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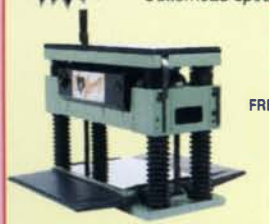

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Fine WoodWorking®

November/December 1993 No. 103

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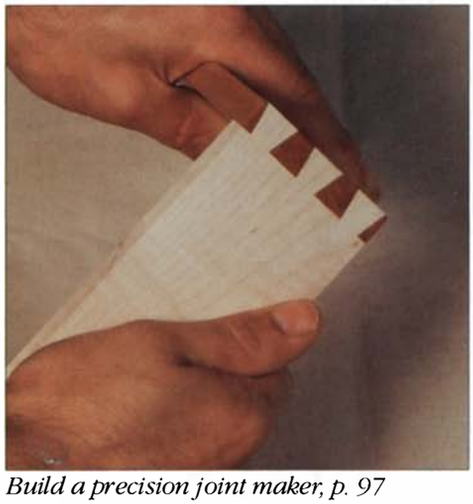

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On the Cover: *This 18th-century desk hides nine secret compartments. Secrets of their construction are revealed on p. 82. Photo: Amanda Merullo, courtesy Historic Deerfield, Inc.*

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Video Takes take off—Over the last few issues, *Fine Woodworking* has been conducting what amounts to a mixed-media experiment. We have expanded beyond the printed magazine page to offer video tapes accompanying a few select articles. Much of what we do in the magazine involves trying to explain techniques, some of which can be complicated. Sometimes even simple tasks can seem more complex when put in print. It's like trying to give written instructions to tell someone how to tie a shoelace. We had a feeling that some subjects could really benefit from "moving, talking pictures," as Paul Roman, the magazine's founder put it.

The idea was to make short, simple video tapes that could be paired with articles to make a powerful package of information. These are not intended to be finely polished entertainment. Instead, each video functions more like a reliable old tool: There may be a few nicks in the handle, but it gets the job done. The tapes are shot by our staff editors in the shops of our woodworker/writers or in the Taunton woodshop. Editing and production are kept to a minimum and so is the price.

Techniques and tool reviews seem to be the natural topics for Video Takes. So far, we have done Tage Frid on veneering (FridVid 11030, $7), Sandor Nagyszalanczy comparing sliding compound miter saws (SawVid 11031, $10) and Peter Korn on preparing stock (PrepVid 011032, $10). In this issue, Robert Vaughan demonstrates how to set jointer knives (JointerKnives 011034, $10).

A fifth tape was intended to accompany the article about cove cutting on the tablesaw, which was featured in *FWW* #102. Unforeseen circumstances kept it from being released for that issue, but it is now ready. The tape (Cove Cutting 011033, $10) features assistant editor Jon Binzen demonstrating a wide variety of cove cutting techniques on the tablesaw, showing what a powerful shaping technique it is. That or any of the other Video Takes can be ordered by calling (203) 426-8171 or writing The Taunton Press Order Dept., P.O. Box 5506, Newtown, Conn. 06470.

Reader reaction has been positive to the tapes, and we will continue to offer them with the articles that especially lend themselves to the technique. Watch for the little Video Takes logo that appears at the beginning of an article. We think of the tapes as another useful tool for sharing important information between woodworkers. We hope that our readers see them as useful tools in their shops.

Valuable contributions—Something that has been an important part of this magazine since its inception is the advice and contributions of experts. People like Tage Frid, George Frank and R. Bruce Hoadley have lent their special knowledge to the magazine in ways that go beyond what appears in print. Their consultation and support have been important in consistently providing the kind of information woodworkers want and need from *Fine Woodworking*. That's why we have a special place on our masthead to recognize our contributing editors, who also include Christian Becksvoort, Robert M. Vaughan, Mark Duginske and Sandor Nagyszalanczy.

Each time we add a name to that list, which is not often, it represents a valuable addition to the magazine. That is certainly true of the newest name to be included. Mario Rodriguez is a nationally recognized expert on 18th-century woodworking. But his skillful approach to his craft goes beyond that period to encompass a diverse repertoire of techniques for both hand and machine tools.

