those familiar corners when feeding the R2400 along narrow edges. But that's no deal breaker. The subbase hole accepts standard guide collars.

RIDGID's spunky, variable-speed motor sailed through both the roundover and dadoing tests. No lurching or chattering here, just plenty of power when you need it.

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Tool Review continues on page 78 ...



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Ryobi offers decent value, especially where power is concerned. Just \$80 makes the TR45KT easy on the pocketbook if you only need a trimmer now and again.

RYOBI

Model: TR45KT

Price: \$80

Phone: 800-525-2579

Amps/Speed (rpm): 4.5; 25,000

Soft start: No

Base size: 3 1/2" x 3 1/2"

Weight (lbs): 3

Height: 7"

Noise (dB): 86

For more info on the web: use our



RYOBI TR45KT

As stated earlier, this tool is a virtual twin to the Craftsman 27715 router. I liked the compact height and its quiet, powerful performance in the cutting tests.

The concerns for this router are the same as for the Craftsman. Still, for the price you get a practical, easy-to-use micro router. If you are installing countertops for a living, this is not the proper tool. However, it will rout dadoes or soften edges right along with the big dogs without complaint.

And the Winner Is ...

Considering features, performance and price, the Bosch Colt bags my "Best Bet" award in this test. The folks at Bosch created a real winner with this compact router. Power, accuracy and accessories ... you get the whole package and then some.

A close runner up — and almost a neck-in-neck competitor in my book — is the RIDGID R2400. Either machine should be easy to find and serve you well.

Whichever trimmer you open your wallet to, be sure to explore its full potential for profiling, template work and joinery. I'll bet that these pint-sized and powerful little routers will surprise you.

Chris Marshall builds projects and tests tools on a regular basis as Field Editor for Woodworker's Journal.

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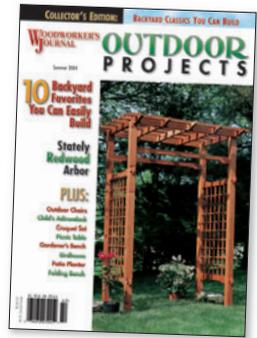
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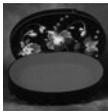


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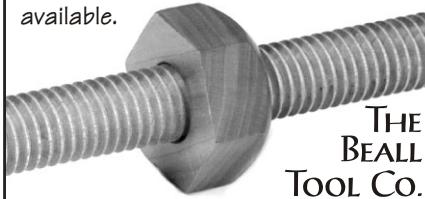
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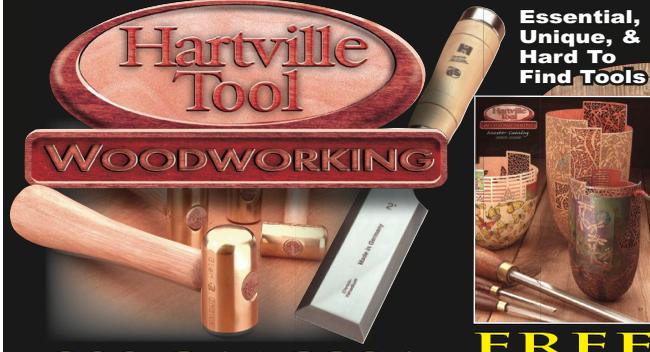
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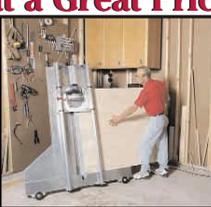
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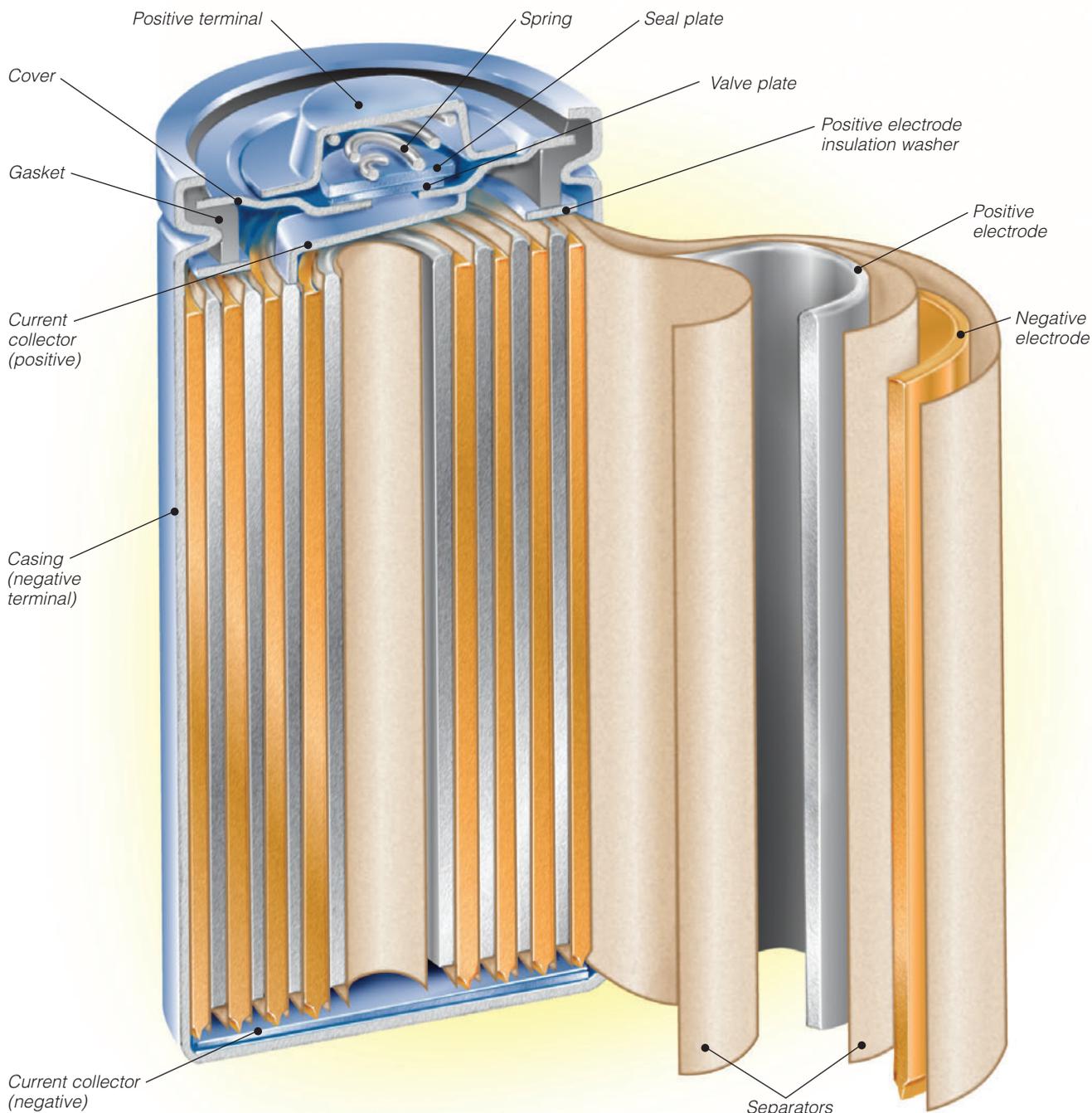
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Lithium-ion's Grand Entrance

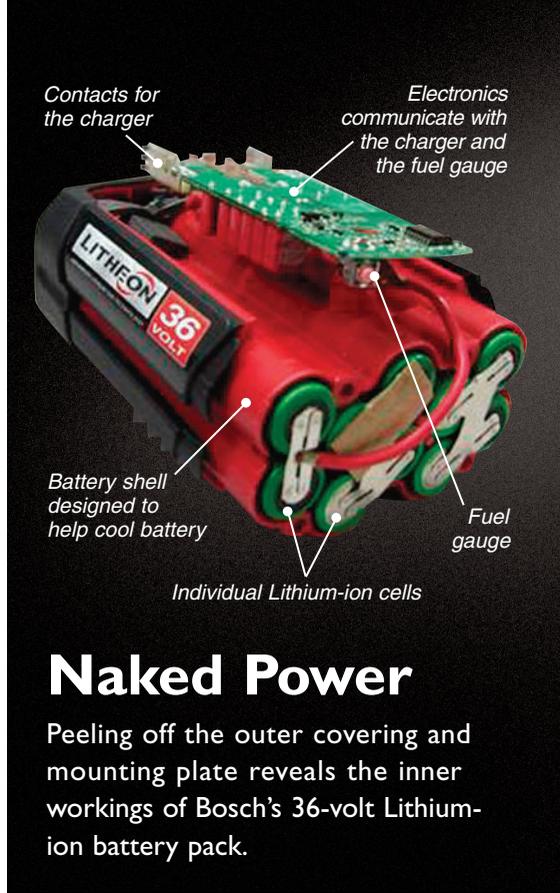
By A.J. Hamler

When it comes to cordless woodworking, the phrase "more power" is inextricably linked to the companion phrase "bigger is better." With the recent introduction of Lithium-ion batteries, all that is about to change.



