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Fine WoodWorking

August 1993, No. 101
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Whetstones

Staining wood

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Fine WoodWorking®

July/August 1993 No. 101

DEPARTMENTS

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On the Cover: *Carl Dimon and Glenn Hughes built this cherry and bird's-eye maple hutch with two lighting systems. For more on cabinet lights, see p. 82. Photo: Mitch Mandel.*

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Numbers for Norm—We had no illusions when we decided to do the article on Norm Abram in *Fine Woodworking* #99. We knew it would be controversial. For all the debate about craft vs. art that has gone on in these pages, we expected some equally vehement responses to the Abram piece. We were not disappointed. Printed in *FWW* #100 and this issue are a few of the more than three dozen letters we've received to date. There were also some phone calls, and all of our editors fielded reactions and responses from woodworkers they came in contact with.

Letter counts are far from scientific as a measure of opinion, but they're interesting nonetheless. So how did Norm score with letter writers? Cracks about power-tool lust and nail belts aside, Norm's fans far outnumber his detractors. Of the letters received so far, 27, or 71%, supported Norm and *The New Yankee Workshop*. Nine letters, or 24%, were opposed, and two letters, or 5%, didn't take a clear stand.

For *Fine Woodworking* to receive that many missives on one subject or article is almost unheard of. And the sentiments expressed in those letters were intense. One woodworker threatened to cancel his subscription because he thought we were too hard on Norm. At the same time, others indicated we had committed something akin to woodworking blasphemy by putting Norm on the cover. (For all the woodworking unknowns who have graced our cover over the years, it was a little hard to take the arguments that only people like Tage Frid, James Krenov and Sam Maloof should be allowed to have their visage on the front of *Fine Woodworking*.)

Amid all the strong words expressed, something got lost on both sides of the issue: the fact that Norm is news in the woodworking world. As an important journal of woodworking, we would be lax in our reporting duties if we did not address the phenomenon of *The New Yankee Workshop* and its 4.5 million viewers. We tried to cover the issues and controversies that surround the program in an even-handed, unbiased way; it's up to our readers to come to their own conclusions.

Puttering into other pages—Whether we are all wrapped up in a major project in the workshop or submerged in the daily duties of the workaday world, a little dose of humor often brings us back to reality. But serious woodworking and humor are often like a blind date: full of lots of excitement and potential as an idea, but rarely as satisfying in the real event.

The problem isn't a lack of a sense of humor among woodworkers. I've shared laughs in many a shop. But most woodworkers' humor has to do with their foibles and foul-ups. That's not the kind of thing *serious* woodworkers want to be publicly associated with. Especially if it's going to wind up in print.

I started thinking about all this when a colleague at another magazine referred me to a book in which *Fine Woodworking* magazine was mentioned. A collection of humorous essays and columns by Patrick F. McManus, the book is *Real Ponies Don't Go Oink*. In one essay called "Puttering," McManus takes on his wife over her description of his activities in woodworking as puttering. His wife argues that woodworking is "merely an excuse to buy tools," while McManus recounts his misadventures in trying to level the legs of the "exquisitely crafted" coffee tables he has been attempting to build.

All woodworkers make mistakes from time to time. For a lot of us that's the only way we learn. I know if I couldn't laugh at some of my blunders, I'd be wearing out handkerchiefs with a flood of tears. The trick for me is to do serious work without being too serious to enjoy the process.

—William Sampson, executive editor

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Fine Woodworking is a reader-written magazine. We welcome proposals, manuscripts, photographs and ideas from our readers, amateur or professional. We'll acknowledge all submissions and return those we can't publish. Send your contributions to *Fine Woodworking*, PO Box 5506, Newtown, CT 06470-5506.

Demystifying furnituremaking—When I saw the picture of Norm Abram on the cover of the April 1993 issue of *Fine Woodworking*, I was pleased. The gods on Mount Taunton had finally deemed him worthy of profiling. But upon reading the article, my joy was tempered. For the ugly specter of "woodworking correctness" had again reared its head. Norm Abram accused of "trivializing furnituremaking"?! Why?

Is it because he doesn't approach his work with proper Krenov(ian) *gravitas*? Is Norm a heretic because he uses ferrous material with which to attach face frames to carcases? Or is it because a "carpenter" has the temerity and the ability to demystify the process of furnituremaking for thousands of weekend woodworkers?

When Jim Boesel suggests that Mr. Abram "take a trip to a professional furnituremaking shop to discuss the elements that refine and elevate a piece of furniture" so as to give Norm credibility, I can't help but be amused. Away with you, Mr. Boesel! Take your dozuki saws, French polishes, wooden planes and fly. Leave me with Norm, my dovetail template, my air nailer and my bliss. —*Jeffery Antkowiak, South Bend, Ind.*

Woodworking Tonight?—Your Norm Abram cover article was a real low point. What's next—Tim Allen? Michael Jackson? Oprah? Please spare us the television celebrities and get back to woodworking. —*Lottie Wolff, Jupiter, Fla.*

Fair and balanced—As one who tried to make it professionally as a cabinetmaker and as one who watches *The New Yankee Workshop* on my local PBS station, I read with interest your article on Norm Abram. Your article provided a different side, which we as a television audience never see, and I greatly appreciated that. It was also a fair and balanced article presenting both his side and his critics'. My only criticism of the show is that he has access to tools like an overarm pin router, which would be found in a professional shop like his; people who do woodworking as a hobby could not afford one for their shop. To make his program relative to the hobbyist, he needs to show substitutes when he uses tools like a pin router, or he needs to modify his design. Thank you for a well-done article.

—*Mark W. Fischer, York, Pa.*

Rambo Abram—Like the *Rambo* films that circulated around Europe a while back and portrayed a side of America that did not add to our appeal, the selection of Norm Abram as the person (or personality) to adorn the cover of the April issue does little to add to the credibility of your magazine.

Norm Abram may be a superstar in the realm of television woodworking, but he does not belong in a publication that calls itself *Fine Woodworking*. His almost total rejection of any handtool usage and his complete insensitivity to the fine points of wood finishing are the only things that are truly extraordinary. If he is sensitive to wood movement during atmospheric changes, as one of the captions in the article suggests, it is a very recent innovation.

The amount of media attention this man is currently receiving, including features in practically every woodworking magazine in print, makes it even more ironic that *Fine Woodworking* would place him on the cover. Norm's only appeal lies in his peculiar ability to balance a router in one hand and a can of polyurethane in the other. With all the splendid and sensitive woodworking that's being done in this country, I can only see this as a sad commentary on the state of your magazine.

—*Mario Scarpy, Chicago, Ill.*

Teaching without insulting—I am writing to thank you for your article on Norm Abram and *The New Yankee Workshop* in the March/April issue (*FWW* #99). One thing that your article did not mention is that *The New Yankee Workshop* teaches viewers basic woodworking without making the viewer feel stupid. Norm's manner is engaging; Norm performs many techniques (which are obviously basic to him) without stressing that they are basic.

Again, thanks for the article. This is the first issue of *FWW* I've bought and am giving serious consideration to a subscription.

—*George Bouras, Reisterstown, Md.*

Committed to mediocrity—When Tom Landry was the coach of the Dallas Cowboys, there was a sign hanging over the locker room door that read: "The quality of life is directly related to the commitment to excellence." *Fine Woodworking* has always had a similar commitment, and it has been your most endearing quality. Whether or not the reader was able to recreate the magnificent craftsmanship detailed in your pages was irrelevant, they were always shown the best way to try, and encouraged to do so.

But television is committed to mediocrity. Having worked in the media for several years, I came away with the firm conviction that it is dominated by a majority of people who have a substantial disdain for the public intelligence.

The New Yankee Workshop is a product of such thinking. It is a show dedicated to mediocrity. Rather than trying to teach us anything, Norm and producer Russell Morash are content to let us sit like couch potatoes and watch Norm work with an infuriating lack of attention to details, design and explanation.

—*Preston Wakeland, Lockport, Ill.*

Shop teacher we never had—Thank you for publishing Jim Boesel's balanced and clearly written article on Norm Abram. I suspect that *The New Yankee Workshop* has thousands of fans who, like me, hated woodshop classes when we were in school. Norm Abram is the caring and modestly humorous shop instructor we never had. He encourages us to try our hand at tasks we former "nerds" never dared before.

However, I believe the appeal of Norm Abram reaches beyond my group of beginning woodworkers and furnituremaker wanna-bes because his show feeds a need for authenticity. We know he's not a Krenov or a Maloof, or even a Thomas Moser, but we are drawn to visit his shop nonetheless. Watching Norm Abram build a table or a clock reminds us that objects of value begin as valued objects; a craftsman nurtures each piece into maturity. While Norm does use more power tools in one Saturday than I'm ever likely to own, he loves his wood in a way that is much more Yankee than modern.

But it's more than that, for in nearly every show I've watched, Norm's eyes twinkle while his beard wrinkled in a moment of pleasure anticipated. Isn't that why most of us work with wood? Don't we all owe many of our splinters to our belief that the piece we're working on right now will give us pleasure far into the future and that maybe our children's children will enjoy it too? —*John L. Labbe, Arlington Heights, Ill.*

Ethics of design—Over the decades, design has definitely metamorphosed within the "crafts" faction of our collective addiction. What is missing, I fear, is an ethic about what we're doing and a discussion about what is ethical within our craft and design endeavors. Some of the questions that come to mind, which hopefully will inspire discussion, are as follows:

When designing and building, what is the expected lifespan/longevity of your project?

If your design is trendy or whimsical, would composites, plastics and paint serve as the best choice of materials, or is this project worth the demise of a rain forest giant? Should Americans stick to North American woods and thereby stimulate meaningful hard and softwood reforestation? Should we,

as individuals plant enough trees to replace what we have used? Should we consider the source of the materials selected and all the impacts and consequences of our collective "20 more board feet, please"?

Finally, since the carbon chain molecular structure of wood and plastic are quite similar, does it not make some sense, if not little difference, if a drawer bottom is a plastic-covered sheet good? And why do we build houses of 2x4s when they inevitably biodegrade?

Well, I know beauty is truly in the eye of the beholder, and don't get me wrong, freedom of design must prevail. However, an ethics of design could start an awareness which just might inspire behavior and consumption patterns that are sustainable. I'll be interested to know if others agree.

–Gregory B. Stewart, Long Beach, Calif.

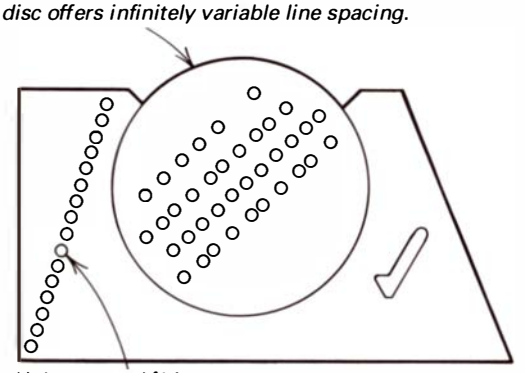
Foam protects pieces—"Sanding in Stages" by Gary Straub in the April issue of *Fine Woodworking* was an interesting and informative article. I have one thing to add. To keep the sanded side of a workpiece from being scratched by small particles left on the workbench when the piece is turned over, I use a ¼-in. piece of foam that used to be a camping mattress. This material can easily be brushed off and protects the sanded side very well. Small pieces will stay where they are put during sanding, making clamping unnecessary.

An additional advantage for those of us who have an orbital sander is that as soon as you turn off the sander, you can put it down on the foam, and it will harmlessly glide to a halt.

–Thomas Waring, Hanover, N.H.

Drawing parallel lines—With regard to the method submitted by Devore Burch in *FWW* #98 concerning drawing parallel lines, there is a commercially available tool to do this: an Ames Lettering Guide manufactured by Alvin (see the drawing below). This was standard issue to engineering students back in the days of slide rules and hand-lettered drawings and is still widely available (from art and drafting supply stores).

Rotating disc offers infinitely variable line spacing.



Holes spaced ⅛ in. apart

The guide comes with a set of instructions that I lost long ago, but there are three characteristics that I do want to point out. 1) The row of holes up the left side are spaced ⅛-in. apart. 2) If this spacing isn't appropriate, the center disc can be rotated to provide an infinitely variable spacing; the more vertical the holes, the greater the spacing, and the more horizontal the holes, the closer the spacing. 3) The biggest advantage of the Ames guide over the shopmade guide is that it allows multiple lines to be drawn without moving the fence. Also, I find that round guides tend to try to roll along the fence, whereas the Ames guide stays flat. *–Ed Hilton, Rowlett, Texas*

"Bending a Big Curve"—Congratulations to Jeff Miller and his method to construct the Windsor bed (*Fine Woodworking* #98). For many years, I have wanted to make a similar bed and have been toying around with ideas on how to make the forms for the lamination. I have just completed the headboard and the footboard bent laminations, and I am pleased with the method and results.

Although the directions have been dependable so far, I have made an error that should be brought to the reader's attention so as to avoid similar results. It states that the laminates should be ripped 1/10-in. wide. I immediately thought of the measuring tape I use surveying where the feet are broken up into tenths. Well, I ripped all the laminates to 1/100 of a foot, mistakenly thinking that I was getting 1/10-in. Wrong! To reach the 1¾-in. thickness, it took me only 13 strips of laminate instead of the suggested 17 strips. This made the bending, particularly the footboard bend, very difficult.

One other comment was that the necessary glue powder for one bending is 1,000cc. After finding the conversion factors in one of my old science books, I was able to calculate that 1,000cc is very close to one quart. *–Michael J. Rogers, Tumwater, Wash.*

Sizing Shaker pegs—The recent question on Shaker pegs (*FWW* #99) may have an alternate answer. The biggest single problem with Shaker pegs from various sources is not the taper in the tenon but the lack of consistency in the diameter of the tenon. I have found over the years that if you can press fit the pegs by hand, the tenons are too small; they need to be tight enough to be knocked in with a mallet. I test fit pegs before insertion and put the small and large pegs aside. The small ones are used in racks drilled with a ½-in. Forstner bit that I had turned down .010-in. in a machine shop. So far, I have not found a convenient way to use the large pegs for production work but a few could be sanded to size.

I would also recommend that craftsmen not assume batches of pegs from the same source have the same dimensions. Tenon length as well as diameter can vary.

–Edward H. Lebetkin, Chapel Hill, N.C.

Carbide cutters not the only way to go—I have to take issue with Jerry Glazer's comments in unequivocal favor of carbide-tipped router cutters ("Questions & Answers," *FWW* #99). Over the years, I have accumulated dozens of high-speed-steel cutters. I buy the cheapest I can find and grind them into whatever profile needed, which rarely takes more than a few minutes. They can be sharpened easily to a razor edge, which in my experience will outlast any job. I enjoy the endless variety of subtly different moldings I produce this way. Carbide cutters with their small range of generic profiles degrade too much otherwise good work. Having said this, I do own a range of carbide cutters for mundane jobs like dadoing and cutting rule joints.

–Bob Dunstan, Wilson, Wyo.

Water-based finishes for bowls—In response to Peter Rohr's question in *FWW* #99, Chris Minick listed several options for bowl finishing but left out water-based finishes. After two years of searching and testing to find a truly clear finish for my projects, I found the Hydrocote water-based finishes (Hydrocote, P.O. Box 160, Tennent, N.J. 07763; 800-229-4937). I have found nothing that comes close for a water-white finish. The Hydrocote clear finish imparts no discernible color to the wood, yet it highlights the natural figure and color of the wood. After five years of use on dozens of wood varieties, I am very pleased with the Hydrocote finishes. As an added bonus, the finishes are nontoxic, nonflammable, almost odorless and clean up with water.

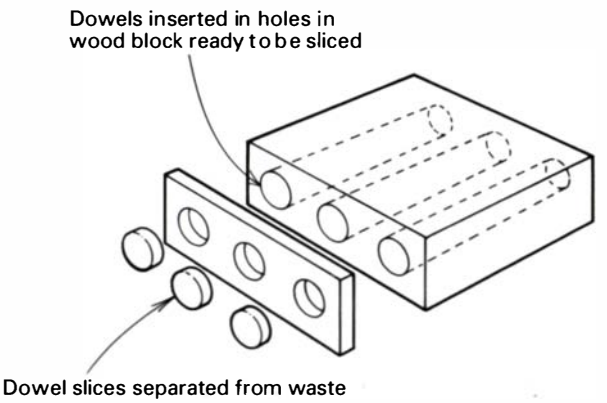
–Steve Wylie, Pearland, Texas

Tuneful precision—In response to Robert Pionzio's question concerning guitar fret spacing (*FWW* #99), the location of the frets must be very exact. I have built two guitars and a dulcimer,

and all the woodworking in the world won't save the project if you get this wrong. I strongly suggest he get a fret scale, which is calculated for several scale lengths. Martin Guitar's repair parts shop sells a metal fret scale along with exotic woods for building instruments (Martin Guitar Co., 510 Sycamore, Nazareth, Pa. 18064; 800-345-3103). The fret scale is not expensive and is worth the money if used only once. There is no feeling quite like stringing up an instrument you have spent many hours on only to discover it will not play in tune. I used Grit Lasken's articles on guitar building, which you ran several years ago (*FWW* #67, #69, #82) when I built my last guitar.

–Ralph Nite, Kansas City, Mo.

Cutting thin slices from a dowel—In the "Questions & Answers" section (*FWW* #99) Roger Heitzman replies to Arthur H. Gerhardt's question about cutting thin slices from a dowel and what is the best and safest way to approach this delicate operation. Mr. Heitzman states that this approach uses a bandsaw.



I would like to propose an alternate method that will provide cleaner cuts with minimum fraying (and fewer rejects), allow the use of table, radial, chop or bandsaw, and provide at least the same or perhaps increased level of safety.

This method requires boring holes the same size as the dowelling to be used into the end grain of small scraps of softwood, such as ponderosa or sugar pine. Once this is accomplished, simply insert the dowels into the blocks, and start slicing on the saw of your choice. Brake away the scrap from the dowel and you have clean and unfrayed slices. An additional advantage is that multiple slices can be produced at the same cut, as shown in the drawing above. *–Frank Ramezzano, San Rafael, Calif.*

Use dozuki for dowel slices—No doubt Mr. Heitzman's reply to Mr. Gerhardt's question (*FWW* #99) concerning how to make thin dowel slices describes a useful technique, if one is making them in large numbers. However, for a dozen or so, would it not be easier, simpler and certainly safer to grab a Japanese dozuki saw and do it manually?

Too often we think of the power tool as the only solution. For control, smooth cuts and minimal chipping, I think one of the current crop of superb Japanese saws should be considered ahead of the bandsaw for small jobs such as this. (For more about Japanese saws, see "Choosing and Using Japanese Handsaws" on p. 48.) *–R.S. Lee, Calgary, Alta., Canada*

Dealing with wood dust risks—I write to you in reference to a question from Richard A. Quance concerning protection from fine dust and the reply from Theodore J. Fink, M.D ("Questions & Answers," *FWW* #99).

The best approach to managing wood dust, without quitting woodworking, is to use local ventilation systems. The use of personal protective equipment such as a respirator is a last resort when no other method of protection is possible. Furthermore, industrial respirator usage gives a false sense of security and may not be beneficial if the user is not properly fitted and trained in respirator use and care.

The use of industrial ventilation/local exhaust systems is considered the industry standard worldwide. A properly designed industrial ventilation system should permit a woodworker to work without the need for using respirators. A typical system for even a small shop is very realistic especially with the current flood of new systems and components on the market. Most woodworking tool catalogs that I have been receiving over the past two years have had a wealth of parts advertised.

I do agree that respirators should be used while cleaning local exhaust systems. An additional way to reduce dust generation during system cleaning is to moisten surfaces with a water or soap-water mist. Finally, wood wastes can be composted if wood dusts are kept separate from wood finishing wastes.

–Gregory B. Dominguez, industrial hygienist, Aurora, Co.

Inventor advice—In response to the letter "Help for inventors" (*FWW* #100) from Richard Fisher, Austin, Texas, marketing your invention is the toughest part of the deal. There is a book available for us inventors. It is called *The Inventor's Desktop Companion: A Guide to Successfully Marketing and Protecting Your Ideas* by Richard C. Levy, Visible Ink Press. You can order this book for $24.95 by calling 800-776-6265 or writing to Visible Ink Press, 835 Penobscot Building, Detroit, Mich. 48226. I have no connection to Richard Levy or the Visible Ink Press, just a satisfied user. *–Bill Cummings, Germantown, Md.*

Bog oak—The question about bog oak in the May/June issue (*FWW* #100) demonstrates how socio-political reasons account for some historical practices unusual to the contemporary mind.

In Poland, however, I am not aware that "black oak," as it is known there, has a similar background. In a largely low-lying, sometimes flooded area, oak trees fall into streams, ponds and other water reservoirs and are retrieved much later.

When I was ambassador there, I was intrigued by its uses, largely for inlay and design work, including parquet floors. I do not know the age of the pieces I brought back with me—still being saved for some as yet unknown purpose. However, I do have one small piece certified by testing as 5,000 years old. Who says wood deteriorates even if it has been lying in water that long? *–William E. Schaufele Jr., Salisbury, Conn.*

Trimming plastic laminate—In reply to John Hayns' question regarding how to trim plastic laminate without scratches (*FWW* #100): When all else fails, don't use a bit with pilot bearings. Use a straight laminate trimming bit with the small radius on the end. Bosch manufactures them. Also, the fix to the problem is to apply a good smear of petroleum jelly on the underside face of the cut. There are more "professional" and costly products for this. Lami-Lube is one available from Alpine Sales (7258 Spa Road, North Charleston, S.C. 29418). I've also used WD-40 and paraffin wax. WD-40 is a bit messy and can cause delamination at the edge. *–Bruce Henderson, Bennington, Vt.*

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–John Lively, publisher

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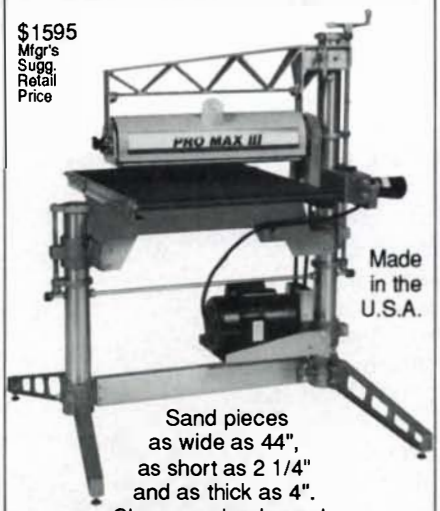

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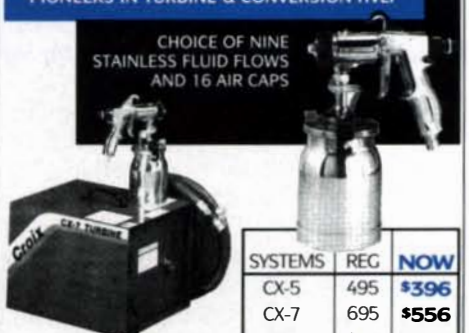

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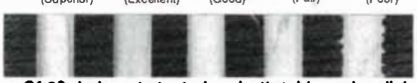
Forrest Dado King (Superior)	Freud SD308 (Excellent)	V-A 26742 (Good)	U.S. Saw 800-C-RPD (Fair)	V-A 26747 (Poor)



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Better Homes and Gardens Wood, Oct., 1991, pg. 60

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12" x 80T x 1" 1/8"	212	Above 1" bore std.	
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Hitachi		12" x 80T x 1"	229	129
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READER SERVICE NO. 17

Dreaming of drill presses

Drill presses are a ubiquitous part of well-equipped woodworking shops. They don't take center stage like a tablesaw; they just quietly do their job, usually off in a corner somewhere. But Eugene C. Hise of Oak Ridge, Tenn., thought drill presses, especially for woodworkers, deserve more attention. And judging from the response his letter in *FWW* #99 got, lots of woodworkers agree. Here are a few of the suggestions they made after reading Hise's own thoughts on what would make a dream drill press for woodworkers. Machine manufacturers take note.

—William Sampson, executive editor

Better worktable—Recently, there were comments/complaints regarding the currently available drill presses on the market and their unsuitability for woodworking. Well, basically, I agree. But I decided to do something about it.

Earlier this year, I replaced an old drill press left to me by my father. It was over 50 years old, not of particularly good quality and it was simply worn out. My new drill press is a floor stand model, and it is fitted with a round worktable. I fashioned a rectangular work surface with a couple of features to be more in keeping with my needs (see the drawing at right).

It provides a large, flat work surface with a replaceable working area where drilling occurs and a fence for easy alignment for mortise drilling. Further, it can be removed when drilling metal and cutting oil is being used. It is based on several ideas seen here and there as well as some personal additions. I thought others might be interested and have some additional ideas to further improve on this. *—David L. Harvey, Mercer Island, Wash.*

Dream machine is available—In the *FWW* #99 letters column, I noticed Mr. Hise complaining about manufacturers of drill presses not offering a machine more suitable to the woodworker. Delta's model 15-126 ram-type radial drill press is almost exactly the machine that Mr. Hise wishes were available. I have also seen a drill press for wood made by Oliver that may also fit his needs. Radial drills made for the machinist industry could also make a good substitute if run at high speeds.

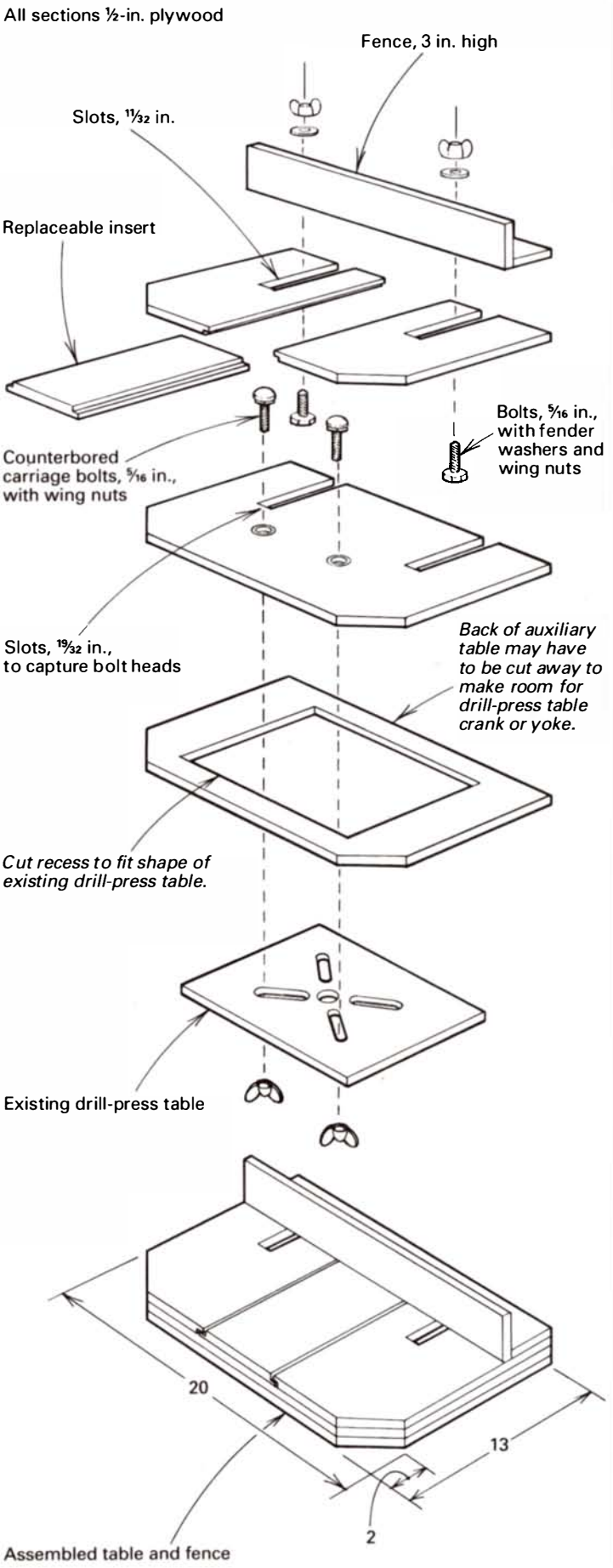
I recommend that Mr. Hise consider these sources and options as a compromise, so he can keep his dream drill press costs below five figures. *—Robert M. Vaughan, Roanoke, Va.*

Look to old machines—I was interested to read the comments on drill press design by Mr. Hise. He has some good points. I, too, have run into some of the very same difficulties that he mentioned. However, there is hope. Several manufacturers, including Delta and Powermatic, produce drilling stations that include most of the changes he has mentioned. Now, if only enough folks would purchase them to bring the cost down from the rather industrial strength several thousand dollars the units currently cost! I agree with the comment you recently published about Americans being unwilling to pay for quality.

I personally am overly fond of Rockwell-Delta equipment, mainly because most of it is built like a tank. Also, I have never had any problems getting spare parts from them, even for old machines. I also like older machines because they just seem to be built more solidly than even the good quality machines that are produced today.

By spending time at auctions, flea markets and such, I have added a Rockwell radial-arm saw, a Delta 10-in. Unisaw, a Delta compound miter saw, a Porter-Cable biscuit joiner and a large number of clamps to my shop at costs ranging from 10% to 60% of retail cost. While it is true that going to auctions is a time-consuming process in that I have yet to be able to assign less than a day to such an event, I feel my time has been well spent, and I have come out ahead. *—David Mundt, Knoxville, Tenn.*

Auxiliary drill-press table



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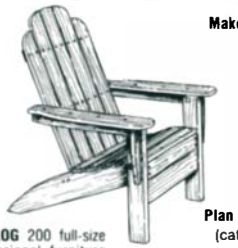

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31-050	1" Belt Sander 2.0 amp	104	78
31-460	4" Belt\6" Disc Sander	198	135
31-340	1" Belt/8" Disc Sander	268	195
31-080	1" Belt/5" Disc Sander	134	94
40-560	16" 2 speed Scroll Saw	266	188
11-990	12" Bench Drill Press	276	224
11-090	32" Radial Bench Drill Press	399	294
43-355	3/4" Shaper 1-1/2 HP	964	709
43-505	1/2" Bench Router/Shaper	399	279
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34-080	10" Mitre Box	Xtra Special	198
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50-179	3/4 HP 2 stage Dust Collector	483	335
50-181	2 HP Dust Collector	885	629
70-200	20" Floor Drill Press	1049	835
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3560	60"	35.58	22.99	129.95
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J-06	6"	8.46	5.55	32.15
J-08	8"	9.48	6.19	35.45
J-10	10"	11.09	8.95	50.99
J-12	12"	13.74	10.55	59.39
J-14	14"	16.50	10.99	62.00
J-16	16"	17.96	11.69	65.00

JORGENSEN ADJUSTABLE HANDSCREWS

Item#	Jaw Length	Opening Capacity	List	Sale	Box of6
#5/0	4"	2"	13.80	8.35	48.59
#4/0	5"	2-1/2"	14.80	8.95	51.99
#3/0	6"	3"	15.90	9.59	55.75
#2/0	7"	3-1/2"	17.10	10.35	58.95
#0	8"	4-1/2"	19.00	11.89	61.00
#1	10"	6"	21.76	12.89	70.65
#2	12"	8-1/2"	24.95	14.95	80.95
#3	14"	10"	31.61	18.95	104.95
#4	16"	12"	42.30	24.95	143.95

JORGENSEN STYLE 37 2-1/2"Throat 1/4"x3/4"

Item#	Jaw Length	List	Sale	Box of 6
3706	6"	9.86	6.25	34.75
3712	12"	10.92	6.75	37.75
3718	18"	12.05	7.25	40.75
3724	24"	13.16	8.19	43.75
3730	30"	14.70	9.10	49.75
3736	36"	16.05	10.19	55.75

JORGENSEN STYLE 45 5" Throat 1-3/8" x 5/16"

Item	Jaw Length	List	Sale	Lots of 6
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4524	24"	33.55	21.75	123.99

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7248	48"	37.12	19.99	114.00
7272	72"	42.71	26.79	149.95

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3304	1 HP variable speed Plunge Router	307	164
3375	3-1/8" Univ. Planer 7.2 amp	329	155
3380	Biscuit Jointer with case	569	248
4024	3 x 21 vanable speed Belt Sander	338	179

BLACK & DECKER

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1180	3/8" Drill 0-1200 rpm 5 amp	197	114
2600	3/8" Drill 0-1200 rpm 4.5 amp	149	89
1703-1	10" Mitre Saw with 73-770 blade	329	165
4011	1/4 sheet Palm Sander	86	59
79-034	Workmate 400	184	109
1349-09	1/2" Timberwolf Drill 2 speed	513	285
1180	3/8" Drill rev. 0-1200 rpm 5 amp	191	108
2037	Drywall Gun 0-4000 5.0 amp	184	98
2038	Drywall Gun 0-2500 rpm 5 amp	184	99
3157	Orbital var spd Jig Saw 4.5 amp	231	145
2665K	NEW 3/8" cdls 12V Cyclone Drill	294	159
5045K	MACHO Rotary Hammer Drill	779	419
5071	3/8" Hammer Drill with case	251	139
5073	1/2" Hammer Drill with case	296	169
2054	Tek Gun 0-2500 5.0 amp	282	154
2660	Drywall Gun 0-4000 4.5 amp	149	79
2700	7-1/4" Worm drive Saw 13 amp	263	145
1321	1/2" Spade hdle Drill 450 rpm 7 amp	307	174
2750	4-1/2" Grinder 10,000 rpm 6 amp	156	83
2694	7-1/4" Super Sawcat Circ Saw w/cse	260	139
2695	8-1/4" Super Sawcat Circ Saw w/cse	285	153

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73-716	6-1/2	18	14.39	7.55
73-756	6-1/2	36	29.51	16.85
73-717	7-1/4	18	14.60	7.99
73-737	7-1/4	24	18.06	9.29
73-707	7-1/4	35	27.77	15.85
73-757	7-1/4	40	32.87	16.89
73-718	8	22	20.95	10.95
73-758	8	40	42.47	24.25
73-759	8-1/4	40	46.88	24.99
73-719	8-1/4	22	20.63	11.95
73-739	9	30	31.34	17.50
73-710	9	45	62.90	35.95
73-769	9	60	75.39	39.89
73-704	7-1/4	18	22.05	11.59
73-740	10	32	34.63	17.95
73-770	10	60	70.37	33.95
73-711	10	50	68.33	33.95

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Model	Size	Weight(lbs)	Sale
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W395	5'	26#	55.95
W396	6'	32#	66.95

WOODEN STEP - TYPE 1- 250# RATING

W384	4'	20#	36.00
W385	5'	24#	42.00
W386	6'	29#	48.00

ALUMINUM STEP - TYPE 1A- 300# RATING

404	4'	16#	65.95
405	5'	20#	77.95
406	6'	24#	92.95

ALUMINUM DOUBLE STEP -TYPE 1A-300# RATING

T404	4'	21#	91.95
T405	5'	25#	105.95
T406	6'	30#	126.95

FIBERGLASS STEP - TYPE 1- 250# RATING

6004	4'	13#	53.95
6005	5'	16#	64.95
6006	6'	18#	67.95

FIBERGLASS STEP - TYPE 1- 250# RATING

6004-S w/pail shelf	4'	15#	59.95
6005-S w/pail shelf	5'	18#	69.95
6006-S w/pail shelf	6'	20#	73.95

FIBERGLASS STEP - TYPE 1A- 300# RATING

6204	4'	14#	65.00
6205	5'	18#	75.00
6206	6'	20#	80.00

ALUMINUM FLAT STEP TYPE 11- 225# RATED EXTEN.

Model	Size	Working Length	Weight(lbs)	Sale
D1216-2	16'	13'	22#	117.95
D1220-2	20'	17'	27#	135.95
D1224-2	24'	21'	33#	159.95
D1228-2	28'	25'	42#	185.95
D1232-2	32'	29'	53#	209.95
D1236-2	36'	32'	62#	239.95
D1240-2	40'	35'	73#	298.95

ALUMINUM FLAT STEP TYPE 1- 250# RATED EXTEN.

D1316-2	16'	13'	26#	127.95
D1320-2	20'	17'	32#	152.95
D1324-2	24'	21'	39#	169.95
D1328-2	28'	25'	50#	199.95
D1332-2	32'	29'	62#	235.00
D1336-2	36'	32'	77#	299.95
D1340-2	40'	35'	85#	329.95

ALUMINUM FLAT STEP TYPE 1A- 300# RATED EXTEN.

D1516-2	16'	13'	31#	159.95
D1520-2	20'	17'	37#	169.95
D1524-2	24'	21'	45#	199.95
D1528-2	28'	25'	56#	219.95
D1532-2	32'	29'	66#	259.95
D1536-2	36'	32'(250# rating)	79#	309.95
D1540-2	40'	35'(250# rating)	89#	349.95

ALUMINUM FLAT STEP TYPE 1A+ 300# RATING

D520-2	20'	17'	42#	209.95
D524-2	24'	21'	49#	239.95
D528-2	28'	25'	66#	279.95
D532-2	32'	29'	74#	319.95
D536-2	36'	32'	89#	369.95
D540-2	40'	35'	99#	419.95

FIBERGLASS FLAT STEP TYPE 1A-300# RATING

D6116-2	16'	13'	34#	179.95
D6120-2	20'	17'	40#	199.95
D6124-2	24'	21'	53#	239.95
D6128-2	28'	25'	60#	269.95
D6132-2	32'	29'	74#	309.95

FIBERGLASS FLAT STEP TYPE 1A- 300# XTRA HEAVY

D7116-2	16'	13'	37#	209.95
D7120-2	20'	17'	43#	245.95
D7124-2	24'	21'	58#	279.95
D7128-2	28'	25'	66#	309.95
D7132-2	32'	29'	79#	369.95

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VSRE500K	V/spd 5" Random Sndr w/cs	279	149
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HBSE75S	3 x 21 variable speed Belt Sander	299	168
ABSE15S	1/2" cdls 12 volt Drill complete w/cs	389	174
FSPE100	Barrell Grip v/spd Jig Saw	265	145
BSPE100K	Top Hdle v/spd Jig Saw w/cse	275	149
EZ560	3/8" cordless 7.2 volt Drill 2 speed	205	139
OFS50	1HP Plunge Router	299	135
TXE150	New 6" var/spd Rand Orb Sander	220	145
SKS600	NEW 10" Compound Mitre Saw	999	539

HITACHI TOOLS

Model	Description	List	Sale
C7SB	7-1/4" Circular Saw	216	115
C7BD	7-1/4" Circular Saw with brake	235	118
M12V	NEW 3 HP variable speed Router	477	225
TR12	Plunge Router 3 HP	355	169
F1000A	12" Planer/6" Jointer	2774	1549
P12R	12-9/32" Planer	1425	719
P12RA	Planer/Joiner	1880	910
C10FA	10" Deluxe Mitre Saw	553	268
C12FA	NEW 12" Mitre Saw	600	298
C8FB	8-1/2" Slide Compound Saw	1026	449
FREUD	LU91M0088-1/2" carb. blade 48 tooth	68	43
C15FB	15" Mitre Saw	773	395
FREUD	LU85M01515" carb. blade 108 tooth.	145	99
F20A	3-1/4" Planer 3.4 amp	179	95
G12SA	4-1/2" Grinder 6.9 amp	147	75
DS10DVAK	NEW 12 volt Cordless Drill Kit with 2 battenes	383	185

Hitachi Air Tools

NR83A	Framing Nailer 2 - 3-1/2 Full Head	680	379
NR83AA	Framing Nailer 2 - 3-1/2 Clip Head	740	409
NT65A	16 ga. Brad Nailer 1 - 2-1/2	590	318
NT45A	18 ga. Brad Nailer 13/16 - 1-3/4	484	269
NV45ABC	Coil Roofing Nailer 7/8 - 1-3/4	740	349
NV83A	Coil Nailer 2 - 3-1/4	740	409
NV50A1	Coil Nailer 1-1/4 - 2	534	305
N5008AA	7/16" Stapler - 16 ga. 1 - 2 lgth	578	309
N3824A	1" Stapler 16 ga. 1/2 - 1-1/2	626	329

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3950	Moto Tool Kit with bits & case	129	79
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8508	Cordless Moto Tool Kit with case	104	68
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Model	Description	List	Sale
IM250	Tnmpulse Finish Nailer Kit complete drives 3/4" - 2-1/2" brads	849	615
IM325	Impulse Framing Nailer Kit complete drives 2" - 3-1/4" nails	849	615
IM-200-S16	Impulse Siding Stapler - drives 16 gauge staples at 3/4" - 2" lgths	849	629
402500	Extra battery	Sale	42.95
402502	No-Mar Work contact element	Sale	19.25

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SENCO AIR NAILERS

SFN1	Finishing Nailer 1" - 2"	377	269
SFN2	Finish. Nailer 1-1/2" - 2-1/2"	571	339
SN325	Nailer 1-7/8" - 3-1/4"	665	375
SLP20	NEW Pinner w/case 5/8" - 1-5/8"	399	269
SKS	Stapler 5/8" - 1-1/2"	351	239
SPS	Stapler 1" wide - 3/4" - 1-1/2" length.	460	299
M2	Stapler 1/16" wide - 1-3/8" - 2" length	490	345
N70	NEW HD Framing Nailer 2" - 3-1/2"	625	479

Not available in all states

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Model	Description	List	Sale
TT45R24L9	24" Fence	369	299
TT45R50L12	50" Fence	399	318
EXSLT30	Sliding Table	599	475
EXSLT60	Sliding Table	745	585

RECORD WOODWORKING VISES

Model	Jaw Width\Opening	List	Sale
53E	10-1/2"\15"	Quick release	189	125
53P	10-1/2"\15"	Plain Screw	174	109
52D	7"\8"	Quick release w/dog	137	94
52-1/2D	9"\13"	Quick release w/dog	175	125

REMINGTON POWER FASTENING TOOLS

Model	Description	List	Sale
75707	476 Power Hammer with case	35	28
77550	480 Power Drver with case	169	104
78480	482 Multi Drver with case	369	235

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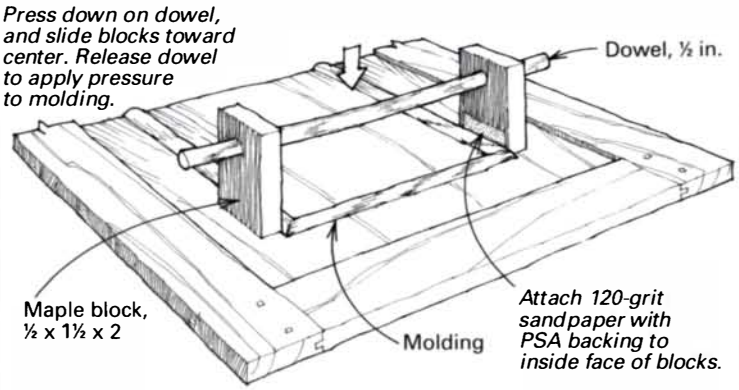
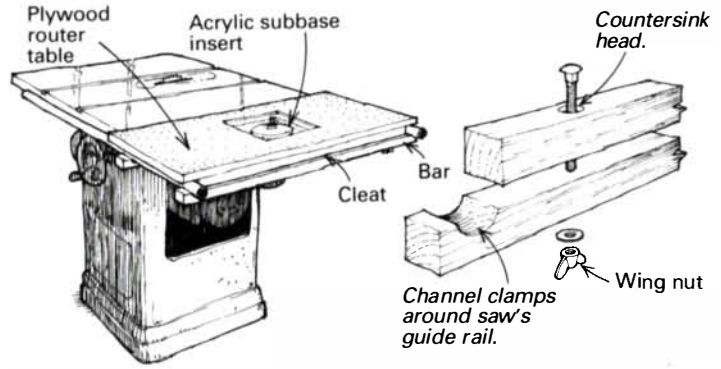
Clamp for holding mitered molding



I use these simple, inexpensive and versatile clamps to close the miters on molding applied to cabinet doors. Cut two maple blocks, 1½ in. by 2 in., ½ in. thick. Drill through the blocks with a ½-in. Forstner bit to make a clean hole. Glue some sandpaper to the inside face of each block. Slide the two blocks, face to face, on a ½-in dowel. To clamp, slide the blocks until they contact the work. Then bend the dowel down, slide the blocks home and release. Voila—pressure! *—Rob Hetler, Langley, Wash.*

Router table attachment for tablesaw



When I began thinking about a router table, it soon became apparent that finding a home for a large, occasionally used table would be a problem in my crowded basement shop. Finally, it occurred to me while looking at the rip fence bars extending from my tablesaw that here was an ideal support system for the router table. In addition, I am able to use the saw's fence and miter gauge for certain operations on the router table.

I cut a piece of ¾-in. plywood, 16 in. wide and long enough to fit over the bars. Into this, I routed a ledge to accept an acrylic router subbase. I attached wooden cleats to the bottom of the plywood tightly between the bars to prevent front to back movement of the table. A second set of cleats along with bolts and wing nuts clamps the table to the bars.

Although the router-table top extends above the saw-table top, limiting the fence travel to the extreme right of the saw table, the saw can still be used for quite a bit of work with the table in place. When necessary, it takes only a minute to remove the table and hang it against the wall.