Mario is also a natural teacher. He shows that skill both as an assistant professor in the Restoration of Decorative Objects program at the Fashion Institute of Technology in New York City and in teaching

his own popular workshops at his restored 18th-century farmhouse in rural upstate New York. His previous articles for *Fine Woodworking* also reflect his skills as a craftsman and teacher. Most recently, he was featured in these pages with advice about setting up a shop. We're sure readers will benefit from his knowledge for a long time to come.

New furniture book—An exciting new project begins with a call for entries ad on p. 19 of this issue. It is an opportunity for woodworkers to showcase in a book the kind of work that our readers keep asking for over and over again. *Fine Woodworking Home Furniture* will be a collection of finely crafted pieces for practical use. This is the kind of furniture most of us like to build for ourselves, our family and friends. It is the kind of furniture we can live with day after day, the kind of furniture that is at home in a home, not a gallery.

This won't be a picture book, and it won't be a book of plans. (And it doesn't replace our *Design Book* series; watch for a call for entries for *Design Book 7* in 1994.) Instead, it will be more of a practical idea book for those who want to build similar pieces. Each selection chosen by the editors and publishers of *Fine Woodworking* will be displayed with photos and information from the maker about the piece, an original design sketch or drawing and a short listing of overall dimensions, materials, finish and what special tools were required to build it.

We hope the book will inspire woodworkers to submit their best work and that work in turn will inspire other woodworkers who pick up the book to create their own fine furniture.

Award-winning writer—We measure the success of articles based on how useful and interesting they are to the woodworkers who read them. But sometimes our articles face a different measure through the scrutiny of professional organizations. One author, whose work has appeared in *Fine Woodworking* on several occasions, recently was honored by the National Association of Home and Workshop Writers. Jeff Greef, a woodworker from Santa Cruz, Calif., won first prize from the association for his article "How to Build a Barrister's Bookcase" (*FWW* #96).

Getting it straight—A couple of concerns surfaced after the publication of Peter Tischler's article "Using the jointer: the advanced class" in *FWW* #102, p.52. Both issues had to do with a technique Tischler described using a sharpening stone to resurface the jointer's knives. This technique, which requires the jointer to be on while a sharpening stone is held on the outfeed table, has long been used. Jim Cummins wrote about it in *FWW* #55, and it is included in the Powermatic owner's manual. However, it should be emphasized that this technique has the potential to be very dangerous. The use of a stop block on the infeed table, as pictured in Tischler's article, is essential.

The second issue is one of nomenclature. The point of the procedure is to put another bevel on the knives, so they may better surface figured stock without tearout. The article mistakenly referred to this as a "back bevel." In reality, the new bevel is formed on the same side of the knife as the original bevel, not the back of the knife. Consequently, it should more properly be called a "secondary bevel."

A tulip by any other name—An alert reader pointed out a typographical error in John Sillick's article "Tulip: Wallflower at the Hardwood Ball" (*FWW* #102). The correct Latin name for tulip, or yellow poplar, is *Liriodendron tulipifera*.

—William Sampson, executive editor

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Quality first—"Made in North America—Still" by Vincent Laurence (*FWW* #101) raised the grain on the back of my neck a little. I've been a woodworker since high school and plan to be till my body gives up. When I buy tools, machinery and accessories for my shop, I look for several things: quality, durability and where it's made. If I can't find that in an American manufacturer, I will buy from a foreign manufacturer that produces quality tools. I'm not wealthy, but I want my tools to last and be serviceable not disposable. I feel misled by companies that promote "made in the USA" for profit reasons and not pride reasons. What is especially upsetting is when a larger part of their product line is foreign made.

Automation in manufacturing also dulls my chisel. How magnificent can it be when so many workers are out of work. I would rather pay a little more for a product from a company that keeps people at work. The alternative is still money I have to pay for unemployment benefits. A scene of a plant full of robot machines with few workers is a depressing one. How about an article about some of the smaller manufacturers that don't have millions to spend on advertising and cheap foreign bench tools to keep their American Star Wars robots building a few machines to put the USA label on?