A Lithium-ion Battery Cell

This cutaway illustration of a single cell from the battery pack shows its "jelly-roll" construction.



Naked Power

Peeling off the outer covering and mounting plate reveals the inner workings of Bosch's 36-volt Lithium-ion battery pack.

We all want our cordless tools to be more powerful, but as they become so, their increased weight makes them increasingly more difficult to use. (Install drywall on a ceiling with an 18-volt drill/driver for a while and your arm will give out long before the battery does.)

It comes as a pleasant surprise, then, that the newest battery technology makes the promise of more power — but less weight.

Woodworkers are being introduced to new cordless tools powered by Lithium-ion (Li) batteries at an accelerated rate. The advantages of the new batteries have been widely touted by nearly every manufacturer offering them. Still, woodworkers know little about them other than they're the same kind of batteries used in cell phones and laptops, they're lightweight, they're capable of higher voltage and they're more expensive. Beyond that, they're an unknown quantity.

What Is Lithium-ion (Li)

Put simply, Li technology's bottom line is more power from a smaller package, thanks to its chemistry. The nickel-based blend in familiar NiCad and NiMH batteries is capable of delivering about 1.2 volts per cell. Simple math tells you that it would take 15 NiCad cells to run an 18-volt cordless tool. Because the chemical blend in Li batteries can deliver about 3.6 volts, it doesn't take as many cells to make that same 18-volt tool run, so woodworkers reap the benefit of either lighter tools of the same voltage, or high-voltage tools of the same weight as less powerful

tools. This is a big leap for the manufacturers of woodworking tools and, by extension, all woodworkers craving higher power without all the weight. And to think ... they did it all for us.

Well, not exactly.

"All the battery companies have had their eyes on hybrid-electric vehicles (HEV) and developing a battery for that," says Christine Potter, group product manager for DeWalt cordless tools. "The HEV industry is very similar to power tools, and because the demands of

power tools are very similar, we've been able to kind of piggyback off a lot of that HEV research."

Still, Li batteries have been around for several years, so why are they only now finding their way into our shops? The main reason is that it's one thing to create a cell to produce higher voltage, but it's another thing entirely to

get enough current out of the cell to do meaningful work. That's why most hybrid-electric vehicles aren't using Li batteries yet, but the technology is extremely workable in the right applications. To date, the main use of Li has been to lower the weight of electrical devices that need the power but not the current.

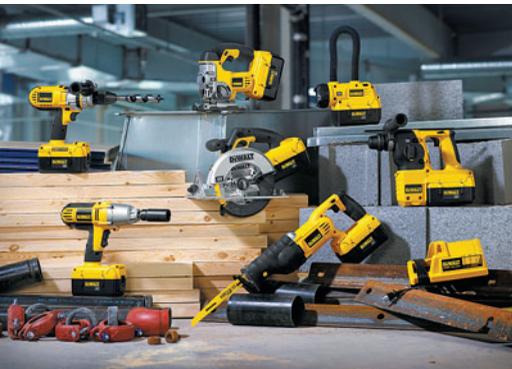
"Cell phones and computers have low-amp draw and consistent power requirements," says Edwin Bender, product manager for

Today's Shop continues on page 86 ...



The higher power and lower weight afforded by Li batteries have led to some tools you may never have seen before. At left is DeWalt's cordless circular saw featuring an industry-first 7/8" blade; at right is Makita's 18-volt cordless band saw.

It's one thing to create a cell to produce higher voltage, but it's another thing entirely to get enough current out of the cell to do meaningful work.



DeWalt's 36-volt Li-powered lineup includes a circular saw, reciprocating saw, flashlight, jigsaw, hammer drill, rotary hammer and impact driver.

Bosch. "If you open up two or three applications on your computer you may get a small blip on your power usage, but essentially it's a very flat-line, easy-to-maintain situation. With power tools, you're doing crosscuts in 2 x 4s and you hit a knot, or you're ripping OSB, or drilling with a 2 1/2" spade bit,

you have much higher power requirements in large chunks."

The trick has been to adjust cell construction and chemistry to be able to provide the higher current — the same thing all those HEVs are clamoring for — so the same type of research the auto industry has been doing for years has benefited woodworkers.

Making a Comparison

Li batteries differ from the current nickel-based standard mainly because the individual cells sealed inside a battery pack are capable of higher voltage, so fewer cells are needed to achieve the same voltage, thus lowering battery weight. That in itself might have assured the technology's future, but the lithium chemistry carries a few other important advantages.

Charge Life

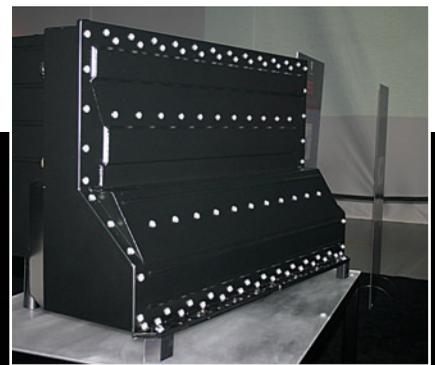
The charge in a tool powered with Li cells lasts longer. We're not



Makita's 18-volt Li circular saw

speaking of the run time here (we'll do that in a moment), but rather of how the electricity dissipates over the life of a single charge.

According to Mathew Shook, product manager at Metabo, Li batteries lose their charge only about two percent within 30 days, whereas NiCads can lose more than 20 percent in the same time. This gives Li-powered tools an incredible shelf life. It's not uncommon to reach for a NiCad drill that hasn't been used in a number of weeks, only to find that there's not much of a charge left. Over a longer



The "guts" of the Tesla Roadster is a power pack made up of 6,831 small (AA-size) Lithium-ion cells. (Photos by RJ Muna)

Tesla: An Electric Car for Car Lovers

Tesla Motors, founded in July, 2003 by Martin Eberhard and Marc Tarpenning, is on a mission to create efficient electric cars for people who love to drive. And it's looking promising. Chairman Elon

Musk has already raised \$60 million in funding and there are already 80 employees, based in California, the U.K. and Taiwan. Their mission: "Design and sell high-performance, highly efficient electric sports cars — with no compromises." The Tesla



roadster (launch date: mid-2007) will be powered by a 3-phase, 4-pole AC induction motor that can deliver up to 248HP — charged by 6,831 small (AA-sized) lithium-ion cells. A home-based charging system is included with the vehicle and is installed in the garage of the purchaser by a qualified electrical technician. For info, visit www.teslamotors.com.

Run Time

Li batteries don't inherently run longer between charges. Run time is a factor of watt/hours, not battery composition.

To figure the watt/hours for a drill with an 18-volt, 2.4-amp/hour NiCad battery, multiply the two numbers together to get 43.2 watt/hours.

A drill using a new 36-volt, 2-amp/hour Li battery will weigh about the same as the 18-volt unit, but will deliver 72 watt/hours, for a considerably longer run time in similar applications.

period, it may be dead. The extremely slow discharge rate for Li batteries, however, means that a tool can be fresh on the shelf for a year or more with no noticeable loss of charge.

This can be especially important for low-voltage, toss-in-a-toolbox utility drivers that may go several months between uses. (See "Mighty Mites," next page.)

Run Time

With NiCads, as you're using them you might notice a tool slowing down considerably in a steady curve as the battery depletes. An Li battery has a flatter discharge curve through its cycle to give full power

throughout its charge, meaning the tool can perform its best even near the end of the charge.

"NiCad slowly loses its power as you use it," says Shook. "Lithium gives everything it has up until

approximately the last four percent of the charge. So when there's four percent left, it drops off and stops running."