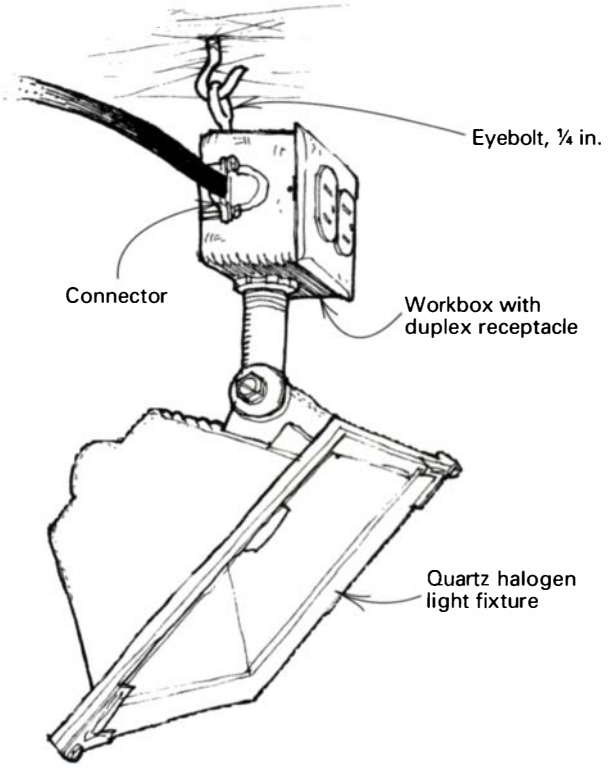
—Martin Gingrich, Palmyra, Pa.

Setting plane irons

I have tried sighting across the sole of a metal handplane to set the iron, but I haven't seen a thing but glare. Here is a new way that works.

Stand in a room with your side to a doorway or window that light is coming through. Hold your plane at belt buckle level with the sole vertical and facing away from the light. Sight down the sole toward the throat and slowly advance the iron. As it emerges, you will see a thin line of light reflecting from the cutting edge. The shape will be a crescent or a straight line, depending on how you have ground your edge. If it is wedge shaped, you need to move the lateral adjuster toward the thicker side to square the cutter to the sole. The thinner the band of light, the less the cutter is exposed and the finer the shaving will be. Be careful not to block the light entering the top of the plane with your hands. *—John Knepper, New Milford, Conn.*

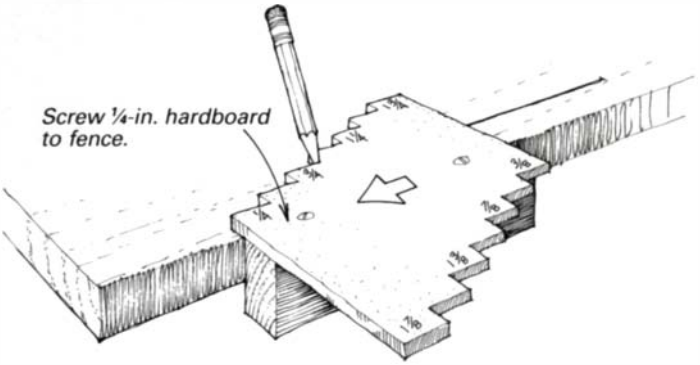
Portable flood lights



To provide a flexible lighting system in my shop, I assembled several lighting fixtures. Each fixture comprises a 300-watt halogen light, a workbox, a duplex receptacle, a ¼-in. eyebolt and about 10 ft. of three-wire grounded cord with plug. Screwing ¼-in. hooks into the ceiling of my shop at key locations lets me move a light to wherever I happen to be working. There is no stand to get in my way, and I always have a receptacle close by for my drill or sander. *—Lester Lavy, Dayton, Ohio*

Quick tip: A chalkboard eraser makes a great sanding block. Use the hard side for sanding bare wood and the soft side for sanding out finishes. *—Howard E. Moody, Upper Jay, N.Y.*

Standard pencil gauge



In cabinetry, there are many occasions when you need to mark distances from an edge and some of these recur frequently. This gauge allows you to mark distances from the edge of stock by

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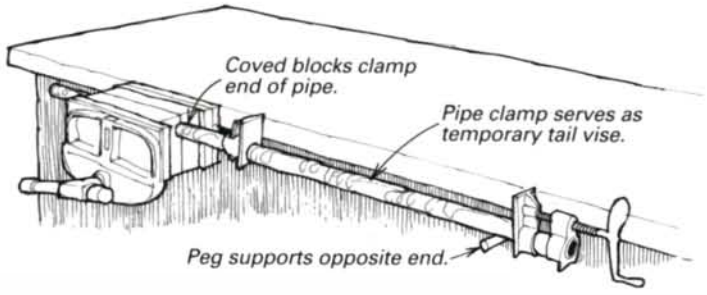
drawing with a pencil in the appropriate notch.

The example shown is made from ¼-in. hardboard screwed to a piece of ¾-in. square stock. It has notches at ¼-in. intervals on one side and intermediate ⅛-in. spacings on the other, but you can arrange notches and the size of the gauge to suit your needs. *—Percy W. Blandford, Stratford-upon-Avon, England*

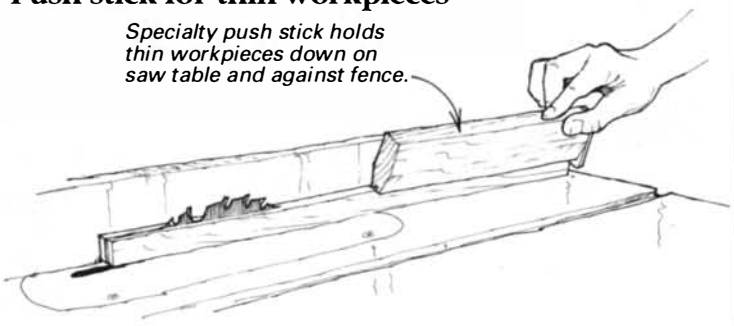
Substitute tail vise



When I found myself in need of a tail vise, which my bench does not have, I designed this substitute that uses a pipe clamp and acts like bench dogs. To make the vise, cut coves in a two-piece block to hold the tail of the pipe clamp in your bench vise and drive a sturdy peg into the edge of the bench to support the other end. The bulk of the workpiece should be supported by the benchtop. You can also turn the pipe clamp 90° to edge-clamp or hold floor-standing workpieces upright.

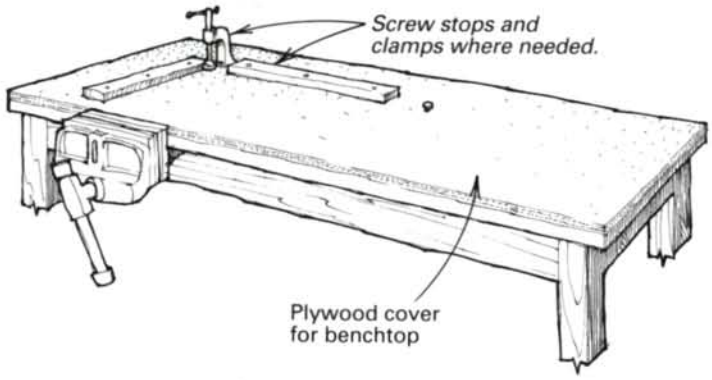
—Tony Konovaloff, Bellingham, Wash.

Push stick for thin workpieces



This push stick is customized for pushing long thin pieces, such as picture-frame parts, through a sawblade when ripping or rabbeting. The sawkerf presses on the upper outer edge of the work, holding it both down and against the fence. The length of the pusher allows it to bear against the whole length of most workpieces. The stop screwed to the end of the pusher should protrude just enough to hook over the end of the work and push it along. *—Abijah Reed, Newton Center, Mass.*

Temporary workbench top

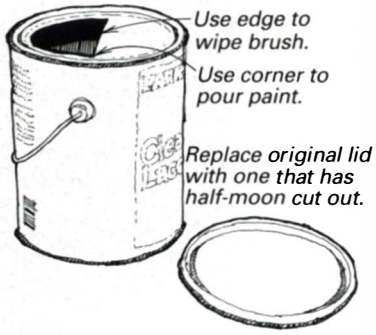


I attached a piece of ¾-in. plywood to the top of my workbench so that I could use hold-down clamps for a special project. Since then, I've discovered that this plywood top, by giving me the freedom to screw jigs, stops and fences anywhere I like, has changed the way I work. For example, I install standard hold-down clamps anywhere I need them by simply screwing large pan-head screws into the plywood benchtop. The possibilities seem to be endless. Once the job at hand is completed, I remove the screws to return to a normal flat work surface. And if I want to return to the pristine surface of the original bench, I remove the plywood. *—Oscar Williams, Lincoln, Neb.*

Quick tip: When a can of paint has been unopened for a few months, turn it upside down for a couple of days before opening. You will find when you open the can that the mixing process is almost complete.

—Herman J. Fersenheim Jr., Woodstock Valley, Conn.

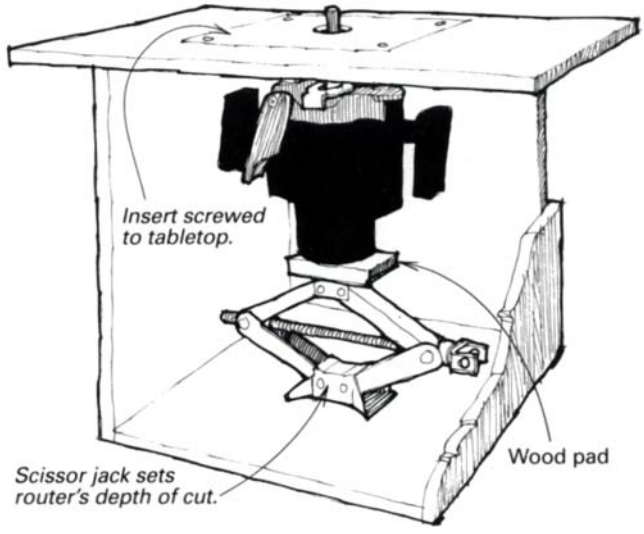
Keeping a paint-can lid dry—revisited



When I open a can of paint, I set the lid aside. In its place, I attach a previously used lid with a semicircular hole in it. The best shape for the opening is a half moon, with a straight edge near the middle and a curve following the outer edge of the rim—not too close, though. I stick my brush into the paint through the opening and use the flat edge to scrape excess paint from the brush. Or I pour the paint using the opening's corner. Through all this, the sealing lip of the can is protected from drips and remains clean. When I'm through, I just reattach the original lid. If the paint is used up, I save the lid for a future cutout.

—Ronald R. Schultze, Redlands, Calif.

Scissor jack router lift



After looking through catalogs and saving my pennies, I finally located the perfect plunge router for my router table—or so I thought. After mounting it in the table, it became obvious that depth adjustments were difficult because I had to fight both the motor weight and the stiff plunge springs.

Using an automotive scissor jack is the solution that I've found. I place the jack below the router on a fixed shelf, mounting a small pad of wood on the top of the jack to protect the router. The only other change is to screw the drop-in insert to the table so that the jack wouldn't push it out of the hole. Now I can set the depth of cut easily and accurately by turning the jack screw

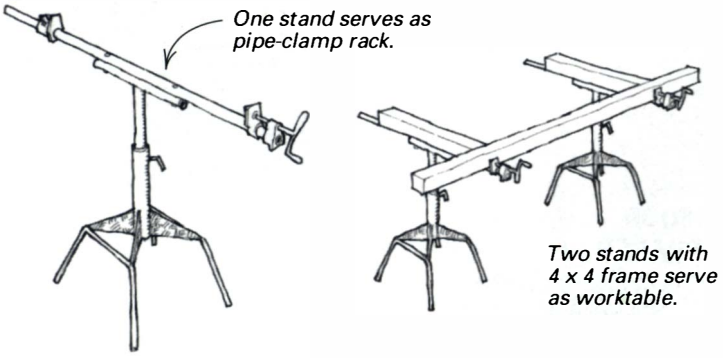
with my fingers. When I have the right depth, I lock the router's plunge mechanism in that position and get on with routing.

—Mark G. Carls, Juneau, Alaska

Quick tip: To make perfectly sized dowels, cut 6-in. lengths of regular birch dowel, and with the lengths chucked in a drill press running at its slowest setting, feed the dowel slowly and steadily through a predrilled hole in a chunk of scrap maple or oak. This operation compresses and burnishes the dowels for a perfect fit. Move to a new burnishing hole after half a dozen dowels. I chamfer the dowel ends with a belt sander, and then I cut a couple of longitudinal kerfs in each dowel to act as glue vents.

—Tom Rose, Los Angeles, Calif.

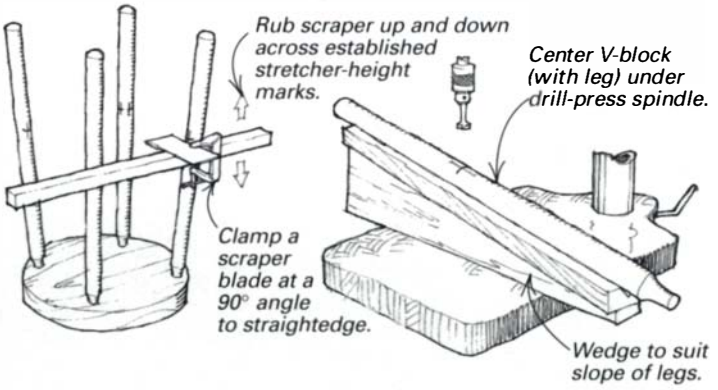
Double-duty clamp stand



These stands serve not only as a clamping rack but also as a plywood worktable. Make the stand by bolting a Jorgenson pipe clamp to the T-top of a work support stand. To use as a clamping rack, simply lay down the boards, and tighten the clamps. Add other clamps on the top and bottom if needed. To use as a worktable, clamp a long 4x4 into the stands using a couple of shorter 4x4 crosspieces to form a frame.

—K. O. Brown, Bessemer, Mich.

Marking stretcher hole locations in round legs



Here's how to accurately mark the location of stretcher holes in round legs. First dry-assemble the stool or chair and upturn it on the bench. Mark the stretcher height locations on the legs with horizontal lines. Now clamp a scraper blade to a straightedge at a 90° angle, and rub this tool up and down the legs to make a scratch mark, as shown in the sketch. Remove the legs, and mark the center of the drilling where the scratch mark crosses the height line.

To drill the hole, clamp a long V-block on the drill-press table centered under the spindle. Use a wedge to incline the V-block

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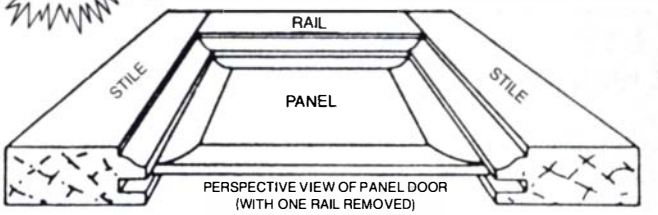

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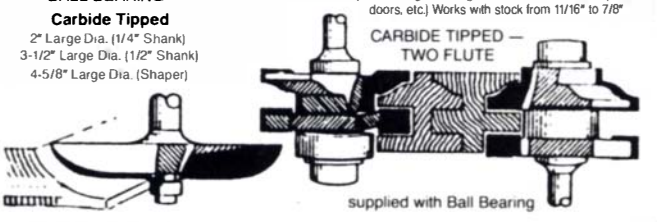

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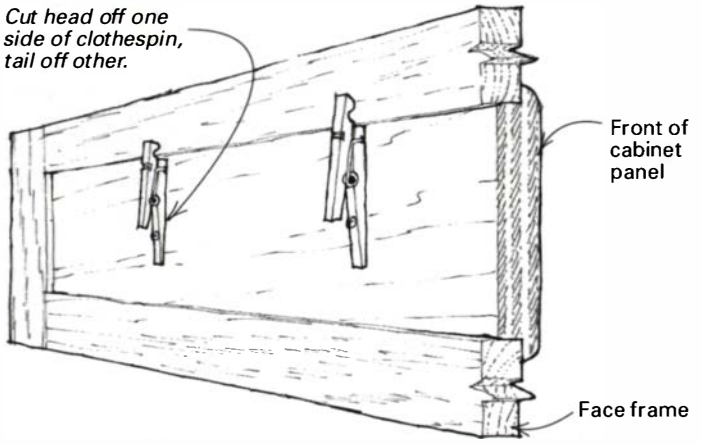
at the same slope as the legs. Place the leg in the V, rotate it to center the mark under the bit and then drill.

–Nigel Atkinson, Long Whatton, Leics., England

Quick tip: To remove broken dowels without damaging the original hole, drill a hole through the center of the broken dowel, and fill it with water with a touch of dishwashing detergent. The water and soap (penetrating agent) will soak through the wood, dissolve the old glue and make it easy to remove the old dowel.

–Bruce De Benedictis, El Cerrito, Calif.

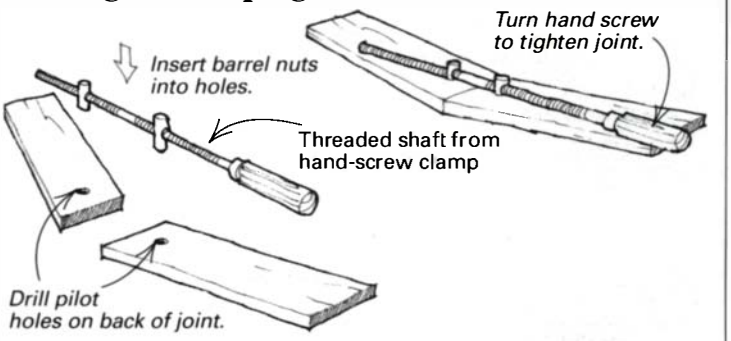
Removable cabinet panels



Here's how to fasten a blank cabinet panel like the one in front of the kitchen sink, so it can be easily removed. Alter a regular spring clothespin by cutting off the top of one side and the tail of the other. Now, using a single screw for each pin, fasten a couple of the altered pins to the back of the panel. Set the panels in the hole, and reaching in from behind, rotate the pins so they spring open and grip the frame.

–Lewis A. Larsen, Eagle Grove, Ia.

Odd angled clamping



I use the hardware from wooden hand-screw clamps to draw odd angled joints together as they are glued. Simply drill pilot holes on the back side of the joint with a Forstner bit that is the same size as the clamp's two barrel nuts. Drill deep, but don't go through the workpiece. Insert the nuts into the two pilot holes, and close the joint tightly by rotating the hand screw.

–Dick Dorn, Oelwein, Ia.

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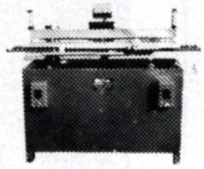

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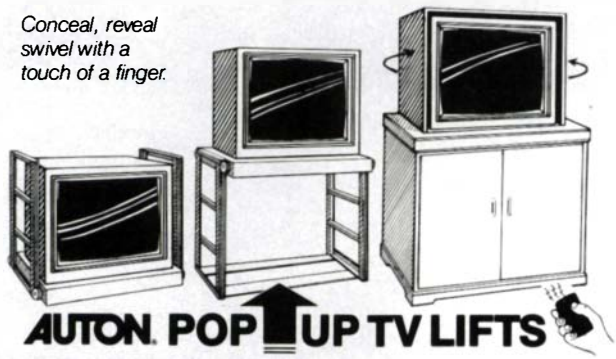

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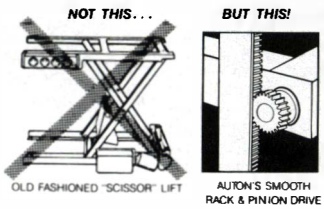

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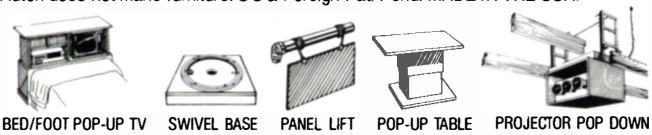

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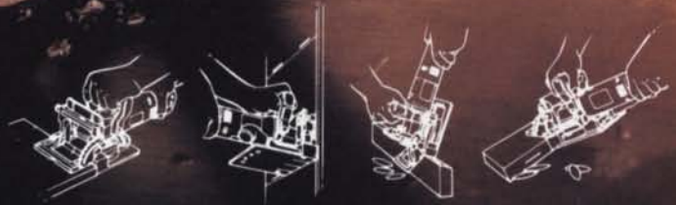

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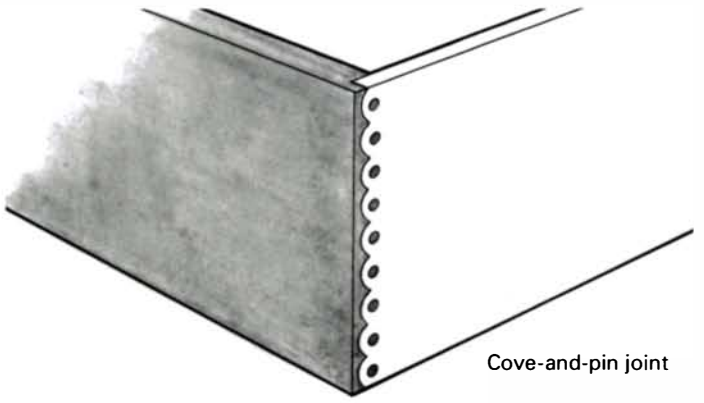
Cove-and-pin joint

I acquired an old walnut dresser about 10 years ago that was built using some unusual drawer joinery. I haven't found anyone who is familiar with this type of joint (see the drawing below). What looks like dowels are actually part of the drawer face. What advantages does this joint have over conventional joints, and how is it made? ***—John Morici, Des Plaines, Ill.***



Cove-and-pin joint

Sandor Nagyszalanczy replies: The joint shown in the drawing is a cove-and-pin joint. Its intricate symmetry makes this joint visually appealing and the interlocking pins offer about the same strength as a doweled joint. The cove-and-pin joint was cut with special machinery that is no longer available and was used by manufacturers to dress up casegoods. David Gray, in *FWW* #59, pp. 74-75, describes a technique for cutting cove-and-pin joints using a combination of machine and hand techniques.
[Sandor Nagyszalanczy is a contributing editor to *FWW.*]

Working with applewood

I am looking for some information about applewood: how to dry it, what its working properties are like and where to get it. Can you help me? ***—Kyle St. Clair, San Marcos, Calif.***

Keith Hacker replies: Apple is a beautiful wood and looks great in cabinets, furniture or jewelry, but it is not without its faults. The main problem I've had with the applewood I've worked is in drying it. I don't know whether the wood's tendency to warp in strange ways while drying is due to the structure of the wood itself or the way that apple trees grow (probably a combination of the two). Unlike other species with larger trees that tend to grow tall and straight, apple trees tend to be small and branch out heavily (a habit further encouraged by pruning), yielding very few large, straight pieces good for woodworking. The trunk of a typical tree may be only a few feet high. The result is lots of reaction wood and many knots.

Given apple's growing characteristics, drying it must be done slowly and carefully. First I crosscut the curved branches at the bends, which results in more short, straight pieces in the 15-in. to 24-in. range rather than a few long, curved sections. Then I cut my stock to a nominal 1-in. thickness and seal all the ends with paint or a thick coat of wax. I sticker the boards into stacks, which are then clamped between 4x4s drawn together by ¼-in. threaded rods passing through them. The clamped stacks are then put in a shady area where they can dry slowly, with sufficient air circulation to prevent mildew.

Even with these precautions, many of the applewood boards twist, warp, or crack during drying. These defects must be removed by jointing and planing. Because of apple's tendency to chip and tear, knives must be extra sharp, and planing with the grain is a must. An abrasive planer or thickness sander would be nice here. Try to plane each board equally from both sides so as not to disturb any tension left in the wood. Even though I start with boards 1 in. thick, I usually end up with stock that's only ½ in. thick by the time the planing is done.

As working properties are concerned, applewood is very similar to black cherry: it's fairly hard, finishes well, but can have a tendency to burn if your router or shaper cutters aren't up to snuff. Apple and black cherry can also be very similar in appearance. I recently built a blanket chest from black cherry and used some apple pieces, which blended in very well. The smaller branches, being mostly sapwood, are very light, almost white in color with beautiful streaked heartwood.

My applewood supply came from my neighbor's apple tree, which he cut down. Because I have a sawmill in my back yard, I couldn't pass up the opportunity to try the wood. Larger pieces were cut on the sawmill, smaller ones on my 32-in. bandsaw.

So is all the hassle of cutting and drying apple worth the effort? I think so, and I keep a lookout for apple trees being removed—the only source I know of for applewood. Although many of the pieces will warp or crack, there will be that occasional piece of heartwood that will remain flat and straight.
[Keith Hacker is a woodworker in Scandia, Minn.]

Installing a cherry sink top

I'm not a professional woodworker, but I do some projects around the house. I installed a cherry sink countertop for my wife 15 years ago. At that time, we treated the cherry with an oil (not linseed oil). Because the original has started to rot around the rim of the stainless steel sink, I have built a replacement cherry countertop. In preparation for the installation of this cherry top, I researched all of the literature I could find on finishing wood countertops. I seem to be at a dead end. Can you help? ***—Raymond J. Moyer, Jr., Hinton, W.V.***

Dick Boak replies: There is a certain obsession among woodworkers to fabricate every last bit of their existence in wood. This is relatively easy with tables, chairs, cabinets, bowls and other treen, but when you start talking about sinks, bathtubs, countertops and showers....where do you turn?

I personally didn't want to resort to a conventional formica countertop and a prefab fiberglass shower, so I bought an old cedar chest, which I converted into a shower. I also made a kitchen sink out of laminated plywood and kitchen counters out of butcher block rock maple. I was quickly plagued with the problem of how to effectively waterproof all of these surfaces, which would come in fairly constant contact with water.

I made every mistake in the book during my search for an appropriate finish for my wooden sink. I wanted something durable yet clear so that the natural wood color was not affected. Having no experience in this area, I resorted to trial and error. I'll recount my nightmares so that you don't follow in my footsteps.

I first tried polyurethane brushed on fairly thick, applying one coat daily until I had a six- or seven-coat buildup. I really thought this would suffice, but the hot and cold water caused the wood laminates to shrink and expand. First finish checking occurred along several seams. Eventually water worked its way under the finish causing a cloudy scunge. Off came the polyurethane.

I turned to my local marine store. The fellow who ran the place surely knew more than I did, so I took his advice. He thought poured fiberglass resin (without the cloth) might do the trick, so I bought a few quart cans, mixed the proper amount of activator droplets and poured a thin ⅛-in. coat. It looked great until about a week later when it began to separate from the wood as a result of shrinkage. It eventually cracked and water got under the surface, necessitating the tedious removal of the coating with a chisel. I was back at the marine store for more advice.

This time I reluctantly purchased a gallon can of Gluevit, which is a gloppy translucent sludge that smells worse than burning tires. Apparently it's used to fill gaps that open up on the underside of boat hulls. It's quite waterproof, I'll say that much, but as for aesthetics, not quite. I scraped it all off wearing noseplugs.

My last hope was a two-part mix of marine epoxy. I decided to

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do a test this time before suffering through another scraping process. It seemed to be perfect in every respect. It dried hard and clear with no shrinkage, so I tried it on the sink. What hadn't occurred to me was the fact that I had contaminated the wood surface with so many different chemicals and incompatible products that the epoxy refused to cure. It remained as gummy as corn syrup for three weeks until I finally gave up on it.

Out came the roofing cement and wire mesh. My sink fantasy was over. I tiled it instead, with lots of grout. It doesn't leak. All I have left of my wooden sink is a buried shell, a black and white photograph and two months of bad memories.

If I had the luxury of backing up and starting over, I think the two-part clear, marine epoxy finish would do the job. But I would do plenty of preliminary tests, and I would make sure that the surfaces were perfectly clean and uncontaminated.

There are other ways to tackle this problem. One option is to use genuine teak. Although expensive, its natural oil impregnation protects teak from water. Teak doesn't really need a finish, but for aesthetics, you might want to revitalize the surface occasionally with a light oil made especially for that purpose.

There are many new two-part catalyzed finishing products on the market. The impermeability and hardness of these finishes makes them quite suitable for kitchen countertops and cabinet faces. But catalyzed finishes are applied with specialized commercial equipment that makes it economically unfeasible for small jobs.

Adding about 10% vinyl to nitrocellulose lacquer can increase moisture resistance for a high-quality polished, waterproof finish. Spraying a few initial coats of pure vinyl to the freshly sanded wood surface can also yield a waterproof surface.

Whatever you do, be ready for the unexpected. If it were that easy, we'd still be taking baths in wooden tubs.

[Dick Boak manages The Saw Mill, the exotic-wood sales division of The Martin Guitar Co. in Nazareth, Pa.]

Veneering round parts

I need to veneer 2-in. birch round stock (36-in.-long legs of a hall table) with hardwood veneer. How do I ensure that the veneer edges meet longitudinally without either an overlap or a gap? Please advise. ***—Philip Jansen, Vallejo, Calif.***

John Kriegshauser replies: I have had good luck veneering curved surfaces by applying the veneer in stages using a white or yellow glue. You will need a half-round concave form that will cradle the round leg. To make the form match the leg precisely, I line the form with a layer of soft material, such as cloth. I place a plastic laminate backing sheet (with a waxed surface to help repel glue) on top of the soft material.

I glue the veneer only to a fourth of the circle at a time. First I cut the veneer slightly wider than needed to completely wrap around the leg and start with the quarter of the circle opposite the seam. I apply masking tape to define the borders of the area to the left and right, both on the veneer and on the core.

Apply the glue sparingly to the core, but do not starve it. Then position the veneer on the core, and gently rub your hand across the area to be glued to drive any flowing glue onto the tape. Again be careful not to starve it. Lift the veneer to remove the tape; then carefully reposition the veneer just where it came from. When the assembly is placed in the clamping form, it is important the clamp reach beyond the limits of any flowing glue. Also, if your veneer threatens to crack in bending, go over the exterior with a wet sponge a few minutes prior to gluing, and it will naturally curl.

When you bond the two quarters on either side of the first quarter, you need only tape on the side away from the previously glued area. Coax the glue down deep into the fold, so it is right up against the original glued area. Squeeze any excess toward and onto the tape, peel away the tape and clamp with the form.

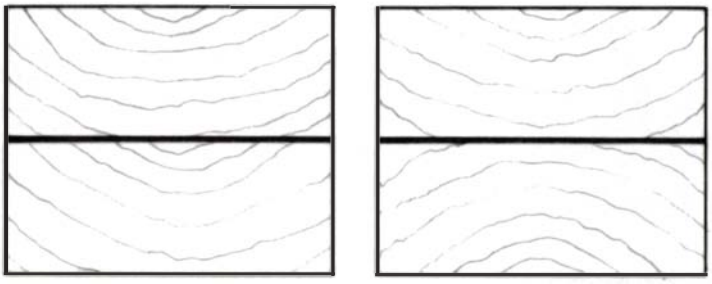
Leave the cutting and gluing of the seam for last. Lap the two flaps over one another and cut through both simultaneously with a thin-kerf veneer saw guided by a straightedge. The kerf left by this saw is almost imperceptible and, properly positioned, should be unobjectionable. Because there is nowhere for the glue to flow except out the seam, no taping will be required for this last glue-up. This method is not fast, but I have had good luck with it.

I have not tried contact cement on ordinary veneer, though it works well on the paperbacked veneers. If this is what you have in mind, you will be able to cut the seam in place by positioning a strip of thin, clean material, such as manila file folder paper, in the area of the seam. When the veneer is wrapped about the leg, the paper will prevent the bond in the joint area. You may then lap the pieces and simultaneously cut them, possibly with a sharp mat knife. Then remove the paper, and rub the edges down.

[John Krieghauser is a designer/craftsman in Kansas City, Mo.]

The best way to glue boards face to face

When gluing boards face to face, is there a proper or best way of orienting the growth rings of adjacent boards to minimize stress along the glue joint and/or provide a more stable assembly? Given a choice of gluing up in either of the two ways shown in the drawing below, which method of gluing is preferred and why? ***—Mark S. Tanzi, North Providence, R.I.***



Boards glued with growth rings in same direction

Boards glued with growth rings in opposite orientation

Bruce Hoadley replies: I would go with the orientation shown in the drawing on the right. For one thing, faces with more similar grain would be adjacent to one another and, therefore, more similar dimensional changes would take place parallel to the glueline. Also, if the stock has a tendency to warp (cup), boards glued with their grain running in opposing directions might hold one another flat; in the glue-up example in the left-hand sketch, both pieces would cup in the same direction.

[Bruce Hoadley is a contributing editor to *FWW* and a professor of wood technology at the University of Massachusetts at Amherst.]

Getting the right hearing protection

I have a condition called tinnitus, which causes constant ringing, hissing and buzzing in my ears. Use of power woodworking tools aggravates this condition. I've tried using ear plugs and a noise suppressor over my ears without much success. If I don't come up with an adequate noise suppressor, I may have to give up woodworking. Where can I get custom-made hearing protection that will do the job?

—Joseph Matsko, Pottstown, Pa.

Joy O'Neal replies: You do not mention in your letter whether you have seen an audiologist or physician who specializes in ear problems (otologist or otolaryngologist) about your tinnitus and inability to find a good noise suppressor.

There are many types of hearing protection devices on the market, about 300 different products from more than 50 manufacturers or providers. When most people want to obtain earmuffs or plugs, they go to their neighborhood sporting goods store. That may be effective for many people, but when a person has more specific needs, as you do, it is vitally important to have the hearing-protection devices fitted by an audiologist who is familiar

with the market and can evaluate the device you use to determine the amount of attenuation you are receiving.

Most audiologists would test your current hearing sensitivity, fit you with the hearing protection devices chosen, and evaluate you in a special sound-field testing setup or with a probe microphone to determine the attenuation of the devices when you are wearing them. In some instances, it is necessary to wear both plugs and muffs to obtain appropriate attenuation.

The important factor is how well the devices fit in or over your ears. If you have had hearing protection devices fitted to your ears by a professional and you are still experiencing increased tinnitus with exposure to equipment noise, you should contact a physician who specializes in ears and discuss this problem.

Most people can be appropriately fitted with hearing protection devices. If you do not know of any audiologists in your area, you may locate one by contacting an otologist or otolaryngologist in your area. Many physicians who are ear specialists have audiologists who work with them. If you are unable to find an audiologist in your area, contact the American Speech-Language Hearing Association at 800-638-6868. They have a listing of all certified audiologists in the United States and can provide names and phone numbers of audiologists in your region.

[Joy O'Neal is a coordinator for the Texas Department of Health in Austin, Texas.]

Excessive tearout in pine

I make wooden toys out of pine and shape the edges with carbide bits in a table-mounted router. But I get excessive tearout. How can I prevent this, and once it occurs, what can I do about it? Presently, I'm hand-sanding torn-out areas, but it's a tedious job. —R. Hammond, Mississauga, Ont., Canada

David Rudolph replies: Because pine is a softwood, you will always get a certain amount of tearout. But tearout can be reduced in the following ways: 1. Buy high-quality carbide bits. The carbide in a good bit can be ground sharper and will hold an edge longer than cheap carbide bits. 2. Try using a router that turns at higher rpms. The faster the revolutions the better the cut. 3. Make sure the bearings in your router are in top shape. Worn bearings let the bit wobble, resulting in a poor cut with more tearout.

To clean up tearout, try power sanding techniques like vibrator sanders, belt sanders and flap-wheel sanders. The ultimate solution might be to use a different species of wood with better characteristics for toymaking, for example, beech, birch or maple.

[David Rudolph is a wood sculptor and furnituremaker in Santa Barbara, Calif.]

Restoring clouded finishes

My wife's prize possession is a fine old grand piano whose mahogany finish has become clouded and sticky to the touch after many years of polishing and waxing. Before I rush in and do something stupid, could you give me a clue as to how to restore the original finish without danger of ruining it.

—Uhle Cassidy, New Kensington, Pa.

Don Steinert replies: A finish that is clouded and sticky to the touch is beyond restoration and will have to be refinished. Products that "restore" old finishes, dissolve them and amalgamate the old finish with some new finishing medium. The amalgamation is then redistributed over the surface.

In the case of a piano, this restored finish will not look much like the original finish. You should be able to determine the appearance of the original finish by looking at the underside of the lid or the inside of the rim. It would help to know exactly how old

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the piano is in trying to determine what the original finish was.

Piano finishes are generally considered state of the art. Used generically, the term *piano finish* refers to the ultimate, flawless, glass-smooth finish, whether it is polished to a high gloss or rubbed out to a satin sheen.

If your intention is to restore your piano to its original condition, then your goal should be to make the finish look as it did when it was new. In your case, this will require stripping off the old finish to bare wood and starting from scratch. This is quite a challenge for an amateur and will probably take more than 200 hours. Definitely not something you rush into.

Instructions for refinishing are beyond the scope of this letter. If you should decide to have your piano refinished professionally, be sure to have the finisher show you an actual sample of the finish he intends to produce and demand a written contract before you commit yourself.

[Don Steinert restores Rolls Royce woodwork and lives in Grants Pass, Ore.]

Tablesawing thin veneers

I do antique restoration for several antique shops and have recently been given the assignment of replacing several missing inlay segments on a box. I've done inlay work and marquetry, but this assignment has me puzzled. The square segments are made up of 20 pieces, eight birch and 12 mahogany. Each piece is 3/32 in. thick, a little too much to cut with an X-Acto knife and rather exacting for a hand-held fretsaw. What tools and techniques are required to safely cut these small pieces so they fit exactly? ***—Issac Kershaw; Alexandria, Va.***

Bill Robertson replies: I prefer a tablesaw for cutting thin stock. I use a special saw that I built specifically for fine work, however, you can modify any tablesaw to this purpose. The right blade is important. I use a Thurston cutting saw, 6 in. dia., .035 in. thick, 10 teeth per inch (Thurston Manufacturing Co., 45 Borden St., Providence, R.I. 02903; 401-331-0243).

The problem with most small tablesaws is they run too fast and this causes the blade to burn the wood. I like to run a 5-in. to 6-in. saw at 1,725 rpm. Because most tablesaws have a 3,450 rpm motor, they should be slowed down either by changing the motor or the belt and pulleys. You also might be able to use an electronic speed controller. An old appliance motor from a furnace, dryer or fan should work as long as it's over one-sixth horsepower. You may even want to set up a separate saw if you will be doing a lot of this type of work.

Whatever saw you use, you will need to make a new wooden table insert and run the blade up through it. This makes a zero clearance insert that helps stabilize the blade and leaves no crack between blade and insert to catch small pieces. When sawing, I raise the blade just past the thickness of the stock to be cut.

To create the small square pieces, I resaw boards on my bandsaw and then run the stock through a planer to the desired thickness. I rip the wood into strips and, using the miter gauge with a back-up strip and stops, cut the strips to length. To help save fingers when cutting little pieces, I use the eraser end of a pencil as a push stick.

[William R. Robertson builds museum-quality scale models and miniature furniture in Kansas City, Mo.]

Send queries, comments, and sources of supply to Q&A, Fine Woodworking, *PO Box 5506, Newtown, Conn. 06470-5506. We attempt to answer all questions, but due to the great number of requests received, the process can take several months.*

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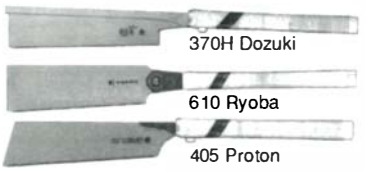

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Photo: Lorraine Burrows

Warner router base

A transparent plastic router base by California woodworker Pat Warner might be just the thing to put your routing on a firmer footing. The teardrop-shaped base simply replaces the stock base that comes with your router (see the photo at left). It takes just a minute or two to make the switch, and it increases the area of the base and provides a handle about 2 in. away from the body of the router. Although that doesn't sound like a drastic difference, I found that the base made the router easier to control, perhaps because the handle is perpendicular to the base rather than protruding from the side of the router.

***The Warner Router Base** provides a firmer footing for most free-hand routing, especially when you're using bearing-guided bits for edge molding.*

I do a lot of routing with bearing-guided bits and really like the base for that purpose. The handle on the narrow end of the teardrop base lets me rest the router firmly on the stock and then rotate the bit toward the wood until the pilot bearing touches the wood. The ½-in.-thick plastic base is slippery enough to let the tool slide easily on the wood.

Warner's router base comes in several versions, one of which will fit most any commercially available fixed-base router. The price is $24.95 from Woodworker's Supply, Inc. (5604 Alameda Place, N.E., Albuquerque, N.M. 87113; 800-645-9292), or you can call Pat Warner for a dealer near you (619-747-2623). *—Dick Burrows*

Portable drafting tools

I might as well warn you at the outset: Neither a portable drafting board nor a rolling ruler are any match for the efficiency and drawing capacity of a mechanical drafting arm or a parallel rule. These portable tools' diminutive size is a serious drawback when attempting drawings much larger than about a foot square. You can extend the useful range of a rolling ruler somewhat by fixing a straightedge to the plate, but it's still not like working at home on your full-sized drafting table.

But if you need to produce a three-view drawing while on the road or at a job site and can live with smaller-scale drawings, these portable drafting tools are a godsend.

Rotring portable drawing board

This tool is essentially a parallel rule, protractor arm-rule and track system made entirely from plastic moldings and extrusions (see the bottom right photo). Not too surprisingly in this space-age of plastics technology, the Rotring board is capable of producing highly accurate drawings. The rules move smoothly along their plastic runners yet become quite rigid when you allow them to self-lock into place. A combination of magnetic and spring clips orients and holds the paper in position.

The optional protractor arm rides on runners formed along the parallel rule. Clearly marked degree lines make it relatively easy to fix the arm at any angle. A serious drawback to using this option is that it further restricts the already limited drawing-size capacity of the board, which I found to be its only major drawback. I preferred using a standard adjustable angle template to draw angled lines with this board.

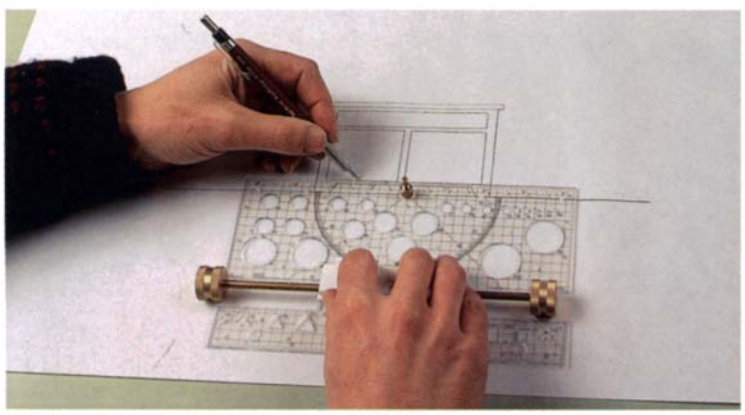
The board comes with a carrying case (plastic, of course!) and enough extra room in the case for drafting templates, erasers and several pads of drafting paper.

The Rotring board is available for $39.95 with the case; the drafting head is another $19.95. The board and drafting head are available from a variety of woodworking mail-order supply houses, including Grizzly Imports, P.O. Box 2069, Bellingham, Wash. 98227; 800-541-5537.

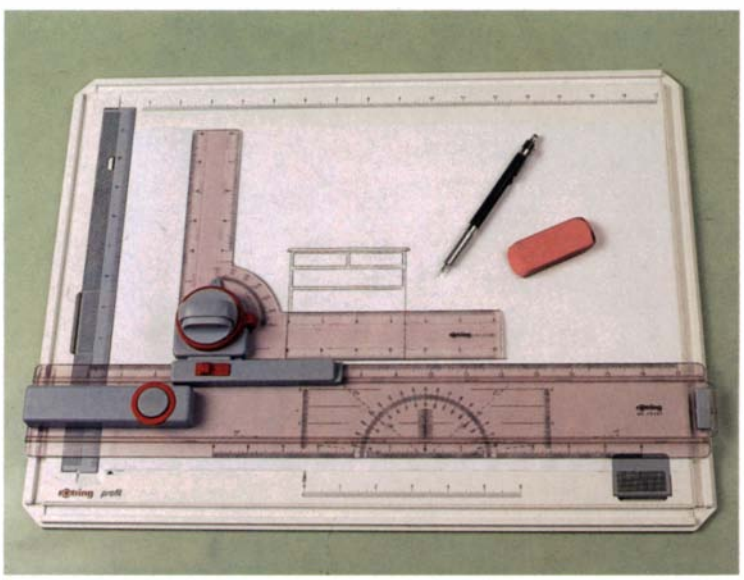
Line/Design rolling ruler

A rolling ruler is an almost embarrassingly simple tool. It is made by mounting a square piece of clear Plexiglas plate to an axle fitted with non-slip wheels (Line/Design's are knurled brass). Physics dictates the front and back edges of the plate remain parallel to the axle, so the tool is inherently a parallel rule (see the bottom left photo).