—Chuck Williams, Norristown, Pa.

Not so new techniques—I was interested in your article regarding North American equipment manufacturers (*Fine Woodworking* #101). Many of the manufacturing techniques described in the article have been used in the so-called "high tech" and other North American industries for many years and with success. JIT (just in time) was in fact an American idea adopted primarily by the Japanese due to the fact that abundant manufacturing and warehouse space in Japan is non-existent. Without room for inventories, components must be delivered exactly where needed, exactly when required. Necessity is the mother of invention.

By the way, I did get a chuckle out of one of the photos of Delta's facility. Right in the foreground was a shipping box marked "Made in Taiwan." Can someone please tell me which components on my "made in the USA," 14-in. bandsaw were made in Taiwan? *—Duane F. Holmes, Ottawa, Ont., Canada*

American firms did better in the past—As an engineer and a woodworker for over 30 years, I read with some interest the article in *FWW* #101 on how proud you folks are of Delta and Powermatic and what a fine job they are doing both in making new woodworking machinery and supporting older machines with parts. Over the years, I have assembled a complete private woodworking shop of used commercial equipment by working through a used-tool broker. I buy only equipment in first-class condition that might need only minor parts or repair. I have also come to some conclusions about Delta and Powermatic.

Newer and better always means cheaper built and more expensive to buy. Although Delta is always exceptional in their ability and willingness to provide documentation and parts, you had better not need anything. It cost more to put a tire on my 20-in., old-style bandsaw than it did to put one on my truck.

Powermatic, now that's a sorry organization. When I needed parts for the sharpener for my 16-in. planer, they told me that it was made in 1969 and was obsolete and unsupported. They wouldn't even send me a drawing of the part, so I could have one made. Finally, I bought the corresponding parts that I could use and designed and had a machine shop build the rest.

With American companies like this, Taiwan doesn't have to try very hard. *—Larry L. Krause, Decatur, Ala.*

Infomercial or National Geographic?—In the August 1993 issue of *Fine Woodworking*, two articles raised the issue of financial arrangements between a journal and an industry. Mr. Vincent Laurence's article on Delta, Powermatic and General should have a disclosure of any financial arrangements. Was this article an infomercial, or was it truly a journalist proud of "made in America"? Mr. Laurence should have stated in the article if he owns any stock in those companies and if he has received any travel expenses, writing fees, presents or publicity contracts from the companies.

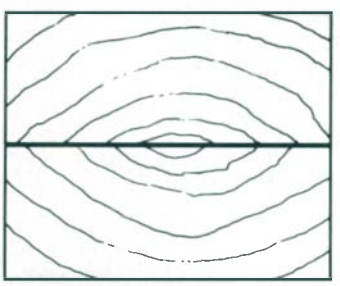
More dangerous is the article of Mr. Sandor Nagyszalanczy ("Random-Orbit Sanders"). This article should have appeared in *National Geographic* magazine. Let us make sure no sponsor is offended. Let us say how beautiful the world is, and let us say something nice about each instrument.

Come on Sandor, you can do better. That kind of sweetness has no place in a decent journal. My suggestion is to follow the *Consumer Reports* style, where a consumer can compare the performances and shortcomings of tools.

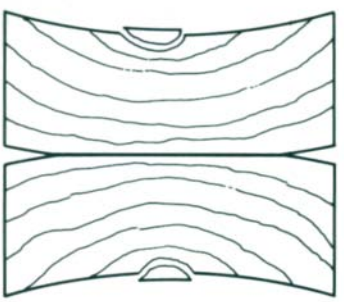
—Alexandre B. Todorov, M.D., Northport, Ala.

VINCENT LAURENCE REPLIES—Delta, Powermatic and General did not pay for my travel expenses, and I have no financial ties to those companies.