Even if you're not familiar with Li tools, you've probably experienced what Shook is talking about. As your cell phone battery nears the end of its charge, it may beep or otherwise warn you that it's losing power, but the phone continues to work the same

— voices don't get fainter, signal range doesn't decrease. That's because cell phones must have a specified level of power to operate

Today's Shop continues on page 88 ...

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Mighty Mites

They're not the most powerful drivers around, but the Black & Decker Smartdriver (above) — and its virtual twin, the iXO from Skil (below) — offer all the benefits of Li technology in a very small and inexpensive package. With just 3.6 volts, these won't be the tools you'll use to build a deck, but they can handle most other quick-driving tasks. Their extremely compact size and the fact that they can languish in a drawer or toolbox up to a year and a half and still come out charged for use, make them handy to have. Weighing about 10½ oz., these little guys sell for around \$40 and include a wide selection of bits and a charging station that can be mounted on a wall.



Li technology's bottom line is more power from a smaller package, thanks to its chemistry.

properly, as do laptop computers. But once the battery reaches the lowest specified level, it simply shuts down. It's the same with Li-powered tools.

No Thanks for the Memory

Li batteries have no so-called memory effect. Whereas nickel-based batteries can sometimes have their charge life affected if the battery is not completely run down before recharging, especially older batteries, lithium-based batteries have no such shortcoming. Like cell phones and laptops, they can be recharged at any point in their charge cycle with no ill effects. If a tool dies with just a few more screws to drive or cuts to make, you can just charge it for a few minutes to get enough juice to finish the job without affecting the battery.

Greener Power

"They're more environmentally friendly," says David Boone, senior engineer at Milwaukee. "There's no cadmium in them to start with, so you don't have the recycling issues related to cadmium."

As recent efforts to promote recycling of used NiCad batteries illustrates, landfills don't need castoffs from the cordless shop. While recycling is still a good idea, not as much potential damage can be done to the environment if Li batteries end up in the waste stream. Shook feels that environmental concerns may even encourage further development in the field.

"NiCads will be phased out as the EPA bears down on the power tool industry," he says. "NiCad is not environmentally friendly at all, neither is nickel-metal hydride. By 2008, all of Europe is supposed to be NiCad-free, and this is forcing manufacturers to perfect lithium-ion technology. Europe is generally ahead of us by a few years, whether

it's dust collection for power tools or the environment. That is going to force our market because that's where almost all our product is made."

Taste Test

All Li batteries offer the same benefits, but they're not all exactly alike. Batteries are a chemical combination, and while the basic chemical properties of lithium remain the same, varying the formula somewhat can yield different results. Combining those varying chemical results with electronics unique to a specific manufacturer can create batteries that won't necessarily be the same as another.

DeWalt uses a lithium-phosphate blend, for example, while Milwaukee Tool favors lithium-manganese. Milwaukee opted for a larger cell size, while Makita chose smaller.

Most of those differences in construction are transparent to the user, but not all are. Milwaukee designs their batteries to run at a steady voltage up to the discharge point where the battery cuts off. Say, for example, that a Milwaukee Li cordless saw gives 100 cuts in a particular application on a full charge. The user won't notice anything different between cut number one and cut 100. Bosch has taken a different approach. Using our hundred cuts as an example, under the same conditions a Bosch saw might show no difference up to 95 cuts, but show a very slight tail-off in power on the 96th cut. As a result of powering down, the Bosch saw might get a few more than 100 cuts, but not quite at full power. But even this tail-off is hardly noticeable to the user, certainly nothing compared to the slow death of the typical NiCad as it winds down.

"It's something controlled by the manufacturer, and not a property of



Lithium-ion but how you design your battery pack," says Bosch's Edwin Bender. "You can structure things through electronics any way you want. You do get a fuller use of the entire energy that's in a Lithium-ion battery pack, but designing it to go to the end and stop is one way of tweaking it. It is true that because of the energy density you have in Lithium-ion, you get more consistent productivity from the beginning to the end of a battery's life cycle."

The biggest difference among manufacturers isn't their chemistry or their electronics, but the choice of exactly what voltage their batteries should be. Each company has its

own theory on what the market wants, so there's something for everyone. DeWalt and Bosch went with 36 volts for their main lines (Bosch also added an ultra-compact 10.8-volt drill/driver), Milwaukee currently offers a 28-volt line but is adding an 18-volt line, and Makita stuck with the tried-and-true 18 volts. Only Metabo currently offers a range of tools more familiar to woodworkers for their lineup: 12, 14.4 and 18 volts.

The end result on the lower end of the voltage scale is that users with no need for the higher power will enjoy lighter woodworking.

"The everyday working man or woman prefers the 18-volt

Of the five companies offering a full range of Li power tools, only Bosch has models at both the high and low end of the voltage scale. These two 10.8-volt drivers are in addition to Bosch's 36-volt line of tools.

Today's Shop continues on page 90 ...

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No high fuel fees for this vintage Chevy! Jesse James and the Discovery Channel's "Monster Garage" gang worked their magic — with Milwaukee Tool's help — to beat the high cost of gas.



Thunder Road Revisited

Power tools demand a lot of, well, power. That's why stronger, better batteries are always welcome. But the energy demands of a cordless drill or circular saw are nothing compared to the needs of a drag racer.

When Jesse James and the crew of Discovery Channel's "Monster Garage" were challenged to transform a shabby 1962 Chevy Bel Air into a souped-up, all-electric mean machine ready for the track, they turned to Milwaukee Tool, the first of the manufacturers to come out with a high-voltage line of Lithium-ion woodworking tools. Working with representatives from Milwaukee Tool and a team that included electrical, welding and automotive experts, James' crew came up with a design that used a pair of DC motors connected to a trunk filled with 384 standard V28 cordless tool batteries. Connected in both series and parallel in a specially designed mounting rig, the

batteries produced 336 volts with a circuit breaker that peaked at 3,000 amps.

The batteries were up to the task ... and then some.

"The first pass they made down the drag strip, they had so much current going through it that they just smoked the rear tires," said Milwaukee's David Boone. "What they had to do was throttle back the current."

After a bit of tweaking, the crew got the current to a manageable level and when it came time for the official test, the electrified Chevy clocked in at over 93 mph, running the 1/4-mile track in a "shocking" 14.53 seconds.

Could they have pulled it off with NiCads? Maybe, but Milwaukee's David Selby said you'd need a lot more of them. "As a pure energy density, Lithium-ion is two-to-one over NiCad, so you'd have needed twice as many, maybe about 2,000 lbs. of batteries," he said, "if it was practical to fit them in."

Lithium gives everything it has up until the last four percent of the charge.

platform," says Makita's Brad Wheeler. "One advantage of bringing lithium into the 18-volt platform, which is the most popular platform in the trades out there, is to make life a bit lighter for most users. Our mantra is basically, '18-volt power, 12-volt weight.' A 28-volt battery may have the weight of an 18-volt battery, but that's still pretty heavy. We wanted to start in the core area, because we feel that to win this game, we need to win the 18-volt platform and go from there."