You use the side of the plate to draw a perpendicular line to a point on the baseline. A clutch on the Line/Design model al-



***Easy to use but versatile,** Line/Design's rolling ruler makes professional-quality drawings possible regardless of where you are.*



***Rotring's portable drawing board** is inexpensive, well-designed and well-built. Shown here with the optional protractor head, it's capable of accurate, high-quality drawings.*

Photos except where noted: Vincent Laurence

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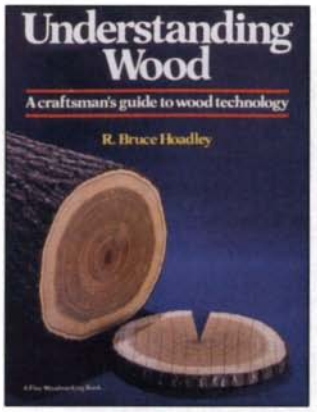

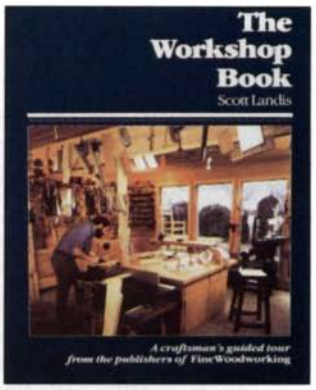

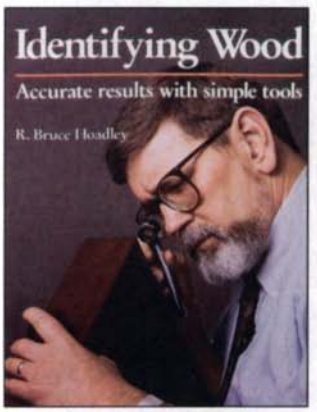

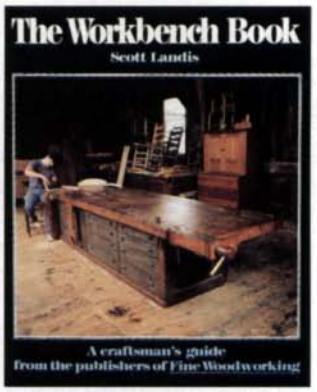

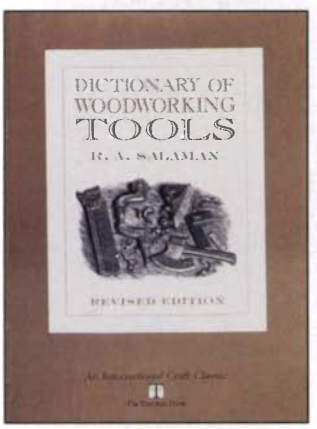

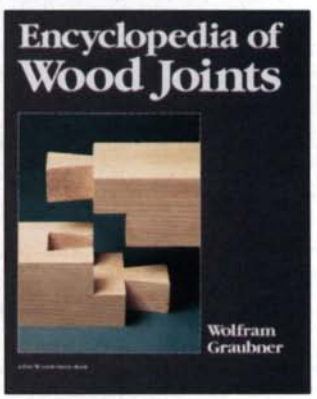

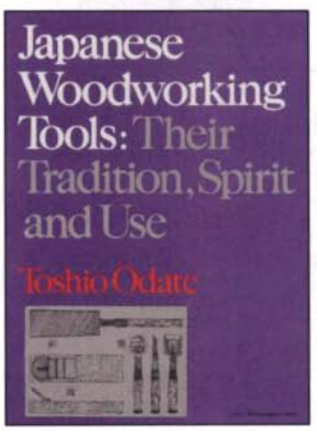

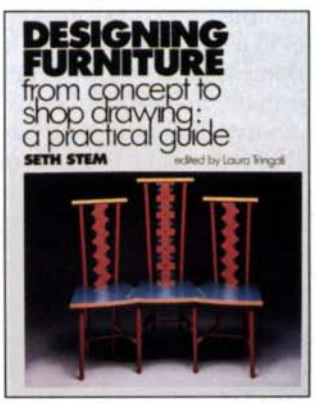

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lows you to slide the plate sideways along the axle to meet the mark. On cheaper versions of rolling rulers, you have to slide the wheels sideways to locate the line along the plate's edge; this can compromise a drawing's accuracy.

You can also draw a perpendicular line by inserting a pencil into a hole in the plate and then rolling the rule up or down from the baseline. You may still, however, have to slide the plate sideways to line up the hole with a mark on the baseline.

You draw angled lines with the Line/Design tool by orienting the protractor baseline etched into the Plexiglas over the drawing's baseline and then pressing a sharpened, brass-knobbed pivot point into the paper. The tool then swings freely. When you line up the desired degree mark over the baseline, you release the pivot point, roll the rule to the mark, and then draw the line. One caution: To ensure accuracy, you must realign the rule to the drawing's baseline each time after moving it before continuing to draw.

You can buy a lesser quality rolling ruler for perhaps a third of what the Line/Design costs ($129.95), which may be fine for a beginner, but you'll most likely be sacrificing accuracy and convenience. For what it is—an easily portable, dependable drawing aid—Line/Design's rolling ruler is the best that I've seen. The rolling ruler is available directly from the manufacturer (Line/Design, P.O. Box 49694, Atlanta, Ga. 30359; 404-321-4558). *—Jim Tolpin*

Robo-sander for template sanding

***"Template-sanding" is possible with the Robo-Sander.** Though a bit slower than using a flush-trimming router bit, it's much safer, especially on figured woods or when sanding across short grain.*

After bandsawing large curved or irregularly shaped parts roughly to size, you can normally finish-shape them using templates and a bearing-guided router bit or a series of bits (see *Fine Woodworking* #93, pp. 44-48). But what do you do if the wood is highly figured or you've got to rout across the grain? If you're not lucky, what will happen is that just as you're finishing the last chair leg, the bit will catch on a bird's eye, and another leg will be tossed in the scrap pile.

Texas woodworker Ken Picou ran into this problem, so he designed the Robo-Sander, a sanding drum with a phenolic-resin bearing mounted on it that lets you follow a template, just as you would with a flush-trimming router bit (see the photo at left). The Robo-Sander mounts on your drill press. Its 50-grit (80-grit is also available) drum isn't as aggressive as a carbide router bit, but what it lacks in speed, it makes up for in safety and dependability. The Robo-Sander will take bird's-eye or curly maple down safely, evenly, without burning and even more importantly, without tearout. If you do much shaping of furniture parts, the Robo-Sander may be of interest to you.

Picou is selling the Robo-Sander directly and through a number of woodworking catalogs. There are three models, ranging in price from $15 to $32. For a free brochure, write Ken Picou Design, 5508 Montview St., Austin, Texas 78756, or call (512) 454-3425. *—Vincent Laurence*

Where to find it

If you've been working wood for a decade or two or three, you probably know where to get almost anything you want or need for your shop. When you're new to a field, though, even the most basic supplies can be a labor to find, and every new lumber dealer, wholesale plastics distributor or industrial parts supplier you stumble upon is a great find. If you know of a great source for any woodworking related tools or materials, preferably one that distributes nationally, drop me a postcard. I'll file all sources and try to pass on as many as I can. Here are a couple for starters.

—Vincent Laurence

Turning supplies

While most extensive woodworking catalogs present a sampling of lathes, chucks, faceplates, drive centers and turning tools, there's one catalog that carries almost nothing but turning (and related) supplies. The Woodturner's Catalog is available for $2 (refundable with the first order) from Craft Supplies USA (1287 E. 1120 S., Provo, Utah 84601; 800-551-8876).

A good knife

A highly underrated and underrespected woodworking tool is a good basic carving knife. Whether it's marking out joinery, carving pulls, shelf supports or other small furniture parts, a good knife will make the job easier, more enjoyable and give better results. Also, a good knife will last decades—perhaps even a lifetime, depending on how much you use it—so what may seem like a pricey little item up front is actually a bargain over the long haul. Here are sources for a couple of the best carving knives you can buy.

Gregg Blomberg has been making tools since 1959 and has been in business as Kestrel Tool for nearly 10 years. Kestrel's specialties are Northwest-Coast crooked knives and elbow adzes, which were used traditionally for carving masks, totems, dugout canoes and bent-corner boxes (see *FWW* #96, pp. 70-73).

Blomberg makes more than crooked knives, though. He also makes an excellent straight detailing knife, a couple of other straight knives, steel blade and adze blanks and a lot of other interesting stuff. If you're a tool junkie, you'll find plenty in his well-done catalog. It costs $4 and is available by writing Kestrel Tool, Route 1, Box 1762, Lopez, Wash. 98261 or by calling (206) 468-2103.

Cape Forge, another small-scale operation, is located a continent away on the outskirts of Cape Cod, Mass. Mike dePunte is Cape Forge's smith and co-owner with his daughter Karyn, who runs the business side of the operation. He makes a number of different carving knives including one of laminated (Damascus) steel, as well as drawknives, chisels, slicks, gouges, veiners and other carving tools. Much of his work consists of custom, one-of-a-kind orders: boatbuilders' slicks larger than anything available commercially, odd-sized carving tools and the like. If fine, handmade tools interest you, send $1 (which is refundable with your order) for the Cape Forge catalog to Cape Forge, P.O. Box 987, Burlington, Vt. 05402-0987, or call (802) 244-7010.

Dick Burrows is a freelance writer and woodworker in Knoxville, Tenn. Jim Tolpin is a furnituremaker and writer living in Port Townsend, Wash. Vincent Laurence is associate editor of Fine Woodworking.

Craftsman-Style Comfort in a Morris Chair

Mortise-and-tenon joinery looks good and makes it last

by Gene Lehnert

Forerunner of today's recliners, *this Morris chair built in the Craftsman tradition features an adjustable reclining back. The back, which pivots on pegs, rests on removable pins that slide into holes on the inside of the arms. To recline the back, simply move the adjustment pins to different holes in the arms. To make his chair even more comfortable, the author also built a matching footstool.*

Photos: William Sampson

The Morris-style spindle chair is my favorite Gustav Stickley piece. In his popular *Craftsman* magazine, Stickley wrote, "No better or more comfortable and useful chair was ever designed." The chair, which features pinned through-tenon joinery, makes a comfortable, adjustable-back chair in the Craftsman tradition. I worked up this version (see the photo at left) after looking at a lot of museum pieces and studying examples in Stickley's *Craftsman* magazine, books and other magazine articles.

Although Stickley sometimes used other woods, his primary choice was quartersawn white oak, which he darkened by fuming with ammonia. Even in his day, Stickley commented that quartersawing was a wasteful method of woodcutting. Today, the wood is rather difficult to find. However, larger retail suppliers have it for about $5 a board foot. It should be selected for color match and figure. Be extra careful when choosing the stock because variations in wood tone mar color uniformity during the fuming process, a finishing technique I'll discuss later in this article. Sapwood should be eliminated as it tends not to darken when fumed.

Building the chair

The legs are composed of a solid core with ⅛-in.-thick veneers glued around them. Veneering this way provides uniform quartersawn figure on all four sides of the legs. The through-tenons at the leg tops are 1½ in. sq. with bevels on the ends, as shown in the drawing on p. 40. I use my motorized miter box set at an angle of 12° to cut the bevels. On the back legs, the tops are both beveled and slanted, using a disc sander, to match the angle of the arms. Note that the shoulders on these tenons are angled to support the arms. Because pinned through mortise-and-tenon joints are Stickley hallmarks, it is important they be properly executed. Also, note the corbels that support the rear arms are angled at the tops.

The bottom side rails are supported also using pinned through mortise-and-tenon joints. I use a hollow-chisel mortiser in my drill press to cut the mortises in the legs and the ½-in. spindle mortises in the rails. The work is held on an angle block clamped to the drill-press table. The slant of the angle block is 1 in. rise to 24¾ in. run. I clamp the same angle block to my tablesaw's sliding table to cut the angled tenon shoulders of the top and bottom side rails and the spindles.

Because of their angles, the upper and lower shoulders on the rails and the front and back shoulders on the spindles must be pared by hand. The tenons for the upper side rails are cut before their top slants are cut. I sometimes cut the tenons using an angled sliding table on my router table. These techniques ensure precisely fitting mortise-and-tenon joints for the legs, rails and spindles.

Making the arms—When you first look at one of Stickley's Morris chairs from the side, you get the impression the arms are sawn from thick pieces of wood. What else could explain the bend at the front of the arm? But upon close inspection, Stickley's ingenuity is apparent. To form the bend on the front of each arm, I follow Stickley's lead and glue a filler block to the underside of the arm board. Then I bevel off the top with repeated cross-grain passes on the radial-arm saw, as shown in the bottom left photo on p. 41. (You could also bandsaw away the waste.) Taking care to match color and grain will make the joint barely discernible. I cut the filler block from the same board to ensure the match.

To hold the arm at the correct angle on my radial-arm saw table when cutting the slope, I use an angle block. The angle is 3⅞ in. rise to 22¾ in. run. I also use this block with the drill-press mortiser to cut the through-mortises in the arms (see the right photo on p. 41).

To accommodate the upper rail, I cut a ⅞-in.-wide, ½-in.-deep groove from one mortise to the other and centered on those mortises. Though it's a tedious process, I use my hollow-chisel mortiser to cut the groove because the bend in the arm prevents me from plowing it all the way through with a router. A router and chisel could be combined to do the job.

Building the back

This part of the chair is perhaps the trickiest. It involves three things—bending the ⅜-in.-thick back slats, cutting long tenons that fit perpendicular to the back posts and assembling the unit so it lies flat.

You can steam the slats in preparation for bending, but I prefer to submerge the slats in boiling water for softening because it's faster and easier. If you do boil the slats, it is a good idea to add a small amount of baking soda to avoid prematurely blackening the wood. This reaction is characteristic of oak. If blackening should occur, the original color can be restored using oxalic acid, which is readily available at hardware stores (see *Fine Woodworking* #86, pp. 65-67).

The slats have a radius of 23 in. To bend them, I sandwich them in a shop-built form made from two bandsawn blocks that mate to create a 22-in. radius, which overbends the wood a little to allow for inevitable springback. Allow the wood to dry completely in the form to prevent excessive springback.

Before cutting the tenons perpendicular to the back posts, small oak wedges (1 in. by ¼ in.) have to be glued to the back of each slat where the tenons will be cut, as shown in drawing detail C on p. 40. The wedge provides enough stock for cutting the long tenons while keeping them perpendicular to the back posts.

I have to admit that I really enjoy devising machine setups. While creating fixtures and jigs to solve joinery problems initially takes more time, it gives me pleasure and ensures accuracy when working

What is a Morris chair?

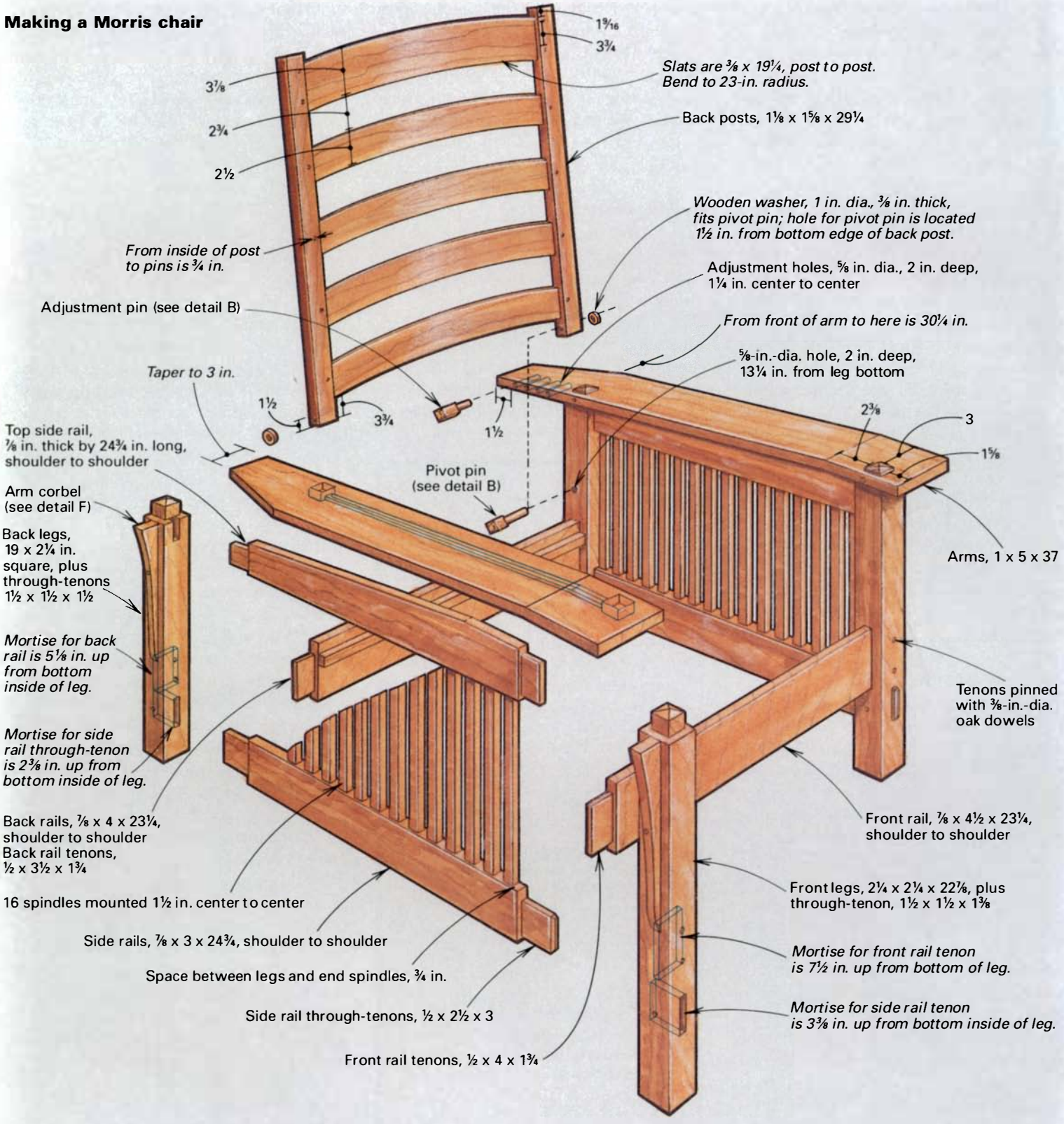
Barbara Streisand melodically asked, "What kind of a chair is a Morris chair?" in her early 1960s recording of "My Honey's Loving Arms." Perhaps some listeners then pondered the answer to this question, but renewed interest in Morris chairs and in other Craftsman-style furniture did not really spark until the '80s.

Gustav Stickley and other furniture builders in the early part of this century produced several styles of chairs that were patterned after the designs of Englishman William Morris. *Morris chair* became a generic term for easy chairs with movable, slanting backs. These chairs were the forerunners of today's reclining chairs. Stickley's spindle chair, introduced in 1905, proved to be the most popular of all. Although the term *spindle* usually refers to turned posts, Stickley and Morris used square spindles.

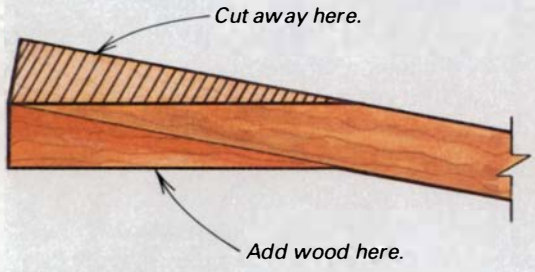
A picture of the original Morris chair appeared in Gustav Stickley's *Craftsman* magazine. He said of it, "This chair has always seemed to be the best of its kind, and one especial advantage is that it harmonizes in structural effect with any good furniture."

Stickley was a successful furnituremaker for a quarter of a century until 1916 when he went out of business. His Craftsman furniture, sometimes called Mission style, is once again gaining great popularity. —*G.L.*

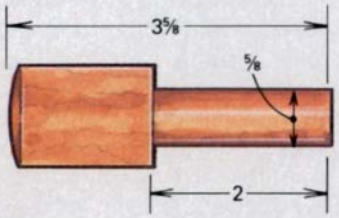
Making a Morris chair



Detail A: Making bent arms

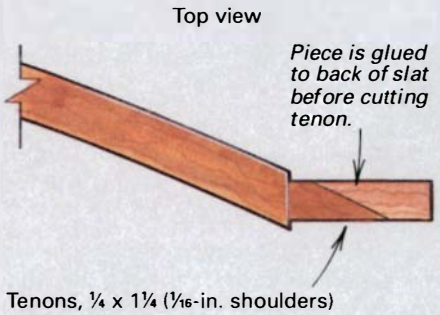


Detail B: Adjustment pins



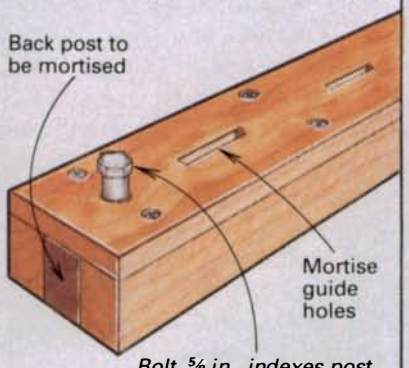
Pivot pins for the back have the same dimensions as the adjustment pins, except the shaft is 3½ in. long instead of 2 in.

Detail C: Making back slat tenons

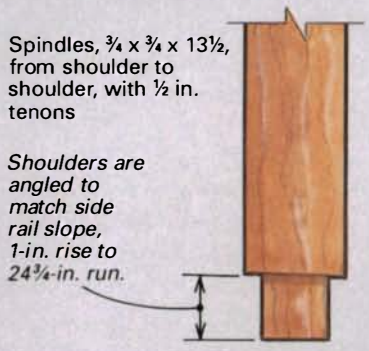


Drawings: Mark Sant'Angelo

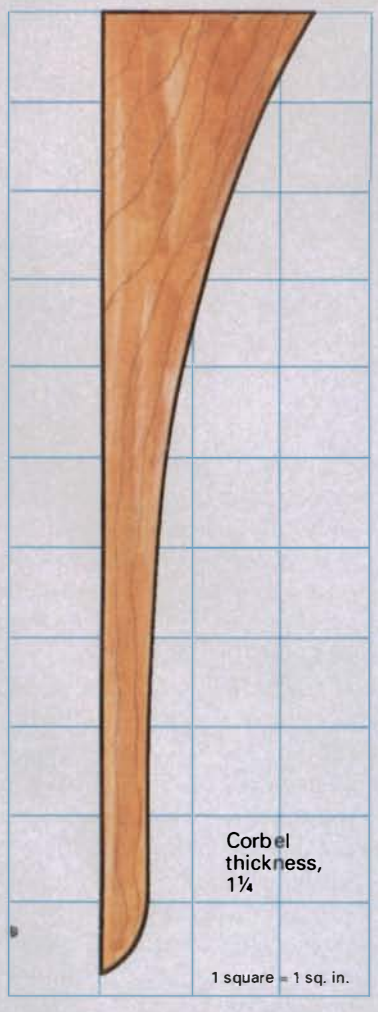
Detail D: Back post pattern board



Detail E: Side spindles



Detail F: Arm corbel profile



on multiple pieces. And, once I make the fixture, cutting a complex shape is elegantly simple and fast. That's why I cut the back slat tenons with a shopmade fixture that holds the router horizontally and lets me shear-cut tenons with a spiral fluted bit.

If you don't have an overarm router as an alternative or aren't inclined to devise a fixture, you can cut perfectly good tenons with a handsaw; then plane or chisel them for a good fit. The important thing is not how you cut the tenon; it's getting the tenon perpendicular to the side of the back post it goes into.

I cut the ¼-in.-wide mortises in the back posts (hollow chisel in the drill press again) using a mortising pattern board to hold the posts in position (see drawing detail D). The channel-shaped board has a ⅝-in. hole 1½ in. from one end that corresponds to the hole that will be used to mount the back to the chair. The posts slide into the channel and are indexed to the ⅝-in. holes to ensure uniformity between parts. The same holes also come into play later during glue-up.

Assembling the parts

To glue up the back, I use the fixture shown in the top photo on p. 42 to hold the entire back unit square, flat and in position until the glue dries. The posts are again indexed to the ⅝-in. holes for correct alignment of the back assembly to the back legs. The sides are glued using plywood fixtures to hold them flat and square. I cut holes in the plywood, so I can clean up the glue before it dries.

The rest of the assembly is conventional. The back is attached to the rear legs using turned pins and washer-spacers, as shown in the drawing on the facing page and in the top left photo below. To recline the back, simply move the adjustment pins to a rearward hole. Flat surfaces on the pins allow the back posts to rest firmly. As an alternative system, on earlier Morris chairs, Stickley sometimes used a back support rod that went from one arm to the other and rested in notched supports screwed to the tops of the arms.

Last, drill and pin the tenons using ⅜-in.-dia. oak dowels. The drawing shows the correct dowel placement.

Finishing touches

Stickley used ammonia fuming to add color to his furniture. He discovered the method by noticing that oak stable stalls changed in color over time. He figured that the ammonia in horse manure reacted with the tannic acid in white oak to shade the wood pleasingly.

***Back adjustment pegs** (above) fit into holes in the arms. Moving the peg back allows the chair back to recline.*

***A radial-arm saw cuts away waste** (below) to form the bend in a chair arm after a block of wood was glued underneath. An angle block holds everything in position.*

***Using a hollow-chisel mortiser attachment on the drill press** makes quick work of cutting the through-mortises in the chair's arms to take the leg tenons. The same device also works to cut the groove under the arm to fit on the side rails, as shown on the already-cut arm in the foreground.*

Fuming the wood—I use the fuming tent shown in the bottom left photo. It is made of wood and heavy builder's plastic. Large and small garbage cans turned upside down over the furniture also work well. The chamber should be as small as the furniture put into it allows so as to concentrate the 26% ammonia fumes as much as possible. Ammonia is put in small cups around the items to be fumed. I usually leave the wood exposed to the fumes overnight to achieve the tone I like. But, by monitoring the process every hour or so, the chemical reaction can be shortened for lighter shades.

With some reservations, I am impressed with the pleasing color and grain appearance made possible with fuming. Fuming does not raise the grain. Because the chemical reaction penetrates about ⅛ in., the wood can be lightly sanded after fuming. The method is also quite economical. A gallon of ammonia that costs about $10 could fume a houseful of furniture.

However, even Stickley had some problems with the method. Variations in tannic acid, sometimes present in even the same piece of wood, can cause variations in color shade. There are some things that can be done to ensure success. Select wood for maximum uniformity. If there are light spots after fuming, brush tannic acid and ammonia directly on the wood to touch it up.

I sometimes fume sanded furniture parts before assembling them. If extra parts are made and fumed, they can be mixed and matched for best color before final glue assembly. The chemical reaction from fuming does not affect gluing, and parts marred during gluing can be touched up. Fuming smaller parts before assembly also allows more parts to be fumed in a concentrated space. As a last resort, regular wood stains may be used to touch up lighter spots. Stickley did that quite often.

Industrial-strength ammonium hydroxide (NH_4OH 26%) can be obtained from Dietzgen, 250 Wille Road, Des Plaines, Ill. 60018, or from local blueprint companies. Be very careful handling this product, which is much stronger than 5% solution household ammonia. The Material Safety Data Sheet describes ammonium hydroxide as a poison that enters the body through ingestion, inhalation, skin contact or eye contact. Use it outside or in a well-ventilated area. Wear protective clothing, eyewear and a respirator. Follow all safety precautions recommended for it.

As a final finish coat, Stickley in some cases simply waxed the fumed wood. However, he usually coated it with shellac or lacquer. I use varnish and get good results, too.

Upholstery adds comfort—An upholstered seat and back cushion complete the chair. Stickley used a variety of materials, including leather, to upholster his furniture. I used cloth fabric for mine. Check the Yellow Pages directory in your community for upholstery supplies. The chair seat requires twelve 5-in.-dia. by 6-in.-tall coil springs sewn to 3-in. webbing stretched over a hardwood frame. Make the frame of ⅞-in.-thick, 2-in.-wide hardwood. The springs are securely tied, then covered with burlap, tow and curled hair. One-inch thick foam rubber and cotton can be substituted for the tow and curled hair.

Pack and shape the materials smoothly to a depth of approximately 2 in. Burlap or muslin is stitched in place over this. After sewing the seat cover and stapling it over the frame, I stapled a section of muslin to the seat frame to cover the bottom (see the bottom right photo). The completed seat slips into the chair frame and rests on cleats screwed to the front and back rails of the chair, so the seat slopes about 2 in. from front to back. The back is a loose cushion filled with cotton floss. Foam rubber 23 in. wide, 28 in. tall and 3 in. thick can be substituted for cotton.

See *FWW* #68 or books available at your local public library for more detailed information about upholstery techniques. If you—or your sewing machine—are not up to doing the upholstery work, you could have a local upholstery shop do the seat and back cushion for you. □

Back parts fit into a clamping fixture *to keep everything straight during glue-up. Bolts through the back post peg holes not only help align the parts in this fixture, but they are used to index the back posts in another fixture for cutting the slat mortises.*

Using 26% ammonia to fume the wood *gives distinctive color, but rubber gloves, protective eyewear and breathing apparatus are a must. Cups of ammonia are placed inside the plastic-sheet fuming tent with items to be fumed and left overnight.*

Stapling the bottom of a seat cushion, *the author finishes the upholstery work for his Morris chair. Upholstery materials such as the cotton batting (right) or webbing and springs (foreground) are available from local upholstery supply stores.*

Gene Lehnert teaches vocational cabinetmaking/millwork and builds furniture in La Marque, Texas.

Whether run by air or electricity, *random-orbit sanders are powerful tools that can handle both coarse and fine sanding jobs.*

Random-Orbit Sanders

Plug-in convenience vs. air-system efficiency

by Sandor Nagyszalanczy

It's strange to think that the current revolution in woodshop sanding started in auto-body shops. These early power-sanding tools were called "DAs," short for dual action, which describes the compound motion of the sanding disc that allowed these air-driven tools to sand aggressively without leaving swirl marks. Over the years, DAs occasionally found their way into cabinet shops, usually production shops with air compressors large enough to keep up with their hunger for high-pressure air.

In the '90s, a whole new generation of DAs (now called random-orbit sanders) has come to woodworking. Most of the attention has been centered on nearly two dozen electric models that have come to market in the past few years (including the seven newest models, which are described in the sidebar on p. 45). But air-powered random-orbit sanders have changed and improved in recent years, too, with new models and features specifically designed to sand wood instead of Bondo.

These innovations have changed the way many woodworkers smooth wood, but there's still a basic choice: air or electric. The division might seem clear; big shops and professionals use air-powered tools, and smaller shops and hobbyists use electric ones. But big compressors have become more affordable for small shops in recent years, and at the same time, large, powerful electric random-orbits have attracted professional users. In this article, I'll take a careful look at the advantages and shortcomings of each system, including what it takes to get an air-sanding system up and running. I'll start by looking at characteristics common to all random-orbit sanders.

Random orbit primer

Regardless of whether they're run by air or electricity, all random-orbit sanders work basically the same way. The tool's round sanding pad spins on a shaft eccentrically mounted on a counterweighted plate. This plate is driven by an impeller (in air tools) or an electric motor. As it rotates, the plate travels through a circular motion, somewhat akin to a regular orbital sander. The rotating action causes the sanding disc to spin. But because the disc itself is not powered, it doesn't spin in the same circle. This random-orbit action allows the tool to sand more aggressively than a standard orbital but doesn't create swirl marks like a disc sander.

To make sandpaper changes quickly and easily, random-orbit sanders use one of two disc mounting systems. Pressure-sensitive adhesive (PSA) discs have a sticky coating, which adheres to a plastic-surfaced sanding pad. Hook-and-loop sanding discs have a loosely woven material backing that mechanically sticks to tiny plastic hooks that cover the sanding pad, much the way burrs stick to your socks when you walk through high grass. Both systems have advantages and disadvantages (see *FWW* #92 p. 47). Regardless of disc type, most sanders allow you to change sanding pads

Photos: Sandor Nagyszalanczy

An air-tool oiler automatically lubricates an air sander as the tool is used. A muffler on the Dynabrade sander shown here (the black cylinder in front of the oiler) reduces air exhaust noise.

***A venturi driven by exhaust air collects sawdust** on the Sioux 690VV. The air propels the dust down a flexible hose (fastened to the air line) into a canvas bag.*

for different operations. A standard stiff pad is best for smoothing flat surfaces, whereas a softer pad has more flexibility for sanding contour surfaces. Dust collection is an option for most random-orbit models, air or electric.

Electric random-orbit sanders

These affordable tools come in three basic designs to suit different operating preferences: right-angle grinder, pistol-grip and palm-grip style units. Right-angle random-orbit sanders are designed to be held with two hands, one on the body of the tool, the other on a top- or side-mounted handle. The two-handed grip is necessary because these machines usually have powerful motors (most draw 5 or 6 amps), which can generate a lot of sanding power. Pistol-grip style handles are great for one-hand control, especially when sanding vertical surfaces or overhead. Most also feature a front grip, for two-handed control. Palm-grip style sanders are designed to be held with one hand around the body or top, allowing you to use the other hand to steady the workpiece or move it as necessary.

Buying an electric model is the easiest way to get into random-orbit sanding; all you need to use one is standard household current. One model, the battery-operated AEG AVSR5005, even lets you work away from 110v outlets. On the down side, the most powerful electric random-orbit sanders are expensive. If you already own a compressor system, buying an inexpensive air sander might be more cost effective because even the cheapest models deliver strong sanding action.

Air-powered sanders

Most air sanders designed for woodworking are held like palm-grip electrics but tend to be physically smaller, easier to grasp and more maneuverable. Their small size belies one of their greatest advantages: power. Although there are no standard measures for directly comparing performance of air vs. electric models, subjectively speaking, typical air sanders feel like they have as much torque as all but the most powerful electric models. Air sanders fitted with a muffler on their air exhaust (see the photo above left) also tend to be a lot quieter than electric models—as long as you keep the compressor out of the work room.

Only a handful of electric random-orbit sanders offer variable speed to adjust sanding rate. However, the speed of any air sander can be adjusted by changing the operating pressure (at the compressor or with the air regulator lever found on most tools) or by applying more or less pressure to the sander's throttle. Most electric sanders with dust-collection features use their built-in fans to extract dust. But new air models, such as the Sioux 690VV (see the photo above right), have efficient dust-collection systems that use the compressed air exhaust to drive a venturi.

Air random-orbit sanders can be used in damp or wet areas without fear of electrocution. This makes them great for boat maintenance jobs, such as stripping a hull before repainting or brightwork before revarnishing. Just keep your compressor in a dry, safe area, and run an air line down to the work site. You'll also lose less power to the tool than you would running a long extension cord to an electric sander.

Clearly, the greatest drawback to using an air sander is that it requires a hefty compressor to operate at top efficiency. However, having a large compressor in your shop allows you to use all kinds of other air-powered tools, including pneumatic nailers, as well as to apply spray finishes and to sand blast. There is a flood of inexpensive, good-quality air tools great for woodworking, including disc and in-line sanders and drills and die grinders, sold through mail-order catalogs such as Harbor Freight Tools (3491 Mission Oaks Blvd., Camarillo, Calif. 93011-6010; 800-423-2567).

Choosing the right compressor

Just about any small portable compressor is adequate for driving a spray gun or nailer, but you need to select the right-sized compressor to get the most out of an air random-orbit sander. And size means not only a compressor's power output (usually stated in horsepower) but also the capacity of its air-holding tank. This is important because air sanders tend to gulp up tremendous volumes of air (measured in CFM—cubic feet per minute) at high pressure (measured in PSI—pounds per square inch). For example, two air random-orbit sanders I've tried, the Sioux 690VV and the Dynabrade model 56005 Dynorbital, both consume between 5 and 20 CFM at 90 PSI. To put this in perspective, even though most small compressors (1 hp and up) are capable of building up

125 PSI, a typical 3-hp compressor with a 12-gal. air tank produces an air volume of only 7 CFM (at 90 PSI). What this means is that a sander run on a 3-hp system will only attain peak performance for a brief period of time before it runs out of the air volume necessary to drive the tool.

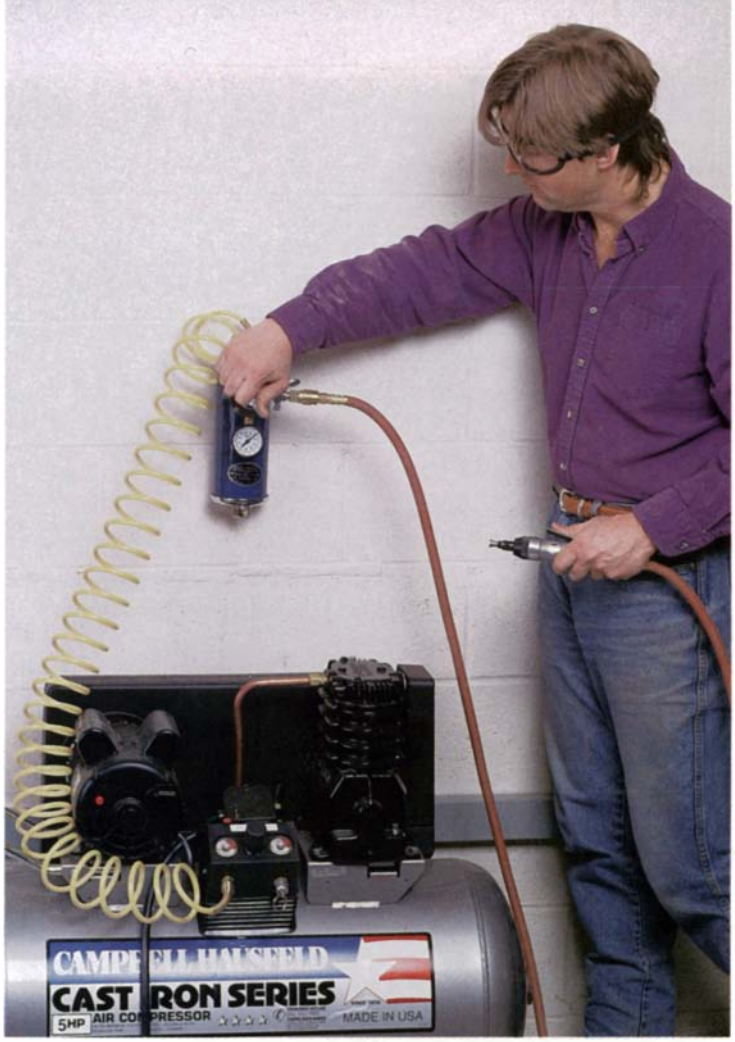
The easiest way to contend with an air sander's high CFM needs is to buy a large compressor. Most of my woodworking comrades agree that a 5-hp compressor is probably the smallest you can get away with for air sanding. But even with a compressor this size, tank size is a consideration. I recently used a 5-hp Campbell-Hausfeld portable compressor fitted with a 30-gal. air tank to drive a Sioux random-orbit sander. I discovered that I could only sand full blast for less than 30 seconds before the compressor's motor kicked in to recharge the tank. With a rated output of about 9 CFM, that compressor ends up working pretty hard to keep up with an extended sanding session. And most consumer models aren't rated for continuous operation, so you can't run these too hard without burning them out.

You can gain extra CFM by buying a stationary compressor with a larger (60 to 80 gal.) air tank, and I've even heard of some people connecting large air tanks to smaller compressors to gain the air capacity necessary for air tools. If you need to run a sander hard full time, you'll have to spend considerably more money ($1,000 to $1,500 or more) for a two-stage compressor capable of much higher PSI and CFM (typically 175 PSI and 16 to 20 CFM/90 PSI). If that price tag scares you, big two-stage compressors are often available used at bargain prices; check with your local dealer who handles used industrial machinery.

Setting up an air system

To keep dust and moisture from fouling an air sander, an air filter should be mounted between the compressor and the tool. Many filters can be mounted directly on the compressor's output port, handy for a portable compressor. Wall-mounted filters, which generally use a larger-capacity filtration element, can be used with stationary compressors or with portables, as shown in the photo at right. Most filter units feature a built-in pressure regulator, which is handy if you buy a larger industrial-duty compressor that doesn't come with its own regulator.

To maintain peak performance, air tools must be lubricated on a regular basis. In a small shop, where the sanders aren't used eight hours a day, simply disconnect the air hose at the tool, and drip 5 to 10 drops of special air-tool oil into the inlet. This should be done every day before you use the tool. In a production shop situation, where keeping up with maintenance might be a hassle, sanders (as well as other air tools) can be fitted with an oiler that automatically dispenses the correct dose of lubrication as you use the tool. You can buy oilers that mount on the compressor or wall like an air filter, but this means you must dedicate a hose to air tools because it will be contaminated with oil. I find it more convenient to mount a small in-line oiler directly on the tool's inlet (the one I use is the model MP2680, available from Campbell-Hausfeld, Harrison, Ohio 45030; 800-241-3848, Ext. 350). □



A large air compressor can drive many pneumatic tools, including air sanders and die grinders. The author adjusts the pressure regulator on a wall-mounted air-filter unit, which is connected to the compressor by a flexible plastic hose.

Sandor Nagyszalanczy is a contributing editor to FWW *and a writer, musician and furniture craftsman in Santa Cruz, Calif. Thanks go to Roger Heitzman for his technical assistance.*

New electric sanders join field

When Sven Hanson's review of electric random-orbit sanders appeared in *FWW* #92, there were already 17 different machines on the market. Since then, seven new models made by five different manufacturers (see the photo on p. 46) have arrived. Given the great popularity of these tools, it seemed appropriate to bring Hanson's original product review up to date. I'll review the basic characteristics of these tools first and then share some of my observations about how well they performed in the shop.

Basic characteristics

The trend in current models is to place the motor vertically above the sanding pad; none of these units are based on right-angle grinder designs popular in earlier models. Among the vertically motored tools, two models, the AEG TXE 150 and the Black & Decker TS710, incorporate pistol-grip handles. The remaining five models—the Makita BO5000, the Ryobi RS112 and the Porter-Cable 332, 333 and 334 are palm-grip machines. Pistol-grip models use trigger on/off switches, which can be locked on with a separate button. The palm-grip models have small rocker on/off switches. Unless you hold these by the top of the body, you must use your free hand to turn them on and off.

The drive systems on two of the sanders (the AEG TXE 150 and the Black & Decker TS710) incorporate a dampener that slows the spinning disc quickly after power is cut off. This is great during intermittent sanding; you can set the tool down right after releasing the trigger and not have it dance off

***Some recent entries to the random-orbit sander market** include the models shown here (from left to right): Black & Decker TS710, Makita BO5000, Porter-Cable 334, Ryobi RS112 and AEG TXE 150.*

the benchtop. For cleaner air (and lungs), all the sanders in this group, save the Ryobi RS112, provide some means of dust collection, either with a dust bag (see the photos on the facing page) or an accessory vacuum hose. The AEG and Black & Decker have shrouds that surround their sanding pads to make dust pickup more efficient.

AEG TXE 150

As with many of their other tools I've handled, the German-made AEG has a certain precision feel that's hard to quantify; it just feels smooth. Even though the AEG orbits its disc at less than half the speed of most other random-orbit sanders (4,000 to 5,500 orbits per minute, depending on the variable speed setting chosen), the unit sands *very* aggressively, no doubt thanks to its powerful 3.5-amp motor. Controlling a big 6-in. disc driven by that high-torque motor did feel a little intense when I used a coarse (80-grit) disc to resurface a strip of old bowling alley for a kitchen counter. But even when applying heavy sanding pressure, I felt the AEG transmitted less vibration than any of the sanders in this article.

For sanding jobs requiring some finesse, say, cleaning up the joint between a face-frame and plywood carcase side with a fine-grit disc, dialing down the AEG's orbits per minute (OPM) slows down the sanding action. A knob in the center of the on/off trigger sets the upper speed limit. The variable speed trigger allows just the degree of sanding that's required. Very slick. Another nice feature is its 9-ft.-long, 16-gauge wired, neoprene-covered power cord, which is long enough to be useful without an extension cord (the other cords range from 7 ft. to not even 6 ft. long). If you need a real workhorse of a sander that isn't a wild stallion in terms of control, I think this AEG sander is worth its relatively high price tag.

Black & Decker TS710

Made in England, the Black & Decker TS710 sander has a strong 2.8-amp motor that operates at two speeds and a flexible handle arrangement for controlling sanding action. One hand holds the pistol grip while the other holds an auxiliary handle that can be rotated and locked on the front or either side of the tool. The TS710's on/off trigger is wide enough for two fingers, making it comfortable to use. But I didn't care for the trigger lock button. It is oddly placed at the back of the pistol grip, so you must depress it with your free hand. Selecting one of the unit's two speeds is done by flipping a switch on top of the pistol grip. Though two speeds don't give as much control as variable speed (Black & Decker currently has plans to offer both single and variable-speed models), TS710 can still handle both coarse and fine sanding jobs easily.

I really appreciated the design of the Black & Decker's sanding pad. Its dust-collection holes are slotted instead of round, making it a lot easier to quickly attach sanding discs without having to fuss to get them aligned exactly. I also liked the TS710's sanding bag, which is slung low and out of the way beneath the tool's handle. Better still, you don't need to remove the bag from the tool to empty it: A slide-off clip opens the back of the bag. If you want to change sanding pads, a single Allen screw in the center of the pad releases it (the Makita's pad also uses a single screw). An included Allen wrench clips to the Black & Decker's handle, keeping it handy. The tool's dust shroud is removable for sanding into corners.

In terms of sheer sanding power, I thought the Black & Decker TS710 was only a notch below the AEG TXE 150, even though the TS710 has a smaller motor and only a 5-in. disc. Overall, it's a smooth-operator with well-designed features and a low price (less than half the cost of the AEG), which makes it a real bargain.

Makita BO5000

The American-made Makita BO5000 offers a nice blend of sanding aggressiveness and operator comfort. I thought the Makita sanded more aggressively than either the Ryobi or Porter-Cable models, despite the fact that the Makita's motor rating and orbit diameter are smaller than the Ryobi's (1.7 amps and ⅛ in. vs. 2 amps and 5/32 in.). Also, the Makita produces 2,000 less OPM than the Porter-Cable models (10,000 vs. 12,000). This goes to show that true performance is more than just a collection of statistics on a chart. On the comfort side, the BO5000 also fits my large hand well—both gripping the tool around the body and by the top. In use, it vibrated less than any of the sanders except the AEG, which was just a tad smoother.