Face-to-face gluing—In your August issue (*FWW* #101), Bruce Hoadley responded to Mr. Tanzi's question on face-to-face gluing. He could have better advised Mr. Tanzi by having him glue the boards together with the pith sides of the board inward.



Face-glue boards with the pith inward for longer-lasting joints and weather protection.



Boards glued with pith side out may lose inner ring to weather and will pull against glue joint.

By having the boards glued the way that has been suggested, there is more chance of glue/wood failure by the tension of the wood's movement. What is more, if the application is of an exterior nature, weathering will cause the wood to check and, more than likely, separate at the innermost ring, causing a piece to fall out and leaving a pit that cannot be easily fixed mechanically or cosmetically, as shown in the drawings.

—Brian Whitehead, Haddonfield, N.J.

Painful experience—Excuse the penmanship. But it is hard to write with a very sore thumb stub. You may want to pass this on to others:

While planing a threshold on a jointer-planer, I allowed the trailing end of the push tool to be caught by the blade. The tool was jerked backward, and the force of my hand and the blade thrust forced my thumb and the front of the tool into the blade. It took me almost a week to figure out how the accident had happened. *—Roland Barber, Chunky, Miss.*

More on an unusual joint—In the "Q & A" column of the August 1993 issue, Sandor Nagyszalanczy answered a letter from a reader regarding an unusual joint found on some antique furniture. Sandor referred to this joint as a cove and pin joint. A more correct designation is a "pin and scallop" joint, which was patented in 1877 by Charles B. Knapp and Nathan Clement of Waterloo, Wis. It is sometimes called a Knapp joint. It was part of

an effort in the latter part of the 19th century to produce a machine-cut joint with the holding power of hand-cut dovetails. Unfortunately, it lacks the superior mechanical lock of the dovetail joint. So as soon as mechanical means of cutting dovetails were invented, this joint faded into obscurity. Nonetheless, joints like this are invaluable aids in determining the age of antique American furniture. *—Jeff Jewitt, North Royalton, Ohio*

Tinnitus and ear protection—In *Fine Woodworking* #101, Mr. Joseph Matsko wrote in to say that he has tinnitus and that the use of ear protectors or a noise suppressor had not helped to prevent the exacerbation of his tinnitus when engaged in woodworking with power tools. My experience with tinnitus comes from the Tinnitus Clinic that we opened in our medical school over 17 years ago. We have seen over 4,000 patients with severe incapacitating tinnitus.

Joy O'Neal suggested seeing an audiologist or an otologist about custom-fitted ear plugs, and that's a good idea. Many custom ear plugs, however, come with a small hole bored through, so insertion will not trap air and produce an improper or uncomfortable fit. What most dispensers do not tell you is that once the custom-made ear plug is in place, the small hole should be plugged (a round tooth pick will do or a small piece of chewing gum) to maximize the sound shielding. Also, as we chew and talk, we move the ear canal. Movement of this sort tends to break the seal of well-fitted ear plugs, so one should periodically reseat ear plugs by gently pushing inward on them.

Ms. O'Neal suggested Mr. Matsko should contact the American Speech-Language Hearing Association. I would respectfully suggest that it would be more to the point to contact the American Tinnitus Association (P.O. Box 5, Portland, Ore. 97207).

One final comment about ear protection. When we have patients with problems similar to Mr. Matsko's, I feel it is essential that they continue with their woodworking. Thus, we tend to go to extremes to protect those ears rather than have the patient give up what to me is one of the finest of hobbies.

The susceptibility of humans to hearing damage from exposure to loud sounds varies enormously. Thus, that which protects one person may not protect another. If all forms of ear protection fail to prevent an exacerbation of Mr. Matsko's tinnitus, I would suggest that he try operating his power tools in short spurts. Hearing damage produced by loud sounds is a time-intensity function, and if it is not possible to sufficiently reduce the intensity, then perhaps reducing the duration of each exposure will help. If even operating in short spurts fails to prevent exacerbation of his tinnitus, I would suggest that he resort to the use of manual tools only as did our forefathers who produced some magnificent specimens of woodworking.