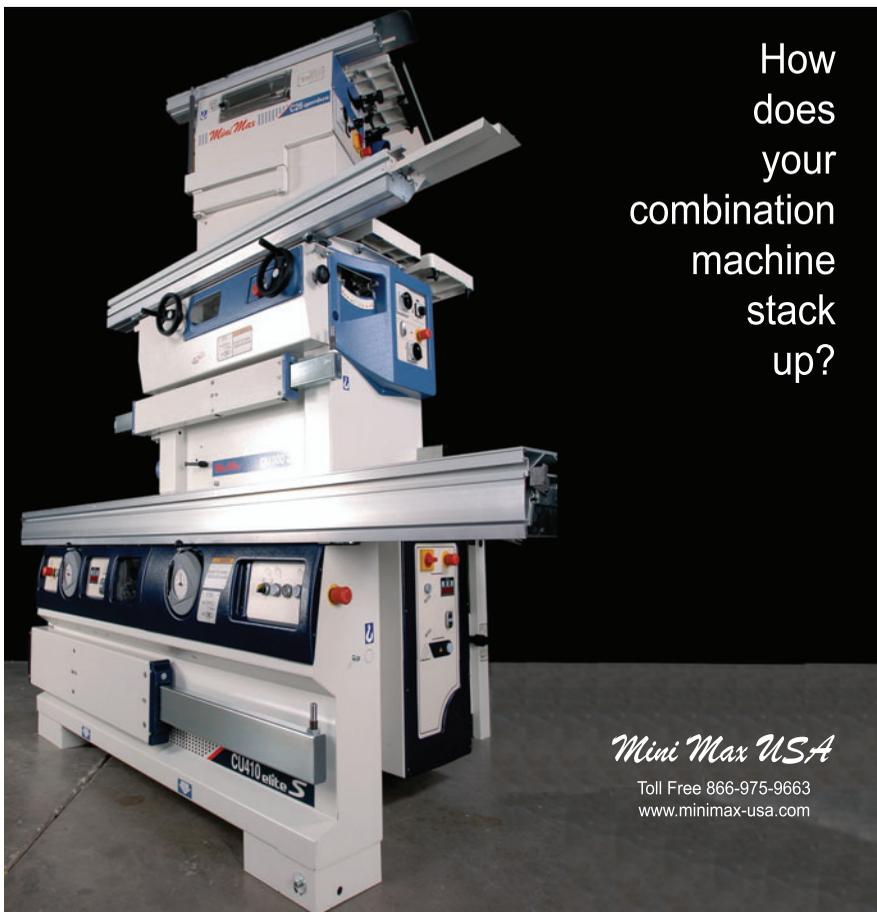
Bosch stayed away from the middle ground to offer tools both higher and lower than what most woodworkers are used to.

"One of the things that Bosch has done differently from anybody else is to invest in a 10.8-volt line, because the dirty little secret is that you don't always need 650 inch/lbs. of torque to drive a 2" screw," says Bender. "The second thing that Bosch has done differently, at least from a couple of the manufacturers, is to go to the highest voltage possible. DeWalt is also at 36 volts, but by going to this higher voltage we get the best efficiency from our tools and a longer run time going head-to-head."

Bender said that another benefit of higher voltage is there's less wear and tear on the battery in heavy-use applications because designing to a higher voltage pulls lower amperage out of the cells. That, in turn, can extend the overall life of the battery, as well as the overall run time between charges.

"Let's say that for an 18-volt drill, an application pulls 2 amps out. If you design it to 36 volts, it'll only pull 1 amp out. It's simple multiplication. It's like the difference between a four-cylinder car and an eight-cylinder car. Driving up a hill, a four-cylinder car has to work

Today's Shop continues on page 94 ...



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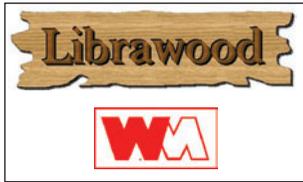


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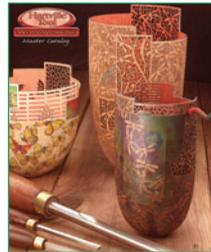


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harder and generate more heat; an eight-cylinder car is going to do it much easier and not have to work as hard.”

And for a battery — any battery, of any type — heat is the enemy. Manufacturers have gone to great lengths to protect Li batteries from heat. Chargers have diagnostics that constantly check a battery’s condition, adjusting the charging cycle accordingly. If an internal chip senses excess heat, a built-in fan pushes air through the cells from the charger to cool it off before recharging, thus extending its life.

“Each company has a different approach to it, but it comes down to one thing,” says Wheeler. “And that’s making sure that the battery is healthy at all times so it maximizes and optimizes its life. The chip actually keeps track of how many

full charge cycles the battery’s gone through. You can actually slip the battery into the charger to find out how many more cycles it has left in its usable life, based on what it senses its use has been, so it can tell when a battery is fatigued on a heavy job or worksite.”

Wave of the Future?

The manufacturers agree that nickel-based batteries will be around for a while, and all plan to continue



Metabo’s 12-volt Li drill. This German offering is featured here in a kit with a circular saw, recip saw, drill/driver and flashlight.

offering tools based on that platform. But they also agree that Li batteries are here to stay.

Should you dump your cordless tools and replace them tomorrow? That depends — are you happy with what you have?

Lithium-ion Powered Cordless Tools

All specs provided by manufacturers. Tool weight is with battery in place.

Mfg.	Line or Tool Name	Tools in Line	Battery Voltage	Battery Amp/hr	Tool Weight	Comments
Black & Decker	SmartDriver	Utility driver	3.6	1.08	10.5 oz.	Single-speed. Reversible. No clutch. Twin of Skil model.
Bosch	Litheon	Drill/driver	10.8	1.3	1.8 lbs.	Single-speed. Reversible.
		Right-angle driver	10.8	1.3	2.2 lbs.	Single-speed. Reversible. Articulating head. 36-volt rotary hammer available.
DeWalt	36-volt system	7¼" Circular saw	36	2.4	9.9 lbs	Currently, only cordless circular saw available with 7¼" blade. Other tools in line include impact wrench, reciprocating saw, rotary hammer and flashlight. Combo kits available.
		Jigsaw	36	2.4	7.5 lbs.	
Makita	LXT	Drill/driver	18	3.0	4.6 lbs.	Other tools in line include hammer drill, impact driver, reciprocating saw and flashlight. Combo kits available.
		6½" Circular saw	18	3.0	7.1 lbs.	
Metabo	Li-Power	Drill/driver	12	2.2	4.4 lbs.	Other tools in line include 18-volt rotary hammer, reciprocating saw and flashlight. Combo kits available.
		Drill/driver	14.4	2.2	4.6 lbs.	
		Drill/driver	18	2.2	4.85 lbs.	
Milwaukee	V28	6½" Circular saw	28	3.0	9.4 lbs.	Other tools in V28 line include rotary hammer, right-angle drill, metal saw, impact wrench, portable band saw and flashlight. Other V18 tools include a hammer drill, metal-cutting saw, impact wrench, reciprocating saw and flashlight. Combo kits and radio available for both lines.
	V18	Drill/driver	18	3.0	6.2 lbs.	
		6½" Circular saw	18	3.0	8.4 lbs.	
Skil	iX0	Utility driver	3.6	n/a	10 oz.	Single-speed. Reversible. No clutch. Twin of B&D model.

The author selected the most compatible Li tools for woodworking applications for this chart. These companies make other tools as well.

Woodworkers reap the benefits of either lighter tools of the same voltage or high-voltage tools of the same weight.



Milwaukee led the Lithium-ion revolution when it released its V28 tools. The 28-volt battery features a "fuel gauge" that shows the remaining charge.

"My argument is that you shouldn't; if you're happy with 14.4 or 18, that's wonderful," says DeWalt's Potter. "Our approach to our cordless platform is that we're going to continue to offer a variety of voltages from 7.2 to 36 and offer a variety of chemistries. We think each voltage and each chemistry has its place in the market."

If you're in the market for new equipment, about the only drawback to buying Li tools right now is the cost, but all the manufacturers we spoke to agree that the prices will come down as the technology matures. For example, Makita's M-Force two-speed, 18-volt NiMH drill/driver kit has a street price around \$240. Their new LXT

three-speed, 18-volt Li drill/driver kit can be had for around \$310.

As to the pluses of buying Li, they have several advantages over current nickel-based tools. There are, of course, the basic characteristics inherent in the lithium technology: Weight-to-power ratio is a given.

You can get more power for the same weight; or stay with the power you're used to and enjoy a tool that weighs about a third less than what you're using now. Reaching for a tool after several weeks, you'll be pleased to find it charged and ready to go. You'll enjoy a steady power level for the life of a charge.

Beyond that, if you're willing to stay with a heavier tool, machines

with a higher power level like Milwaukee's 28-volt platform and the 36-volt offerings from Bosch and DeWalt will give you longer run time than you've ever gotten from lower-voltage tools. That same high power makes it possible to have tool capacities you've never seen before. For example, DeWalt's

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Just Out ...

Both RIDGID and Hitachi have announced new Lithium-ion powered tools that will be on the shelves by the time this magazine is printed. RIDGID will offer five new Max Select™ stand-alone tools that can be powered from either a 24-volt Li or 18-volt NiCad battery — an industry first. Hitachi claims their new 18-volt Li tools will be marketed at a much lower price than the competition.



36-volt Li circular saw is the first cordless to offer a full-sized 7¼" blade. Makita, meanwhile, is offering an 18-volt Li portable band saw.