On the downside, I wasn't too impressed by the Makita's dust-collection system. An optional 8½-ft.-long hose plugs into a very small (9/16 in. dia.) port near the base of the tool. I liked the compactness and flexibility of the hose, but it didn't fit directly into the port on my Sears ShopVac and no adapter is supplied (I taped it on for my trials). Worse, the system didn't collect dust very efficiently; a dust boot around the base would help. Despite this shortcoming, the Makita was one of my favorites for general sanding jobs.

Porter-Cable 333 and 334

These two Porter-Cable sanders are identical, except for their sanding pads: The 333 uses hook-and-loop discs, and the 334 is set up for PSA discs. Although many random-orbit sanders can be fit with a different pad system from what they come with, I think it's terrific that Porter-Cable gives buyers a choice. The bodies on these two models (as well as the 332) are identical and are shaped and proportioned much like Porter-Cable's legendary model 330 Speed-Bloc orbital finish sander. Because I've owned a Speed-Bloc for over a decade, these sanders were easy for me to get used to, although the top grip is a little angular for my taste; I found it tiring to hold for a long time.

The most innovative aspect of the 333 and 334 models is their dust-collection system, which features a canister collector, which

Electric random-orbit sander specifications

Brand/model	Retail price ✧	Disc diameter/type ▲	Motor amps	Orbits per minute	Orbit diameter (in.)	Dust collection	Weight (lbs.)
AEG TXE 150	$298	6 in./H&L	3.5	4,000-5,500◗	¼	Bag/vac	5.5
Black & Decker TS710	$120	5 in./H&L	2.8	7,500-10,000■	3/16	Bag	4
Makita BO5000	$118	5 in./H&L	1.7	10,000	⅛	Vac❖	2.9
Porter-Cable 332	$109	5 in./PSA	1.7	12,000	3/32	No	3.2
Porter-Cable 333	$125	5 in./H&L	1.7	12,000	3/32	Cannister/vac❖	3.5
Porter-Cable 334	$125	5 in./PSA	1.7	12,000	3/32	Cannister/vac❖	3.5
Ryobi RS112	$80	4½ in./H&L	2	11,000	5/32	No	2.3

✧ Actual selling prices typically 30% to 50% lower
▲ H&L = hook-and-loop fastener
PSA = pressure-sensitive adhesive
❖ Vacuum hose optional
◗ Model has electronic variable speed
■ Model has two speeds

looks something like an expansion-chamber muffler on a dirt bike (motorcycle). Although it looks solid, it's actually made from a porous plastic, which allows air to escape while trapping sawdust. The canister easily pops off its mounting flange for emptying, which needs to be done fairly often during heavy sanding because the canister has a relatively small capacity.

Even though I found all three of these American-made Porter-Cable models easy to control, they sand a bit less forcefully than most of the other sanders I tried, probably due to their small (3/32 in.) orbit diameter. Still, given their maneuverability and convenient dust collection, I think these random-orbit sanders aren't a bad choice for general light- to medium-duty sanding chores.

Porter-Cable 332

The 332 is identical with the other Porter-Cable models described above, save that it doesn't include a dust-collection canister. The unit's sanding pad is for PSA discs. The only sanding discs on hand during my trials had holes in them, but they didn't seem to adversely affect sanding performance, which was the same as the 333 and 334, described previously. The absence of dust collection reduces the price (and weight) of the unit slightly. But unless your shop has a special vacuum sanding table or a free-air dust-control system, I don't think the small amount of extra money is too much to pay for that neat canister system.

Ryobi RS112

Physically the smallest electric random-orbit sander on the market, the Ryobi RS112 drives a diminutive 4½-in. sanding disc. Because its pad has less area, it sands less surface area in a given amount of time than the 5-in. and 6-in. units do. But this shortcoming is somewhat balanced by the RS112's compact size and light weight. At only 5⅜ in. tall, this tool can sand in some pretty tight places, and at only 2.3 lbs., you could probably hold the unit above your head and sand all day without fatigue (well, maybe not *all* day).

Although its nameplate rates the motor at 2 amps, I was unimpressed by the RS112's performance, which seemed high on vibration and low on sanding aggressiveness (OPM dropped noticeably when even a 120-grit disc was put in contact with wood). The on/off switch is thoughtfully housed in a protective plastic dust boot, which unfortunately, makes it hard to tell at a glance if the tool is on or off before plugging it in. I was puzzled at first by the dust-collection holes in the Ryobi's sanding pad and discs because the unit has no provision for dust collection. Then I realized that this allows the RS112 to use the same 4½-in. pads and discs as its brother, the Ryobi RS115 random-orbit sander.

This clearly isn't the tool to use to refinish the hull of your 100-ft. yacht. But if your sanding needs are more moderate, I think you'll appreciate the Ryobi RS112's handy size and low price. —*S.N.*

The Porter-Cable 334's porous-plastic canister collects sawdust, *just like a regular canvas bag. The small container easily dismounts for emptying.*

The Black & Decker TS710's slotted sanding pad makes disc mounting easier *because you don't have to line up the dust holes as carefully. The unit's fan sucks dust through the pad and into its canvas bag.*

***Traditional Japanese handsaws** come in many styles to suit different cutting situations, but all cut on the pull stroke. The saws, or* noko, *displayed in front of Odate are (from left to right) Anahiki-noko (log saw); ryoba-noko (combined rip and crosscut saw); azebiki-noko (for cuts in the center of a panel); kataba-noko (rip saw); dozuki-noko (fine crosscut saw) and kugihiki-noko (flush trimming saw).*

Choosing and Using Japanese Handsaws

Thin blades and sharp teeth to pull through the wood

by Toshio Odate

I remember the first time I went to Atlanta, Ga., to lecture on Japanese woodworking tools. I packed most of my tools in my luggage except my saws. I kept them with me because they were fragile. But when I tried to carry them through the gate to the airplane, I was surrounded by security guards. They did not believe me right away when I explained that the peculiar-looking saws I carried were actually woodworking tools.

Perhaps it was the exotic appearance of Japanese saws that first caught the eyes of many Western woodworkers when these tools became popular in America around the early 1970s. But even though the Japanese planes and chisels that appeared around that time gained rapid acceptance, many Westerners who first bought the saws were disappointed with the results. That isn't surprising because these saws are very different from their Western counterparts. Also, there wasn't a lot of information available at that time about how Japanese saws should be used.

I will describe several Japanese saws that are most useful to cabinetmakers, including more general-purpose saws, like the ryoba-, kataba-, dozuki-nokogiri (*nokogiri* or just *noko* means *saw* in Japanese), as well as more specialized saws, such as the azebiki- and kugihiki-nokogiri (see the photo above). I'll also describe how to properly take a cut with each one.

Japanese saw design

Unlike Western saws, which cut on the push stroke, Japanese saws all cut on the pull stroke. Sawing with a pulling action allows you to cut using both arms and the muscles of the entire body, without having to put your body weight into the stroke. This suited the traditional Japanese *shokunin* (craftsman) who typically worked in a squatting or sitting position. Because a Japanese saw is put into tension during cutting, the blade can be made very thin and from harder steel, so teeth stay sharp longer. Furthermore, a thin blade removes less material, so it requires less power to use.

The teeth on Japanese saws work on the same principle as their

Photos: Sandor Nagyszalanczy

Western counterparts but have some important differences. Rip teeth are graduated, so they're smaller at the blade's heel (near the handle) and larger at the toe (see the drawing at right). Crosscut teeth remain the same size along the length of the blade but have an extra bevel on top. The angle of the teeth and top bevel of crosscut teeth also vary, depending on whether the saw is made for cutting hardwoods or softwoods.

Ryoba-nokogiri

This is the Japanese saw most commonly known in the West. It has rip teeth on one edge and crosscut teeth on the other. The blade is narrower at the heel than at the toe and slightly thinner in the center than at the edges to decrease binding in the kerf. Ryoba-noko are available in many sizes, with blades ranging from 8 in. to 14 in. long. The number of teeth per inch depends on blade length; the smaller saws have finer teeth than the larger ones. A small ryoba-noko would be used by a craftsman for fine cutting jobs, such as mitering trim for installing cabinets or framing doors. The larger saws are often used by carpenters and are especially good for cutting large tenons for a timber-frame house.

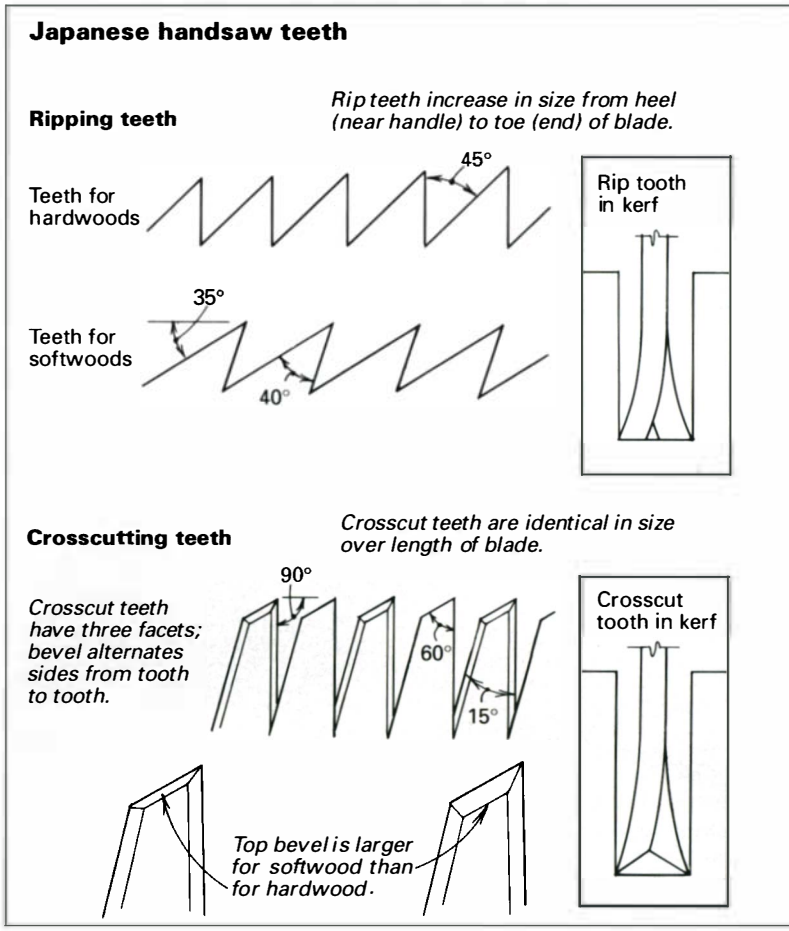
Ryoba-noko are typically used with both hands, although small saws can be used one handed. When using two hands, space them well apart for maximum power and control, as shown in the photo below. To start a cut, use the fingernail of your left index finger or thumb as a guide (if you are a lefty, use the other hand). Start your cut near the heel of the blade where the rip teeth are smaller and hold the blade at a 30° to 40° angle up from the surface of the workpiece. Once the cut is started, you can raise the angle of the blade. Keep in mind that the greater the angle of the saw to the work, the easier the cut—the smaller the angle, the better your control. When cutting wood between ¼ in. and ½ in. thick, use a shallower saw angle to decrease the tendency of the wood to vibrate as you cut. You don't have to apply very much down pressure (especially on the push return stroke when the teeth aren't cutting) for the saw to cut properly. If you're ripping a long board or panel, you may spread the kerf slightly with small wooden wedges to decrease binding and to prevent the saw teeth from scratching the cut surfaces.

The kataba-noko is a variation of the ryoba-noko. It has either ripping or crosscutting teeth on only one edge. By not passing an extra set of teeth through the kerf of a thick workpiece, as the ryoba-noko does, the kataba-noko allows smoother cut surfaces. Kataba-noko are available in a size range similar to ryoba-noko.

Dozuki-nokogiri

The dozuki-noko is a kataba-style crosscut saw with an extremely thin blade supported with a rigid strip of steel or brass folded over its back edge. It is commonly used to cut tenon shoulders on small members, as shown in the top photo on p. 50 (tenon shoulders are called *dozuki*, giving the saw its name). Dozuki-nokos have blades that range from 8 in. to 11 in. long. The smallest saw has 28 teeth per inch (t.p.i.), the largest has 17 t.p.i. Like any other crosscut saw, the dozuki-noko's teeth are the same size from heel to toe and have very little set, which results in a cut so smooth that neither a chisel nor a plane is required for finishing. The bevel ground on the top of the teeth varies depending upon whether the saw is to be used with hardwood or softwood (see the drawing).

Dozuki-nokos are usually used one handed, but every craftsman has a different grip. Most of the time, I hold the last third of the handle, but sometimes I hold the front third. It depends on the work. I stretch the index finger of my right hand along the top of the handle and press down gently while sawing. Start your cut just as with a ryoba-noko, using the nail of your left index finger or



***Using two hands on the ryoba-noko** yields maximum power and control. Here the author cuts a tenon's shoulder, using the saw's crosscutting teeth. He'll flip the saw over and use the rip teeth on the other edge for cutting the tenon's cheeks.*

Drawing: Kathleen Rushton

***The rigid-backed dozuki-noko makes fine crosscuts** with small teeth that leave a very smooth cut surface. It's a good choice for cutting tenon cheeks, as shown here, or for other joinery.*

***The azebiki-noko can start a cut in the middle of any surface,** allowing it to do cutouts or stopped grooves. The author uses a straight stick to guide the saw while cutting the sides of a slot, which will be chiseled out later.*

***A kugihiki-noko can flush trim a dowel** and leave behind a smoothly cut surface that needs no further sanding. Its teeth have no set, so they won't scratch the surrounding panel.*

thumb as a guide. Cut at first with the teeth near the toe of the saw holding the blade at a 10° to 15° angle to the work. Use only the front third of the blade and cut with short strokes until you have cut about 3/16 in. into the workpiece. Gradually lengthen your strokes until you are using the full length of the blade, keeping the blade parallel to the surface of the wood. Try to keep your strokes as straight as possible, as even small deviations can result in a kinked blade or broken teeth. A crooked stroke can also cause the saw to bind in the kerf. To make the cutting action smoother and discourage rust from developing, wipe the sawblade with a little Camellia oil (available from The Japan Woodworker, listed in the sources of supply box below) or vegetable oil.

Azebiki-nokogiri

The azebiki-noko is a ryoba-style saw, with crosscut and rip teeth on its short, curved blade and a long neck that fits into the handle. The curved cutting edge allows you to begin a cut in the center of a board, perfect for making stopped cuts or dadoes in a carcase panel (see the photo at left). The azebiki-noko is also useful for sawing sliding-dovetail joints (a dozuki-noko could also be used, but long cuts that build up sawdust in the kerf can clog a dozuki's fine teeth). Azebiki-nokos are also available in the kataba style (teeth only on one edge) with an offset neck that allows your hands to clear the wood more easily than with the ryoba-style saw.

Kugihiki-nokogiri

This kataba-style crosscut saw looks like a dozuki without the back support. It has a blade about 7 in. long and is mainly used to flush trim through-tenons or dowels (traditionally, the kugihiki-noko was used to cut wooden nails used to join softwood parts, hence *kugihiki* means *to cut nails*). The number of teeth-per-inch varies from 20 to 26 depending on the fineness of the work the saw is intended for. The body of a kugihiki-noko is quite thick near the handle and thin at the end. This allows the saw to bend easily. During cutting, the front two-thirds of the blade is held flat against the work, as shown in the photo at left. Because the kugihiki-noko's teeth have no set, the cut part's surface is very smooth and no scratches are left on the wood surrounding it.

Saws with changeable blades

Traditional Japanese saws are difficult to sharpen. A convenient alternative is a saw with a changeable, disposable blade, available in most traditional types, including ryoba- and dozuki-nokogiri. A changeable blade's fine cutting edge stays sharp for a long time. These saws are especially good if you are learning to use a Japanese saw for the first time. If you put a kink into the blade or break some teeth, you can simply replace the blade, which costs only half as much as a new saw. □

Toshio Odate is a woodworker in Woodbury, Conn., and teaches sculpture and woodworking at New York's Pratt Institute. His book, Japanese Woodworking Tools: Their Tradition, Spirit and Use *is available from The Taunton Press.*

Sources of supply

Japanese saws can be mail ordered from the following companies.

Hida Inc., 1333 San Pablo Ave., Berkeley, CA 94702; (800) 443-5512

The Japan Woodworker, 1731 Clement Ave., Alameda, CA 94501; (800) 537-7820

Nippon-4-Less, 5477 Sharon Lane, San Jose, CA 95124; (408) 356-4184

RMI Design, 411 AABC, Aspen, CO 81611; (303) 920-9615

Tashiro's, 2939 Fourth Ave. S., #101, Seattle, WA 98134; (206) 621-0199

Making a Sliding Saw Table

Smooth and precise crosscuts for less than a hundred bucks

by Guy Perez

A sliding table improves crosscutting and mitering. *Guy Perez made this sliding table to extend the usefulness of his old Sears contractor's saw. Using lightweight everyday construction materials like plywood, pine and aluminum angle, Perez built the table with an adjustable fence, which makes the jig ideal for multiple crosscutting and for mitering.*

Until I came upon a 9-in., used tablesaw (a 1937 Craftsman model), I cut all my wood with an 8¼-in. circular saw aligned by a pair of shopmade guides. But even the Sears tablesaw still lacked a stand, table extensions and a miter gauge. So I set out to bring my bargain saw up to a higher standard.

The first additions I made to the saw included a stand, table extensions and a T-square fence, which allows me to rip stock up to 32 in. wide. These improvements served me well through several furniture projects, but I continued to crosscut with my circular saw and guide instead of using a miter gauge. As I saw it, standard miter gauges have three weaknesses: Their bars often fit loosely in the miter slots, they don't support long pieces well and they're ineffective for crosscutting wide pieces, especially sheet stock. I decided a sliding table would solve all of those problems.

But I found that most commercial sliding tables cost in excess of $350. The ones I looked at also failed to address another constraint I had—scarcity of shop space. So I built a scaled-down sliding table (see the photo above) that has a 32-in. crosscut capacity. The table cost me less than $100, but it performs comparably to the expensive commercial models. It was fairly easy to build, too, and I can still roll my entire tablesaw out of the way to save space.

How the table slides

Like a few of its store-bought cousins, my sliding table rolls on precision bearings that are guided by steel rails. The whole assembly (see the drawing on p. 52) consists of four main components: an 18-in. by 24-in. plywood table, an 18-in.-long carriage that has four pairs of bearings, two 5-ft.-long tubular guide rails and a 60-in.-long aluminum crosscutting fence. Similar to one of Robland's sliding tables, the rails are spaced about 6 in. apart and are mounted left of the saw table. Drawing detail A on p. 52 shows the wooden frame I built to support the rails. You can easily modify the frame to suit the saw you have, as long as the sliding table is level with and travels parallel to the saw table.

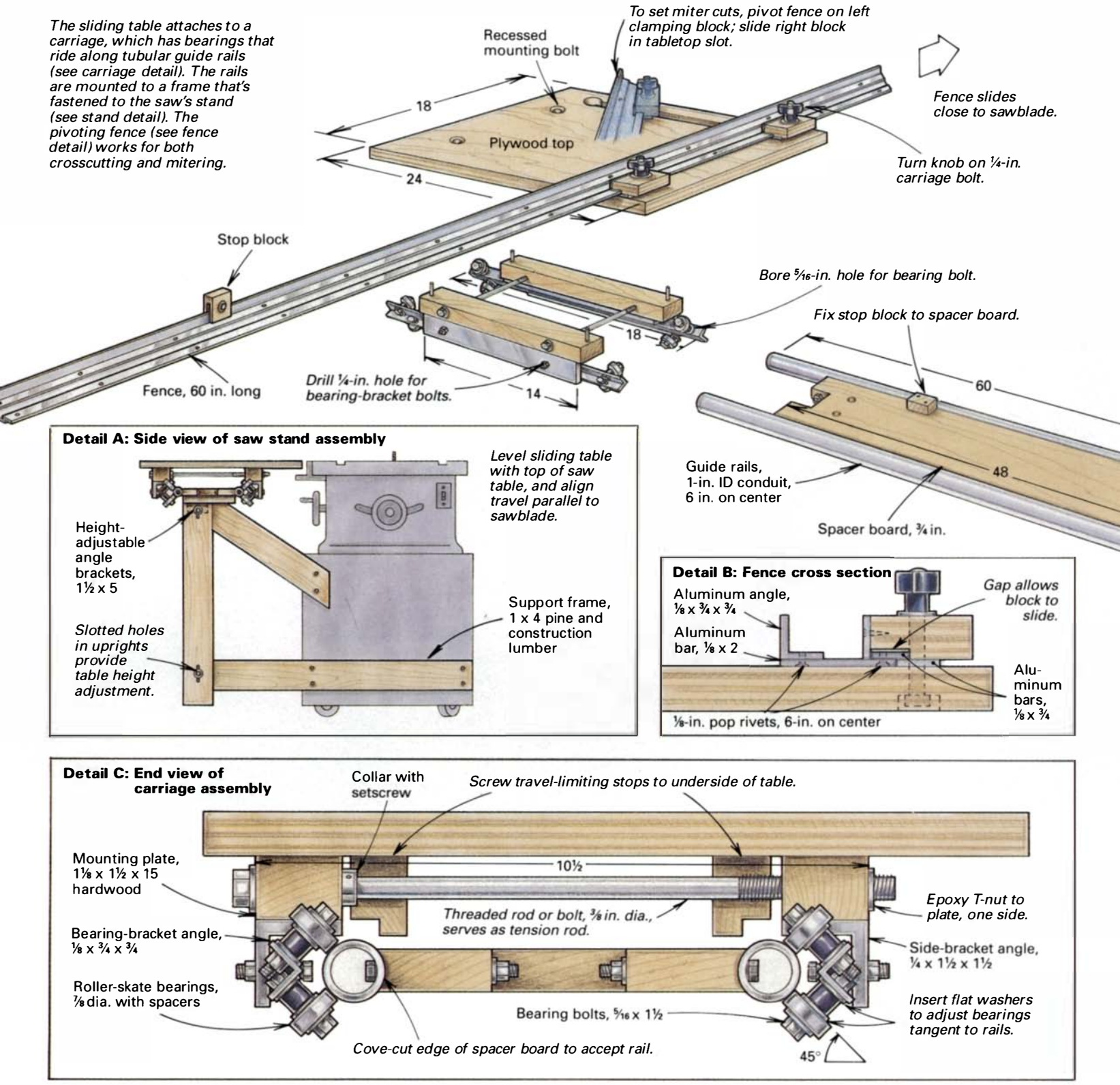
Constructing the table

Before you start to build a sliding table, there are a couple of things worth noting about aluminum. First, when buying aluminum bar or angle, check out recycling centers and salvage yards because they usually don't require a minimum quantity or charge the premium that metal-supply shops often do. Second, you can cut aluminum to length on a tablesaw fitted with a carbide-tipped blade. But be sure you don't let the hot chips touch your skin.

Photos except where noted: Alec Waters

Sliding table anatomy

The sliding table attaches to a carriage, which has bearings that ride along tubular guide rails (see carriage detail). The rails are mounted to a frame that's fastened to the saw's stand (see stand detail). The pivoting fence (see fence detail) works for both crosscutting and mitering.

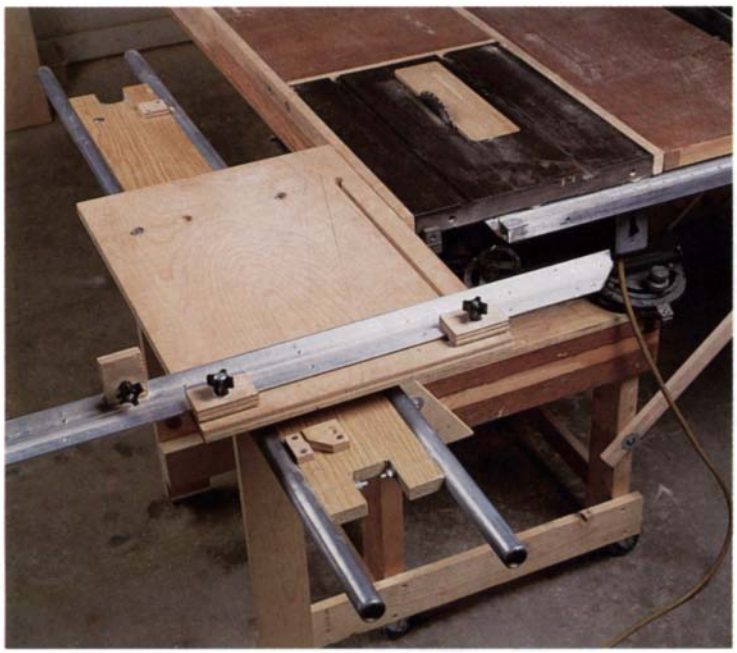


Carriage—The carriage is the heart of the sliding table, so I built it first. It acts much like a sliding dovetail joint, in which a pin is held by the tapered dovetail groove, thus restricting side-to-side or up-and-down movement. In my sliding table, the pin is replaced by guide rails captured by opposing pairs of bearings (see drawing detail C). By mounting the bearings 45° above and below the plane of the rails, I restricted both lateral and vertical carriage motion while allowing the table to roll forward and back.

I mounted two pairs of bearings and spacers to each of two bearing brackets (¾-in.- by 18-in.-long aluminum angles), putting one bearing and spacer pair at each end (see the photo at right on the facing page). The bearings and spacers I used are intended for skateboard wheels and are available at most sporting-goods stores and hobby shops for around $16 for eight bearings with spacers. I secured each bearing bracket to the vertical leg of the side brackets (1½-in.- by 14-in.-long aluminum angles) so that each leg of the bearing-bracket angle is 45° off the horizontal plane of the rails. I found it easiest to first drill the mounting holes in the 1½-in. side-bracket angles. Then, with the ¾-in. bearing-bracket angle clamped in place, I drilled its corresponding holes.

The side-to-bearing bracket assemblies are held together by two tension rods (I used hex bolts, but ⅜-in. threaded rod will also do).

Drawing: David Dann



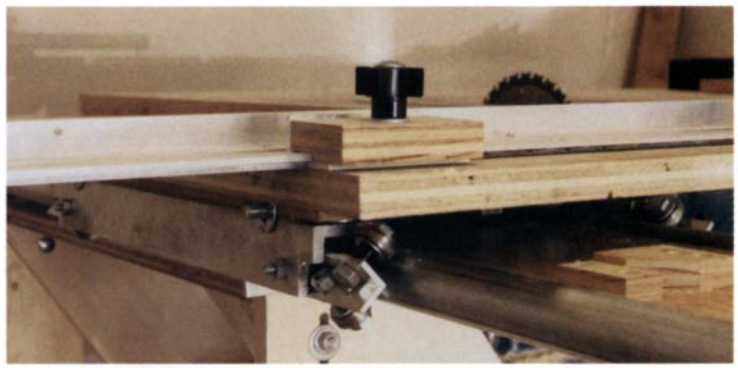
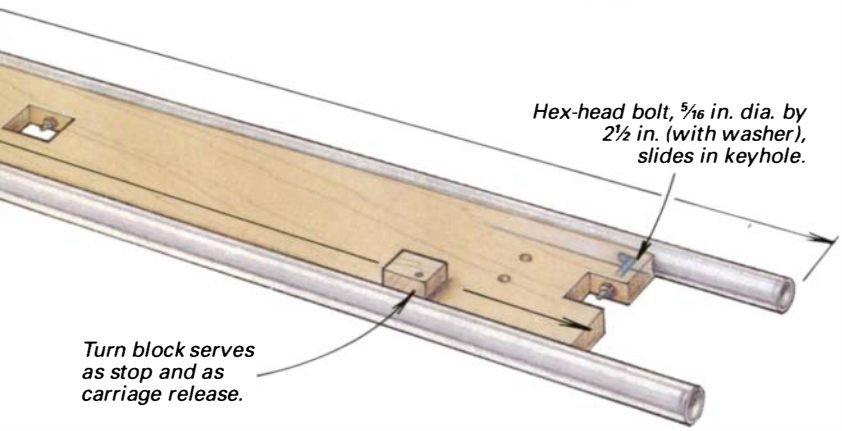


Photo: author

The guide system is strong and accurate *(above). Adapting a design from commercial-grade sliding tables, Perez made a roller-skate-bearing carriage and attached it to the underside of the table. The carriage is guided by a pair of tubular rails.*

Crosscutting fence, extension and outfeed tables *(left) add to the accuracy, safety and versatility of the author's saw. Reduced friction and vibration of the sliding table are real assets when crosscutting long stock and sheet goods or mitering pieces—operations made possible by the added accessories.*



The tension rods allow the carriage to be precisely fit to the guide rails. The rods are fastened so that they turn freely in a mounting plate and are fixed to another plate with a T-nut that's epoxied in place. The 1⅛-in.-thick hardwood mounting plates are screwed to the top of each 1½-in. angle. Four T-nuts with bolts near the ends of the mounting plates secure the table to the carriage.

Guide-rail assembly—I built the guide-rail system to fit between the four pairs of carriage bearings. For the rails, I used 1-in. ID electrical conduit, which goes for about $4 per 10 ft. at building supply stores. I bolted a 6-in.-wide strip of ¾-in. particleboard as a spacer between the rails to stiffen them and keep them parallel. An easy way to determine the exact width of the spacer board is to set the tension rods, so there is ½ in. of adjustment either way. Then hold the rails between the bearings, and measure the distance between the rails. Because the spacer board is cove cut on both edges to accept the tubing, add ¼ in. to the measurement. In each of the rails, I cut three keyhole-shaped slots by drilling sets of holes—each set with a ½-in. hole overlapping a ¼-in. hole. The slots let me insert the hex bolts that fix the rails to the spacer board. I screwed a block at the rear of the spacer board to limit the table's travel. Then I added a turn block at the front (see the photo at left above), which lets me release the carriage from the guide rails.

Support frame—To make the frame that supports the guide-rail system, I used eight board feet of 1x4 pine. I made the frame so I could easily get to all my saw's controls. Two 1½-in.- by 5-in.-long aluminum-angle brackets hold the rail assembly to the frame's uprights. Slotted holes in the uprights and oversized holes in the brackets provide the means for height adjustment.

Final adjustments

The carriage should be fit to the guide rails before you mount the sliding top. After adjusting the tension bolts so the bearings fit the rails, you should check two other things to ensure that the table will slide properly. First, the bearings should contact each guide rail tangentially. Second, each mounting plate should be parallel to the rail below it. I adjusted my bearings by using flat washers to get the proper spacing. To ensure parallel travel (vertically with respect to the rails), I used a combination square and set each mounting plate the same distance above the rails at the front and rear. Initially my carriage was misaligned. To fix this, I elongated the bearing-to-side-bracket holes using a rat-tail file, and then I repositioned the brackets.

I made the final carriage adjustments with the sliding table in place. To align the sliding table with the top of the saw table, I clamped 4-ft.-long straightedges across the front and rear of the saw table. I leveled the sliding table up to the straightedges and tightened the frame's height-adjustment bolts. Next I clamped a board to the sliding table, perpendicular to the rails. I drove a finishing nail in one end of the board, leaving it about ¼ in. proud. As I moved the table to and fro (with the saw unplugged), I measured from the nail head to the blade, both front and back. Once I was sure the table was parallel, I snugged up all the mounting bolts. Then I screwed travel-limiting stops to the underside of the table in line with the spacer-board blocks. To position the stop blocks, I rolled the carriage and marked limits for the table's normal movement.

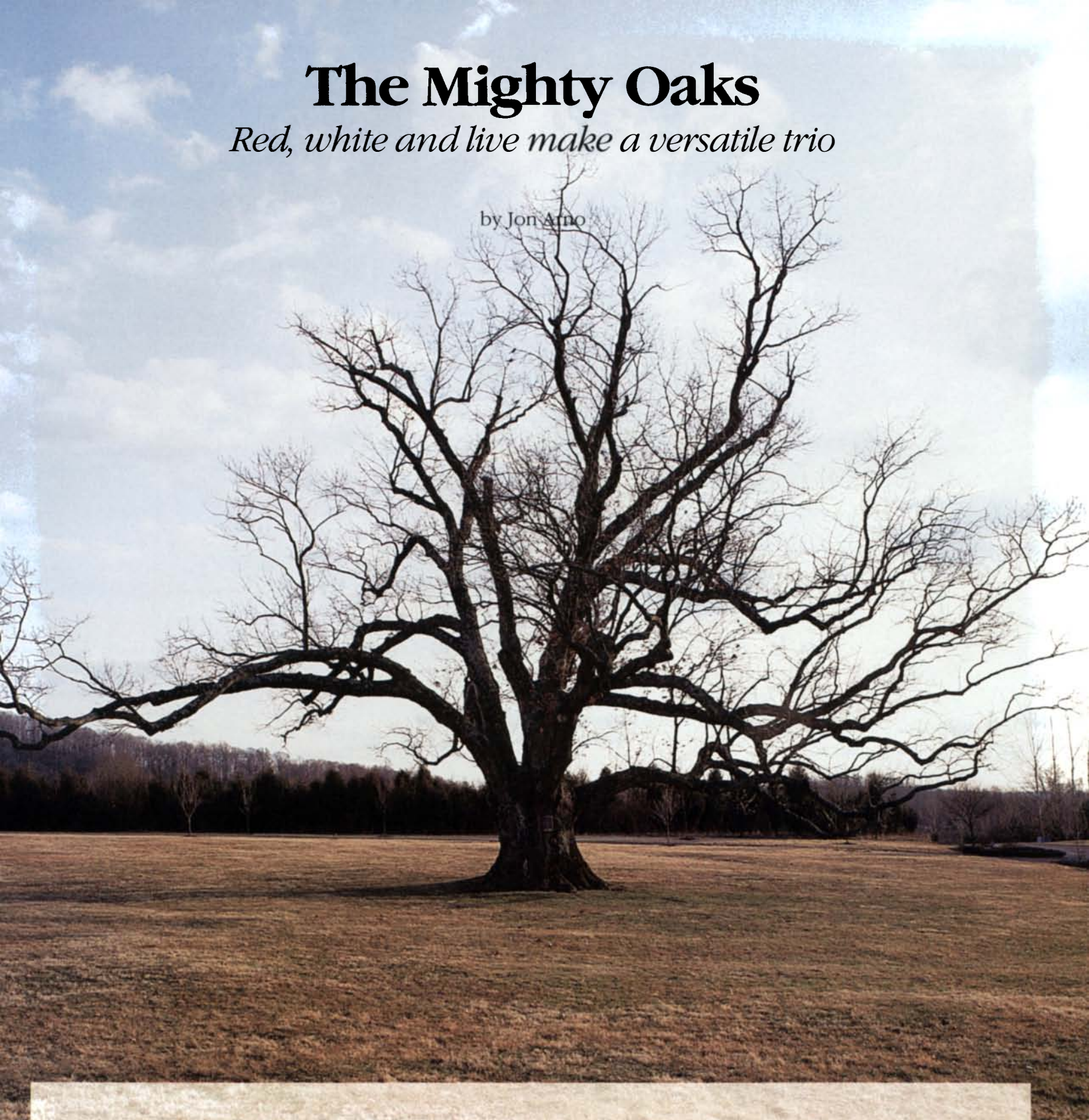
Finally, I equipped my sliding table with a 60-in. crosscut fence (see drawing detail B on the facing page). Because the fence is adjustable, I can set it for mitering, and I can position it to support a workpiece right up to the blade. Fitted with an adjustable stop, my fence and sliding table made quick work of cutting slats for a crib and couch I was building. □

Guy Perez is completing his dissertation in political philosophy at the University of Wisconsin in Madison. In his spare time, he builds woodworking machines to improve his furnituremaking.

The Mighty Oaks

Red, white and live make a versatile trio

by Jon Arno



Our senses tell us it is nothing more than a coarse-textured wood with showy rays and a harsh acidic scent. Yet there's something about oak that causes most of us to think of it in human terms: bold, strong and dependable. There can be little doubt why.

These trees, their fruit and their timber, are an inseparable part of the story of humanity. Acorns predated grain in the diet of our Stone-Age European ancestors. The pagan Germans worshipped oak, and in England, dense groves of the European white oak, *Quercus robur*, served as holy places for Druid rites well before written history began. From ancient times until just before our grandfathers were born, oak served as a strategic military and economic commodity, being the primary naval timber for ships of the line and tall Yankee clippers.

Oak's role in the modern world may be somewhat less romantic, but it has not diminished. Oak remains our most-used hardwood for interior trim, cabinets, flooring, furniture and for many heavy construction applications. The two primary factors that have made oak so enduringly popular are its abundance and its utility. Before exploring these topics, though, let's examine the great diversity of the timbers we lump together botanically as oak.

Oak's family tree

Oaks belong to the beech family, Fagaceae. That this family should be referred to as the beech family is one of the more irrational snubs in taxonomy. Of the 600 or so species in the family, including the beeches, chestnuts and chinquapins, well over 500 of its most important members belong to the oak genus, *Quercus*.

The oaks are also the most abundant and widespread genus of hardwoods in the Northern Hemisphere. In the United States alone we have a growing stock of 100 billion cu. ft. of oak—more than twice our reserves of any other hardwood genus. The natural abundance of the oaks is due to their genetic vigor and their resulting adaptability. Oaks hybridize with very little difficulty. Over millions of years, this natural, genetic experimentation has resulted in a host of species ideally suited to almost any viable environment.

In the course of evolution, the genus divided into two botanically distinct groups: white oaks and red oaks, which are sometimes called black oaks. (There's also a third group—the live oaks, which are climatic variants of the white and the red. I'll discuss live oaks later.) The most significant botanical difference between the two is that white oaks mature their acorns within a single season while the red oaks require two seasons. To tell them apart, all you really need to know is that most white oaks have round-lobed leaves, and the lobes on red-oak leaves come to a point.

Other differences in the cellular anatomy of the woods are of particular interest to the woodworker. Woods in the white oak group tend to have larger rays and smaller, but more abundant, thin-walled pores. The red oaks have fewer, but larger, thick-walled pores, and the rays tend to be smaller and darker in color (see the photos on p. 56). Also, the pores in white oak are almost always clogged with foam-like structures known as tyloses, but the pores in red oak are normally unobstructed (see the photos on p. 57). Because these features are responsible for many of the functional properties of these woods, the lumber industry has adopted essentially the same groupings as the botanists, marketing oak lumber as either white or red. Beyond this, little or no effort is made to differentiate the species. For most construction applications, this broad-brush approach is adequate, but for furniture and finer craft work, it leaves much to be desired.

Within the oak genus there's an extremely broad range of cabinetwoods. The softest of our domestic oaks, with a specific gravity of 0.52 (see the box at right for a definition of specific gravity and a comparison of some of the more common North American species), is the Southern red species *Quercus falcata*. This species is only about as dense as black walnut (0.51). Some of the live oaks have specific gravities approaching 0.90, making them even denser than rosewood. No other genus of domestic hardwood spans such a broad range. In the United States alone, there are 58 formally classified domestic species and perhaps a third again as many recognized hybrid varieties and naturalized foreign species.

Genetics alone, however, do not account for all of the variation in the oaks sold as cabinetwood. Climate, soil and even the way the lumber is processed can produce lumber of the same species with strikingly dissimilar characters, both in appearance and working properties.

The most significant factor besides genetic makeup that determines an oak's character is climate. Red oaks and white oaks that grow in our temperate North-American forests are ring-porous woods. At the beginning of each growing season, these trees produce a band of large earlywood pores, which accent the annual rings and give the wood a showy, open-grained character. Some live oaks are botanically related to the white oaks and some to the reds, but because live oaks do not experience seasonal interruptions in growth, they do not produce the usual bands of large earlywood pores. Instead, they tend to be less figured and much harder woods. As seen on the end grain, the pores in live oak form long radial chains, like the strings of bubbles in a glass of champagne, extending outward from the pith to the bark.

From the woodworker's perspective, categorizing the oaks into these three basic groups (red, white and live) provides a logical and useful framework, though this is only a starting point. The woods in each group share similar functional properties, but there can be considerable variation from one species to another even within each group. The live oaks make up the hardest and heaviest group; the white oaks are next in terms of weight, strength and durability; and the red oaks are the softest and lightest. Most species of white oak have slower growth rates, producing smaller-diameter pores and a more compact cellular structure. This gives the wood great strength and a high resistance to splitting. White oak's rays tend to be larger, tying the vascular (vertically oriented) cells together and giving the wood greater resistance to compression.

All oaks contain high concentrations of tannin (see the box

***This majestic white oak** (left), over 500 years old, serves as an eloquent explanation of why humans have imbued the oak with human characteristics, such as strength and dependability, and why ancient peoples worshipped such trees.*

Photo facing page: Vincent Laurence

The oaks

Some common North American oaks arranged by group

Common and botanical names	Specific gravity	Volumetric shrinkage
White		
Eastern white, *Q. alba*	0.60	16.3
Bur, *Q. macrocarpa*	0.58	12.7
Overcup, *Q. lyrata*	0.57	16.0
Post, *Q. stellata*	0.60	16.2
Chestnut, *Q. prinus*	0.57	16.4
Swamp chestnut, *Q. michauxii*	0.60	16.4
Red		
Northern red, *Q. rubra*	0.56	13.7
Southern red, *Q. falcata*	0.52	16.1
Cherrybark, *Q. falcata, v. pagodifolia*	0.61	—
Scarlet, *Q. coccinea*	0.60	14.7
Willow, *Q. phellos*	0.56	18.9
Water, *Q. nigra*	0.56	16.1
Black, *Q. velutina*	0.56	15.1
Laurel, *Q. laurifolia*	0.56	19.0
Pin, *Q. palustris*	0.58	14.5
Live		
Live, *Q. virginiana*	0.80	14.7

***Specific gravity** is the ratio of the weight of a given piece of wood to the weight of water occupying the same volume. It reflects the relative density of the wood in question. The figures above are based on the wood's green volume and oven-dry weight.*

***Volumetric shrinkage** is expressed as a percentage decrease from original green volume to oven-dry volume. Shrinkage indicates a wood's relative in-use stability.*

Size and distribution of rays *and pores are the best way to identify the oaks. White oaks (left) have smaller but more abundant pores than the red oaks (center) and larger rays. Live oaks (right), because they're largely tropical in origin, have the most even distribution of pores of any of the oaks, as well as the greatest density and the least figure.*

below), which provide at least a modest amount of protection in inhibiting decay. But white oak is substantially more durable than red oak when exposed to the elements because the pores of white oak are clogged with tyloses, which retard the absorption of moisture and help to prevent decay organisms from being established.

Which oak to use?

White—Given white oak's many favorable attributes, it is not surprising that many of the cabinetmaking and wood technology texts published in the 19th and early 20th centuries cite white oak as the preferred, or at least most useful, of our oak timbers. White oak's durability and strength made it superior for uses such as bridge beams and railroad ties, and its low permeability to moisture made (and still makes) it ideal for wine barrels and other cooperage applications. In contrast, a red-oak barrel, regardless of how well the staves were fitted, would leak because its contents would simply flow out through the wood's large, unobstructed pores.

For cabinetmaking, white oak also possesses the virtue of being much more flamboyantly figured than red oak, especially when quartersawn. This radially cut white oak is sometimes called silvered oak and was the height of fashion a century ago. Although red oak also can be quartersawn, its rays' darker color and relatively smaller size don't provide the same degree of splashy contrast as does the white.

Today, silvered oak is no longer the rage, and many of the construction and container duties that were once the exclusive domain of white oak are now being performed by metals and synthetics. White oak's clear-cut advantage over red oak has faded.

Eastern white oak is also not as plentiful today as it once was. In the American market a century ago, the term ***white oak*** was all but synonymous with Eastern white oak (*Quercus alba*). This plentiful species (along with a few virtually indistinguishable hybrids) provided almost all of the commercially processed, higher-grade cabinetwood in the white oak group. Although *Q. alba* still accounts for a large portion of the annual harvest, other species, most notably bur oak (*Q. macrocarpa*), are quite commonly sold as white oak today. Bur oak is a much coarser textured wood with a grayish color and exceedingly large rays. It doesn't turn as well or finish as smoothly as Eastern white oak, but it is not without its virtues. With an average volumetric shrinkage of 12.7%, green to oven dry, it is more stable than Eastern white oak (at 16.3%) and makes excellent hardwood flooring. However, the two woods are not totally interchangeable and should not be used together where their differing shrinkage properties could cause problems, such as in edge-glued tabletops or wide panels. Because of the lumber industry's propensity to commingle these species, buying white oak these days can be tricky. If at all possible, you should inspect any white oak before buying, or at least buy from a supplier who can guarantee that all the lumber you purchase for a project will be of one species.