—Jack Vernon, Ph.D., professor of otolaryngology, director, Oregon Hearing Research Center, Oregon Health Sciences University, Portland, Ore.

More on ear protection—The prevention of loud noise exposure in woodworking is twofold: First, personal protection is critical and can be maximized by using a combination of molded custom-fitted ear plugs and ear muffs. The ear muffs should have fluid-filled bumpers that conform to the side of the head, even around eyeglass bows.

Whenever selecting hearing protectors, you should always find out the device's Noise Reduction Rating (NRR), which is the approximate expected reduction in sound loudness measured in decibels. Look for devices having a NRR of 25 or greater.

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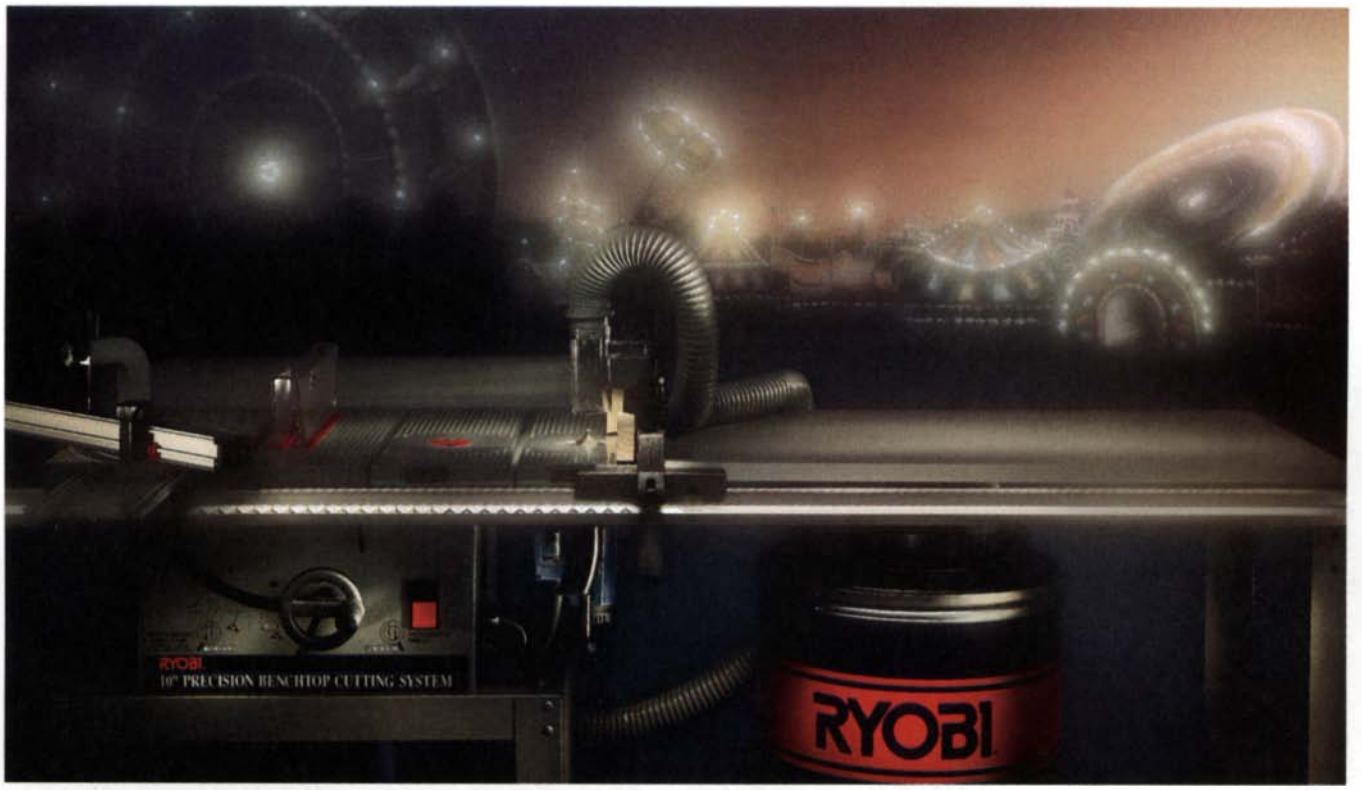

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The second component of a noise avoidance program should be aimed at reducing the noise being produced. This can be done in several ways, starting with tool purchasing. In general, high-quality, heavy tools tend to be quieter. Some manufacturers are even emphasizing the quietness of their tools in advertising. Try tools before buying.