As the technology is further refined, expect to see more high-voltage cordless tools in areas now offered only sporadically by manufacturers, like routers and miter saws. Add to that the environmental benefits of eventually phasing out NiCads, and this battery technology may indeed be the wave of the future.

"I think we're on the verge of it taking over now," sums up Milwaukee's David Boone. "As the technology matures and cell prices come down, and we're able to put Lithium-ion in lower-voltage and lower-cost tools, your normal do-it-yourselfer is going to be able to afford them. It's going to be the next thing, and it's going to be here for a while."

A.J. Hamler is the former editor of Woodshop News and an avid woodworker.

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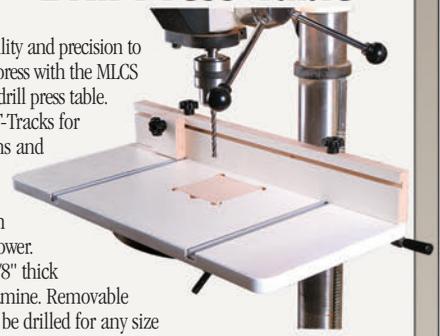
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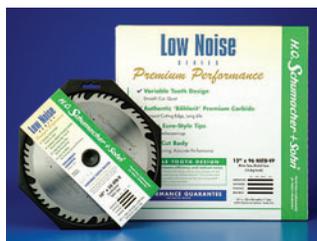


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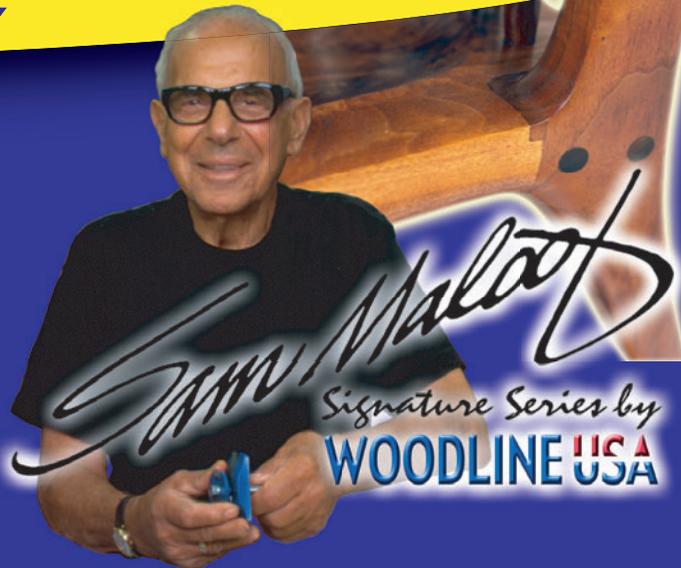
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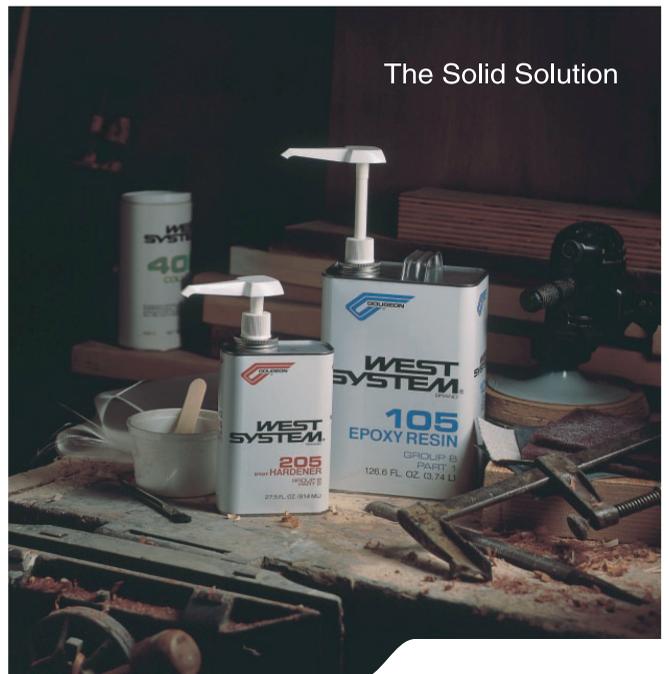
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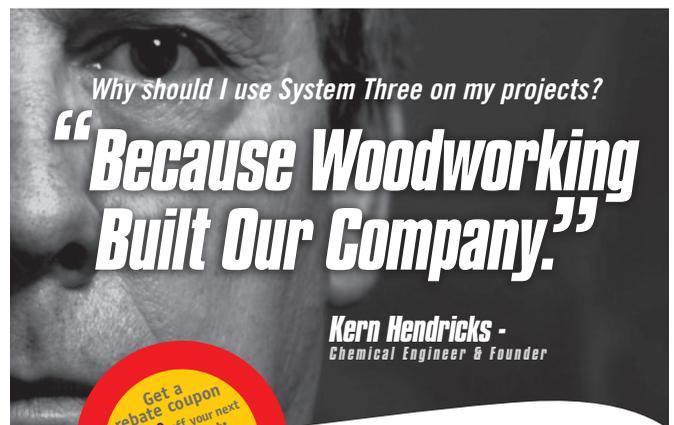
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A Simple Slurry Solution

ABOUT MICHAEL DRESDNER

Michael Dresdner is a nationally known finishing expert and the author of *The New Wood Finishing Book* from Taunton Press. When not writing about woodworking, he is an active community theater participant.



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Please include your home address, phone number and e-mail address (if you have one) with your question.

Q I finish with cabinet scrapers. While they leave most surfaces glassy smooth, there are still some small scratches and pits that turn up when my first coat of finish goes on. Do you think these small imperfections will fill in with enough coats of a wipe-on oil finish?

— Ed Musho
Portland, Oregon

Michael Responds: Yes, eventually, but since you are using a wipe-on oil finish, there is a quicker way to fill the voids. Instead of simply wiping the finish on and off, sand it onto the surface with 600-grit wet and dry paper. Sanding will create a slurry of oil finish and sanding swarf that will fill these voids even quicker.

Q What kind of finish do guitar builders use on electric guitars?

— Keith Neville
Rifle, Colorado

Using a scraper to smooth wood for finishing is a sound technique. Michael offers a sweet tip for finishing wood worked in this manner.

Michael Responds: Various guitar companies use different finishes. I know of classical guitar makers who use shellac or their own French polish formulas, and many acoustic builders still use nitrocellulose or CAB lacquer, which was the standard for many decades. Of course, some electric guitar makers use these finishes as well, while others use water- or oil-based polyurethane, conversion varnish, automotive polyurethane, acrylic or polyester.

One of the more popular and growing trends is to coat electric guitars with UV-cured acrylics or polyesters. The final finish is virtually the same as chemically cured coatings, but the process is much faster. In some cases, you can start with a raw wood body in the morning; apply a thick, high gloss UV-cured finish; and have it polished and in the case by the end of the day.

Q Whenever I apply any finishing material to California black walnut, it immediately turns a very dark color, almost black, and loses almost all the detail of the lighter grain color. However, when I apply any of the above-mentioned finishing materials to Eastern black walnut, this wood does not lose its light brown color and grain detail. Can you provide any help or solution to my problem of finishing California black walnut? I have quite a big stack of it, but I just can't use it to my satisfaction.

— Dan Titzel
La Grange, California

Michael Responds: As you now know, the appearance of cut dry wood is not the same as it is under a finish. However, there are a number of ways to change the color of a wood you find too dark. The first is by your choice of finish. Solvent-based or oil-based finishes will turn most woods slightly to dramatically darker, while waterbased finishes typically preserve them closer to their dry color. If that is not enough, you can lighten the raw wood with a yellow or amber watersoluble dye, which will help bring out the golden highlights.

continues on page 106 ...