Red—There's plenty of variety among the red oaks as well, with their average specific gravities (see the box on p. 55) spanning an

Tannin, pro and con

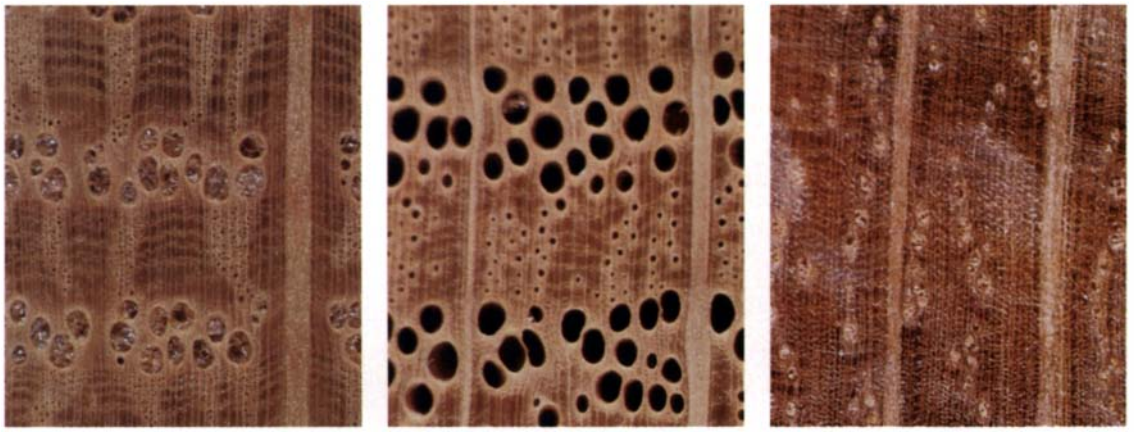
Chemically speaking, one of the most distinctive features of oak is its high tannin content. Indeed, the scent of most species is so powerful that it will linger in the air for hours after the wood has been milled. Although I very much enjoy the fragrance of many woods and view their aromas as one of the more pleasant aspects of working with wood, I find oak to be downright offensive. And for those of us who are sensitive to oak, exposure to the dust can cause watery eyes, skin rashes and even heartburn.

Even so, the offending agent—tannin—magnifies oak's utility in many ways. Tannin has antiseptic properties, and the highest concentrations are in the bark; therefore, oak bark has long been used for preserving or tanning leather. Tannin also reacts with iron to produce black pigment, and oak-leaf galls were once a major ingredient in the making of ink.

For woodworkers, the interaction between tannin and iron is a mixed blessing. On the one hand, care must be taken in using steel nails or screws in oak because over time the surrounding wood will develop an ever enlarging black blotch. Yet when oak logs are submerged in a swamp, this same chemical reaction creates bog oak, a unique and beautifully highlighted, silver-black cabinetwood that is much prized in the British Isles.

Tannin, because it's highly acidic, also reacts with ammonia to produce rich brown pigments. Although modern oil-based wood stains are a lot easier to work with, ammonia-fumed oak was once a very popular finish. In this process, trays of highly concentrated (industrial strength) ammonia are placed in an airtight area along with whatever unfinished oak items are to be fumed. In a matter of hours (or days, depending on how dark a hue is desired), the raw oak becomes indelibly and deeply pigmented. For more on fuming, see "Craftsman-Style Comfort in a Morris Chair," on p. 38. *—J.A.*

Photos this page: Susan Kahn



***End-grain sections show** one of the biggest differences between the oaks. White oak (left), which has been used for barrels for centuries, holds liquids because its pores are largely clogged by tyloses. But red oak's pores (center) are mostly unobstructed and allow liquids to pass through. The pores of most live oak (right) are also open, like those of red oak, but much smaller.*

even greater range than the whites. Southern swamp (or cherrybark) red oak (*Q. falcata var. pagodifolia*) is actually slightly heavier than Eastern white oak. Species like cherrybark, which are native to the extreme South where the climate is moist and the growing season is long, grow rapidly and produce proportionately more dense latewood within each annual ring than do Northern-grown oaks. Oaks from the temperate North tend to produce softer and more flamboyantly figured woods.

In recent years, Southern red oak has developed a somewhat tarnished reputation in the interior trim and cabinetmaking fields for being too streaky and often curly grained. Personally, I prefer this streaked, curly, Southern-Appalachian oak for the special character it lends some furniture projects, especially in tabletops and book-matched panels. But then again, I prefer red oak over white in most applications for rather pragmatic reasons.

Red oak is stocked by more of the high-volume lumberyards where construction contractors buy, so it's generally a little less expensive than white. Red oak is also softer than white, so it's easier to work. This is most noticeable with hand tools and when thickness planing because white oak's rays have a greater tendency to tear out. Neither red nor white oak are particularly well-suited for turning, but typically, gouges stay sharp a lot longer with red oak.

The rays in red oak are less pronounced than in white, so it is not as difficult to match boards. The thing to look for when selecting boards is whether a board is flatsawn or quartersawn. While both grain patterns are attractive, they tend to clash when used together in the same project, so I regard them almost as two different woods.

Finally, because the ray flecks are darker than the background wood in red oak, relatively dark stains can be used without any danger of overemphasizing the rays. With white oak, using a dark stain is not a good idea unless you really want to accentuate the rays. They'll inevitably stand out as contrasting yellow bands against the surrounding, more porous (therefore darker) wood tissue. If you're going to stain white oak, use a blond stain.

Live—Live oak has never been a commercially important furniture wood. One reason is that live oak is absolutely punishing to work with. Historically, live oak has only been used in very specialized applications. Our most plentiful domestic live oak, *Q. virginiana*, was much prized during the 18th and 19th centuries for building warships because of its superior ability to withstand a broadside attack. But given the hand tools of the time, it was never the oak of choice for finer work, and it never became associated with a popular period-style of furniture. This may change, though, in the years ahead. Modern power tools can handle it at least as well as rosewood, bubinga or purpleheart.

Moreover, prospects are high that the live oaks will remain in good supply. In Mexico alone there are well over 100 species of oaks, and the vast majority of them belong to the live oak group. Though they contain fewer species, the forests of Central and extreme northern South America also contain large quantities of live oak, some of which have strikingly unusual ray patterns and vivid color. In fact, they're so different from our domestic species that often the only clues to their kinship with oak are the wood's tannic scent or the use of Spanish trade names containing the words *roble* or *encino*.

By whatever name, these tropical oaks are a world apart from our ring-porous domestic oaks in either the red or white oak groups. With few exceptions, they're brutally hard, but they polish extremely well. Although generally considered diffuse-porous woods (because the pores do not congregate in the earlywood), the live oaks are still relatively coarse textured and open grained compared to the familiar domestic species we think of as typical, diffuse-porous woods, such as maple and birch.

The live oaks have as much potential as cabinetwoods, but there has not yet been much research or technical data gathered on their working properties. Though our domestic live oak (*Q. virginiana*) is relatively stable, some imported species with high volumetric shrinkage have caused disappointment when brought into our somewhat dryer and more temperate climate...so be forewarned.

Forever in fashion

In construction, cabinetry and furnituremaking, as well as in a host of other fields, oak has been in style almost since Western history began. As many a surviving royal throne, treasure chest or ancient armoire will attest, it was the preferred wood throughout the Middle Ages and in the Jacobean period. Even in the 18th and 19th centuries, when mahogany alone would do for elegant pieces, oak was the primary wood for common, utilitarian items such as dry sinks, cupboards, tables and chairs.

In the New World, the Spanish conquest of the Southwest left us the legacy of mission oak. At the turn of the century, massive pedestal tables and rolltop desks in golden oak were popular. At mid-century, our soldiers returned home from World War II to raise their families in houses furnished with limed-oak coffee tables and dining-room sets. Oak still dominates the furniture and cabinetmaking scene, although nowadays, much of that coarse-grained look is actually veneer or synthetic laminate. And for kitchen cabinets, flooring and interior trim, the use of oak still far exceeds any other hardwood—and probably all other domestic hardwoods combined. Given their history, enduring popularity and the existing stock of oaks, they're likely to remain stalwart favorites for a long time. □

Jon Arno is a wood technologist and consultant in Troy, Mich.

Photos this page: Bruce Hoadley

Made in North America—Still

How Delta, Powermatic and General have dealt with the Taiwanese challenge

by Vincent Laurence

On the 14-in. bandsaw assembly line, *and throughout the assembly areas in Delta's factory, part bins are gravity-fed to the front of supply racks. Sensors detect when a part is running low, and a robot cart retrieves a replacement part bin without any human action.*

The woodworking machinery market looked a lot different 15 years ago. A handful of European companies and a Japanese newcomer or two were all the competition North American manufacturers faced. Then, in the early 1980s, Taiwanese machines began to flow into the United States, and everything changed. Little more than a decade later, what at first was a trickle has long since become a torrent. Open any woodworking magazine and chances are you'll see more advertisements for Taiwanese-made machines than for American machines.

Despite the fact that American machines frequently cost twice as much as their Taiwanese counterparts, the American companies are thriving, which means they must be doing something right. Because everyday we hear from readers who want advice on buying machinery—should I by American or Taiwanese?—we thought it was a good idea to get reacquainted with the American manufacturers of stationary woodworking power tools. I wanted to know how the American companies have remained competitive, what they've had to do here and in some cases, overseas, and what it all means to an average power-tool buyer like me.

I visited the big three North American stationary power-tool manufacturers—Delta, Powermatic and General—and talked with manufacturing, marketing and managerial people at each company. Each of the three has found its own way to cope with increased competition from overseas and recession right here at home. Although there are a great many differences between the three, there are more similarities. Here's what I learned from a week of travel and first-hand inquiry.

General: More of the same, more efficiently

One of the most important questions anyone running a business can ask is "What market am I serving?" General Manufacturing Co. asked that question in the early '80s, and the answer was "We're manufacturers of industrial-grade woodworking machinery." Unfortunately, the industrial market wasn't growing, labor and material costs were rising and Taiwanese machinery was on the streets for a fraction of what a comparable U.S. or Canadian machine cost. Disaster wasn't imminent, but the handwriting was on the wall.

General's solution was twofold: First, it decided to continue building the same heavy-duty industrial equipment it has since 1946 but to market that equipment to home-shop woodworkers as well as to professionals. Second, General increased the efficiency of its Drummondville, Quebec, plant and foundry. General upgraded its foundry with an electric furnace, allowing smaller, more consistent batches of iron to be poured more quickly. The firm also began buying CNC (computer numerically controlled) equipment for its machining and assembly plant (see the top photo).

CNC machines are flexible, programmable milling machines, capable of performing a whole spectrum of operations. They require far less monitoring than traditional machining stations, so one worker can operate a number of machines safely and effectively. Also, set-up time for a new part or operation is all but eliminated because the bulk of the setup is in the programming.

Most significantly, though, improved quality is virtually assured because CNC equipment is inherently more consistent than any human operator. When I visited the General factory last January, Gilles Guerette, General's vice-president of operations, told me that 75% of the machining that goes into any General tool was being done on CNC equipment. What all this means for the purchaser of a General machine is that, while prices today aren't much higher than they were in the mid-'80s when General began modernizing, quality is at least as good and probably better.

What General hasn't done is as significant as what it has done. Of the big three stationary tool manufacturers, General alone has not taken any of its manufacturing to Taiwan. When I asked Guerette why, he told me that going to Taiwan would have meant a waste of managerial energy and capital. It would have required a much more extensive dealer network to handle the increased volume needed to warrant setting up an import business in the first place. Rather than take that route, General took the same human and capital resources and upgraded its existing facilities—choices that seem to have served the company well.

Guerette was upbeat, saying that the company's toughest times are behind it. With prices on the Taiwanese equipment rising, the recession easing and consumers demanding more for their money, he thinks General is well-positioned for the '90s.

Another reason General decided not to go to Taiwan to develop a do-it-yourselfer line is that even though the home-shop market is burgeoning, many novice woodworkers are becoming frustrated with inaccurate or unreliable Taiwanese tools they bought to save money. Guerette said that the flood of cheap tools from Taiwan has left something in its wake: The quality of North American-made industrial tools has become all the more obvious.

So what's so special about General machines? I asked Guerette.

***General's Drummondville, Quebec, plant** is something of a hybrid, working with both computerized equipment and traditional dedicated machinery. As the plant modernizes, existing workers are being trained to operate the new equipment.*

***Powermatic still relies primarily on traditional machinery** dedicated to single tasks as part of each work cell, though its manufacturing process has changed completely. Even so, with power feeds on much of the equipment, operators can move parts through several operations at the same time in a cell.*

Photos: author

I wanted to know why I should buy one over a Taiwanese machine or for that matter, over a Delta or a Powermatic. Guerette replied that the quality of General's castings is consistently high, all made from 30,000-pounds per square inch (psi) tensile strength (industrial grade) gray iron. The castings are all precisely controlled in a state-of-the-art Meehanite foundry. (The Meehanite process is a licensed technology, which ensures a very consistent, fine-grained casting of uniform hardness.) General machines are heavy; its saw tables are substantially heavier than Delta's or Powermatic's, Guerette said. All saw tables and beds are Blanchard-ground, meaning the cutting heads rotate in the opposite direction from the carriage on which they're riding, which leaves an exceptionally well-polished surface. The paint on most General machines is applied electrostatically. An electrical charge is applied to the machines, dry-powder paint is sprayed on (the charge holds it in place) and then the machines are baked, bonding the paint to the metal and leaving a surface more chip- and scratch-resistant than an ordinary paint job. Finally, General machines are shipped out with adjustments made, extension wings attached, very nearly ready to plug in and turn on.

***Foundries are much the same today** as they were 100 years ago; At Powermatic, it still comes down to pouring molten metal into densely packed sand.*

***Automated Guided Vehicles (AGVs)** cruise the aisles of Delta's Tupelo, Miss., plant, beckoned by electric eyes and guided by antennae recessed in the concrete floor. Programmed to load, transport and unload all the parts, subassemblies and finished product through the plant, the AGVs save labor costs.*

Powermatic: Japanese manufacturing philosophy

"JIT cellular manufacturing," was the big news at Powermatic's McMinnville, Tenn., headquarters. JIT stands for "just in time," a manufacturing process pioneered by the Japanese in which entire machines are made as they're needed, with nothing going into inventory. This process saves time, energy, inventory space and company tax dollars. George Delaney, Powermatic's president, explained that when Powermatic started shifting to the JIT process, it looked at every step in the manufacturing operation and asked, "Is this step adding any value to the end product?" If the answer was no, the step was eliminated.

The cellular component of JIT cellular manufacturing refers to the arrangement of the factory itself. All machining and assembly for a given machine take place in one area of the factory—a cell—perhaps half as long as a football field. Rough castings, stamped steel, bar and round stock come in at one end and a Model 66 tablesaw or Model 27 shaper comes out the other. Parts and subassemblies are machined or assembled as needed, and nothing extra (which would only have to be inventoried) is created.

Powermatic's cells are still largely made up of traditional machine setups, each dedicated to a single purpose (see the bottom photo on p. 59). I saw some CNC equipment, but the managerial emphasis was clearly on establishing a new work flow—converting completely to the cellular concept—rather than on bringing in lots of expensive new equipment.

Within a cell, all workers are cross-trained, so someone who's machining an arbor one day might be putting together a trunnion assembly the next. It's a manufacturing process that fosters a sense of responsibility. If a worker has to assemble a machine from parts he's made, he has a strong incentive to machine the parts right in the first place. At the same time, if something doesn't fit, he'll find out and be able to correct it right away. Moreover, when workers perform a diversity of tasks, their jobs are more interesting and they're less prone to quality-sapping boredom or inattention.

What does all this mean to the power-tool buyer? Essentially the same as with General: Prices on Powermatic tools have held fairly steady since the mid-'80s, Delaney said, and in some instances have even come down. At the same time though, the designs on most of the core products (the industrial equipment) have changed little, and the quality has actually improved because of the switch to JIT cellular manufacturing.

But the U.S. operation is only part of the story with Powermatic. Even though all of its industrial-grade machinery is made in McMinnville (with the exception of the 36-in. bandsaw, which it imports from Italy), its Artisan line is made in Taiwan. I asked Delaney about the decision to go to Taiwan. He explained, as did Gilles Guerette at General, that the North American industrial power-tool market is a no-growth market. At the same time, the home-shop market is booming. Powermatic did some research and found that, though older woodworkers knew the Powermatic name, younger woodworkers did not.

The best way to increase Powermatic's name recognition and build brand loyalty was to introduce novice woodworkers to its product with a new line. To do that economically, Powermatic went to Taiwan. When looking for a Taiwanese factory to manufacture the Artisan line, Delaney investigated a number of companies, finally settling on one that already had good internal quality control. In addition to working with the best factory it could find, Powermatic also keeps three inspectors in Taiwan to spot-check machines being assembled, to do rigorous periodic laboratory in-

***Hydraulic fixturing and independently programmable cutterheads** make computerized machining versatile (above). Here, a worker adjusts the clamping pressure on a rough casting.*

***Row upon row of computer-controlled equipment** constitutes Delta's various manufacturing cells (left). In the foreground is part of the flexible turning cell, which does all turning and related operations. One operator typically works between two and five machines, depending on the operations.*

spections of finished machines and to "run-test" boxed items on a regular basis, just before they're crated for shipment across the Pacific. Also, teams from Tennessee regularly go to Taiwan to check the factory's inspection records and to check on the subassembly shops (sub shops) supplying the factory.

I asked Delaney why I should buy a Powermatic over a generic Taiwanese equivalent or over a Delta or a General. He told me that for its U.S.-made product, Powermatic uses 30,000-psi iron for all its castings; its foundry is Meehanite-licensed, like General's (see the top photo on the facing page). The tables are Blanchard-ground. The original patterns are still used for the castings (they haven't gotten any lighter over the years). And, finally, the blade on the Model 66 tablesaw tilts left, meaning that if you use your fence to the right of the blade like most folks, the blade tilts away from the fence, preventing angled offcuts from getting caught between fence, table and blade.

Delta: 21st-century manufacturing

The shift to more modern manufacturing practices and technology that I saw at General and at Powermatic were only a glimmer of what I saw at Delta. With Automated Guided Vehicles, or AGVs (robotic material-handling carts), cruising around its 330,000 sq. ft. of floor space (see the bottom photo on the facing page) and cell after cell of CNC equipment looking crisp and efficient beneath cavernous 23-ft. ceilings, Delta's Tupelo, Miss., manufacturing plant looked like a set from *Star Wars*.

The Tupelo plant was a traditional factory until 1984, when Delta realized that Taiwanese competition wasn't going away. After taking legal action to protect its trade dress (a product's signature look, which makes it identifiable as that make or model), Delta moved forward on two fronts, in the United States and in Taiwan. In the United States, Delta's parent company, then Rockwell, began funding a sweeping modernization, and when Pentair bought Delta in 1984, the new management accelerated the process. What I saw when I visited this past January was an almost wholly automated manufacturing facility (see the photo at left above).

Delta invested over $14 million in the first few years at the Tupelo plant alone to become efficient enough to compete with Taiwan. Even though Delta's product quality was superior, the Taiwanese were taking a big bite of the market share because their machines were so much cheaper. Delta had to contain costs.

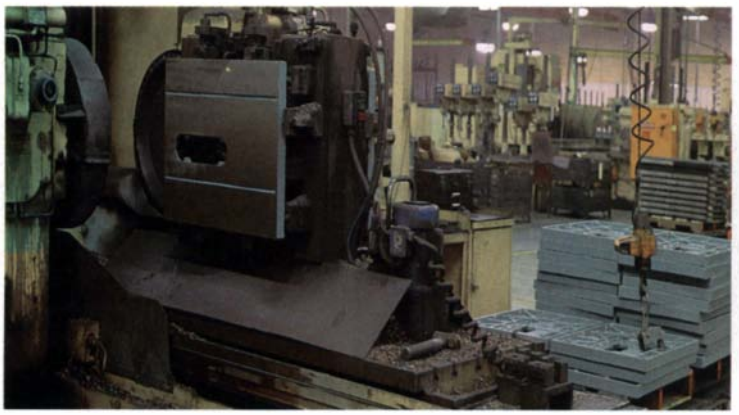
Like General and Powermatic, and long before either of them, Delta converted to a JIT cellular manufacturing process. In addition, Delta decided that the flexibility offered by CNC equipment more than offset the high initial cost of converting to it. Thanks to a parent company with deep pockets, the conversion was swift and nearly complete. Today, 90% of turning operations are done with CNC equipment and a comparable percentage of milling, grinding and other machining is computer-controlled. The most versatile of the machines are capable of machining a host of different parts simultaneously, having 90 independently programmable cutterheads (see the photo at right above). Other changes have also increased productivity. In addition to the AGVs, which move materials around the plant, Delta installed boom cranes four years ago wherever heavy components—particularly cast-iron machine tables—had to be lifted (see the top photo on p. 62).

Some things haven't changed. When I was touring the plant, Dennis Palmer, Delta's quality assurance manager, told me, "A punch press is a punch press is a punch press." Essentially, a giant sheet-metal brake, a punch press is used mostly to form base cabinets for tools such as the Unisaw. I saw several presses, all huge (250 to 300 ton) steel hulks, looking more like what I'd imagined heavy manufacturing would look like than the CNC stations (see the bottom photo on p. 62). Taking rolled-coil steel stock in at one end, these presses spit out bases that are finished except for a weld at one corner.

One of the things that surprised me with all three companies was how they handled quality control. I half expected to see someone running around with a clipboard and micrometer, wagging his finger at any less-than-precise workers. That wasn't the case. All three companies *do* have people checking tolerances throughout manufacturing and inspecting finished machines, but each also insisted that quality control was built into the cellular-manufacturing process. When the same worker who machines a part has to put it

into a subassembly, it's machined right the first time. By the end of my tours with Powermatic and General, what they were saying made sense: Quality control is an integral aspect of this manufacturing process. At Delta's facility, quality control went a step further.

Delta's CNC equipment is hooked up to a quality-control system called Statistical Process Control (SPC). This system monitors tolerances of milled components by sensing the horsepower draw at the cutterhead's spindle. As a cutterhead dulls or wears away, the demand for horsepower changes. Small groups of units are represented by a dot on a computer monitor. As a run of parts is machined, a pattern of dots develops So long as the dots fall within 70% of a prescribed tolerance, everything's fine. But when a dot hits the line or goes beyond it, the machine is shut down, and the tooling is either adjusted or replaced.



***Surfacing saw and shaper tables** is a two-step operation. The tables are first taken down to within .020 in. of flat and are later ground to .005 in. or less depending on the table. The hoist on the right is used to move the tables.*

***A 300-ton punch press is a deafening behemoth** capable of stamping out one machine's sides every couple of seconds. With one motion, the machine can sever rolled-steel stock, form it around removable fixturing, punch holes in it and create louvers.*

Just as with Powermatic, Delta's U.S. operation is only part of the story. Delta manufactures its Unisaw, cabinet saw, contractor's saw, 14-in. and 20-in. bandsaws, shaper and all their radial-arm saws in Tupelo, but builds its benchtop line and its jointers and planers in Taiwan. Delta's Taiwanese operation benefits from an economy of scale just as its U.S. operation does. It sells enough of the Taiwanese-made tools to guarantee business to three factories there; in return, these factories act as partners, building only Delta tools—and building them to Delta's standards.

Fifteen Delta engineers and inspectors live and work in Taiwan, monitoring the quality of components their partner factories get from the sub shops, checking the actual machining in the sub shops, monitoring the assembly in the partner factories and inspecting the product as it comes off the assembly line. All critical machining goes on in the partner factories. In fact, the partner factories use Delta's CAD (computer-aided design) programs, which they get directly from Pittsburgh (Delta International's headquarters), to program their CNC equipment. In short, Taiwanese-made Delta equipment bears more of a resemblance to U.S.-made Delta equipment than it does to most other Taiwanese-made goods.

When I asked the Delta people why I should buy a Delta tool over a generic Taiwanese machine or over a Powermatic or a General, I was told that any of the American companies make an excellent product, but that "dependability, consistent quality, more accessories and the best parts and customer service support in the business" are all good reasons for buying from Delta.

Consistency and service

Over and over in talking with everyone at General, Powermatic and Delta a couple of common themes came up: consistency and customer service. When a company is committed to the long haul, reputation is more important than the profit margin on any one piece of equipment. Accordingly, satisfying the customer takes on a whole new meaning. The way that North American manufacturers have ensured that satisfaction has been by maintaining a consistently high-quality product, modifying it very little and only after extensive research, and standing behind their product. It's a lot easier to sell a satisfied customer a second machine than it is to sell that first machine, so from a marketing perspective, this way of doing business just amounts to enlightened self-interest.

Before leaving Delta, I was asked (rhetorically), "Who's going to help you out if you have a problem with one of their machines next week or next year? Who's going to be around in 20 or 30 years to sell you replacement bearings or some obscure part it took you 27 years to destroy or to send you a new owner's manual to replace the one you lost?" Delta's been around since 1919, Powermatic since 1921 and General since 1946. They all stock extensive parts inventories and have people to help you if you've got a problem with one of their machines. Delta still stocks parts from machines made in the '30s and has a customer service representative whose title is Discontinued Product Specialist.

I asked the presidents and vice presidents of each company, "If someone who buys one of your machines has a problem with it and can't get a satisfactory resolution, what should he do?" Without fail, the answer was "Call me." The price tag for an American-made machine may be bigger up front, but the confidence that you've bought a tool that will give accurate, reliable service both now and 20 years from now is worth something, too. □

Vincent Laurence is associate editor of Fine Woodworking.

Shaker-Style Clock

Modern works and classic design create convenient storage

by Phil Lowe

This Shaker-style wall clock is a beautiful adaptation of the original design. Its smaller size, about 7 in. shorter than the original, fits well in modern homes, and the shelves added behind the panel door provide storage in a space that was intended for a pendulum.

The simple beauty of Shaker styling teamed with modern clockworks offers an attractive and accurate timepiece as well as room for storage.

However, when I had a commission for such a Shaker clock, I found a lot of pictures of clocks, but no dimensioned drawings. So I scaled my design from a photo.

Because of my clients' space limitations, my version is only about 80% as large as the original. The dimensions of this downsized version fit very well in modern interiors. I proportioned the sides to the front, being careful to accommodate a modern quartz movement. That also left room for shelves in the lower compartment, which usually houses the pendulum.

The cherry and pine case is held together with typical Shaker construction: Mortises and wedged through-tenons join the carcase, and blind mortise-and-tenon joints connect the door frames.

Clock design

A frequent admonition for any project is to buy your hardware before beginning to build. This is particularly true for a clock. You must accommodate hinges, latches and clockworks, and don't forget to allow enough room between the clock's face and the glass in the door for the hands.

Although original Shaker clocks had wooden works, I substituted a quartz movement from Klockit, Inc. (P.O. Box 636, Lake Geneva, Wis. 53147; 800-556-2548). Because the quartz movement I chose didn't have a pendulum, I added some shelves to the bottom compartment to make a convenient storage place for small items.

Hand-detailed stock preparation

I use the normal array of woodshop machines, such as a jointer, planer, tablesaw and crosscut saw, to dress and dimension stock slightly oversized for my projects. But to add a true, handcrafted touch and to remove machinery millmarks, I make a couple of light passes on each face and edge of the stock with a handplane. To cut pieces to length, I scribe my cutting line with a knife, rough cut shy of the line on the tablesaw and then handplane to the scribed line. I mold the edges of the top, bottom and doors on a table-mounted router with the appropriate bit.

Planning mortises and tenons

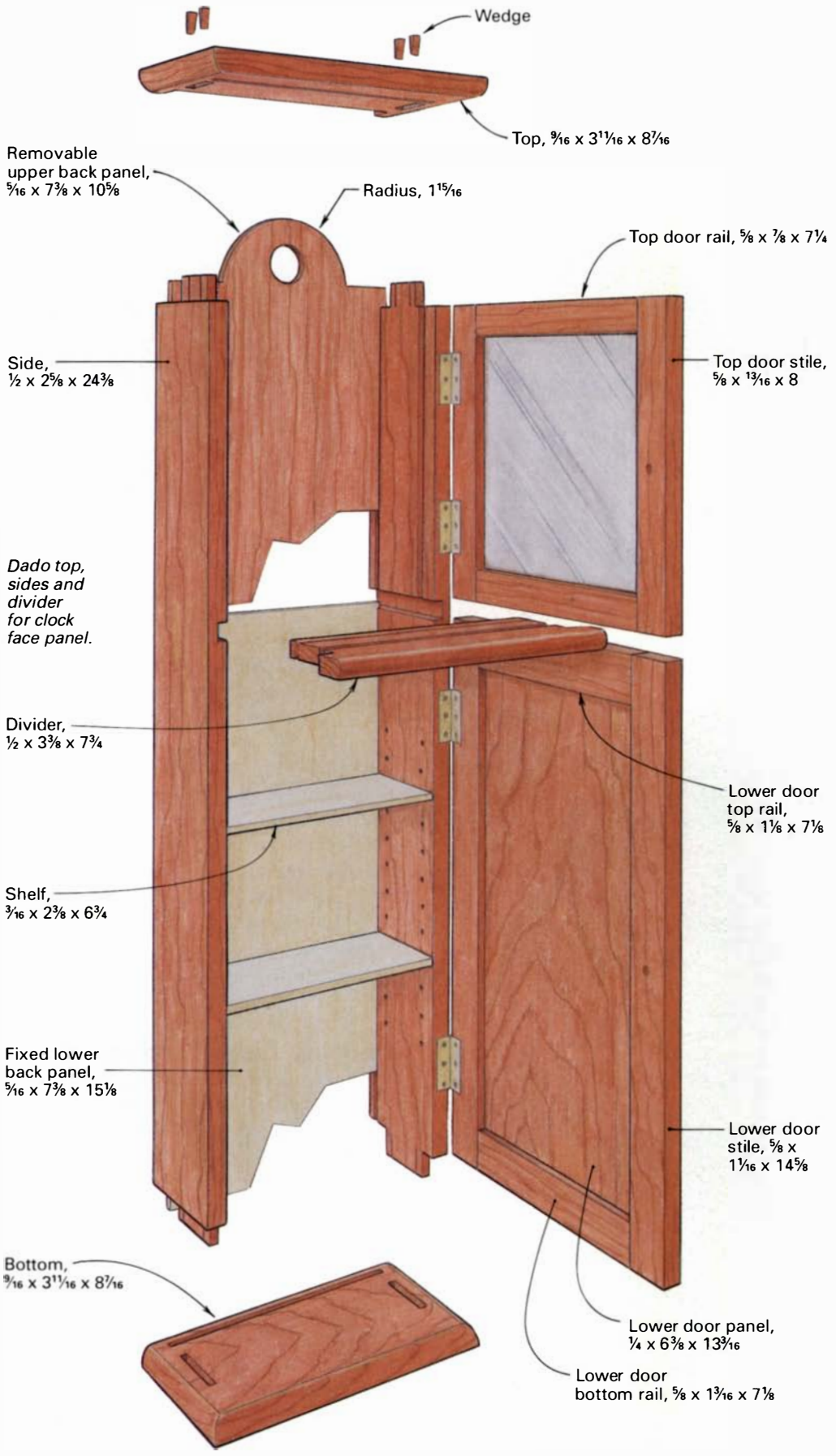
When laying out the mortises and tenons for the carcase, I didn't want the grooves for the back to interfere with the sides' tenons. I was also worried that the ends of the top and bottom might split during assembly when I drove the wedges into the sides' tenons. I avoided both these problems by extending the tenons' shoulders at the front and back and adding a shoulder to the outer side while leaving the inside barefaced, as shown in the drawing on the following page. This way, the tenons clear the grooves, and the top and bottom mortises have greater strength.

Putting on a good face

The face and works fasten to a pine panel that sits in grooves cut in the sides, top and

Shaker-style wall clock

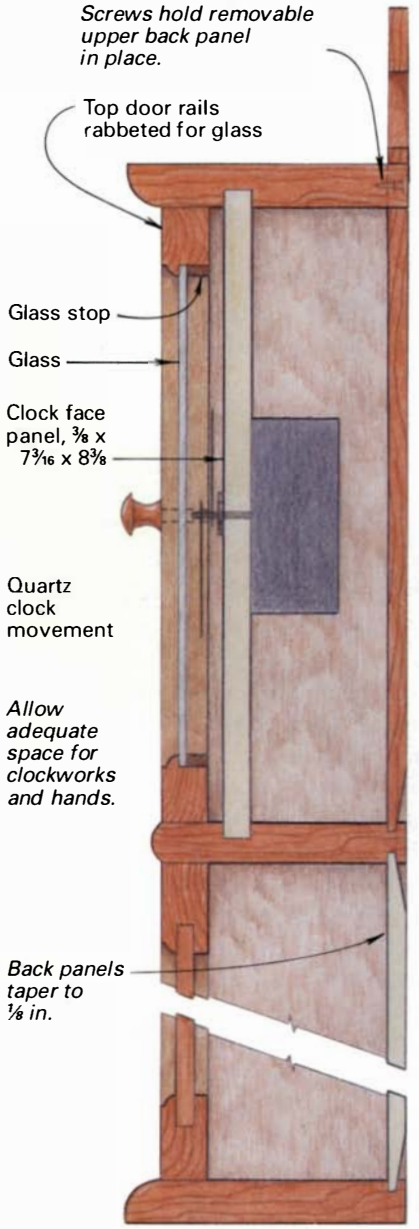
Scaled from a photograph, this drawing shows the author's interpretation of a Shaker wall clock. Joinery is based on traditional Shaker construction techniques, but the size is about 20% smaller than the original clock, which was about 31 in. tall.



Note: Pins to hold shelving are 1/4 in. dia. by 3/4 in. long.

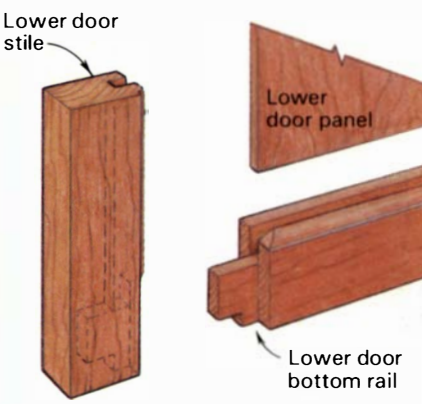
Detail A: Top door

Construction details for top door



Detail B: Lower door

Construction details for lower door



Haunched tenon fills panel groove that runs out end of stile.

Photo: Susan Kahn; drawings: Heather Lambert

divider. To ensure the face panel grooves line up, I referenced all the cuts off the back edges of these pieces. When cutting these grooves, be sure to allow clearance for the clock's hands.

Grooves for double back panels

I used double panels in the back: a fixed lower panel and a removable upper panel for access to the clockworks. I beveled the back side of these 5/16-in.-thick panels, so their edges will fit into a 1/8-in.-wide groove.

The lower panel is captured in grooves in the sides, bottom and divider. The grooves run from end to end on all pieces except the bottom, which has a stopped groove. Through-grooves are easily cut on the tablesaw, but a router is probably the safest way to cut the stopped groove.

The top back panel slides from the top into grooves in the sides and divider. The panel includes a semicircular section extending above the clock with a hole for hanging the clock on a Shaker peg. Two screws driven through the top panel and into the back edge of the top secure the removable back panel.

To let the back panel drop into its grooves, I use a tablesaw to cut away the back edge of the top, as shown in the drawing. I make this stopped cut by raising the blade through the top with the same fence setting used to groove the sides, so the cut lines up with the grooves. Don't make this cut without a stop block clamped to the fence in front of the piece.

To position the stop block, I use the top, laid out with start and stop marks for the cut, as a gauge. I lay the marked top next to the blade and then raise the blade until the points at which the teeth of the blade penetrate the tablesaw top at the front and back of the blade are just shy of the start and stop marks on the top. I clamp the stop block to the fence and lower the blade, counting the number of turns until the blade is completely retracted. After positioning the top against the fence and the stop block, I turn on the saw and raise the blade through the stock, the same number of turns it took to lower it, being sure to keep my fingers clear of the cutting area. I then lower the blade, turn off the saw and finish the cuts with a handsaw.

Although this procedure is easily done, you might be more comfortable just cutting away the waste on a bandsaw.

Assembly and glue-up

Before assembly, I drilled holes for the shelf pins in the sides and then sanded the carcase pieces to 180-grit, raising the grain between sanding with a damp cloth.

To assemble, I applied glue to the divider dadoes and to the tenons for the top. I slid the divider and the face panel into position before putting the top onto the tenons. Next I slid the bottom back panel into place, applied glue to the two bottom tenons and put the bottom on the sides. While the glue was still fresh, I tapped the wedges into the tenon kerfs, being careful not to drive the wedges so far as to crack the top or bottom. I measured across the diagonals to make sure the carcase was square and then gave it a final sanding with 220-grit paper.

Frame-and-panel doors with mitered molding

The rails and stiles of the doors are molded with a quarter-round and fillet pattern along the inner edge. This molding, or sticking, is mitered, and the rails and stiles are joined with mortises and tenons, as described in Mac Campbell's article in *FWW* #98, pp. 66-69. The top door is rabbeted to accept the glass and a glass stop, as shown in drawing detail A, and the bottom door is grooved for a flat, floating panel, as shown in drawing detail B.

Aligning the mortises and tenons for the stiles and rails with the panel groove and the glass rabbet made it easier to cut the joints. The tenon is as thick as the panel groove is wide, so it is easy to cut a haunch on the tenon to fill the groove where it runs out the end of the stile, as shown in drawing detail B.

After assembling the doors, I glued and wedged in the turned knobs and mounted the doors to the carcase. When satisfied with the fit and alignment, I removed the hinges and finished the carcase and the doors, as described in the box at right.

When the finish dried, I completed the clock by reinstalling the hinges, inserting the glass with glass stops and mounting the face, works and hands in the top. I used 3/32-in.-thick, light restoration glass from S. A. Bendheim Co. (61 Willett St.,Passaic, N.J. 07055; 800-221-7379) to give the clock an authentic antique appearance.

I had the face for my clock hand-painted on a sheet of tin by a local artist (Herschel B. Burt, P.O. Box 399, Exeter, N.H.; 603-772-3598) to duplicate the original. A variety of printed faces are also available from Klockit, Inc.

All that was left after sliding the upper back panel into its grooves and screwing it in place was to make a nice strip of Shaker pegs from which to hang the clock. □

Phil Lowe designs, makes and restores fine furniture in Beverly, Mass.

Reproducing an aged finish

Building accurate replicas of old pieces is always compromised when using new wood because it lacks the patina that develops only with age. This is particularly true of cherry, which darkens considerably as it ages. However, I've found a chemical solution that can impart an aged looked to cherry without waiting years.

I apply a saturated solution of Sal-Soda, an unpure carbonate of soda that painters use for cleaning prior to painting. Sal-Soda can be hard to track down, but you may find it at large, commercial paint-supply stores, or you can mail order it from the Johnson Paint Co. (355 Newbury St., Boston, Mass. 02115; 617-536-4244). One pound ($1.20/lb.) will make about 1½ gals. to 2 gals. of saturated solution.

I mix the Sal-Soda with water until no more crystals will dissolve, strain off the undissolved crystals and then apply a heavy coat of the mixture with a foam brush. I wipe off any excess puddles of solution after approximately 15 minutes, let it dry thoroughly and then apply a second coat. Because this process can raise the grain, it's important to wet sand the piece several times before applying the Sal-Soda.

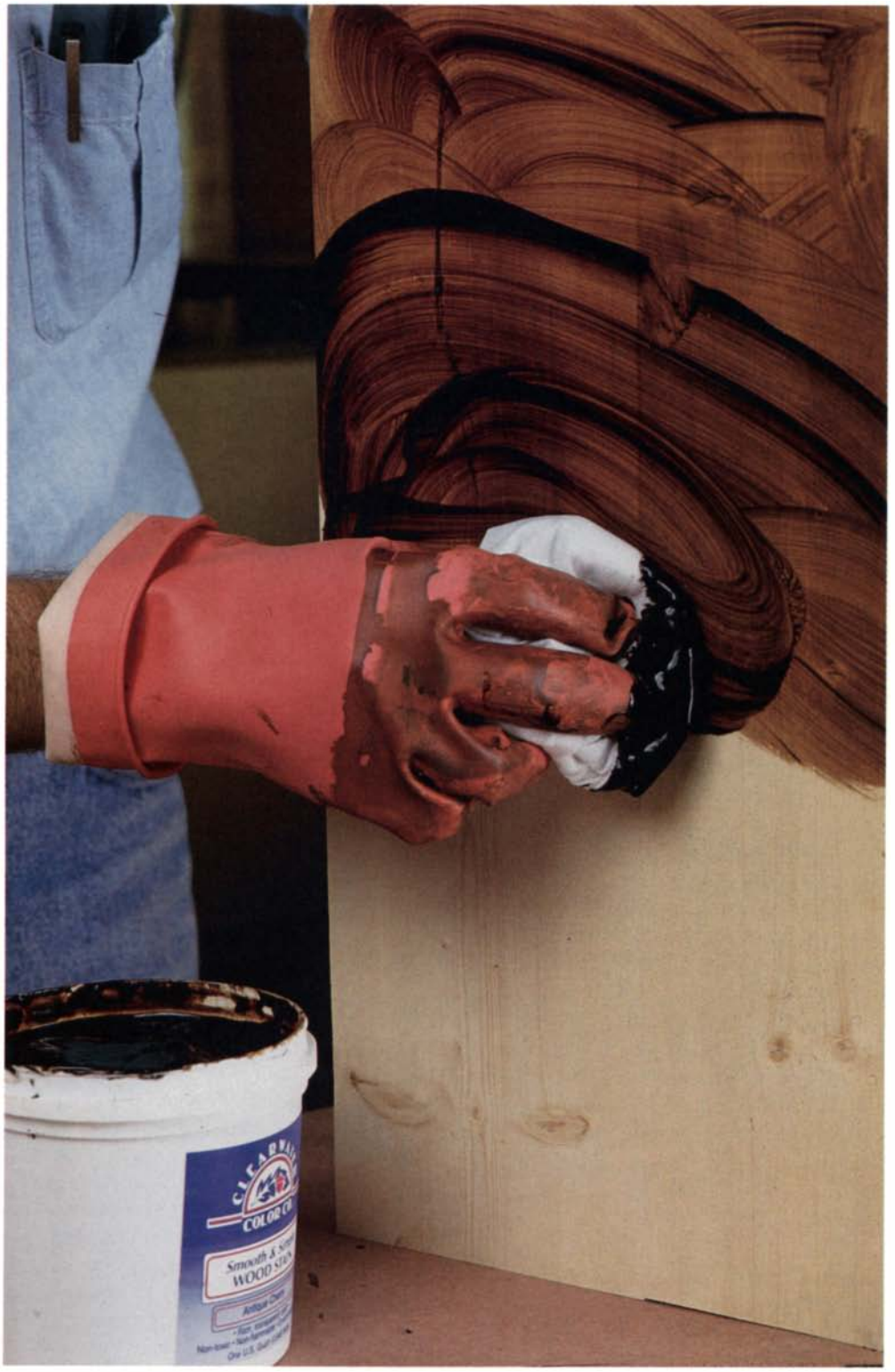
Sal-Soda also works on oak and mahogany, but it shouldn't be used on veneers. The solution must be neutralized with a vinegar and water wash before applying any topcoats. Results can vary, so experiment on scraps of the wood you're using, and allow about a week for the darkening to fully develop.

After treating with Sal-Soda, I brushed on three coats of orange shellac, allowing each coat to dry overnight and then rubbing between coats with 0000 steel wool. To add just a hint more color to the wood, I waxed the clock with a coat of Kiwi brown shoe polish and finished up with a clear coat of butcher's wax. —*P.L.*

Changing the Color of Wood

A primer on modern stains

by Chris A. Minick



***Gel stains are great for vertical surfaces** like cabinet sides because, unlike liquid stains, they don't run off.*

Why would anyone want to stain a piece of furniture or cabinetry and cover up the natural color and figure of beautiful wood? While few of us would even consider staining flame-grained mahogany or burled walnut, not all of us can afford to build every project from first-rate cabinet hardwoods. Most woodworkers I know often employ cheaper woods, such as pine, poplar and birch. And the appearance of such plain woods can be enhanced by staining.

In addition to giving inexpensive woods a richer color, stains are indispensable for matching the color of new woodwork to existing wood furnishings or for evening up natural color variations in boards glued up into wider panels. A judiciously applied coat of stain can even lend a subtle color contrast to bring out the spectacular grain of a highly figured exotic species.

But don't expect to get a perfect staining job by picking up the first can of stain you see on the shelf at your local hardware store and sloshing it on. To get good results for a wide range of staining situations, you need to know the characteristics and qualities of different types of stains, so you can choose the best one to obtain the desired effect. Good stain jobs also depend on proper surface preparation and application technique, so the wood receives the stain evenly. A further assurance of success comes from making stain samples to test the color before applying the stain.

Pigmented stains

Most stains used in modern woodworking shops can be divided into two broad cate-

Photos except where noted: Sandor Nagyszalanczy

gories according to colorant type: pigmented stains and dye stains. Pigmented stains are suspensions of finely ground colored minerals (mostly iron oxides) mixed into a solvent-based solution. Pigmented stains color the wood when pigment granules lodge in the natural crevices and grain pores on the surface of the wood. This quality makes pigmented stains a good choice for accentuating the grain of ring-porous woods like oak and ash. Unfortunately, the pigment particles will also lodge in sandpaper scratches and boldly reveal a poor sanding job. Pigment particles are opaque; therefore, they resist fading well. They also act like thin paint to obscure the delicate figure of wood like fiddleback maple, making them good for covering up unattractive inexpensive species or plywood.

Most of the stains you'll find on your local hardware store's shelves are pigmented, oil-based stains. The solvent, or vehicle, used in these stains is mineral spirits, and stains also contain a binder (usually linseed oil or an alkyd resin) that acts like a glue to hold the pigment particles on the wood. Without the binder, the dry pigments would simply rub off. The oil binder is the reason you must apply a seal coat, such as shellac, before using a water-based topcoat over an oil-based stain.

Dye stains

Unlike pigmented stains with color particles suspended in a liquid vehicle, dye stains are mixtures of synthetically derived colored powders that are completely dissolved into solution. The color in a dye stain never settles out, so dye stains don't require extensive stirring. Also, unlike pigmented stains, which are made from a limited range of earth tones, dye stains are available in a wide range of hues, including brilliant primary colors. They are ideal for color-matching applications because you can combine exactly the colors you need to make the stain yellower, greener or bluer.

Dye stain solutions penetrate deeply into the wood matrix, coloring each individual cellulose fiber, accentuating the subtle grain patterns in figured woods. However, dye stains won't bring out the contrast in non-figured open-grained woods like butternut and oak, creating a monotone look I don't care for. Dye stains are not as fade-resistant as pigmented stains, so care should be taken to keep dye-stained wood out of direct sunlight.

Dye stain powders come in three main varieties based on which solvent they're mixed with: water-soluble, oil-soluble and alcohol-soluble dyes. Even though dye stains are often referred to as "aniline" dyes, modern dyes contain no aniline. The name is an unfortunate holdover from 19th-century Germany, where the dyes were first developed from derivatives of aniline (a toxic petroleum-based liquid that's a suspected carcinogen). Rest assured that modern synthetic dye powders are safe to use in the shop.

Water-soluble dyes have the greatest penetrating power of all common wood stains. The deep penetration creates the illusion of depth associated with high-quality furniture. Water-soluble dyes are also relatively resistant to fading, so I prefer them over all others dyes for staining fine hardwoods. And, in case you sand through the finish, water-soluble dyes are more repairable than other wood stains.

Powdered water-soluble dye stains are easily prepared in the shop. Merely dissolve the dye crystals in warm water, let the solution cool to room temperature and it's ready to wipe on the wood. No stinky or hazardous solvents are needed, and cleanup is in warm soapy water. The only real complaint about water soluble dyes is that they raise the wood's grain when applied. But this is easily remedied by wetting the wood before final sanding.

Oil-soluble dyes are closely related to water dyes but are dissolved in a hydrocarbon solvent—usually glycol ether or lacquer thinner. These dyes are often sold premixed as "NGR" (non-grain-raising) stains, so called because the solvent base does not fuzz the grain when applied to raw wood. Oil-soluble dyes form the bridge between pigmented stains and dye stains, giving woodworkers the best of both worlds. But the relatively poor penetration and poor lightfastness of NGR stains somewhat limits their use for fine furniture.

Alcohol-soluble dyes are primarily used for tinting or special effects that can be applied with a spray gun. They dry too fast for any other application method. This feature makes alcohol-soluble dyes popular with production furniture finishers. In the small shop, they're normally used only for touch-ups or finish repairs.

Though they are harder to apply evenly

Stain conditioner prevents a blotchy look

I spent the better part of two months building my first major woodworking project: an Early American-style pine corner cupboard. But when I applied the stain, my would-be masterpiece was instantly transformed into a blotchy mess (even though I carefully followed the directions on the can). I've since learned to eliminate the blotchy stain problem by applying a pre-stain conditioner to the raw wood before applying any solvent-based stain. The stain conditioner evens out the absorbability of the wood, allowing it to take color more uniformly.

Stain controllers made by Minwax and McCloskey are available at most hardware stores, but I home-brew my own conditioner that works fine and costs a lot less. Simply dissolve 1 to 2 cups of boiled linseed oil into 1 gal. of mineral spirits. Brush a heavy coat of the mixture over the entire project, making sure porous areas are kept wet. After 10 minutes or so, wipe off the excess, and follow your normal finishing routine.

Pre-stain conditioners work best on resin rich woods like pine (see the photo at left) cherry or birch. But regardless of species, any parts with lots of exposed end grain (raised panels for instance) will benefit from this treatment, but make a test sample just to be sure. *—C.M*

Pre-conditioning wood prevents blotchy staining. *The author's shop-brewed wood conditioner, applied only to the top half of this pine sample before staining, ensures that all areas of the grain will absorb stain evenly.*

Photo: Susan Kahn

than water dyes, alcohol-dye stains have one major advantage over all other stains: They're perfect for tinting or shading wood to create special finishing effects. The best example of this shading technique is the sunburst finish commonly used on guitar bodies.

Any type of dye stain can be a little hard to find locally. The best way to buy them is from woodworking supply catalogs. Woodworker's Supply (1108 North Glenn Road, Casper, Wyo. 82601; 800-645-9292) has a finishing supply catalog that has a complete selection of all types of dye stains. If you don't like to order through the mail, try regular fabric dye from your local grocery store; it's basically a dye stain. A pre-mixed, water-soluble dye gel made by Clearwater Color is available from Garrett Wade Co. (161 Avenue of the Americas, New York, N.Y. 10013; 800-221-2942). This product is good for staining vertical surfaces, such as cabinet sides, because the thick gel doesn't run down and make a mess (see the photo on p. 66). Bartley's makes a pigmented gel stain, which is available at hardware stores.

Chemical stains

While certain woodfinishers advocate the use of chemicals for changing wood's color, I'm thoroughly against it for several reasons. First, most chemicals used for wood coloring are strong oxidants or are highly caustic and dangerous if they come in contact with your skin. Further, some chemicals, such as potassium dichromate are very poisonous and potentially fatal if ingested. Worse, potassium dichromate looks like a bright orange-colored kiddie drink when mixed in solution.

The second reason to avoid chemical colorants is that they are unpredictable. They create color by reacting with chemicals naturally present in the wood, and results can vary, even in different sections of the same board. Worst of all, these chemicals can deteriorate (oxidize) the clear finish applied over them! Given the low cost and convenience of modern wood stains, there are plenty of reasons to steer clear of chemical colorants.

Mixing different stains together

If you don't see the color you want on the manufacturer's chart, you can often mix stains from different cans in various proportions to achieve the desired color. The catch is that not all stains have the same vehicles (water, oil, alcohol); some types can be mixed and others can't. Further, all oil-based stains will mix with all other oil-based stains regardless of brand. To be safe, you can always restrict yourself to the same brand name and type. The same goes with water-based stains. Manufacturers sometimes mix two different types of stains together, say, an oil-based pigmented stain and an oil-based dye, for certain colors or special applications. But I'd avoid this practice because it usually brings out the bad qualities of both types and minimizes the good ones.

***Sludge settles out of a pigmented stain** because the color particles are in suspension. The particles are not dissolved in solution as in a dye stain.*

If you're unsure about the vehicle type of a stain, there are a couple of simple tests you can do. First, smell the stain before it's stirred. It's probably an oil-based pigmented stain if it smells like mineral spirits, and there's a layer of sludge on the bottom of the can (see the photo at left). In contrast, if a drop of stain in a glass of water dissolves, the mixture is probably a water-soluble dye stain. A drop of oil-soluble dye stain will just sit on the surface of the water.

Layering stains for better effects

If you are trying to match an existing finish of a commercially produced piece, chances are the original stain was applied in *layers* rather than all at once. Even if you mix exactly the right shade and hue of color in the can, sometimes the results just aren't satisfying on wood. It is not uncommon for commercial finishers to apply a brightly colored dye stain first to bring out the grain, followed by a wood-toned pigmented stain to even up the color. In practice, I often stain the wood initially with a yellow dye stain before applying additional layers of reddish or brownish stains (see the photo at left). I find this tends to bring out the inner figure and heighten the luster of woods, such as cherry, mahogany and walnut.

Photo: Susan Kahn

***Stains can be mixed or applied in layers.** Solvent-compatible stains can be mixed together in the can and applied at once, here over cherry (left sample). Note the difference in the right sample showing the same three stains applied one at a time (from top to bottom): unstained cherry, yellow, reddish mahogany and medium-brown dye stains.*

Another advantage of layering is that it allows you to mix different stains, even if they're not compatible. Nine times out of ten, you'll get away with it. Even if there's a problem, you can try changing the order in which the stains are applied (save any oil-based/self-sealing stains for the last layer). For a dramatic effect, try applying a dark stain to an open-grained wood (such as oak or ash); then lightly sand before applying a lighter-color stain. The dark color remains only in the open grain while the lighter stain colors the surrounding areas, creating a high-contrast effect. Again, experimenting will show you the true effects, and perhaps you'll discover a color effect you couldn't have gotten out of a can. □

Chris A. Minick is a product development chemist and an amateur woodworker in Stillwater, Minn.

Getting the stain on the wood

There's more to getting a good stain job than just choosing the right color. The final results are determined by how well the wood is prepared (including sanding), choosing the best application method and testing the stain before committing it to your precious workpiece.

Surface preparation

While the degree of surface preparation of raw wood for a clear finish demands fairly standard practices, surface preparation for staining may vary depending on the stain and the wood you choose.

Water-soluble dye stains raise wood's grain and should be applied only after wetting the wood with plain water and sanding the fuzz away after it dries (the grain will not raise again during staining). With pigmented stains, the wood surface *must* be evenly sanded and free of stray scratches; otherwise, the pigment will show scratches (see the top photo). This is especially true on close-grained woods that tend to show scratches anyway. Sand using successive grits, from the roughest to the finest (at least to 180-grit), not skipping more than one grit size between passes. Be especially careful with orbital sanders. Pressing too hard or moving too quickly causes swirl marks that will show up later. Resanding after scratches show up during staining is twice as much work. Certain resinous woods, such as pine, will take stain unevenly even if they've been perfectly sanded, so treat such woods with a pre-stain conditioner, as described in the sidebar on p. 67.

If you're working with dense woods, such as hickory, the degree of sanding affects the amount of pigmented stain the wood accepts, hence the darkness of the final color. It's best not to sand maple with finer than 180-grit paper. Otherwise, the pigment will have no place to stick and the color will look washed out. It is better to switch to a dye stain, which will give you the desired color regardless of how smoothly the surface has been sanded.

Application

There are few restrictions in the way most stains can be applied to wood. You can use a brush, a sponge or a lint-free rag. But avoid paper towels or loosely woven cloth rags that might snag on open-pored woods such as oak. If you own a spray gun and a compressor, spraying can be a time-saving way of applying dye stains to large surfaces, and it's the only way to get an even finish with fast-drying, alcohol-soluble dyes. Avoid spraying pigmented stains. The abrasive pigment particles can damage the delicate (and expensive) nozzle on your spray gun, literally sandblasting it from within.

Pigmented stains should be thoroughly stirred before application to get the pigment particles that have settled to the bottom of the can back into suspension. Otherwise, you'll end up with a considerably different color (see the bottom photo). Because they are true solutions, dye stains can be applied without stirring (I shake them anyhow, just to be sure). Wear gloves and a respirator when applying any solvent-based stain, just as you would for application of a clear wood finish.

The length of time you wait before wiping the excess stain off is relatively unimportant; the final color of the wood is controlled by the concentration of dyes or pigments in the stain formulation. To darken a pigmented stain finish, apply a second coat. To increase the color intensity of a dye stain, increase the concentration of dye powder mixed with the solvent. Incidentally, if you accidentally sand through a dye stain during finishing, apply the original dye solution to the damaged area. The color match will usually be perfect, and the repair will be undetectable.

Test the color first

Examining and evaluating your staining results on raw wood is usually misleading. All stained surfaces look muddy when dry. Dye stains in particular change color considerably once topcoated with a clear finish. Also, different topcoats will change the final color and sheen of the piece in different ways. The best way to avoid surprises is to create one or more test panels before staining the workpiece. First, be sure to use the same species of wood as your project—different wood species take stain differently. After applying stain to your test panel, follow your normal finishing procedures, applying all the coats of stain and clear finish, then waxing and buffing your samples. Second, make your samples from larger boards, not small pieces of scrap. I like my test panels to be 4 in. to 5 in. wide and at least 18 in. long. I've found large sample panels to be indispensable for accurately judging the finished appearance of the project. I save the test panels that look good for reference, with complete finishing instructions written on the back. The ones I don't like are used to heat my shop. —*C.M.*

Pigment particles lodge in sanding scratches, *revealing a poor sanding job. Proper surface preparation requires careful, even sanding, using successive grades of grit, coarser to finer.*

Stirred vs. unstirred *pigmented stains can be vastly different in color. Therefore, always mix thoroughly if you are applying stain right out of the can.*

***Simple forms and restrained ornament** characterize Charles Weaver's coffee table and Dale Helms' wall-hung display cabinet and cherry drop-leaf table.*

***Corner crossing inlays** of ebony and maple are reminiscent of intricate Celtic knot work and lend visual interest to Charles Weaver's coffee table.*

***"Design and build a chair only 7% stronger than it needs to be."** That assignment, from his days as a student at Boston University's Program in Artisanry, was Garrett Hack's inspiration for this ash chair, a study in refined strength.*

From the Forest

Vermont exhibit showcases a wealth and diversity of talents

by Jean Sousa

From harpsichords of Italian cypress to hats of maple, an incredible variety of wooden objects testifying to homegrown Vermont talent were on display at Stowe's Helen Day Art Center last summer and fall.

The exhibit, "From the Forest: Vermont Artisans in Wood," featured 80 jury-selected objects made primarily of wood. Among the offerings were various sculptures, carvings, musical instruments, bowls, a boat, turned wooden hats, a briefcase, a rifle, wooden planes, boxes, puppets, a tall case clock and, of course, furniture, a sampling of which you see on these two pages.

This exhibit was the most popular ever—in any genre—at the Art Center. What made the exhibit unique was its accessibility for sight-impaired visitors and its educational corner. Visitors could touch 60 of the 80 objects on display, and large print, braille and audio guides made it possible for the sight-impaired to gain a greater appreciation of the work. In the educational corner, there were jigs, fixtures, molding planes, samples of inlay and banding for visitors to examine.

The exhibit was sponsored by General Woods and Veneers of Longueuil, Quebec, and the Franklin-Lamoille Bank. □

Jean Sousa is the director of art and education at the Helen Day Art Center in Stowe, Vermont.

Photos: Vincent Laurence

***Tiger maple and cherry** were both used by the Shakers but not like this. The clean lines of Garrett Hack's Shaker-inspired server, or worktable, let the play of contrasting colors and figure take center stage. Wedged rosewood knobs and rosewood pegs, a quirked bead at the bottom of the carcase and a bit of detail on the turned legs complete the ornament.*

***Cabriole legs and classical architectural moldings** are among the features that distinguish Norm Vandal's highboy as Queen Anne. Its dyed tiger maple, chased brass backplates and cocked beads around the drawer openings are also all authentic period details.*

A New Angle on Whetstones

Can oil and water be mixed?

by Gerald Polmateer

Oilstones have been the choice of American and European woodworkers for centuries for honing a keen edge on their cutting tools. The only conflict was whether a natural white Arkansas stone produced a sharp enough edge or whether the harder and finer black Arkansas stone was needed. But, about 15 years ago, waterstones began finding their way to this continent from the Far East in quantities large enough to create a new controversy. Although the brouhaha has settled somewhat, many woodworkers are still confused as to which sharpening stones would work best for them. To help resolve the issue, this article takes a look at the care and use of oil and waterstones and the advantages and disadvantages of both.

Whetstones and how they work

The purpose of a whetstone, whether oilstone or waterstone, is to sharpen an edged tool, such as a plane or chisel, by abrasion. When sharpening, you actually grind away the two faces of the blade to make them meet precisely at the cutting edge. The smoother the intersection of these two faces, the sharper and longer lasting the cutting edge will be. The process of obtaining the smoothest edge is much like sanding: You start with a coarse grit to quickly remove excess material and then switch to ever finer grits to refine the surface and remove the larger scratches of the previous grit.

When sharpening, metal particles can quickly fill the pores of the abrasive surface and reduce the cutting action unless they are removed. That's where the oil and water come in. Water and particularly oil are frequently and mistakenly referred to as lubricants. But a lubricant is the last thing you want when trying to abrade a surface. Both the oil and water actually increase the cutting action by holding the metal particles in suspension to prevent them from clogging the surface of the stone.

***Waterstones vs. oilstones**—Typical synthetic waterstones are shown in the top row, ranging in grit from 800 to 8,000. Waterstones are fast cutting and leave a finely polished edge. The oilstones in the bottom row include man-made silicon carbide and aluminum oxide stones (left) and natural white and black hard Arkansas stones (right). Natural oilstones are capable of producing razor-sharp edges but are slower cutting than the waterstones.*

***Flattening an oilstone** is a difficult task because of the hardness of the stone. It requires lapping the stone on a flat steel plate with a silicon carbide abrasive powder. Because this can be an arduous task, stones should be checked regularly to prevent them from becoming excessively cupped.*

Oilstones

Oilstones are whetstones that use oil to float away the metal particles. Man-made stones generally cut faster than natural stones, but natural stones produce the finest edge. Some of the best natural stones are made of novaculite, which is mined primarily in Arkansas, and hence, they are called Arkansas stones. Arkansas stones are slow cutting and are categorized by name according to coarseness and hardness. Included are the Washita, the coarsest stone, which is comprised of several colors; the soft Arkansas, gray with green specks; the hard white Arkansas; and the hard black Arkansas, sometimes referred to as a surgical stone because of its ability to impart razor-sharp edges to medical instruments (see the photo at left). A stone that performs as well as the black Arkansas is a white translucent Arkansas stone, but this stone costs a great deal more than the very expensive black Arkansas and is even more brittle.

As technology developed, manufactured oilstones became a satisfactory, cheaper alternative. (Although white and black Arkansas stones remain unsurpassed in the field of oilstones for producing a keen edge.) The man-made stones are formed by compressing an abrasive, usually silicon carbide or aluminum oxide, with a bonding agent (such as ceramic, resin, shellac or sodium silicate) into a brick. The bricks are then fired in a kiln at a high temperature.

Silicon carbide and aluminum oxide stones come in three different grits: fine, medium and coarse. Silicon carbide cuts faster than aluminum oxide, but aluminum oxide produces a finer edge.

Storage and care of oilstones—Oilstones should be kept clean and moist. I store mine in a wooden box with a piece of felt under the stone to help keep it moist and a lid on top to protect it from dust. After each use, I wipe off any metal particles and apply a clean coat of oil before shutting it in its box.

To get a true straight edge on your cutting tools, the sharpening stone must be flat. Because oilstones are very hard and wear slowly, their flatness is often taken for granted. But they should be checked periodically and flattened if needed before they become excessively worn.

Flattening excessively worn oilstones is difficult, but the process is easy with regular maintenance. Probably the easiest way to flatten a stone is by lapping it on a flat plate of soft steel or cast iron with a loose abrasive powder or grinding compound. The lapping plate should be thick enough to remain rigid against pressure and large enough to accommodate your largest stone. I use a 3-in.-wide by 14-in.-long piece of ½-in.-thick mild steel that I flattened using a 100-grit sanding belt placed on a tablesaw top. Mounting the plate on a wooden block with a space underneath, as shown in the photo above, helps keep the back side from rusting, prevents the base from warping the plate and makes it easy to clean.

To use the lapping plate, spread oil on the surface, sprinkle some silicon carbide abrasive powder on top, and then move the sharpening stone back and forth with a medium amount of pressure, much like sanding a board with a sanding block. Once the stone is flattened, it should be conditioned by rubbing a piece of iron across the stone a few times to return it to its normal coarseness.

The abrasive powder, which is also used for polishing stones, is available from lapidary supply stores in several grits. (It may also be available at auto supply stores as valve grinding compound.) I prefer 90-grit because the particles break down as it's used and effectively act as a finer grit.

Using oilstones—To keep the stone from glazing over or clogging, the proper oil must be used to float the metal particles to the surface. For coarse and medium stones, I use an oil of the consistency of 3-In-One or Smith's honing oil (see the sources of supply box on p. 75). The finer the stone, the lighter the oil I use. For the white and black Arkansas stones, I prefer kerosene, but some people use water. Just a few drops of kerosene spread evenly over the surface of the black stone is enough; the white stone will require a little more.

If your man-made stone seems to continuously absorb oil, it means your stone wasn't filled. Filling is a process of baking in a petroleum jelly-like grease, which makes it easier to keep a coat of oil on the surface of the stone. If your stone isn't filled, you can let it soak in an oil bath until bubbles stop rising from the stone, or you can try baking some petroleum jelly into your stone in your own oven. Immerse the stone in petroleum jelly and then heat it for about an hour at 200°F. Remove the stone and let it cool. Don't try this with a natural stone because the heat will destroy it.

When the honing oil turns black from metal particles as you sharpen tools, wipe it away and apply fresh oil. When using the finer stones, apply a little less pressure and constantly check for particles because they can chip the finely honed edge.

Waterstones

Waterstones are whetstones that use water to float away the metal particles and also are available in man-made or natural stones. The natural stones usually contain

Photos: Susan Kahn

quartz, sericite and/or volcanic ash that have been compressed over the eons through natural stratification. The natural stones have been mined in Japan for more than 2,000 years and because of the natural compression process, can have varying degrees of hardness within the same stone. These stones have become scarce and thus very expensive.

Synthetic stones were developed less than 100 years ago in response to the shortage of natural stones. The manufacturers of waterstones are more secretive than their oilstone counterparts; therefore, it's hard to determine the exact composition of these stones. They are, however, usually made of silicon carbide or aluminum oxide with various kinds of clay bonding agents. They are pressed into bricks and fired in an oven just as man-made oilstones are. The clay is a softer and looser bonding agent than used in oilstones, so the stone wears away easily. The fast-wearing stone continuously exposes new and sharp abrasive material for fast cutting. This high performance, combined with reasonable cost, makes the synthetic stone a good choice for almost any waterstone application.

Waterstones come in a variety of grits, including very coarse (80- to 220-grit), coarse (600- to 1,200-grit), medium (1,200- to 2,000-grit) and finishing (4,000- to 8,000-grit), as shown in the photo on p. 72.

Storage and care of waterstones—Before use, most waterstones need to be soaked for about 20 minutes or until air bubbles stop rising from the immersed stone. I store most of my synthetic waterstones in plastic containers full of water with lids so that the stones are continuously soaking, as shown in the photo at left. The stones are protected from dust and dirt but ready to use whenever needed. Whether stored in water or dried after each use, waterstones should be protected from freezing, which could split the stone into small pieces.

Storing each grit stone in its own box will keep the grit from a coarser stone from getting on a finishing stone and ruining that finely polished edge you've been honing. If different grit stones are stored in the same container, they should be thoroughly washed before use.

Submerged storage works for all stones except those that are permanently mounted on a base. Generally, only the finishing stones are mounted and these stones can be sprayed with water on the surface as needed during sharpening.

Natural stones should be allowed to dry between uses. Immersing natural stones for long periods of time may cause fractures along naturally occurring fault lines in the stones.

Like oilstones, waterstones also need to be flattened before use. Because waterstones are soft and wear quickly, flattening needs to be done frequently even during sharpening. Unlike oilstones, flattening a waterstone is a relatively easy process. Even badly worn stones can be salvaged by rubbing them on the face of a concrete block using plenty of water. Less severely damaged stones can be flattened with a piece of 220-grit wet-or-dry sandpaper laid on a sheet of glass at least ¼ in. thick. Add a little water, rub the stone across the sandpaper for a couple of strokes and then look at the surface of the stone. The surfaces that are rubbing on the sandpaper will be a different color from the low spots that aren't yet hitting the sandpaper. Keep rubbing until the stone is a uniform color over its entire surface. After flattening, a quick pass or two along the edges will prevent chipping the stone during sharpening.

***Waterstones cut quickly** and are great for flattening the backs of plane irons and chisels. Here, the author uses a stick to apply pressure as he flattens a plane iron. Using the side of the stone saves the face for working on the bevel and increases its life. The plastic containers in the background store the stones in water, so they're always ready to use.*

***Keep the surface of the waterstone wet** enough to let the tool slide smoothly over the stone. Add more water as the stone starts to dry, but don't wash away the slurry that develops. The slurry speeds the cutting process and helps polish the edge.*

The pros and cons of oilstones and waterstones

Waterstones		Oilstones	
Advantages	**Disadvantages**	**Advantages**	**Disadvantages**
1. Cut very quickly	1. Water can be messy	1. Convenient and ready to use	1. Slow cutting
2. Easy to flatten	2. Water can cause rust	2. Oil won't rust tools	2. Lapping plate must be used to flatten
3. Inexpensive (synthetic)	3. Water evaporates quickly	3. Easily stored in box	3. Expensive (Arkansas stones)
4. Uses cheap and readily available water	4. Soft stone easily damaged by tools	4. Hard and resistant to gouging by tools	4. Oil can stain wood
5. Uniform size and grit (synthetic)	5. Algae can form in water storage tubs	5. Won't freeze	
6. Large sizes available	6. Wears quickly	6. Uniform size and grit	
7. Quickly develops slurry, which aids in honing	7. Must be protected from freezing		

Using waterstones—Before using the stones, you may want to make a base like the one in the top photo on the facing page to hold the stone and prevent it from slipping during sharpening. A wedge holds the stone in the base, making it easy to change stones for a finer grit. Another alternative is a flat piece of plywood or lumber with stops screwed at each end of the stone. Clamping the flat piece to the workbench keeps it from sliding around.

Sharpening with waterstones can be a messy proposition. I protect my benchtop with newspaper, so I can just roll up the mess and throw it away when done.

During sharpening, the surface of the stone should be kept wet enough to keep the tool moving smoothly, but it should not be flooded. Add more water as the stone starts to dry up, but do not wash away the slurry that builds up on the surface of the stone, as shown in the bottom photo on the facing page. The slurry speeds the cutting process.

Check the stone frequently for flatness by rubbing on the wet-or-dry sandpaper and note the high spots. Try to work the tool evenly over the stone to eliminate these high spots.

As with oilstones, start with the coarse grits and work through to the finishing stone to remove the previous grit's scratches. After honing on the finest stone, allow the slurry to dry out, and continue honing. The slurry acts as an even finer grit to further polish the edge.

Alternative sharpening stones

Although water and oil stones are the primary choices for honing cutting edges, there are a couple of other alternatives worth at least a mention: diamond stones and ceramic stones.

Diamond stones aren't really stones. They are a piece of steel with industrial diamond particles bonded to it. The hard diamond particles stay sharp and cut fast, but a diamond stone won't produce a polished finish. Another problem I've encountered with diamond stones is the bases are too flexible. If the sharpening stone is not rigid, it will produce a convex surface on the tool being sharpened.

Ceramic stones are almost as hard as diamonds and resemble conventional whetstones in size and shape. Ceramic stones wear very little, require no honing fluids and clean up easily with water, a scrubbing pad and cleanser. However, for sharpening plane irons and chisels, ceramic stones have a serious flaw: they are not flat and they're almost impossible to flatten by hand. They work great for carving knives and tools where a flat stone is not a prerequisite.

Mixing water and oil

For some reason, people have an either/or attitude about selecting water or oil stones. However, I've had great success using both types. I prefer waterstones when first sharpening a tool because they cut fast. But in the middle of a job, I like the convenience of making a couple of quick passes on my Arkansas stone with just a couple of drops of oil to touch up a dull tool.

Whatever you buy, seek out a reputable supplier and buy good quality stones. I don't recommend stones that share a common oil or water bath because the coarser grit particles always seem to find their way to the finer stones. I like the thicker stones because they remain rigid. The stone should be wide enough to accommodate plane irons and long enough for smooth strokes without worrying about the tool dropping off the end of the stone. I buy 1-in.-thick stones that have a 2-in. by 8-in. working surface.

Use the chart above to help weigh the pros and cons of water and oil stones. Keep in mind a dull edge may not be the fault of your sharpening stones or technique. Poor quality tools are difficult to sharpen and won't hold an edge, even if sharpened with the best stones. Buy quality stones and tools; they'll last longer, give better service and you'll never regret it. □

Gerald Polmateer is a woodworker in Houston, Texas.

Sources of supply

Most mail-order companies and even some home centers or hardware stores now offer both oil and water stones. In addition to these sources, the following companies manufacture or supply sharpening products:

Oilstones

Smith Whetstone, Inc., 1700 Sleepy Valley Road, Hot Springs, AR 71901; (800) 221-4156. Catalog available.

Norton Co., 1 New Bond St., Worcester, MA 01606; (508) 795-5000. Catalog available.

Waterstones

The Japan Woodworker, 1731 Clement Ave., Alameda, CA 94501; (800) 537-7820. Catalog available.

Hida Inc., 1333 San Pablo Ave., Berkeley, CA 94702; (800) 443-5512. Catalog available.

Honing oils

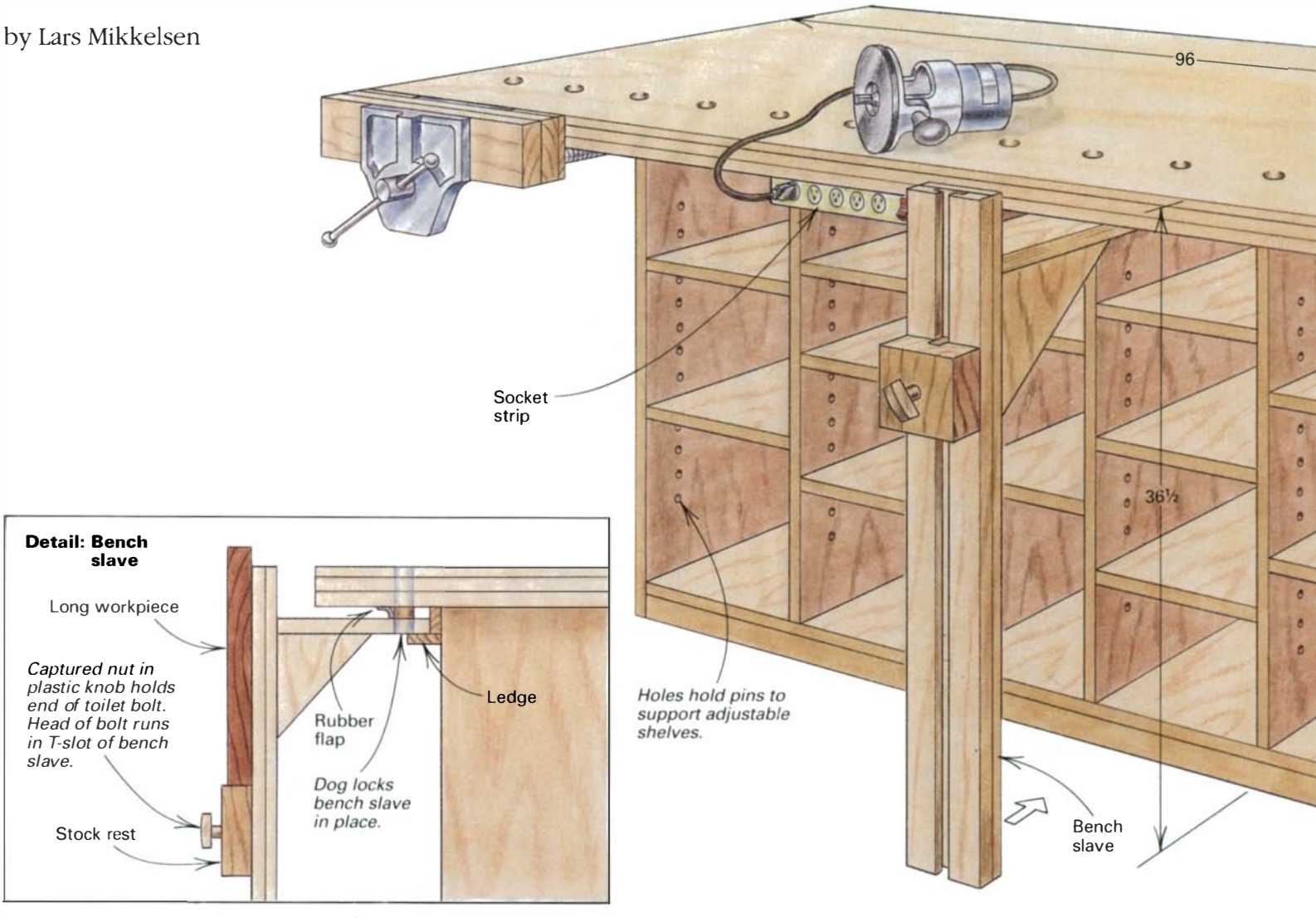
3-In-One is available from any hardware store.

Smith's honing oil is available from Smith Whetstone, see address above.

Power-Tool Workbench

Tool storage within an arm's length of the job

by Lars Mikkelsen

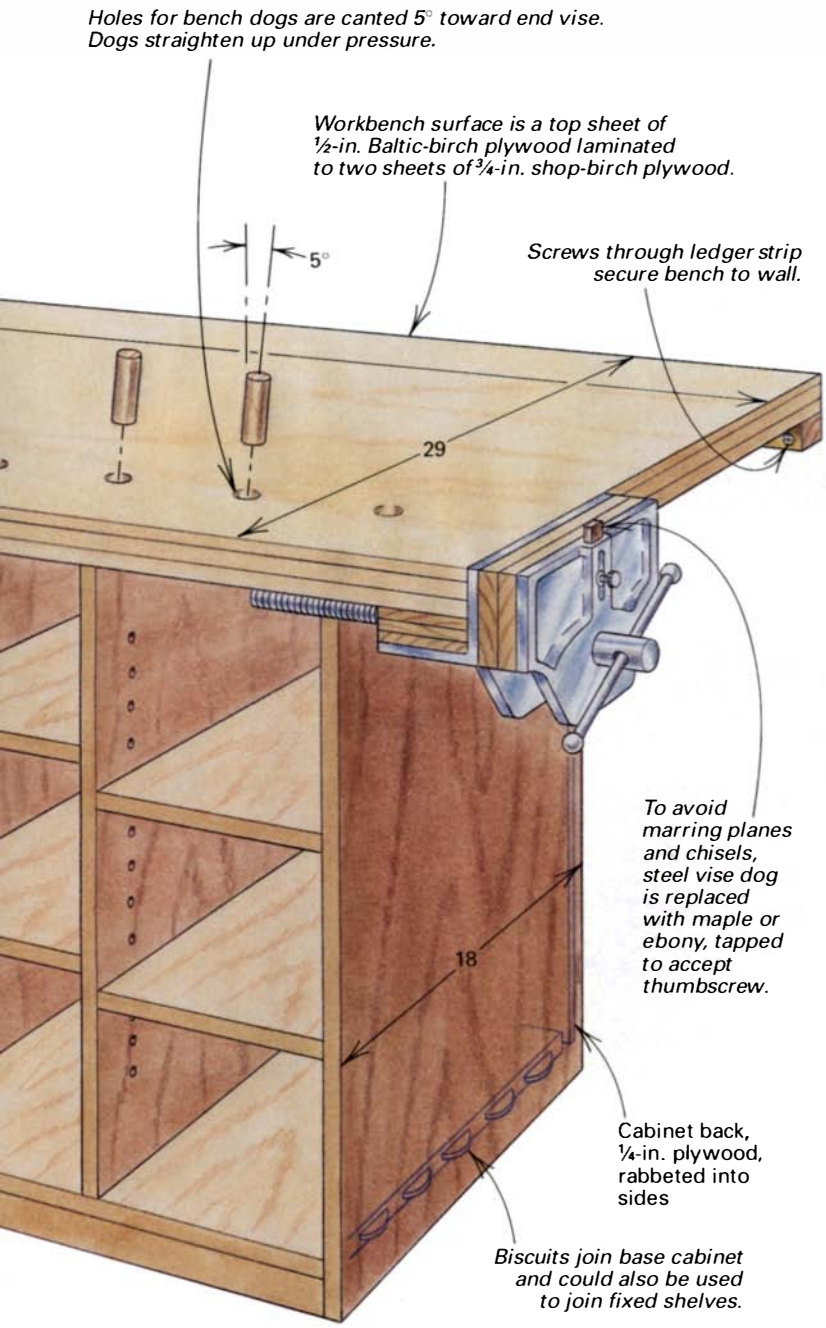


Space is at a premium in my small shop, so the more functions any one thing can serve the better. I had two things that needed improvement—my hand power tools were cramped in a small cabinet, their cords always entwined, and my bench needed a good base. So I decided to kill two birds with one stone and build a base cabinet for the bench with cubbies for my tools.

These cubbies have worked out very well for me. Each tool has its place, where I also keep the miscellaneous wrenches and screwdrivers needed for that particular tool. The small size of the cubbies makes the tools much easier to find than if they were stored on long shelves. The cords never get tangled, and it's so easy to get and put away a tool that I avoid the usual clutter on the benchtop. The power strip that I attached to the bench makes it possible for a tool to be in its cubby while still plugged in ready to go.

***Bench slave holds long stock**—The author made a bench slave with a brace at the top that locks into the 1-in. dowel bench dogs he uses. Round dogs are easier to make and install than traditional square dogs.*

Photo: Sandor Nagyszalanczy



Quick-access tool cubbies—I made the base cabinet from ¾-in. birch plywood edged with ¼-in. strips of solid birch and biscuited together, as shown in the drawing. The biscuits could be replaced with tongue-and-groove joints or dadoes and rabbets, but biscuits are the simplest. I measured my biggest tool to determine the maximum width and depth of the sections. The desired final height of the benchtop sets the base height, and the shelves are adjustable. The dimensions can all be adapted to your own situation, but it is helpful to keep the combined width of the benchtop (mine is 29 in.) and depth of the base cabinet (mine is 18 in.) below the standard 48-in. width of a sheet of plywood, so you can use the cutoffs from ripping the top to make parts for the base. And while I used all the space for cubbies, one of the sections could easily be set up to hold simple sliding shelves for bit storage. The shelves could slide in dadoes cut across the width of facing vertical dividers before assembly.

I used ¼-in. plywood for the back of the base and anchored my bench to the wall with 3-in. screws driven through a ledger strip on the underside of the top. For a freestanding bench, I would recommend, at minimum, a ¾-in. back and a hefty face frame to add stiffness against racking. For maximum strength in a freestanding bench, cubbies could be made to fit beneath a traditional mortise-and-tenon trestle base.

A plywood work surface—The top of my bench is made from two layers of ¾-in. shop-birch plywood and one layer of ½-in. Baltic-birch plywood. Unlike shop-birch plywood, which has a core of thick softwood veneers between thin outer layers of birch, Baltic birch is all birch with a core of thin, high-quality veneers, free of voids. (Baltic birch sheets are often sized metrically and will run approximately twice the cost of shop birch.) This sandwich of shop birch and Baltic birch makes the benchtop amply stiff, and the Baltic birch has a surface hard enough and thick enough to withstand some abuse. I laminated the three sheets of plywood with Liquid Nails construction adhesive. I did not have any way of clamping something this big, so I used lots of screws coming up from the bottom. I removed the screws once the adhesive had set, so I wouldn't run into them later when drilling for the bench dogs or other fixtures.

A new twist on old dogs—I mounted two Record #52½ ED vises to the top, one as an end vise, the other as a front vise. Both have wooden jaw faces. I tapped the metal jaws, so I could change the wooden faces easily without removing the vises from the bench. The front vise has oversized jaws to get a better grip on large pieces. To make bench dogs, I cut up a 1-in.-dia. dowel. I drilled a series of 1-in. holes for the dogs in line with the end vise dog. The holes angle toward the vise at 5° so the bench dogs straighten up under pressure. To keep the dogs from sliding down when in use, I tacked small strips of rubber to the underside of the bench, partially overlapping the dog holes. But I was afraid vigorous pounding on the bench might make the dogs fall out, so I screwed and glued a ledge to the base that supports the inside half of the dogs. I can easily reach under the bench to push the dogs up, and when not in use, they are firm against the ledge.

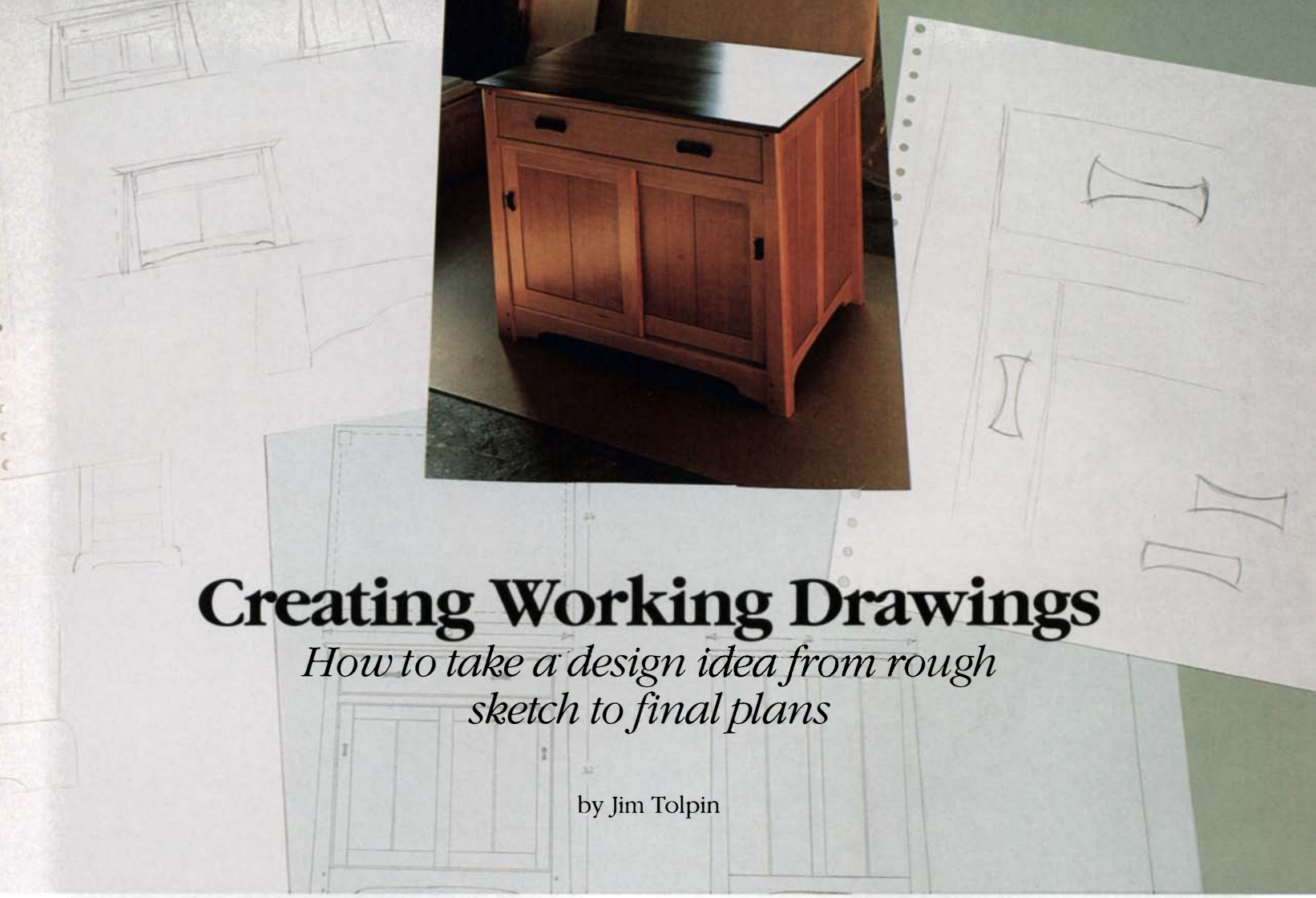
Long stock support—For the times when I have a long piece of stock clamped in the front vise, I made a bench slave to support the free end (see the photo). The outer face of the slave leg is in the same plane as the inner jaw of the shoulder vise. I use the bench dogs and the ledge beneath them as a way of locking the slave to the table. Instead of making it freestanding, with feet that might get in my way, I built a kind of peg leg with a brace near the top that slides under the benchtop and rests on the ledge beneath the bench dogs. I drilled a slightly oversized hole through the brace, so it can easily be locked in place under any of the bench dogs.

The stock rest, a block of solid wood, is attached to the leg with a toilet bolt that slides in a T-slot (as shown in the drawing detail) and can be locked at any height on the slave. To make the leg, I cut a shallow groove in a piece of ¾-in. solid wood and glued it, grooved side in, to a piece of ½-in. plywood; then I cut a narrower groove in the outside face, forming a T-slot for the head of the toilet bolt. A spline glued into the back of the stock rest rides in the stem of the slot.

My bench was relatively inexpensive to build and serves my purpose well. I like the big top, and the vises can hold everything I work on, from big doors to the occasional miniature. Doors on a base like this might look good, but the ease of access would be lost, and in a shop, efficiency comes before aesthetics. □

Lars Mikkelsen is a professional woodworker in Santa Margarita, Calif.

Drawing: Mario Ferro



Creating Working Drawings

How to take a design idea from rough sketch to final plans

by Jim Tolpin

***Loose concept sketching fosters creativity** and allows you to refine your rough idea to the point where you're ready to create a three-view drawing and then an isometric projection. From there it's not all that far to full-scale drawings and to creating something with wood. The time spent getting a drawing right will pay for itself many times over.*

For much of my woodworking career, I dreaded the drawing stage of a project. It was always a daunting, tedious process that only put off the true fun—shaping real wood into real objects. After erasing a misplaced or poorly drawn line for the umpteenth time, I'd often think that I could have built the darn thing in the time it took to do the drawings. Considering the way I was producing drawings, I was probably right.

Today, however, I thoroughly enjoy the drawing process, and I relish seeing my ideas first come to life on paper. I've learned to appreciate the unlimited design freedom afforded by freehand concept sketching, as well as the ability to express my ideas clearly and precisely with more refined drawing techniques. The difference in my attitude came from learning to use the right tools and techniques. In this article, I'll share what I've learned about materials and techniques and explain how you can take your design ideas from rough, raw images to refined, scale working drawings. Here's an overview.