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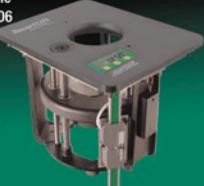
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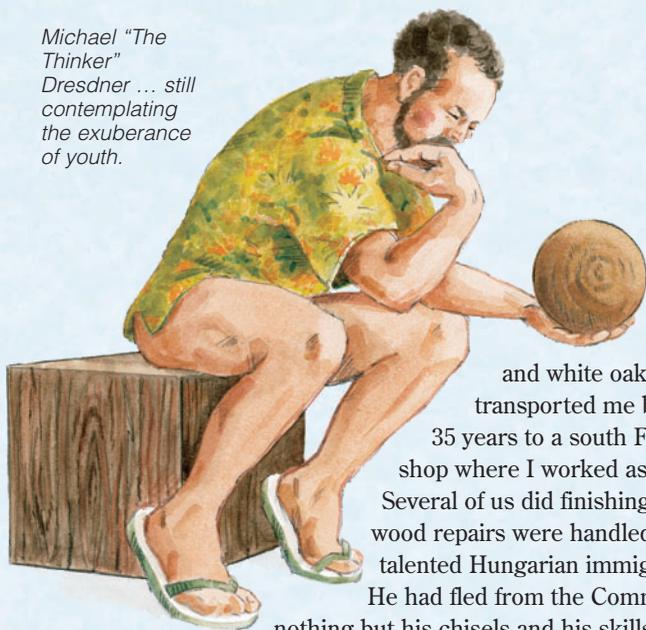
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A Woodworker's First Lesson

Michael "The Thinker" Dresdner ... still contemplating the exuberance of youth.



Yesterday, someone asked me how one tells the difference between red oak and white oak. It instantly transported me back some 35 years to a south Florida finishing shop where I worked as a young man. Several of us did finishing chores, but all wood repairs were handled by an amazingly talented Hungarian immigrant named Peter. He had fled from the Communists with nothing but his chisels and his skills.

Most of us recognized the common woods, but whenever one puzzled us, we asked Peter, who seemed to know them all. "That's palisander," he would intone, or "that's hornbeam." Enamored with Peter's ability, I vowed that some day I would be able to identify every wood on sight. My goal was short-lived. I soon discovered that there are some 75,000 identified species of wood, many of which look astonishingly similar.

Undaunted, I set a new goal. I asked Peter to teach me woodworking. "It's too late for you," he said. "You are already past 20. You must apprentice at 12 or 13 so that by the time you are 18, you can start to make a living."

"But if I did start now," I pleaded, "what would be my first lesson?"

He cocked his head to one side. "The first lesson is to make a perfect solid cube from a single block of wood, using only hand tools. Every face must be flat, every angle exactly 90 degrees and every side exactly six inches by six inches: no more, no less."

I instantly realized the implications of such a chore but, being young, I impulsively asked, "And the second lesson?"

Peter responded tersely. "Make a six-inch sphere."

I'm still working on the cube. Any day now...

— Michael Dresdner



Our reader is asking about the characteristics of California black walnut, like this log harvested in the northern part of the state.

using cedar and redwood. I would like to use an oil finish of some kind to preserve the attractiveness of fresh wood. Would something like Danish oil be appropriate?

— Howard Sahl
Longmont, Colorado

Michael Responds: The common patio furniture woods, Western red cedar, yellow cedar and redwood, will all do just fine with an oil-based finish. However, most Danish oil mixtures are designed for interior use only. The companies that make them usually offer an exterior version as well, sometimes called simply exterior Danish oil and sometimes branded with other names, such as Teak Oil. These, along with any other exterior finish, such as exterior polyurethane or spar varnish, will be good choices for lawn furniture.

By the way, it is a good idea to pre-seal the end grain in the feet with epoxy before you finish. That will help prevent water from wicking up into the wood behind the finish when the chairs and tables are forced to sit on the wet ground.

For a more draconian approach, you can bleach the wood prior to finishing. So-called A/B, or two-part, wood bleach will take the color out of wood, lightening it considerably, even to full white. How much color you remove is controlled by how strong the mixture is and how long you leave it on. Try it on some scrap pieces, and you will see what I mean. You can stop the bleaching action at any point by washing the wood with lots of water, or by neutralizing the bleach with a mixture of water

and household vinegar. Be certain to read the safety precautions on the box, as this bleach is very caustic and requires not only ventilation but also goggles, gloves and a protective apron. It will burn skin on contact.

Q I am building lawn furniture consisting of chairs and tables



WINNER! For simply sending in his question on outdoor furniture finishes, Howard Sahl of Longmont, Colorado wins an **Olympic Interior Wood Finishing Kit**. Each issue we toss new questions into a hat and draw a winner.

“Ouch.”

That's gotta hurt.

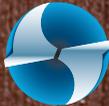
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Plan 1



Rug-running Sports Coupe



The perfect toy for that cute little rugrat in your life. This project can easily be completed in a weekend and is designed to be tough enough to take a three-year-old's beating!

Step-by-step instructions to complete the rug-running sports coupe!

Cars come in so many shapes and sizes that the design possibilities are limitless, and kids always have vivid imaginations when it comes to automobiles. We recommend softwoods for the parts, as they're easy to shape with files and sandpaper. For contrasting colors, try pine and redwood. The pine blends well with manufactured parts like wheel axles, tire hubs and dowels. Rubberider wheels, a fun product from Rockler, add a delightful realistic feel to this project (*Call Rockler Woodworking & Hardware for specialty parts; 800-279-4441*).

Full-size Patterns for the car are shown on the previous pages, and the *Material List* will help you pick woods of the correct dimensions for each part. The primary tool used for making the car is a scroll saw, although the drill press also came in handy.

Building The Car

Most of the construction is straightforward, but there are four details to

review to keep everything crystal clear. None of them are difficult, but pointing them out now will help you avoid head scratching when you build your car.

Each side and its mating door start out as one piece of wood. Cut the overall shape of the side on the scroll saw, then drill the 1/8" hinge pivot hole for the door. By drilling the hole now you can guarantee its accuracy. After the hole is drilled, cut out the door with a scroll saw. When you put the doors back in the sides, tap in the pivot dowel without any glue. The doors always swing perfectly.

Although this is hidden from view on the completed car, the trunk lid and hood each pivot on 1/8" x 1/2" dowels held in the sides. Be sure to drill the holes on the inside face of each side before assembling the car, then pin the hood and trunk lid when you join the sides with the body. Don't use any glue on these pivots.