I begin the drawing process by first creating a series of concept sketches that show the object in a roughly accurate perspective view—in other words, the way the object would appear to your eyes. Choosing the sketch that comes closest to my design goal, I commit its dimensions to a scaled-down, three-view drawing—an orthographic projection. This gives me a way to see the parts of the piece in their true proportion to one another. But because this type of drawing limits me to viewing each face independently from the others, I will often go on to draw an assembled view of the drawing—an isometric projection. This drawing shows me how all the parts relate to one another, and it gives me an accurate feel for how a piece will look when it's built.

Concept sketching

This is where the fun begins. You get your first look at the project-to-be, and you can work out the bugs in the overall look of the piece without laboring over the details. Approach concept sketching by giving your hand free rein to draw and redraw any inspiration that comes to mind (see the photo above). This is not the time to worry about crisp lines, perfect symmetry, properly scaled proportions or fair curves. You can take care of all that later when you produce the mechanical drawings. Do not, however, go on from sketching to drafting until you have something you really like. It's too time-consuming to make major design changes at the drafting stage.

A ring-bound artist's sketchbook is the best place to do your concept sketching. Choose a soft (#2 or # 2½) lead pencil with a pink-tipped eraser. Avoid using harder pencils because their lines are difficult to erase from typical sketchbook paper. Keep a half-dozen or so well-sharpened pencils handy as you sketch. You don't want a dull pencil to interrupt the flow of your creative juices. Hold the pencil lightly, keeping your wrist loose and flexible. When sketching out a long line, allow your arm to move with your hand. And finally, get in the habit of turning the sketchbook to accommodate the natural sweep of your wrist when drawing angled lines.

One of the benefits of doing freehand concept sketches is that

Photos: Vincent Laurence

you can easily create a series of "what-if" views. Instead of redrawing the form over and over again, simply trace it onto a piece of translucent paper, leaving out the areas that will be changed in the what-if views. Or you can photocopy as many basic outlines as you'd like, and then flesh them out with your new design ideas.

From concept sketch to orthographic drawing

Once you have settled on a concept sketch that comes closest to representing your idea, it's time to assign some dimensions to the project. By setting out the design to scale in a mechanical drawing, you can see clearly how the size and shape of components relate to one another. Methods and sequences of joinery also become more obvious. These working drawings are a bridge between your freehand concept sketches and a master cut list.

Equipment—buying the right stuff—Luckily, the type of equipment a woodworker needs to produce adequate working drawings is relatively simple and inexpensive. Unless you do a lot of room-sized architectural millwork, a 2-ft. by 3-ft. board will provide plenty of space for rendering projects in a suitable scale. This board can be nothing more than a flat piece of plywood set on a desktop, but to make it more comfortable to work at, tilt up the back of the board 3 or 4 in. Adding a piece of drafting-board vinyl (available through most office-supply stores) smooths the drawing surface and will allow holes left behind by compass points to self-heal. To pinch pennies, you can cover the board with a ⅛-in. sheet of corrugated cardboard, but pin holes and pencil grooves will soon telegraph through to the drawings.

You can draw consistently parallel lines and angles with templates and a simple T-square, but I highly recommend spending a bit more money and setting yourself up with a sliding parallel rule fixed to a cable run along either side of the board. These rules are widely available for well under $100—a small price for the frustration one will save you. This is supposed to be fun, remember.

You can further reduce drawing-board madness by using only high-grade (16 to 20 lb.), fine-grained vellum paper for mechanical drawings. Unlike sketch paper, vellum erases easily with a standard pink gum eraser, leaving behind a smooth, smudge-free surface. The vellum is also translucent, letting you trace over prototype sketches, speeding the drawing of repetitive elements.

Other pieces of equipment you'll need for mechanical drawing include the following:

Pencils—Forget wood pencils. They're time-consuming, messy to sharpen, and because their width changes as they dull, they make lines of uneven thickness. Instead, get a set of three mechanical pencils (3mm, 5mm and 7mm) and use an HB grade lead. It will dull quickly, but it will produce a dark line that reproduces well in a copy machine, eliminating the need to ink the drawing.

Erasers—On vellum paper, the classic pink gum eraser works as well as any. To make fine corrections, use pencil-type erasers in conjunction with eraser shields (see the photo at right).

Ruler—I use an architect's scale rule for laying out dimensioned lines. I prefer a flat ruler with eight scales rather than the twelve-scale triangular rulers, which I find more difficult to mark dimensions from. To keep the edges of a rule smooth and clean, use it *only* to mark dimensions, never as a straightedge for drawing lines—that's what a parallel rule and angle templates are for.

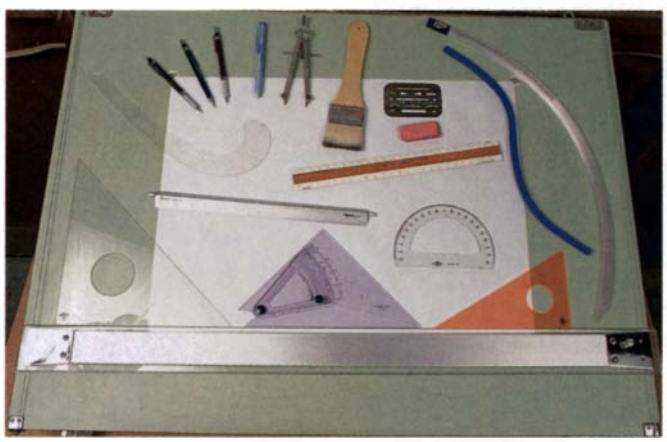
Angle templates—To start out, get an 8-in. 45° to 45°, an 8-in. 30° to 60° and an adjustable-angle template. Later, you'll want to add a 4-in. version of this set for drawing small details. I like my templates in green or orange, so I can readily find them amid the papers strewn about the drawing board.

Shape templates—Circles, ellipses, squares and rectangles, as well as a variety of other shapes, are available on templates. I also use French-curve templates and their larger cousins, ship's curves, to draw in curves of progressively changing radii.

Adjustable curves—To draw curves between fixed points, I use either a flexible lead bar or a plastic slip curve. If the curve is very large, I'll bend a 3/16-in.-sq. length of straight-grained wood to the marks while I trace a line against its edge.

Protractor—I use a 4-in.-radius protractor to draw angles from a baseline.

Compass—A pencil compass is useful for drawing circles.



***Drawing supplies used by the author** include, clockwise from lower left, a 45° to 45° angle template, a metal architect's rule, a ship's curve (a large version of a French curve), mechanical pencils in three sizes (3mm, 5mm and 7mm), a pencil-style eraser, a compass, a dust brush, an eraser shield, a pink eraser, a flat architect's rule, a lead flexible curve, a plastic adjustable curve, an orange 30° to 60° angle template, a protractor and an adjustable angle template.*

Drafting basics—Unless you move on from woodworking to designing and building space shuttles, you won't need to learn more than the most basic drafting skills and conventions to produce quick, accurate and easy-to-read working drawings. The skills are mostly common sense: Make sure your board is free of lead and eraser debris before taping paper to it. Align the bottom of the paper to the parallel rule, and then secure it to the board with a small piece of tape in each corner. Keep a scrap piece of paper between your hand and the drawing to avoid smudging your work. And never wipe away eraser debris with your hand—always use a brush.

Once you establish a baseline, draw any degree angle to it using either angle templates or a protractor and straightedge. Begin the angled line precisely on a dimension mark by first holding the pencil to the mark and then sliding the template or straightedge to it. If you reverse this process, parallax can play tricks on your eyes, causing you to misjudge the placement of the pencil. Draw out a waver-free line by tilting the pencil slightly into the corner formed between the edge of the template and the paper.

A mechanical drawing is nothing more than a happy meeting of lines that indicate the outlines of an object and where measurements are being made to. Unless these lines vary in some way, however, the drawing can be difficult to read. Figure 1 on p. 80 shows how lines with different meanings are conventionally rendered in mechanical drawings. Note that dimensions are not given a unit symbol. This would only crowd the drawing. Instead, a note in the legend box tells you what units are represented by the dimension numbers.

A three-view drawing—The first type of working drawing I produce from a concept sketch (or from dimensions taken from a

Fig. 1: Lines used in working drawings

Lines of different thickness help to distinguish different meanings in working drawings. Here are some of the most common line types.

Border line and legend box (.7 mm)

Working line (.5 mm)

Hidden line (.3 mm)

Dimension line (.3 mm)

Extension line (.3 mm)

Centerline (.3 mm)

Cutting plane (.5 mm)

Fig. 4: Setting in dimension lines

Note: The overall dimension—the height in this case—is drawn to the outside of all other dimensions. In general, the smallest dimensions are kept closest to the object.

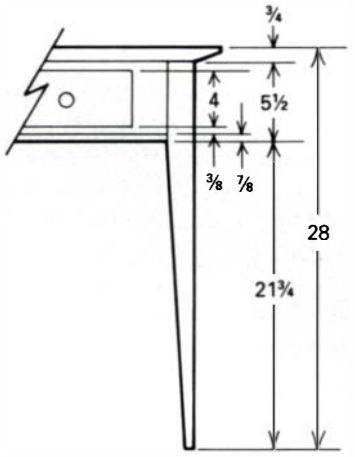
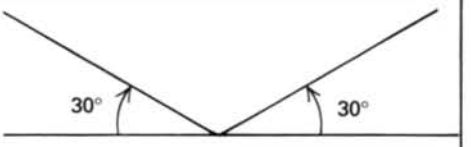
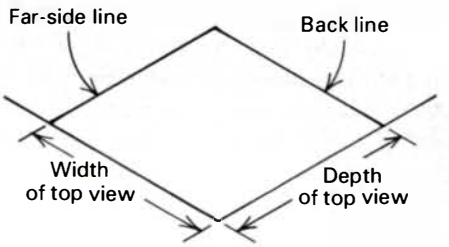


Fig. 5: Creating an isometric projection

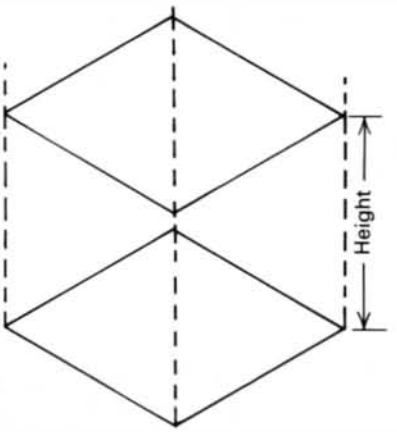
Step 1: Create two angled baselines, each at 30° to your original horizontal baseline.



Step 2: Draw in the "footprint" of the top view along the angled baselines. Extend the view back into the isometric projection by drawing the back and the far-side lines. Keep these lines parallel to the angled baselines.



Step 3: Establish the actual top view by extending vertical lines up from the corners of the footprint. Measure up along the line to the overall height of the front view. Draw in the outline of the top view parallel to the angled baselines.



Step 4: Now simply draw in the piece of furniture using the dimensions from your orthographic drawing.

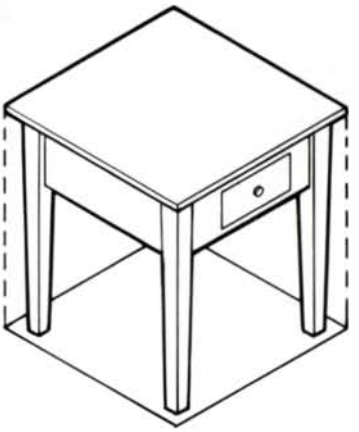


Fig. 2: Setting out a three-view orthographic drawing

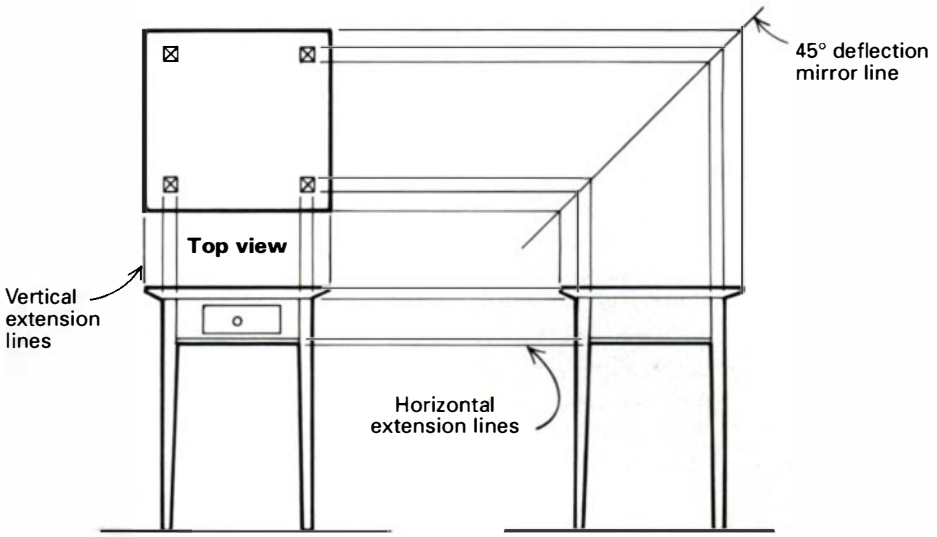
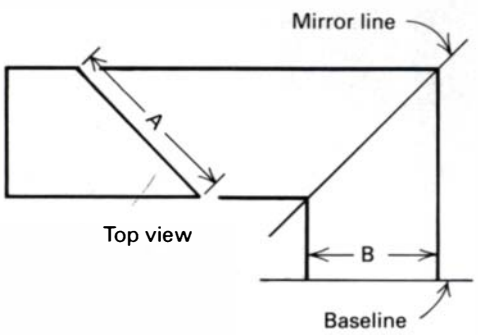
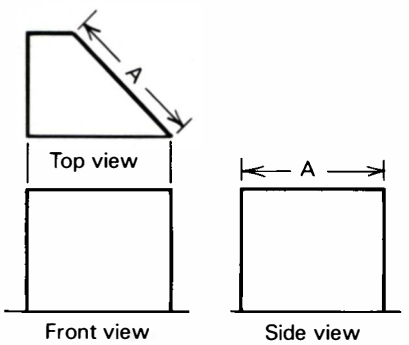


Fig. 3: Producing a side view of an angled side

Problem: You cannot use mirror line to project side of top view to baseline because distance B is foreshortened to look as though it's less than distance A.



Solution: Use an architect's rule or a compass to measure distance A and transfer distance directly to horizontal line extended over from front view. Drop lines to baseline from distance marks.



Drawings: Maria Meleschnig

photo or some other source) is a three-view (orthographic) projection. I tape a copy of my final concept sketch (or a combination of sketches) to the top of my drafting board and then attach a piece of vellum to the board. I draw a thick (.7mm) borderline around the perimeter and a legend box in the lower right-hand corner. Within this box, I record my name and a copyright symbol (©), followed by the date and the name of the client, if any. If the piece has a name, or if it is a reproduction, I will title it accordingly. Finally, I indicate the scale and units of measurement used in the drawing.

Unless the project is very large, such as a floor-to-ceiling entertainment center, I use ¼ in. to represent 1 in. This reduction allows me to fit the front, side and top views onto one sheet without creating a cluttered drawing that's difficult to read. I use two scales on my architect's rule to lay out the dimensions: the ¼ scale and the 3 scale. Although the ¼ scale is useful for representing full-inch increments, its divisions are in twelfths (because this scale is designed primarily to equate ¼ in. to 1 ft.), which is not a convenient scale for fractions of an inch. For fractions, I use the 3 scale, where a ¼ in. segment is broken down into eight divisions, each representing ⅛ in.

After drawing a horizontal baseline about 2 in. up from the lower border of the paper, I lay out the rough positions of the three views with a light pencil line. As a right-hander, I find it more comfortable to draw from left to right, so I place the front view in the lower left-hand corner of the drawing, the top view above and the side view to the right (see figure 2 on the facing page).

I do the front view first, constantly referring to the concept sketch (or to dimension notes) as I draw in the outline of the form with light lines. I generally trust my eye to judge whether proportions are correct. When I'm satisfied with this light pencil rendering, I darken in the outline with 0.5mm working lines.

I draw the top view next, extending lines up vertically from the front view to define the widths. I ascertain the positions and depths of the various elements by again referring to my sketches or notes. Next I create the side view. Only one is necessary unless the piece is asymmetrical. With the front and top views already completed, the dimensions of the side view are already established in the drawing. To draw this view, I need only extend over the outlines of the other two views until they intersect over the baseline to the right of the front view. As you can see in figure 3 on the facing page, I reflect the top view's extension lines down to the baseline with a 45° mirror line.

A note of caution: reflecting extension lines from a top view across a mirror line works only if the side of an object is perpendicular to its front. At any other angle, reflected lines create a foreshortened view. Although this is technically correct in a true orthographic projection, it makes more sense to draw the angled side so that the length of its side remains true to scale. Skip the top view reflection and scale the depth dimensions directly from the architect's rule or with a compass (see figure 3).

I finish the three-view drawing by penciling in all my dimensions, working my way out from the smallest elements of the components, to the components themselves, to the overall size of the structure (see figure 4). Then I draw in the fine details shown in my concept sketches: curved or molded corners or edges, knobs, pulls and the like. I rarely bother with cross sections or detail blowups in my three-view drawings. Instead, I wait to do these on a full-scale rendering. If I need this kind of information, I want it actual size, so I can transfer the information directly onto a story pole, or measuring stick. I do label all the parts on the three-view drawing, so I can refer to them in the bill of materials and cut lists.

From three-view drawing to isometric projection

The advantage of an isometric projection is that it shows you how the various faces of an object will relate to one another. And because an isometric doesn't diminish or foreshorten dimensions as does a vanishing-point perspective drawing, all the views of this working drawing remain true to scale, making it simple to draw and easy to take off scaled dimensions (see figure 5).

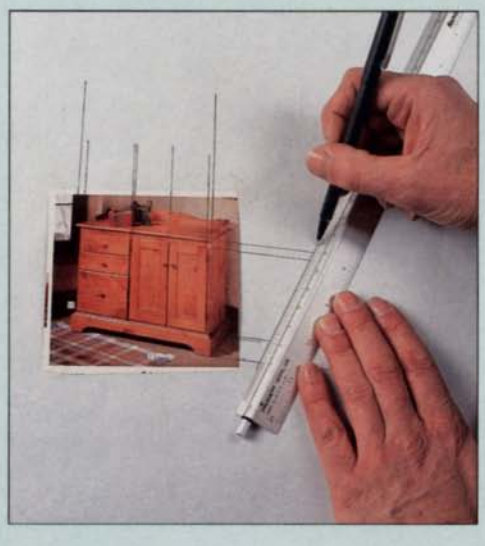
Once I've created the isometric cube that establishes the perimeter of the piece of furniture I'm drawing, I fill in the three views by transferring scaled measurements from the three-view drawing, being careful to orient the lines parallel to the 30° baselines. You may find it helpful to place isometric grid paper under the vellum as an aid to sketching in some details. When you're finished filling in the details of the piece, erase the extension lines used to raise the structure, and you're done. □

Jim Tolpin is a writer and woodworker in Port Townsend, Wash.

Developing a three-view drawing from a photograph

It's possible to develop scaled views of a piece of furniture from nothing more than a photograph. It helps, of course, if you know the overall dimensions of the piece, but some detective work—such as scaling dimensions from familiar objects in the photo—can often provide enough clues. The picture should be as free from distortion as possible (no wide-angle shots) and should offer a three-quarter view, which lets you see the front, side and top of the piece.

To determine the dimensions of doors, drawers and other elements of the piece, affix the photo to the center of a piece of vellum paper with double-faced tape. Use a straightedge to extend lines out from the overall width and height of the piece. Then lay an architect's rule between the two lines



that represent the overall dimension of the piece (see the photo at left). Usually, you'll have to angle the rule to get the scaled dimension to fall between the lines. Use whatever scale allows you to correlate the overall dimensions of the piece to a reasonable, divisible section of the rule.

Draw this angled reference line, and then extend over the outlines of the internal elements. To find their dimensions, simply consult the same scale on the rule. Repeat this procedure to find the dimension of elements within the other planes of the photograph. Once you've established all the dimensions for all elements of the piece, use this information to create a three-view drawing of the piece from which you can create a cut list. *—J.T.*

Cabinet Lighting

Illuminating options cover a wide spectrum

by Alec Waters

If you need to light up an entertainment center, a liquor cabinet or a curio case, there are lots of lighting options available. You can illuminate a piece with conventional types of room lighting (spot, track or sconce, to name a few). But if you want to be sure that your display case and its contents will be well lit, consider lighting the cabinet itself (see the photo at right). I'll discuss several cabinet lighting systems and explain how lighting can be disguised with shades and valances or shaped with diffusers and reflectors. I'll also shed some light on how others have illuminated their work (see the gallery on pp. 84-85).

Determine your lighting needs

Before you rush out to buy a lighting fixture for the piece you're building, first determine which parts of the piece you want to illuminate, and then figure how much light those areas will need. Not only can you light up the interior of a piece, but you can brighten things on the outside, too. Lighting-design books, such as GTE/Sylvania's *Lighting Handbook* (Sylvania Lighting Center, Danvers, Mass.) or *Scene Design and Stage Lighting* by W.O. Parks and H.K. Smith (Holt, Rinehart and Winston Inc., New York, N.Y.), will help you out. But one of the best places to get information is lighting manufacturers (see the sources of supply on p. 86). I found most companies have fixtures in a variety of price ranges and control options (see the bottom right photo on the facing page). With product literature in hand, it's easy to get on the phone with a lighting technician to discuss your requirements. They'll usually help you decide which system you need and offer suggestions for its installation.

Conventional and low-voltage AC fixtures

In terms of supplying electricity to your lighting system, there are basically two ways you can go: conventional alternating current (AC) fixtures and low voltage AC fixtures. Most of us light our homes with conventional fixtures that require 110v AC, such as the 30-watt light used in the cabinet at left. Less familiar, but certainly not new to the market, are low-voltage fixtures, such as the 12v, 20-watt lights shown in the top photo on the facing page. Both fixture types are available in recessed and in surface-mounted styles and most offer color choices for trim.

Although low-voltage fixtures generally cost more than standard-voltage fixtures, there are a few advantages with low-voltage systems. Low-voltage units typically operate on 6v or 12v, so lead wires and switches can be smaller, making them easier to conceal. The smaller low-voltage fixtures are also ideal for recessing in cases with limited space (see the bottom left photo on the facing page). However, if you use a low-voltage fixture, you'll need to provide a space—at least 4 in. wide by 8 in. long—for the transformer, which steps down your household voltage. Finally, low-voltage fixtures are more efficient: A 50-watt, 12v halogen lamp can usually replace a 150-watt, 110v incandescent. Despite all the differences, both types of fixtures share the same options for lamp types: incandescent, fluorescent and halogen (a brighter type of incandescent). Lamp types are not interchangeable, however.

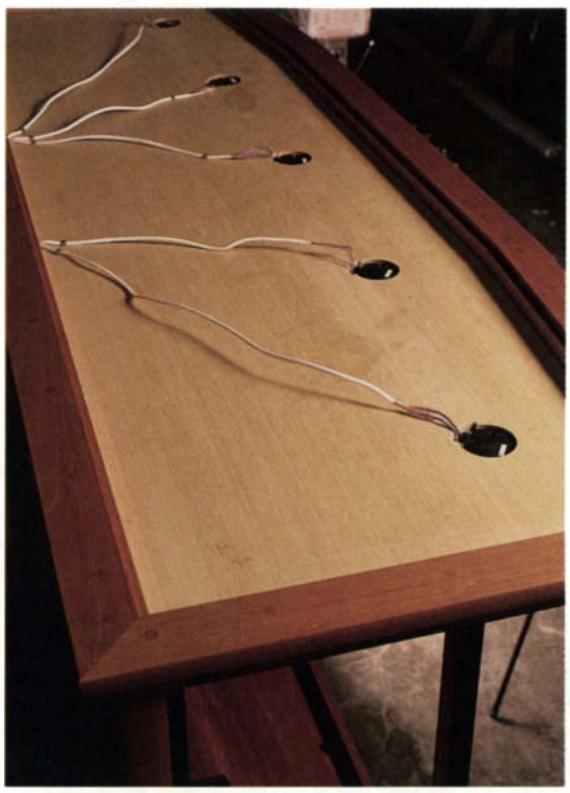
Incandescent vs. fluorescent—The most common lamp (bulb) type is incandescent, which produces light by passing current

Back lighting—*Within his display case, Leon Segal of Randolph, N.J., mounted a chrome reflector to direct light from a 30-watt, tubular incandescent bulb (above). He built the 31-in.-dia. case from padauk, cherry, holly and ebony. To conceal the fixture, Segal made a valance using a cutoff from the olive-ash burl back. Glass shelves let light trickle down and refract through the case.*

through a tungsten filament in a vacuum globe. The filament acts as a resistor and glows once it heats up. A fluorescent bulb produces light when current passes through a gas (argon and a small amount of mercury vapor), causing the gas to radiate ultraviolet rays, which makes a phosphor coating on the inside of a tube fluoresce.

Although most of us prefer cooler and cheaper to operate fluorescent lighting in our shops and offices, fluorescent fixtures are not the best choice for cabinet lighting for several reasons: First, fluorescent lights cannot be easily dimmed. Second, the slow illumination time of fluorescents is a disadvantage compared to quick-start incandescent fixtures. Third, the devices needed to start fluorescents, ballasts, are bulky and heavy and generate heat and hum. On the plus side, fluorescent light is more even and less harsh, so it produces less shadow. Color-temperature balanced and full-spectrum fluorescent bulbs are also available, which provide lighting that's closer to natural light—an important consideration if you need to display a light-sensitive object, such as a turned bowl. Another plus is that fluorescent bulbs generally outlast incandescent ones. New energy-saving fluorescents that are compact and have integral starters are the most practical for cabinet lighting.

***Down lighting**—Dan Trimble of Indiana, Penn., custom-made this cabinet to house a collector's rifles. To ensure the guns would be well lit, Trimble installed five, 12v, 20-watt halogen spotlights overhead. The battens in the back will be covered by mirrors.*



***Lighting controls**—The gun-cabinet lights (above) can be controlled with this pocket-sized remote unit or by a switch in one of the drawers. A cavity in the lower case houses the low-voltage transformer and the remote's transmitter.*

***Recessed halogen canisters**—Trimble built a 1-in. air space into the top of the gun case to run wires to the halogen 20-watt canisters (left). Each fixture measures about 2 in. across and can be recessed in just ¾-in.-thick plywood.*

***Halogen fixtures**—*Halogen lamps, originally developed for the auto industry, shed very intense light. This intensity also makes them ideal for focused cabinet lighting, such as spotlights. Halogen-filament bulbs produce light the same way that tungsten-filament incandescent bulbs do, but halogen globes are made of quartz (hence, the name quartz-halogen) instead of glass. Halogens also burn at a higher temperature, providing a whiter light than the yellowish cast of ordinary incandescents. Cabinet-type halogens are commonly low voltage and are available in 5-, 10- and 20-watt sizes. The bulbs last 2,000 hours on average, double the life of conventional incandescent bulbs. However, don't touch a halogen bulb when installing it—you'll considerably shorten its life.

Most low-voltage halogen fixtures made for cabinets are called canisters (or cans). The cans are shallow and their temperature usually won't exceed 100°F, so they can be directly installed in woodwork. Halogen fixtures not specifically meant for cabinets should not be used because they can get extremely hot. Halogen spotlights shed a fairly narrow cone of light, so if you need to cover a wide area or if you anticipate changing lighting needs, you might want to install an adjustable (eyeball) spotlight. Eyeball spotlights have a swiveling head (some have movable brackets) to give complete directional adjustability. Keep in mind, though, that this type reduces your interior cabinet space and is more visible.

***Strip lights**—*If you're concerned about clearance or about how much heat your lights will produce, strip lights could be your answer. Besides tiny LEDs (light emitting diodes) and the more familiar under-cabinet (kitchen) fluorescent, there are other kinds of lighting strips. One strip variety, which lasts up to 40,000 hours, encases a string of Christmas-tree-type bulbs in a clear tube (see the top photo on p. 86). If you're looking for strip lights that are colorful or unusual, Lucifer/Emerald Light (see the sources box on p. 86) carries neon strips in just about any shape.

***Mini track lights**—*If you want to retrofit an existing cabinet with custom lighting, consider the latest halogen track lights, which come in shallow (under ¼ in.) profiles. A power channel (track) allows you to plug in lamps along the track. A cover strip conceals the open channel between the lights. Connectors allow you to change the track direction and to connect to a power source.

***Battery lights**—*Another versatile light is the battery-powered type. Because these lights are compact and lightweight, they are

Photos except where noted: Alec Waters

ideal for illuminating small spaces, such as inside a nightstand or an armoire. In addition to having spring switches triggered by opening a door or drawer, many battery-operated lights mount with double-faced tape, so you can relocate them without leaving screw holes. To save batteries, many units have sensors that automatically shut the light off after a half-minute or so.

Safety considerations

No matter what type of lighting you choose, it's wise to talk to a professional lighting expert or licensed electrician before you wire and connect to power to ensure a safe installation. To obtain fixture listings, contact Underwriter's Laboratories Inc. (UL), a non-profit product-safety group. For a fee, UL will send you standards for each type of cabinet fixture you're installing. Ask for standards UL-1570 (fluorescent), UL-1571 (incandescent), UL-1574, (track) or UL-153 (portable lamps), Publication Stock Dept., 1285 Walt Whitman Road, Melville, N.Y. 11747; (516) 271-6200. Here's a quick installation check list to help safeguard your design:

- Use only UL-rated fixtures, wire, receptacles and connectors.
- Select proper wire sizes for each fixture (for more on this, see "Wooden Lamps," on p.78 in *FWW* #71).
- Follow UL ground requirements for fixtures and junction boxes.
- Check local building codes on enclosing wire and connections for built-ins (see *FWW* #72, p. 42 for more on permanent wiring).
- Provide adequate heat removal through air space or fan cooling.

Cabinets of light

The best way to explain what light can do for a cabinet is to show a few shining examples. The photos on this and the following page reveal a variety of lighting—everything from a combination of under-shelf and overhead lighting, to a dazzling display of special-effect lighting, to lamps with floral-shaped shades, to a set of custom fixtures. Although each cabinet was made for a client's specific needs, collectively they demonstrate how proper lighting can illuminate objects of art as well as a cabinetmaker's work. *—A.W.*

For a showcase of furniture and sculpture lighting, see Reggiani's Light Gallery, Fifth Ave. and 61st St., New York, N.Y. Reggiani is featuring the work of artists from the Peter Joseph Gallery in 1993.

Photo: Julian Eubank III

Photo: Julian Eubank, III

***Concealed illumination—Carl** Dimon and Glenn Hughes illuminated this hutch (above and on the cover), with its Neoclassical details and ebony accents, by installing four 40-watt eyeball spotlights in an overhead bridge. The arch is 5/16-in. bending plywood sealed with fire-resistant paint. To light the chinaware, they recessed 30-in.-long strip lights under the shelves.*

***Lighting effects—**For his walnut cabinet (right), Julian Eubank III specified halogen lights in the bar, activated by automated "guillotine" doors. To add sparkle to the glassware (left), Eubank chose overhead halogen spotlights and under-lighting boxes (strip lights with parabolic-reflector grids). Mirrors and reflective glass create the infinite lights in the cabinet made by Tim Abbott.*

- Allow plenty of room for wires, and don't bend leads sharply.
- Don't use halogen bulbs in a non-halogen fixture.
- Observe manufacturer's recommended maximum wattage for bulbs, and adhere to their guidelines for valances and diffusers.
- Only install non-combustible shades and reflectors.
- Keep combustible materials away. (Many fixture companies give a "security distance," which is the minimum clearance recommended between the fixture and a lighted surface.)

Disguising fixtures and shaping light

Just as your cabinet will be more visible once it's lit, so too will your craftsmanship. This is particularly important when you're deciding how to mount a switch, recess a fixture or conceal a lead. Be aware, too, that the finish you choose will affect how much light is absorbed and reflected. Two of the manufacturers I spoke with (Hafele and Hettich) offer special hole cutters and drill bits that let you neatly install their lights in wood. Once you have a fixture in place, there are several ways to hide the unsightly parts.

Valances and shades—Valances (or blinds) let you shield a light without diminishing its intensity. Valances can be made of matching cabinet stock (see the photo on p. 82) or another material if you prefer a reveal. Be sure to allow a safe distance between the light and your valance. Another way to shield a fixture is to use a shade or screen. The photo at left below shows how a shade can soften a light while adding interest to a piece of furniture.

Photo: Chris Honeywell

Photo: Paul Boyer

Front lighting—*Bob Boardman built this poetry display case (above) for a Port Townsend, Wash., library. The case opens from the front and sits on a 3-ft.-high, ebony-inlaid pen and pencil stand. To light only 10 in. of depth without hot spots, Boardman used five, 40-watt refrigerator-bulb fixtures and vented the top of the case. Brass reflectors, made by the late metalsmith Larry Scott, cast a warm glow on the Honduras mahogany.*

Shades of light—*It took Lucinda Leech of Oxford, England, 160 hours to build this 72-in.-high, cabinet,* Equatorial Etagere *(left). Incandescent fixtures light up the cabinet's display area and its lesser-known tropical woods, turapay and tornillo. Leech bent-laminated strips to brace the glass shelves to the corner pillars, which conceal the wires. The flower-shaped lamp shades are porcelain, custom-made by ceramicist Margaret O'Rorke.*

A luminous chest for jewelry

by Edwin P. Sheriff

"Enjoy your beautiful jewelry even when you're not wearing it." This is the slogan I printed on a card that accompanied a tall, lighted jewelry chest I made several years ago from teak, rosewood and amaranth. Although I hadn't seen jewelry illuminated in a chest like this before, I suspected light would distinctly display the chest's contents (see the bottom photo).

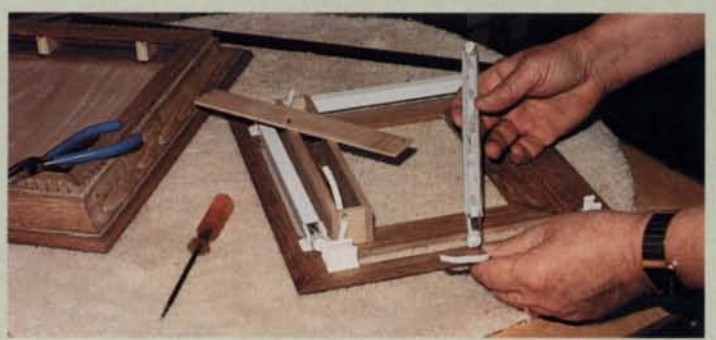
Case design: I wanted the chest to have a stately look, so I designed it around classical architectural motifs. The chest has a pedestal, an entablature and nine suede-lined drawers with compartments to hold rings, earrings, pins and bracelets. Necklaces hang in two glazed side cases.

To give the illusion of multiplying the contents of the side cases, I added mirrors. But what really adds a striking effect is the lighting from above. I set the drawer fronts with their heart-shaped cutouts back from the beveled-glass doors, so an additional overhead fixture washes the drawer fronts with light.

Lighting provisions: I chose the tiniest showcase lights I could find. Each fixture (made by Satco Products) is UL-listed for 6 watts and has six Christmas-tree-type bulbs inside. I mounted the fixtures in the entablature (see the top photo), which is vented for cooling. The entablature's bottom molding is fixed to the carcase and the glued-up top molding is screwed to the bottom. I routed ¾-in.-wide slots in the bottom molding so that light can enter the case. The fixtures have their own reflector channels that direct the light downward.

I replaced the fixture switches with a single switch at the back. After snaking the leads down through a raceway, I enclosed the wiring splices in a junction box under the pedestal. Finally, I placed a cord-storage bracket in the pedestal. □

Ed Sheriff is a jewelry box maker in Birmingham, Ala.



Making jewelry sparkle— *Ed Sheriff of Birmingham, Ala., built this 22-in.-tall jewelry chest (right) with mirrored necklace cases on each side. To light the cases from above, Sheriff concealed three 9¼-in.-long strip lights within the removable entablature (top). Before he installed the lights, he shortened their mounting clips to save space. Then he screwed the fixtures to the inside of the entablature and snaked the wires down a chase in the chest's back.*

Reflectors and diffusers—If you need to direct light, you can add a reflector. Most reflectors are made of brass, polished aluminum or chrome-plated steel. To spread light or reduce glare, use a reflective liner or mirror (see the bottom photo). Diffusers, by contrast, can dissipate light (see the bottom left photo on p. 84). Good diffuser material includes textured or translucent panels, metal grills or filters. With cabinet-type halogen fixtures, you can likely add colored filters or cone-shaped lenses to create visual effects or to reduce peripheral dazzle. However, UL advises not to install a diffuser or reflector unless it's part of your fixture's listing.

Wires and controls—No lighting installation is complete without proper wire management. One way to hide a lamp lead, power cord or wire harness is to build a wire chase. A chase can be a false back (cavity) in a cabinet, or molding over a conduit or a commercial wire raceway. Lighting dealers carry other accessories, such as muffin fans, grommets and connectors, so you can cool your lights and make junctions. Finally, you need to integrate the right controls into your wiring scheme; timers, dimmers, relays and switches—in light-activated, remote or touch controls—all help to fine-tune the lighting to your cabinet's design. □

Alec Waters is an assistant editor for FWW. *Special thanks to Julian Eubank III for his lighting research and guidance.*

Sources of supply

American Lite Inc., 1901 Brickell Ave., #B1412, Miami, FL 33129; (305) 858-5432 **(C,H)**

Custom Service Hardware, Inc., 1214 Hwy. 143, Cedarburg, WI 53012; (414) 377-1736 **(A,B,C,G,H)**

Eubank Inc., PO Box 2, Gardenville, PA 18926; (215) 766-0197 **(H)**

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Honeywell Inc., 435 W. Philadelphia St., York, PA 17405; (717) 848-1151 **(H)**

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Progress Lighting, Erie Ave. & G St., Philadelphia, PA 19134; (215) 289-1200 **(B,C,D)**

Specialty Lighting, PO Box1680, Shelby, NC 28151-1680; (704) 482-3416 **(A,B,C,D,G,H)**

Sunbelt Sources, 1151 Mineral Springs, #1, Arlington, TX 76017; (817) 472-6669 **(C,G)**

Task Lighting, 910 E. 25th, Kearney, NE 68848; (800) 445-6404 **(D,G)**

The Woodworkers' Store, 21801 Industrial Blvd., Rogers, MN 55374; (612) 428-2199 **(A,B,C,D,H)**

Vista Manufacturing, 52864 Lillian Ave., Elkhart, IN 46514; (219) 264-0711 **(F,G)**

Wise Light/Larkin Enterprises, 100 Wells Ave., Newton, MA 02159; (617) 964-5100 **(F)**

Woodworker's Supply Inc., 1125 Jay Lane, Graham, NC 27253; (800) 645-9292 **(A,B,C,D,H)**

KEY:

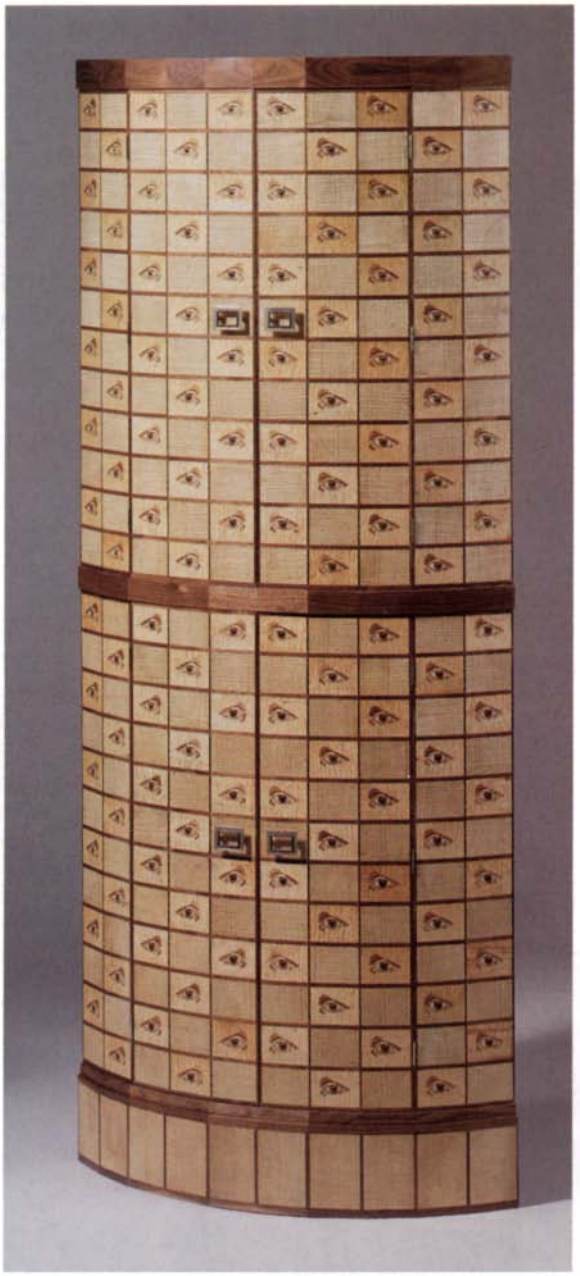
A = Conventional incandescent fixtures
B = Compact fluorescent fixtures
C = Low-voltage, halogen spotlights
D = Under-cabinet strip lighting
E = Miniature track lighting
F = Battery-operated cabinet lighting
G = Task and accent lighting
H = Lighting controls and wiring accessories

Photos this page: Ed Sheriff

Repetitive-Motif Marquetry

French technique permits multiple identical images

by Silas Kopf



***The one hundred and twenty eyes** on Silas Kopf's* Argus *cabinet, made up in batches of a dozen at a time from the same master drawing, create an interesting, almost eerie, effect.*

I first encountered Pierre Ramond's book on marquetry about 10 years ago. It was the French edition, and even though my high-school foreign language skills weren't up to the task of translation, I was able to make enough sense of the book to become acutely aware of a world of traditional marquetry technique virtually unknown in America. From the time of Louis XIV (early 18th century) to the Art Deco furniture of Jacques Ruhlmann in the 1920s, French furniture has always made use of exquisite marquetry. For much of that time, the skills for this traditional work were kept alive in the workshops of Paris and at the Ecole Boulle where Pierre Ramond teaches. I was fortunate enough to spend two months in Professor Ramond's workshop at the Ecole Boulle in 1988.

In the 18 years I've been using marquetry in my furniture, I relied almost exclusively on the double-bevel cutting method I wrote about in *Fine Woodworking* #38. With this method, two mating parts for a picture are held together, cut simultaneously and then taped together. This process is repeated until the whole picture is completed. The advantage of this method is that the joints between pieces come out almost effortlessly flawless. The disadvantage is that only one picture can be made at a time (see the photo on the back cover).

One of the techniques taught at the Ecole Boulle that intrigued me most was the traditional method of cutting a number of stacked pieces of an individual species of veneer all at the same time. Then those pieces, along with many others cut in the same way, are used to produce multiple copies of a given picture Because pieces are cut all together and in a stack, the number of identical copies of a marquetry motif that can be made is nearly limitless. I thought that if I could gain the skill to cut numerous identical copies, I would design furniture around that technique (see the photo above).

To prepare the veneers, I stack a number of the same species into a packet. First I use hot hide glue to affix a sheet of newsprint to the back of each piece of veneer. The newspaper helps to hold the wood fibers together during cutting. Then I slip a few pieces of waxed paper in between the layers of veneer to lubricate the sawblade, and I add a piece of thicker veneer to either side of the stack to stiffen the packet. Last I wrap the edges of the whole packet with veneer tape to keep it all together.

I take my drawing and make as many photocopies of it as I'll need for all the various parts in the marquetry picture. I cut the pieces carefully from the photocopies and glue the pieces to the appropriate packets of veneers, orienting the grain as desired. To hold the packets together when cutting, I drill pilot holes for brads in the waste near the cut line but out of the saw's way. Then I drive brads flush with the top surface, flip the packet over, clip the brads off slightly proud and peen them flush.

I cut much of my marquetry on a chevalet, the traditional tool for the job, which dates from the 18th century. The beauty of the machine is that it will keep the sawblade in exactly the same axis throughout the length of the stroke. Also, its stroke is about 4 in.; a modern scroll saw's stroke is only ½ in. or so. When I'm cutting the picture pieces out, I just "erase" the line around the piece, taking care not to cut into the piece, which would create a gap, and not cutting wide of the line, which would cause the picture to be too tight, perhaps not fitting at all.

After cutting out all the picture parts, I cut out the background, making sure the sawkerf stays on the inside. Then I use hide glue to attach a piece of paper to what will be the front of the marquetry picture. I spread hot hide glue against this paper background and begin to place the picture parts into this "frame," working from the outside in. Once the glue dries, I sand any excess off the back side. The marquetry is now ready for gluing to the groundwork. □

Silas Kopf is a marqueteur in Easthampton, Mass.

Photo: David Ryan

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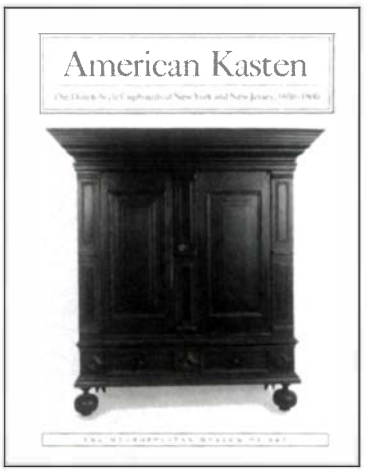
American Kasten, The Dutch-Style Cupboards of New York and New Jersey, 1650-1800 by Peter M. Kenny, Frances Gruber Safford, Gilbert T. Vincent. *The Metropolitan Museum of Art, New York, N.Y.; 1991. $16.95, paperback; 80 pp.*

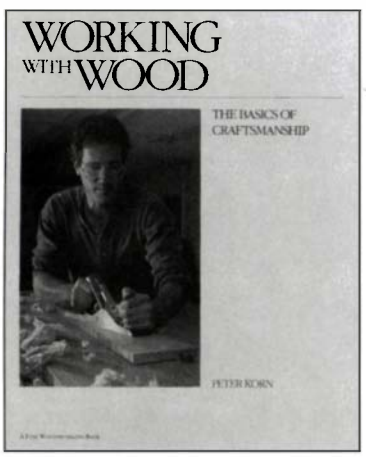


This profusely illustrated publication is a catalogue produced by The Metropolitan Musem of Art for an exhibit held from January through April, 1991 and represents the most comprehensive, in-depth study to date of these impressive pieces.

The kast is a large storage cupboard with a commodious drawer in the base, shelves behind two large paneled doors above, and topped with an enormous cornice. Variations occur primarily due to the arrangement of the panels and their surrounding moldings, the profiles of the cornices and the type of feet. Most kasten have large-diameter bun-style turned feet. The great cupboard with its contents was frequently mentioned in wills and household inventories, being probably the most important piece of furniture in the house. Usually equipped with locks, kasten were useful for storing valuables as well as linen, and the top was a place for safe-keeping and display of breakable ceramic and glass items. The number of kasten owned by a family was a good indication of wealth.

The book traces the European Dutch origin of kasten, relating these pieces to 17th-century architecture and decoration. Beautiful photos of noteworthy pieces are augmented by additional photos showing details and other related pieces for comparative analysis. Appendices offer line drawings of typical details, including actual-sized profiles of moldings, which will be particularly useful to cabinetmakers. *—Norm Vandal*

Working with Wood: The Basics of Craftsmanship by Peter Korn. *The Taunton Press, 63 S. Main St., Newtown, Conn. 06470; 1993. $25.95, paperback; 199 pp.*



Peter Korn has set himself a difficult task: to write a book on basic woodworking which both introduces the absolute beginner to the joys of craftsmanship and provides the more experienced woodworker with a review of hand-tool fundamentals. The result of his efforts, *Working with Wood*, is a book that will be of great help to the person just starting out. But it will be of limited value to the experienced woodworker.

There is a basic choice to be made in writing an introductory book on woodworking: You can cover a broad range of topics very quickly (and of necessity leave out much of the depth that makes each topic interesting), or you can select the most important areas and treat them in more detail (thereby omitting some topics completely). Korn has chosen the former route. In the first four chapters of his book, he presents a broad overview of wood technology, joinery, machinery and hand tools. In the other five chapters, he covers five projects; they range from dressing a piece of rough lumber to dimension (by hand and by machine) to building a dovetailed wall cabinet with a frame-and-panel door. In such a rapid overview, individual topics are inevitably treated very quickly. For the most part, this approach works well, and the beginning woodworker will, by reading Korn's book and working through the projects, get a good introduction to the joys (and frustrations) of the craft.

It has always been my view that when teaching basic skills to a beginner, one should not teach anything that must be unlearned later. There are times when Korn's book has some trouble in this regard. He recommends, for instance, when running a board over the jointer, you shift your weight to the outfeed table "as the bulk of the board passes the cutterhead." Sooner or later, the student will have to learn to shift his weight as soon as there is enough of a milled surface on the bottom of the board to receive it. Similarly, he recommends roughing out a mortise by drilling a series of holes, then paring the sides with a wide chisel. If the sides are inadvertently overcut, Korn's advice is, "just live with it." A better approach would have been to teach the proper use of the mortising chisel and to emphasize the critical importance of a good tenon-to-mortise fit for the full depth of the mortise.

Korn's treatment of safety, a crucial topic for the beginner, is generally good, but has some inconsistencies. In his discussion of machinery, he gives the most critical safety rules for most tools, but omits them for the grinder, the chopsaw and, most surprisingly, the radial-arm saw. Korn describes variable-speed routers as "quieter and less threatening," but doesn't mention their increased safety with larger bits. And in discussing the power required of routers, he cites only the noise factor; that larger, more powerful machines are easier to control with large cutters is not mentioned.

Korn's book is certainly not perfect, but I doubt if any single volume could be. Despite some shortcomings, *Working with Wood* is by far the best introduction to woodworking that I have seen. *—Mac Campbell*

The Woodworker's Dictionary by Vic Taylor. *Storey Communications, Inc., Pownal, Vt., 05261; 1991. $24.95, hardback; $12.95, paperback; 260 pp.*

This useful book is based on a British compilation of items gathered from *Woodworker* magazine, which accounts for much of the handiness and plain fun of this attractive volume. As a reference, its 4,000 items and 700-plus line drawings aptly answer most woodworkers' questions, but the book is also good straight-through reading.

The Woodworker's Dictionary is a great aid in coping with Brit-isms like lime (basswood), deal (almost pine), cramp (clamp), through and through (plain sawing), badigeon (sawdust-glue filler), scribe joint (coped joint), spiling (scribing) and cissing (fish eyes in a finish).

Technical information is concise but surprisingly detailed. The descriptions of finishes, veneer ground work and every imaginable joint are excellent. Hundreds of exotic woods, architectural terms and historical references make this book a practical and entertaining guide for woodworkers—not to mention Scrabble fans, for whom springing "druxy" (rot), "ekki" (an African hardwood) or "cwpwrdd" (a Welsh cupboard) on an amazed opponent would be worth the price of the book. *—John Sillick*

Norm Vandal makes period furniture in Roxbury, Vt. After 14 years of professional furnituremaking, Mac Campbell is now studying theology in Halifax, N.S., Canada. John Sillick makes and repairs furniture in Lyndonville, N.Y.

WOODWORKER'S MART

WOODWORKER'S MART

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CLASSIFIED *(continued)*

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Listings of gallery shows, major craft fairs, lectures, workshops and exhibitions are free, but restricted to happenings of direct interest to woodworkers. We list events (including entry deadlines for future juried shows) that are current with the time period indicated on the cover of the magazine, with overlap when space permits. We go to press three months before the issue date of the magazine and must be notified well in advance. For example, the deadline for events to be held in March or April is January 1; for July and August, it's May 1, and so on.

NATIONAL & INTERNATIONAL: **Competition**-International Lathe-Turned Objects: Challenge V. Deadline: July 10, 1993. Send a #10 SASE to Albert LeCoff, Wood Turning Center, PO Box 25706, Philadelphia, PA 19144. (215) 844-2188.
Competition-1993 Northwest International Arts Competition, thru Aug. 8 at the Whatcom Museum of History and Art. For more information, write The Whatcom Museum, 121 Prospect St., Bellingham, WA 98225. Contact Mike Vouri (206) 676-6981.
Meeting-Wood West, Oregon 1993. International Wood Collectors Society's annual meeting, Aug. 15-19. Springfield/Eugene, Oregon. For more information, contact Don Roberts, 1810 S. Fairmount Ave., Salem, OR 97302.
Show-Tecno Mueble Internacional, July 8-11, Guadalajara, Jalisco, Mexico. For more info, contact Eidson Trade Shows, Inc., PO Box 609, Conover, NC 28613.

ARKANSAS: **Meetings**-Woodworker's Association of Arkansas meets the first Monday evening of each month at 7:00 at Woodworkers Supply Center, 6110 Carnegie, Sherwood, 72117. For more information, call (501) 835-7339.

CALIFORNIA: **Workshops**-Woodworking for women. Furnituremaking with hand tools using traditional joinery, weekends. Four-day workshop this summer. San Francisco. Call for schedule: Debey Zito, (415) 648-6861.
Workshops-Various workshops including Japanese woodworking, joinery and sharpening. For further information, contact the Hida Tool Co., 1333 San Pablo, Berkeley, 94702. (415) 524-3700.
Lecture-Charleston Furniture with Brad Rauschenberg, July 13. American Decorative Arts Forum of Northern California. Trustees' Auditorium, Asian Art Museum, Eighth Ave. & John F. Kennedy Drive, Golden Gate Park, San Francisco. For more information, contact Mrs. Fox (510) 524-7304.
Show-Turned Wood, '93, thru July 10. A national show of work by contemporary turners. For more info, contact Del Mano Gallery, 11981 San Vicente Blvd., Los Angeles, 90049. (310) 476-8508.
Show-Woodworking Machinery Furniture Supply Fair, Sept. 9 thru 12. Anaheim Convention Center. For more informationn, contact Ellen Schwartz, (310)477-8521.
Show-13th Annual Artistry in Wood, Aug. 14 thru Sept. 26. Sonoma County Museum. For info, call 707-579-1500.
Exhibition-Designs in Wood, thru July 4. Southern California Exposition at Del Mar. For more information, contact the San Diego Fine Woodworkers Association, Bill Collins, (619) 232-4626.

COLORADO: **Classes**-Woodworking and related classes, year-round. Red Rocks Community College, 13300 W. 6th Ave., Lakewood, 80401. (303) 988-6160.
Workshops-Woodworking and furniture design, thru Aug. For more information or a free catalog, contact Anderson Ranch Arts Center, PO Box 5598, Snowmass Village, 81615. (303) 923-3181.
Workshops-Scribe-fit log construction with Robert Chambers. Beginning course: Aug. 16-21; intermediate course: Aug. 22-28; Advanced course: Aug. 30-Sept. 4. Colorado State University-Mountain campus. For more information, contact Peter Haney, 505 N. Grant, Ft. Collins, 80521. (303) 482-1366.
Seminars-Woodworking seminars, Sept. thru April. For more information, contact Schlosser Tool and Manufacturing Co., 301 Bryant St., Denver, 80219. (303) 922-8244.

CONNECTICUT: **Exhibition**-Guilford Handcrafts, July 15-17. Town Green, Guilford. For more information, call (203) 453-5947.
Classes-Restoring Wood and Canvas Canoes, Aug. 6-10; Building an Adirondack Guideboat, Aug. 23-28. For more information, contact Brookfield Craft Center, P.O. Box 122, Brookfield, 06804. (203)-775-4526.
Competition and show-The SONO Arts Celebration, Aug. 7-8. For application, send SASE to SONO Arts Celebration, Exhibiting Arts, PO Box 600, South Norwalk, 06856. (203) 866-1887.
Show-1993 Master Woodturners, featuring work by David Ellsworth, Giles Gilson, William Hunter and others, thru July 29. For more information, contact Mendelson Gallery, Titus Square, Washington Depot, 06794. (203) 868-0307.

DELAWARE: **Show**-Art From the Lathe, thru November 30 at Hagley Museum, Rt. 141, Wilmington. (302) 658-2400.
Show-The Delaware Valley Woodworking Show, Sept. 17-19. Valley Forge Convention Center, Pennsylvania Hall, 1200 First Ave., King of Prussia, 19406. For more information call (800) 826-8257.

DISTRICT OF COLUMBIA: **Show**-Marketplace for 19th Century Crafts, November 5-7, Decatur House, 748 Jackson Place, N.W. Contact Sarah Saville Shaffer (202)-842-0915.

FLORIDA: **Meetings**-Central Florida Woodworkers Guild, second Thursday of every month, Winter Park. For information, contact Ed Harte (407) 862-3338.
Meetings-Sarasota Woodworking Club, second Thursday of every month. For info, contact Tom Clark, 3544 Oak Grove Drive, Sarasota, 34243. (813) 351-9059.
Exhibition-Florida Craftsmen, Inc., thru July 29 at Visual Arts Center of NW Florida, Panama City. For more information, contact Michele Tuegel (813) 821-7391.
Competition-31st annual Coconut Grove Arts Festival, February 19-21. Juried by 5 slides. Entry deadline: Sept. 15. For application contact Coconut Grove Arts Festival, P.O. Box 330757, Coconut Grove, 33233-0757. (305) 447-0401.

GEORGIA: **Workshops**-Japanese woodworking by Toshihiro Sahara. One Saturday each month, year-round. For info, contact Sahara Japanese Architectural Woodworks, 1716 Defoor Place N.W., Atlanta, 30018 (404) 355-1976.
Classes-Woodworking classes, throughout the year. Woodworkers Guild of Georgia, PO Box 8006, Atlanta. For info, contact John Gorrell (404) 460-1224.
Exhibition-The Art of the Wood Turner, thru the end of the summer. The High Museum of Art, 1280 Peachtree St., Northeast, Atlanta, 30309. For more information, call Shelly Unger. (404) 898-9286.

IDAHO: **Juried show**-Art on the Green, July 30 thru Aug. 1. North Idaho College. For more information, contact Citizens' Council for the Arts, P.O. Box 901, Coeur d'Alene, 83816-0901. (208) 667-9346.

INDIANA: **Classes**-Various woodworking classes and workshops. Woodworking Unlimited, 6038 E. 82nd St., Indianapolis, 46250. (317) 849-0193.
Call for entries-Juried competition open to emerging and unrepresented craftpersons. Deadline: July 1. Official entry form required. For more information, send SASE to Anticipation '93, Route 10, Box 106, Upper Mt. Vernon Road, Evansville, 47712. (812) 464-1851.

IOWA: **Exhibition**-Holzfest woodworking exposition, Aug. 20-22. Little Amana, exit off Interstate 80. For more information or application, send SASE to Ron Toppenberg, 713 E. 5th St. N. Newton, 50208.
Workshops-Japanese Master Workshops, July 19 thru Aug. 28. One day to six weeks. For more information, contact SHRINE, 406 W. Depot, Fairfield, 52556. (515) 469-3369.
Fair-Sixth Annual Construction, Remodeling & Woodworking Fair, Sept. 17-19. Featured craftsman: Norm Abram. Greater Des Moines Convention Center, Des Moines.

KENTUCKY: **Workshops**-Woodturning and joinery instruction. For info, contact Jim Hall, Adventures in Wood, 415 Center St., Berea, 40403. (606) 986-8083.
Meetings-Kyana Woodcrafters Inc., first Thursday of each month. Bethel United Church of Christ, 4004 Shelbyville Road, Louisville, 40207. (502) 426-2991.
Workshops-Traditional Windsor chairmaking instruction. One-week courses. Contact David Wright, 503 Prospect, Berea, 40403. (606) 986-7962.

MAINE: **Courses**-1993 season opens June 6. Write Haystack Mountain School of Crafts, PO Box 518, Deer Isle, 04627.
Workshops-Craftsmanship & Design with Peter Korn, July 12-23, Aug. 9-20 and Sept. 6-17. Basic woodworking with Peter Korn, July 26-Aug. 6 and Aug. 23-Sept. 3. For more info, contact Center for Furniture Craftsmanship, PO Box 654, Camden, 04843. (207) 236-3032.

MASSACHUSETTS: **Instruction**-Full-time program in fine furniture construction. Complete facilities. Wm. B. Sayre, Inc., One Cottage St., Easthampton, 01027. (413) 527-0202.
Exhibition-Garden Treasures II: The Wooded Garden and the Seaside Garden, thru July 30. The Society of Arts and Crafts, 101 Arch St. Contact: The Society of Arts and Crafts, 175 Newbury St., Boston 02116. (617) 266-1810.
Classes-Woodworking classes, throughout most of the year. For information, contact Boston Center for Adult Education, 5 Commonwealth Ave., Boston, 02116. (617) 267-4430.
Juried competition-Limited Production Furniture, Oct. 9-Nov. 14. For prospectus, write Danco Design Center, 10 West Street, West Hatfield, 01088. (413) 247-5681.
Show-Hilltown Artisans Guild's ninth annual show and sale, July 17-18. For more info, call Joan Schiffer (413) 634-5015.
Workshop-Sculpture: Expressions in Wood, Rich Penziner, Aug. 12-15. For more information, contact Horizons, 374 Old Montague Road, Amherst, 01002. (413) 549-4841.
Exhibition-Second annual Art of Craft, Sept. 24-26 at Boston University's Peter Fuller Showroom, 808 Commonwealth Avenue. For more information, contact Maureen Mullin, American Concern For Artistry and Craftsmanship, P.O. Box 650, Montclair, N.J., 07042. (201) 746-0091.

MARYLAND: **Show**-Art Furniture by recent graduates of the Rhode Island School of Design, thru Aug. 21. For more information, contact Meredith Gallery, 805 N. Charles St., Baltimore, 21201. (410) 837-3577.

MICHIGAN: **Instruction**-Violin plate turning, July 25. Michigan Violinmakers Association. Host: Bob Meade. For more information, contact the association at 1661 Heather Wood, Troy, 48098. (313) 641-5138.

MINNESOTA: **Workshops**-Wood carving, Aug. 8-14. Classes include whittling animals, relief carving, figures/faces. For more information, write Villa Maria Wood Carving Workshops, PO Box 37051, Minneapolis, 55431.
Classes-Woodcarving classes year-round. For info, contact the Wood Carving School, 3056 Excelsior Blvd., Minneapolis, 55416. (612) 927-7491.
Classes-Creative Arts & Collectibles Expo, Aug. 27-29. Deadline: Aug. 1. For more info or an entry blank, contact Upper Midwest Wood Carvers Exhibition, 111 North Main St., Blue Earth, 56013.

MISSISSIPPI: **Classes**-Various classes. Allison Wells School of Arts & Crafts, Inc., PO Box 950, Canton. (800) 489-2787 or (601) 859-5826.

NEW HAMPSHIRE: **Classes**-Fine arts and studio arts. Manchester Institute of Arts and Sciences, 114 Concord St., Manchester, 03104.
Classes-Various woodworking classes, year-round. For info, contact: The Hand & I, PO Box 264, Route 25, Moultonboro, 03254. (603) 476-5121.
Auctions-Antique and craftsman's tool auctions, year-round. Contact: Richard A. Crane, Your Country Auctioneer, 63 Poor Farm Road, Hillsboro, 03244. (603) 478-5723.
Fair-60th Annual Craftsmen's Fair, Aug. 7-15. Mt. Sunapee State Park, Newbury. For more info, call (800) 639-1610.

NEW JERSEY: **Workshops**-Making and using wooden handplanes with David Finck, July 9-13; Mastering the bandsaw with Mark Duginske, July 16-18; Basic woodworking: three legged stool with James Jewell, July 31-Aug. 3. For more information write or call Peters Valley Craft Center, 19 Kuhn Road, Layton, 07851. (201) 948-5200.

NEW MEXICO: **Classes**-Woodworking classes. N. New Mexico Community College, El Rito, 87520. (505) 581-4501.
Classes-Fine woodworking classes, Santa Fe Community College, Santa Fe 87502. (505) 438-1361.
Exhibition-1993 New Mexico Woodworkers' Exhibition, July 24-Aug. 11. Santa Fe Community College, Santa Fe. For further information, call (505) 438-1230.

NEW YORK: **Classes**-Various beginning and advanced woodworking classes. Constantine's, 2050 Eastchester Road, Bronx, 10461. (718) 792-1600.
Meetings and classes-New York Woodturners Assoc., first Tuesday of each month. Craft Student League, YWCA, 610 Lexington Ave. (53rd. St.) New York City. (212) 735-9732.
Workshops-Traditional 18th-century woodworking techniques. Planemaking, carving, joinery and planecraft, thru Aug 21. Contact Mario Rodriguez, Warwick Country Workshops, PO Box 665, Warwick, 10990. For brochure and schedule, call (914) 986-6636.
Show-Crafts Festivals '93, July 2-4; Aug. 6-8. Bestor Plaza (outdoors), Chautauqua Institution, Chautauqua. For more information, contact Kay Collins, Festival Director, Chautauqua Crafts Alliance, PO Box 89, Mayville 14757.
Classes-Sharpening Woodworking Tools and Traditional Wood Joinery with Bill Smithers, July 10-11; Stripbuilding an Adirondack Guide Boat with Steve Kaulback, July 12-17; Refinishing with Mike Mahoney, July 24-25. For info, contact The Antique Boat Museum, 750 Mary Street, Clayton, 13624, (315) 686-4104.
Show-Contemporary Woodturning, thru Aug. 28. For more info, contact Frances Kelly, Elsa Mott Ives Gallery, YWCA, 53rd Street and Lexington, (212) 755-4500.

NORTH CAROLINA: **Workshops**-Green woodworking with kids with Drew Langsner, July 7-10; Toolmaking for woodworkers with Hans Karlsson, July 19-24; Windsor chairmaking with Drew Langsner, Aug. 2-7; 17th-century joinery with John Alexander, Aug. 16-21. Country Workshops, 90 Mill Creek Road, Marshall, 238753. For more information, contact Drew Langsner (704) 656-2280.
Meetings-North Carolina Woodturners, second Saturday of each month. Contact: Eric Hughes, Route 3, PO Box 300, Conover, 28613. (704) 464-5611.
Show-Blue Ridge Hearthside Craft Show, July 9-11, Aug. 6-8, Oct. 8-10. Main shop in Foscoe. For more info, contact Carolyn C Francis, 512 Cline Road, Dandridge, TN 37725. (615) 3997-2172.
Classes-Textile tools, Aug. 15-20, Nesting oval boxes in Shaker tradition, Aug. 20-22, Basic woodworking for production, Aug. 28 thru Sept. 3. For further information, contact John C. Campbell Folk School, Route 1, Box 14A, Brasstown, 28902. (800) FOLK-SCH.
Show-Piedmont Woodcarvers Annual Show, Oct. 2. Agriculture Building, 201 Water St., Statesville. For more information, contact Bob Williams, Rt 7, Box 234, Mooresville, 28115. (704) 663-3736

OHIO: **Show**-Greater Columbus Woodworking Show, Sept. 10-12. Ohio Expo Center/Fairgrounds, Lausche Building, 600 E. 17th Avenue, Columbus, 43211. For more information, call (800) 826-8257.

OKLAHOMA: **Show**-Eastern Oklahoma Woodcarvers Association 17th annual woodcarving show, July 9-11. Tulsa Promenade Shopping Mall. For more information, contact Russell Hayman, (918) 847-2236.

OREGON: **Meetings**-Guild of Oregon Woodworkers, third Friday of every month. Contact the guild at PO Box 1866, Portland, 97207. (503) 293-5711.
Juried show-Fifth annual summer Siskiyou Woodcraft Guild show and sale. July 29 thru Aug. 1. Pioneer Hall on

Winburn Way, Ashland. Regional juried entries welcome. For further information, contact Phil Clark (503) 482-9634.
Meetings-Cascade Woodturner's Association, third Thursday of each month. For info, contact Cascade Woodturners, PO Box 91486, Portland 97291.
Show-Nehalem woodworking show, Aug. 1-31. For more info, contact Artisans Gallery, PO Box 367, Nehalem, 97131. (503) 368-7301.
Show-Table, Lamp & Chair 1993, Aug. 5-Sept. 5. Portland. For more info, call (503) 226-3556.
Exhibition-Northwest Wood Carving by Jerry Stoopes, thru July 18; Cook Gallery, 705 Oregon St., Port Orford, 97465. Contact Rick Cook (503) 332-0045.
Classes-Oregon School of Arts and Crafts offers classes and workshops year-round. For more info and a free schedule, contact Oregon School of Arts & Crafts, 8245 SW Barnes Road, Portland, 97225. (503) 297-5544.
Meeting-The International Wood Collectors Society, Aug. 15-19, Red Lion Inn, Springfield. For information, write Don Roberts, 1810 S. Fairmount Ave., Salem, 97302.

PENNSYLVANIA: **Classes**-Windsor chairmaking, weekly and weekends. For further information, contact Jim Rendi, Philadelphia Windsor Chair Shop, PO Box 67, Earlville, 19519. (215) 689-4717.
Festival-Woodcarving show and all wood festival, July 10-11. Cooksburg. Contact: Cook Forest, Sawmill Center for the Arts (814) 744-9670; after May, call (814) 927-6655.
Festival-10th annual Penn's Colony festival, Sept. 18, 19, 25, 26. Entry deadline: July 1. For information, contact the Penn's Colony Festival, 603 East End Ave., Pittsburgh, 15221-3423. (412) 241-8006.
Workshops-Advanced detailing with Wayne Edmondson, July 12-16; Advanced power carving with Nancy Jones, July 14-16; Relief woodcarving with Dick Belcher, July 19-23; Woodturning with David Hout, July 26-30; Woodcarving with Bob Butler, Aug. 2-6; Woodcarving with Harold Enlow, Aug. 9-13; Realistic bird carving with Carl Sinkula, Aug. 23-27. For more information, contact Sawmill Art Center, PO Box 180, Cooksburg, 16217.
Exhibition-Bird sculptures in wood by Grainger McKoy, thru Sept. 6. Brandywine River Museum, Chadds Ford. For more information, call (215) 388-2700.
Juried exhibition-10th annual invitational of contemporary crafts, Sept. 24-Oct. 3. For further information, contact Chester Springs Studio, PO Box 329, Chester Springs, 19425.
Classes-Sharpening with Prew Savoy, Aug. 21; 18th-century inlay and marquetry techniques with Gene Landon, Sept. 11-12; Build a sack back Windsor with Mike Dunbar, Sept. 18-22; Traditional chip carving with Wayne Barton, Sept. 25-26. For further information, contact, Olde Mill Cabinet Shop, 1660 Camp Betty Washington Road, York 17402. (717) 755-8884.

RHODE ISLAND: **Exhibition**-Tools from the Bornstein collection of Coggeshall Farm, July 31 thru Aug. 15. Bristol Art Museum, Bristol. For more information, call (401) 245-7693.

TENNESSEE: **Classes**-Arrowmont School of Arts and Crafts. For further information contact Cynthia Huff, Communications Coordinator, (615) 436-5860.
Workshops-Advanced woodturning with John Jordan, July 19-23; Woodcarving with Paul Bitts, July 19-23; Ladies on the lathe with Betty Scarpino July 26-20. For further information, contact Tennessee Technical University, Appalachian Center for Crafts, Box 430, Route 3, Smithville 37166. (615) 597-6801.
Show-11th annual Smoky Mountain Woodcarvers show, Sept. 24-26 at Dollywood. Applications are now available. For more information, contact Jack Williams, 2608 Reagan Road, Knoxville, 37931. (615) 691-1855.

TEXAS: **Show**-Third annual turned wood show, thru July 25. For more information, contact Carlyn Galerie, 12215 Coit Road, Dallas, 75251. (214) 702-0824.
Meetings-North Texas Woodworker's Association meets the third Tuesday of Each month. For information, write NTWA, PO Box 831567, Richardson, 75083, or contact Bruce May (214) 271-0125.

UTAH: **Juried exhibition**-Sitting Pretty, Aug. 13-Sept. 24. An exhibition of chairs. Art Barn/Finch Lane Gallery, Salt Lake City. For further information, contact Kim Duffin (801) 596-5000.

VERMONT: **Courses**-Yestermorrow Design and Building School, Route 1 Box 97-5, Warren 05674. (802) 496-5545.
Exhibition-Shaker design exhibition, thru Aug. 2 at the Brattleboro Museum and Art Center. For further information, call (603) 942-8506.
Courses-Cedar/Canvas Canoe Building, July 4-9, Sept. 5-10. Sterling College, Craftsbury Common. Cedar/Canvas Canoe Restoration, July 11-16, Cedar/Canvas Canoe Building Aug. 22-27, Lake Champlain Maritime Museum, Basin Harbor. For more information, call Amy at (800) 648-3591 or Horace or Shirley Strong at (802) 586-2575.

VIRGINIA: **Show**-29th annual Richmond craft and design show, November 19-21. Richmond Center for Conventions. For further information, contact The Hand Workshop, 1812 West Main St., Richmond 23220. (804) 353-0094.
Call for entries-The Wood Show, July 31 thru Aug. 29. Deadline: July 1. For more information and entry form, contact the Middle Street Gallery, PO Box 341, Washington, 22747. (703) 675-3440.

WASHINGTON: **Exhibition**-Northwest international art competition exhibition thru Aug. 8. Whatcom Museum's Arco Exhibits Buildings, 206 Prospect St. For further information, contact the Whatcom Museum, 121 Prospect Street, Bellingham 98225.

AUSTRALIA: **Exhibition**-For Tomorrow by the Woodworkers' Association of New South Wales. Sept. 4-Oct. 3, New South Wales State Library, Sydney. For more information, contact Richard Vaughan (02) 818 1688.

CANADA: **Show**-Bob Gonzales woodturnings, July 10-11, 17-18. Arnold Mikelson festival of arts, 13743 16th Ave., White Rock, British Columbia V4A 1P7.
Workshops-Ultra Light Sawmilling for five days with Will Malloff. For further info, contact The North Island College, Box 320, Sointula, British Columbia V0N 3E0. (604) 973-2035, or fax (604) 973-2025.
Call for entries-SAWS 1993. Slide deadline: July 15. Juried exhibition of original works in wood. For entry forms, write the Southern Alberta Woodworkers Society, PO Box 6753, Station D, Calgary, Alberta Canada T2P 2E6. For further information call Henry Schlosser (403) 255-7372.
Classes-Build your own acoustic guitar with Colin Butler, July 5-17; The art of Japanese-style woodworking with Scott Nehring. Arkandor Foundation, Bras d'Or, Cape Breton, Nova Scotia. For more information, contact Dawn Nehring (802) 874-7002.

ENGLAND: **Workshop**-Cabinetmaking—an intensive foundation with Bruce Luckhurst, Aug. 22-29. For further information, contact The Little Surrenden Workshops, Bethersden, Kent, TN26 3BG. 0233 820 589.
Exhibition-Recent work by John Makepeace and students, July 21-28, Sotheby's, 34/35 New Bond St., London W1. For more information, contact Sue Bond, Public Relations, 5A Bramber Road, London W14 9PA. (071) 381-1324.

SWEDEN: **Workshop**-Traditional hand finishing. Conserving, restoring and refinishing antique furniture with Bruce Luckhurst and Jane Thomas, Aug. 2-6, Goteborg. For more information, contact Betty Hammar, August Abrahamsons Stiftelse, Naas, S-448 92, Floda. (046) 302-355-18.

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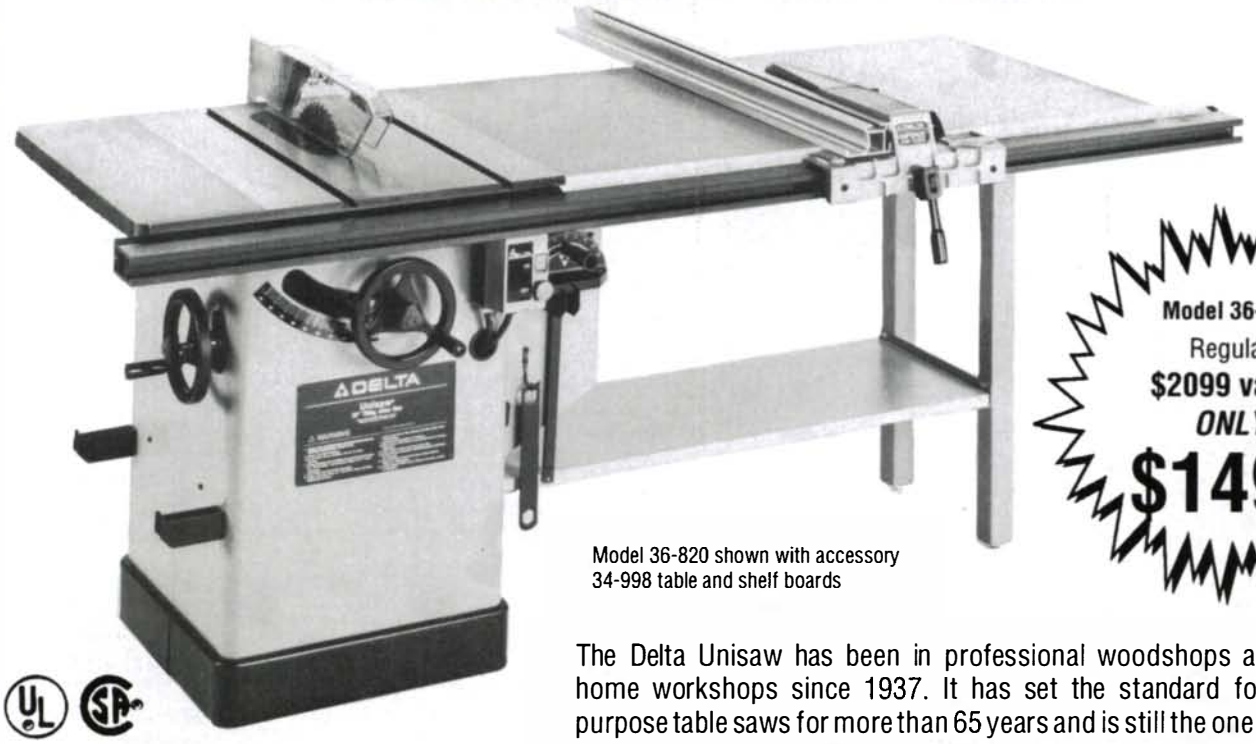

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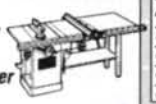

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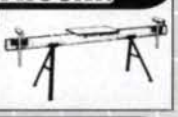

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3258 3-1/4" power plane 139
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3283DVS Dustless Random Orbital Sander — $95

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1348AE 5" elec. mini grinder 119
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1609 offset base laminate trmr 122
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1604 1-3/4 hp router 134
1606 1.75 D-handle router 169
1609K 3 in one trimmer kit 174

1021VSR 3/8" VSR, 0-1100 Drill — $98

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1404VSR 0-4000 Drywall Driver — $99

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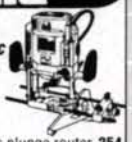

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1311 1/2" HD VSR Holgun drill 124
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2600 3/8 HD VSR drill 92
2660 0-4000 VSR drywl scrugn 79

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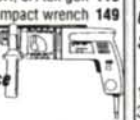
2054 0-2500, VSR, 5A scrugun 148
2059 0-2500, VSR, 5A tek gun 119
2670 1/2" HD impact wrench 149

5014 3/4" Rotary Hammer w/Case — $189



5071 3/8" VSR hammer drill kit 138
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The gauzy lightness of this dancer's skirt *(above) and the drape of the fabric all around her would be admirable enough if done with pencil or ink. Done with a soldering iron on wood, it nearly defies belief.*

White pine makes the best "canvas," *says woodburner Dino Muradian, because it allows such a wide range of tone. This woodburning, a copy of the original 1956 photo by Milton Greene, brings Marilyn Monroe almost back to life.*

Immortalized on lauan, *Muradian's wife Catalina and daughter Nadine (right) look like figures in a painting by one of the Flemish masters.*

Pyrography: The art of woodburning

To call Dino Muradian's work unconventional would be an understatement, but the same could be said of his life.

Now living in Renton, Wash., Muradian was born in Romania and lived there 30 years until 1983. On August 25th of that year, with Romania still repressed by the Ceaucescu regime, Muradian piloted a Soviet-built Antonov 2 crop duster to escape with his mechanic and the mechanic's pregnant wife. The three flew from Romania, across the length of Hungary (still communist then) and made an emergency landing on an Austrian highway. Muradian eluded radar—and capture or death—by flying below the tree line, "hedge-hopping" from field to field until he was safely in Austria.

Even before his passion for freedom led him to escape Romania, Muradian worked at nights, on weekends and whenever he could take time off from his job as a crop duster to pursue another passion in craft. Muradian burns images of amazing detail onto wooden surfaces (see the photos above). At first he used woodburning irons like the ones bird carvers use, but more recently, he switched over to a modified soldering iron. By using the flat side, the edge or just a point on the edge of the soldering iron, he's able to achieve different qualities of line in the same way someone would with a pencil. Because of the complexity of detail he renders, Muradian can be found looking through a magnifying glass for hours at a time, constantly

Photos this page: Vincent Laurence

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comparing his burning to the original image that he's copying.

Muradian's favorite "canvas" is pine, the whiter the better, because it allows him the widest range of tone (see the top right photo on p. 102). If he's doing a large burning, though, he'll use lauan plywood because of its availability in 4x8 sheets.

Before escaping to the West, his most frequent customers were churches, which commissioned Muradian to do religious renderings and paid him handsomely for his art. On a couple of occasions for a month's work, he earned the equivalent of a year's wages as a crop duster. His largest woodburning to date was of a detail from Michelangelo's *Creation*, commissioned by the church of St. Dumitru in Bucharest, Romania. That pyrograph took six months to complete and measures 6 ft. by 10½ ft.

These days, Muradian's commissions are more likely to be woodburnings of someone's child or dog. His art form just hasn't caught on in a big way yet, but he's confident he'll get his break. In the meantime, he's paying his dues and continuing to hone his skills on woodburnings of art photos, old paintings and portraits of family members (see the bottom right photo on p. 102). *—Vincent Laurence*

A new home for Canadian crafts

The Canadian Craft Museum, Canada's first museum devoted exclusively to crafts, opened its doors last May in Vancouver, B.C. For its inaugural exhibition, "A Treasury of Canadian Craft," the museum filled its galleries with work by 198 Canadian craftspeople, 30 of them woodworkers.

The debut show was well-attended, but if you couldn't make it to Vancouver, you might not have to miss out entirely. Before the exhibition closed, 90 pieces from it, including both Peter Fleming's *Cuttle Fish Box* and Michael Fortune's *Convocation Chair*, as shown in the photos above, were selected for inclusion in a traveling show.

The pared-down exhibit, "Selected Treasures," has been trekking through the Far East, with stops in Taiwan, Tokyo and Hong Kong. It recrosses the Pacific in late summer and will be on view at the Chicago Cultural Center from August 28 through October 24. It then moves to the Canadian Embassy in Washington, D.C., where it will be displayed through the end of the year. In 1994, the show will travel to Edmonton, Alta., where it will be housed at the Alberta Craft Council, and then to the Art Gallery of Nova Scotia.

For further information about the museum or the traveling exhibition, contact Gillian Schick at The Canadian Craft Museum, 639 Hornby St., Vancouver, B.C., Canada V6C 2G3; (604) 684-7174.

Catalogs of the inaugural show are available for $21.35 (Canadian) plus postage and handling.

—David Shath Square, Tyndall, Man.

Wood is good for cutting boards

Wood is a better and safer material for cutting boards than plastic according to the findings of microbiologists at the Food Research Institute of the University of Wisconsin-Madison.

Traditionally, wood has been the material of choice for cutting boards because it is readily available, easily renewable and provides a soft, resilient surface that protects countertops and the knife's edge. But, prompted by a rash of food poisoning cases a few years back, the U. S. Department of Agriculture began recommending hard plastic cutting boards. Although the plastic is much harder on the cutting edge, it was believed the plastic could be more thoroughly washed and disinfected than porous wood surfaces.

Recently, microbiologists Dr. Dean O. Cliver and Nese O. Ak tested a variety of both plastics and woods by contaminating the cutting boards with three different types of animal-born bacteria that cause food poisoning, including salmonella, listeria and escherichia coli. To their surprise, they discovered wood was a much less effective host for food poisoning bacteria than plastic.

Tests on the long grain surfaces of hard maple, birch, beech, black cherry, basswood, butternut, American black walnut, oak and ash, and the endgrain of hard maple, commonly used in chopping blocks, all had the same results.

Researchers found that 99.9% of the bacterial cultures placed on a wood board were unrecoverable and presumed dead within three minutes, but the same cul-

Photos this page: Derik Murray Photography, Inc.

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tures thrived on plastic boards. When left overnight, bacteria on the plastic boards multiplied, but no live bacteria were found on the wood boards. Even after washing by hand with detergent and hot water as much as 10% of the original bacteria cells were still found on the plastic boards. Knife scars in the plastic were a safe haven for bacteria. Dr. Cliver plans to test a theory that wood may contain a chemical substance, such as tannin, that might be anti-bacterial.

The performance of wood boards did deteriorate when the board was coated with chicken fat (chicken is a common source of food poisoning) or finished with anything that prevented the absorption of water. A thorough cleaning, however, removed the chicken fat, and when dry, the board was again free of bacteria. Old boards that have begun to splinter or come apart at the glue joints should be discarded because the defects can hide bacteria-supporting food particles and are difficult to clean.

For safe food handling, it is important to thoroughly wash not only the cutting board but also the knife and your hands with hot water and detergent whenever you change foods. Bacteria from the first food item can contaminate the next food item prepared. After washing, air drying is best, but it's okay to wipe off excess water with a paper towel if you're in a hurry.

—Charley Robinson

Restoration confab

Visitors at Boston's Hynes Convention Center will be treated to the North American debut of "Restoration 93," an exhibit December 6-8 about preserving buildings, antiques, documents, fine arts and virtually any artifact. Of special interest to woodworkers will be finish restorations and the tools, machines and furniture on display.

Exhibitors will include conservators and industries working to restore valuable objects, and there will be a techniques and technologies area for demonstrating the latest methods and products.

The most recent "Restoration" was held in Amsterdam in 1992 and was supported by organizations like the Smithsonian Institution. That event drew more than 9,000 attendees and 250 exhibitors from 15 countries. "Restoration" has continued to grow each year. This year's theme is "Preservation and the Real World," which will be presented through roundtables, panels and workshops.

For information about exhibits and admission, call (617) 933-9699.

—Alec Waters

Photo: William Sampson

***Lesson planes**—These aluminum-bodied planes were made by high school technology students as a lesson in the marriage of wood and metal craft. Clockwise from top are two scrub planes, a wooden casting pattern for their totes, a small smoothing plane, a lever cap pattern, a smoothing plane body casting pattern and the plane made from it.*

Making planes with kids

About five years ago, I decided that by making planes my junior high and high school technology students could receive a sound understanding of mass production techniques and, at the same time, leave the class with a useful, quality tool.

The planes begin with a computer-drafted 3-D model from which I make wooden patterns for sand casting. I use the traditional patternmaker's materials of sugar maple and wax fillet to produce patterns that can be used in our shop. Making these is a lesson in precision woodworking, and this is a place for me to show the students the interdependency that wood and metal working have. Students do not build the patterns, but by using them they can understand the concepts behind the patternmaker's trade.

To date, we have (on a small scale) mass produced three planes. The first was a small block plane loosely patterned after Stanley's #101. Because a plane this small is not commonly used, I designed a more conventional block plane incorporating a low cutting angle with a captive lever cap. It takes students between two and three weeks of class time to complete this low-angle block plane.

The third plane is a scrub plane made so far only in my high school production systems class. This model enables me to introduce students to one of the rarer types of planes, which most of the students have never seen, much less used.

The body and lever cap on all the planes are sand-cast aluminum. The blades are from Starrett oil-hardening tool steel. "Machining" the finished surfaces consists of hand filing, sanding and buffing because there is no metal lathe or milling machine in the shop. These processes, though crude, can with patience yield an accurate surface with almost a mirror finish.

Many of the processes we use are compromises making use of common tools rather than investing in expensive, automated equipment. One of the best lessons is that with simple tools quality work is possible.

My goal for this entire process is to have students learn mass production techniques. Planes were among the first products with truly interchangeable parts. Therefore, I consider this a good way to learn about our American system of manufacturing. Along with this, I can show the interdependency between woodworking and metalworking. Without metal tools, modern woodworking would not exist. Without wooden patterns, sand casting would not exist. The vast majority of the students leave with a good understanding of these concepts along with a tool that introduces them to woodworking.

—David McKane, Brushton, N.Y.

Notes and Comment

Do you know something we don't about the woodworking scene in your area? Please take a moment to fill us in. Notes and Comment pays for stories, tidbits, commentary and reports on exhibits and events. Send manuscripts and color slides (or, black-and-white photos—preferably with negatives) to Notes and Comment,* Fine Woodworking, *PO Box 5506, Newtown, Conn. 06470-5506.

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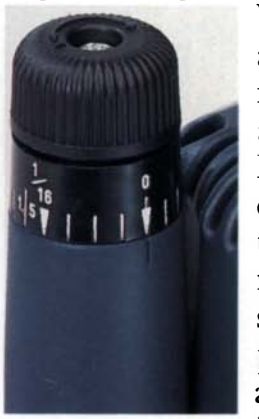

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Then there's that smooth, raw, Bosch power that lets you make high speed passes for aggressive stock removal. And on the electronic models, your selected speed is maintained even under full load.

Change templet guides with a push of a lever.

For detailed product information on single speed Models 1613 and 1614 and electronic variable speed Models 1613EVS and 1614EVS, contact your Bosch dealer. Ask him for a demonstration and price. You'll soon discover real Bosch precision, performance and value.

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BONE-DRY CABINET

Its sleek parabolic form and "cracked" surface resembling a parched desert floor make Silas Kopf's *Parabola* a captivating piece of work. Inspired by crackled-glaze pottery he'd seen, Kopf interpreted that effect with his marquetry, using satinwood veneer for the background, black aniline-dyed basswood for the cracks and Ebon-X (chemically altered walnut, which is used as an ebony substitute) for the base and arches. At the epicenter of the 64-in.-tall piece, where the densest cracking occurs, is a digital clock.

Kopf's recent work has focused more on repeated motifs (in this case, the cracks, which grow as they emanate away from their point of origin) than on conventional marquetry pictures. Many of his other recent pieces feature smaller identical marquetry pictures used all together for cumulative effect. For an example of this work and an explanation of Kopf's technique, see p. 87.

Photo: Kevin Downey