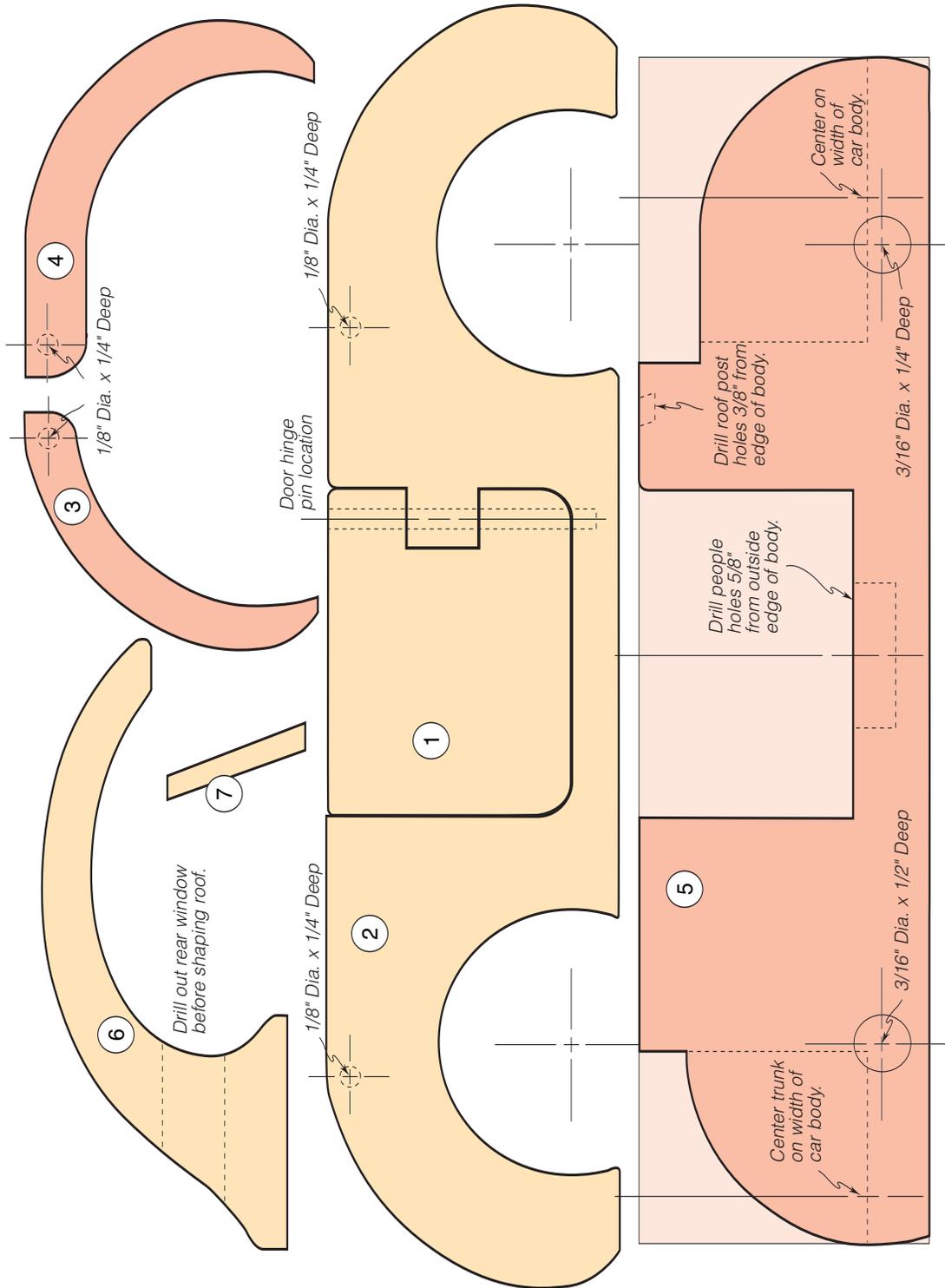
The third point concerns drilling the

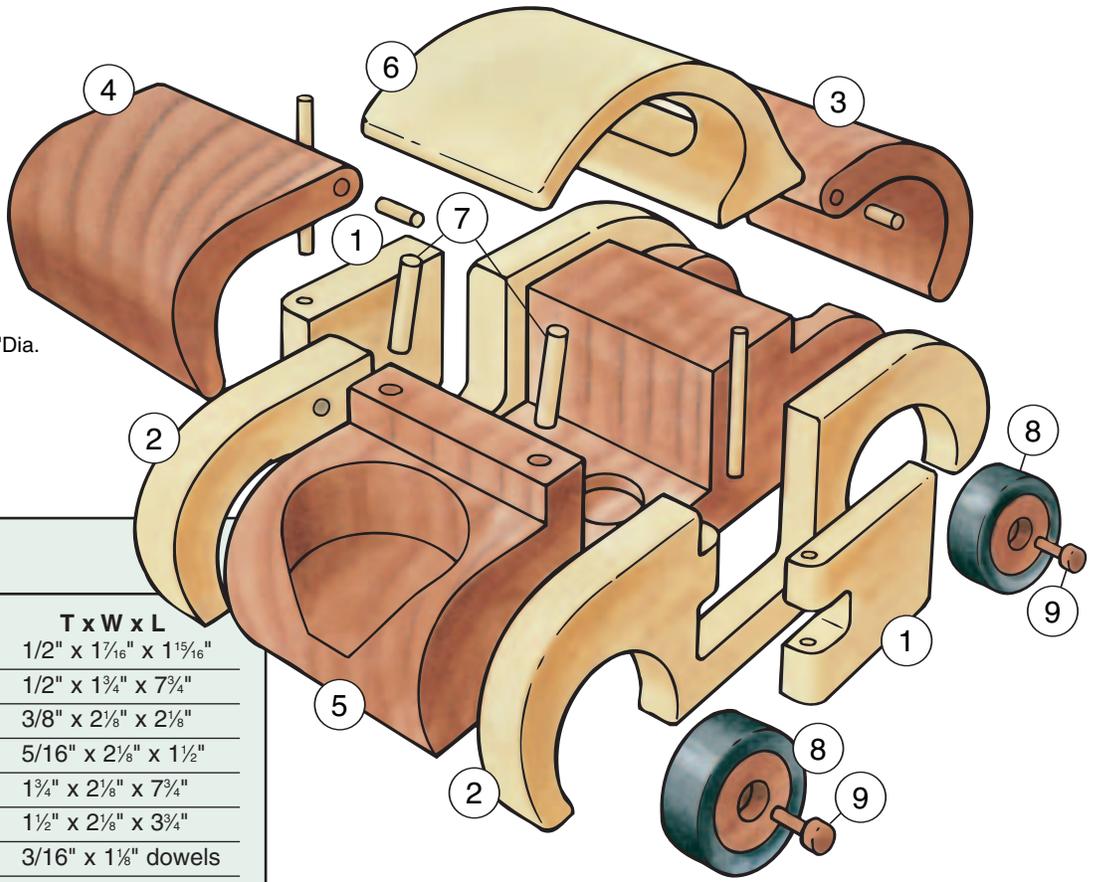
1/8" holes in the body for the trunk and engine compartment, as well as the back window in the roof. Use a drill press and a Forstner bit to bore out these holes before shaping the blocks of wood, then cut the blocks to shape with a scroll saw. It's more difficult to drill the holes after the wood is shaped.

Our last note has to do with fitting the roof on the posts. Drill the post holes in the body at a 20° angle, then, after joining the sides to the body, glue in the posts. Next, carefully file the top of each post at an angle to meet the roof. When the roof sits evenly on the body ledge and the posts, glue everything in place.

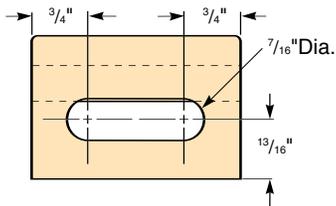
The rubber wheels come with axles, but you should cut them a little shorter so they don't break into the trunk or engine compartments when they're installed. After assembly, tint the wheel hubs with a little cherry stain to match the redwood, then topcoat the car and the wooden people with two coats of oil finish.

Full Size Patterns





Rear Window Drilling Detail



MATERIAL LIST

	T x W x L
1 Doors (2)	1/2" x 1 7/16" x 1 15/16"
2 Sides (2)	1/2" x 1 3/4" x 7 3/4"
3 Trunk Lid (1)	3/8" x 2 1/8" x 2 1/8"
4 Hood (1)	5/16" x 2 1/8" x 1 1/2"
5 Body (1)	1 3/4" x 2 1/8" x 7 3/4"
6 Roof (1)	1 1/2" x 2 1/8" x 3 3/4"
7 Roof Posts (1)	3/16" x 1 1/8" dowels
8 Tires (4)	1 1/2" diameter
9 Axles (4)	7/32" diameter
10 People (2)	7/8" dia. x 2 3/8" tall

Plan 2 Circus Elephants on Parade

If you're creating a folk art collectible, use a piece of 2 x 6 pine for this project. But if you've got a child in mind, try laminating two pieces of 3/4" Baltic birch and your pachyderms will last for years!



Step-by-step instructions to complete the circus elephants on parade!

Antique shops are full of old toys that kids would love to get their hands on. Instead, they're purchased by folk art collectors. With this family of elephants you have a choice. If you're looking for an "instant heirloom" use 2 x 6 pine. If you'd like the perfect gift for a child, laminate two pieces of 3/4" Baltic birch plywood. Your elephant will be stronger, especially in the trunk and tail areas.

Install a 1/8" hook tooth blade with 9-10 teeth per inch on your band saw to get started. If you can make the tight curves on the *Full-size Pattern*, make one photocopy, temporarily glue it to your stock, and start cutting. If you can't cut the tighter curves, make three photocopies of the pattern and use one for each elephant, temporarily gluing them to three separate pieces of stock. Before band sawing the elephants, drill out the inside curve of each trunk,

using a 1/2" bit for the larger elephant and a 3/8" bit for the other two. This way, you'll eliminate the toughest band saw cuts. The rest of the body can be cut easily, and a little filing will ensure a tight fit.

Once your elephants are cut out, drill a 7/32" hole completely through each pair of legs for the wheel axles. Follow the pattern to locate the holes to accommodate 1 1/2", 1 1/4" and 1" toy wheels.

Finishing the Elephants

To prepare the wood for finishing, sand the elephants to 150-grit, and then carefully file the interlocking joints until they slip together easily. The first coat is a mixture of two parts black oil-based enamel with one part flat urethane varnish. This makes a tough finish with a somewhat transparent appearance. For the second coat, mix two parts of blue oil-based enamel with one part ure-

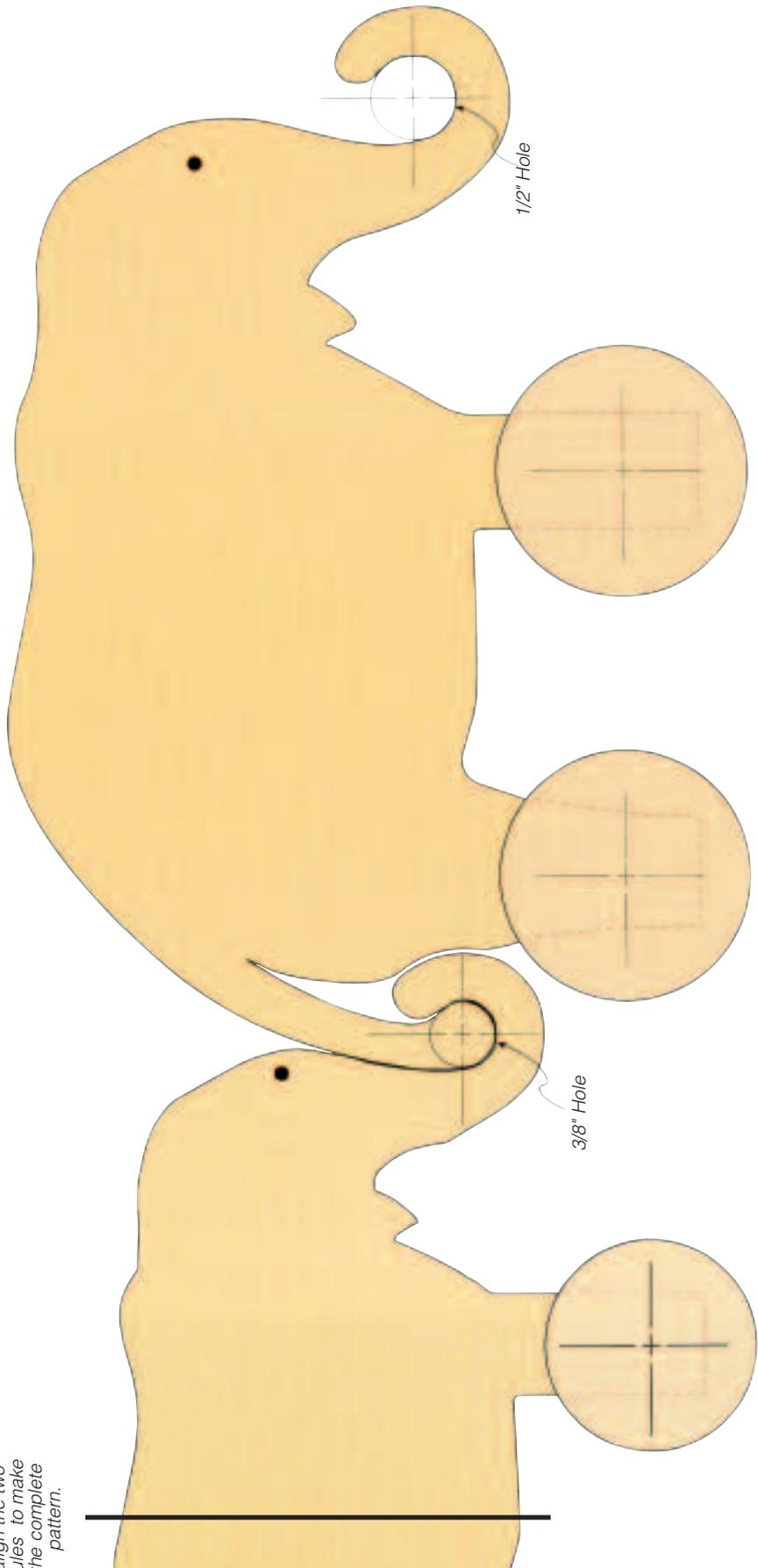


To get an antique look, use a base coat of black followed by a coat of blue. Paint for each coat is mixed with urethane first.

thane. When painting the red wheels (black undercoat first), suspend them with fishing line with a split shot weight at one end so you can paint both sides at once. Complete the assembly by slipping the axle pegs through the wheels and gluing them to the legs. To give the elephants their antique appearance, lightly sand a few spots with 600-grit sandpaper and some 0000 steel wool. Limit your sanding to the edges and a few spots, particularly where you think normal wear and tear would occur.

Full Size Patterns

After printing out, align the two rules to make the complete pattern.



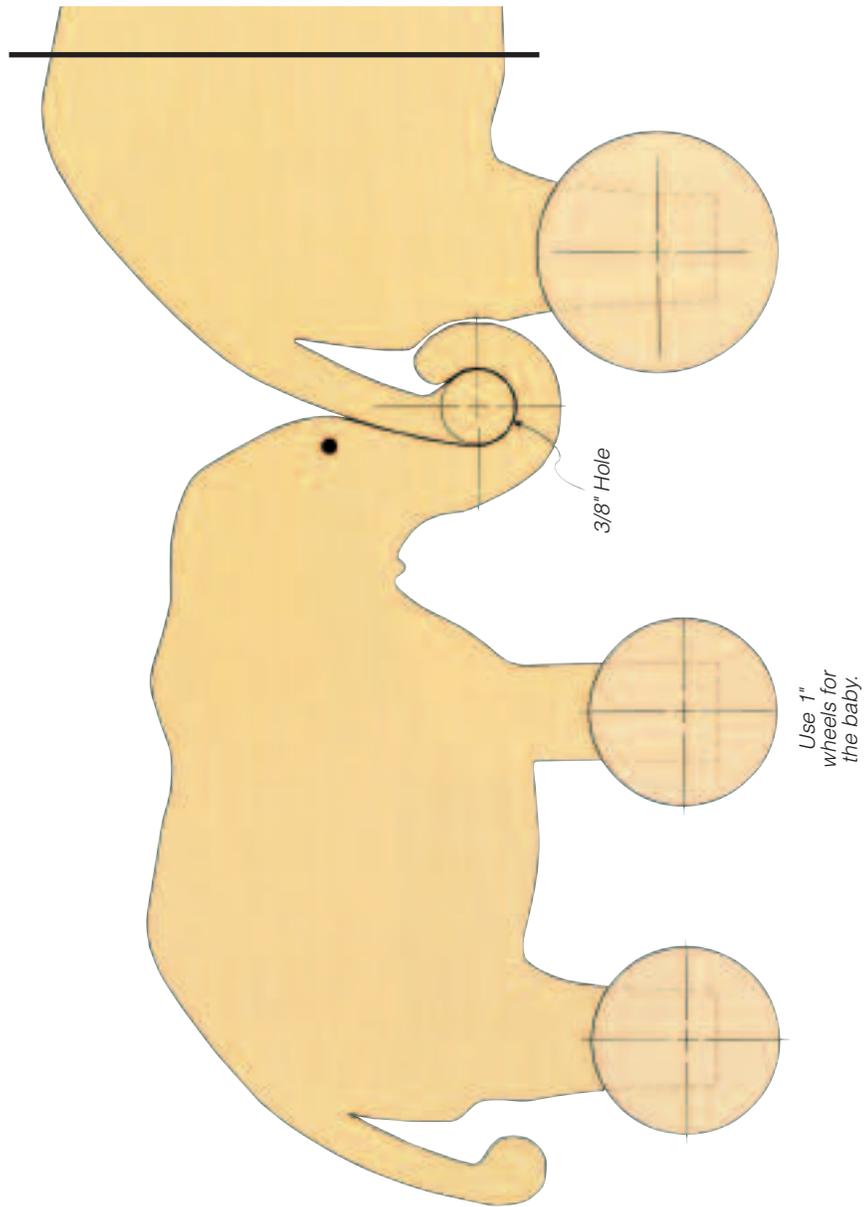
1/2" Hole

Use 1/2" wheels for the father.

3/8" Hole

Use 1/4" wheels for the mother.

Full Size Patterns



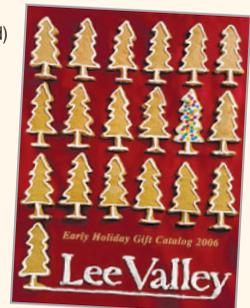
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