Tool installation should be designed to minimize vibration, (e.g. lag screw equipment to the floor using rubber spacers between machine leg and floor). Also pad rattling metal on metal components, such as machinery cabinet doors.

Further noise reduction can be achieved by eliminating the bouncing around of noise in the shop. Wood, masonry and metal are all sound reflectors and, as such, intensify noise. This can be greatly reduced by the use of sound absorbers. For example, hang a few framed acoustic tile panels vertically, and cover bare walls with cork.

With the exception of hammering, hand-tool use is much quieter than power tool use and should be used whenever feasible, such as using a cabinet scraper rather than a belt sander.

–Theodore J. Fink, M.D., Shelburne, Vt.

Clearing a clouded finish—I would like to respond to Don Steinert's answer to Uhle Cassidy's question on a clouded piano finish in *FWW* #101. Mr. Steinert incorrectly assumed that the cause of Mr. Cassidy's problem of a sticky and clouded surface was the breakdown of the surface coating. Mr. Cassidy clearly stated that the surface became that way after years of polishing and waxing.

Traditionally, most factory-produced pianos are coated with nitrocellulose lacquer. We know that we have a substantial surface coating to work with. So it is clear to me that the real culprit of the clouding and stickiness is the years of self-admitted oiling, polishing and waxing, not the surface coating itself. Mr. Cassidy's problem is not necessarily restoring a damaged finish but a question of how to clean all those years of accumulated oils and spray waxes and polishes.

Mr. Steinert's statement that the products that advertise themselves as "finish restorers" will not give the desired effect is correct. These materials are merely strippers without the methylene chloride and can damage a surface and should be avoided.

We have been experimenting with automotive polishing compounds as an alternative for some time and feel it would be a practical solution for the weekend restorer. We first began using Ditzler DRX 24 and DRX 25 (25 is the finer abrasive) but have also began using Meguiar's MO-4 and MO-1, which seem to work as well. These products do not have any silicone in them, and they are available where automotive paints are sold.

The only problem that could arise from the use of this treatment is that if the surface coating has begun to severely craze, the very fine abrasive may become lodged in the cracks. However, mineral spirits has proven helpful in washing it away.

Some key points to remember are that you must have an intact and stable resin-based surface coating. You are cleaning the surface, not attempting to amalgamate the surface coatings. This technique will not work on historic oil and wax surfaces. Always test in an inconspicuous spot to see results. And because you are working with an aliphatic hydrocarbon, always vent the area thoroughly.

–Craig Deller, Deller Conservation Group Ltd., Geneva, Ill.

Chemical comments—Here are some comments on chemical subjects discussed in *FWW* #101 p. 65. Phil Lowe's description

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of Sal-Soda as an impure form of sodium carbonate is incorrect. Sal-Soda is an old-fashioned name for sodium carbonate, also called washing soda. Some years ago, *FWW* published a letter suggesting washing soda for cleaning gum from sawblades. I could not find it anywhere. Since then, the emphasis on non-phosphate cleaners has brought it back to the supermarket shelves. I recently bought a 3-lb., 7-oz. box of Arm and Hammer washing soda for $1.44 (42 cents a pound).

Chris Minick ("Changing the Color of Wood," p. 66) must have forgotten the basic chemistry lesson found even in elementary school science texts. When you react chemicals, the properties of the products are greatly different from those of the starting materials. The classic example is the reaction of sodium, a metal that reacts explosively with water, and chlorine, a green, poisonous gas (the first chemical warfare agent) to produce sodium chloride, table salt.

The earliest synthetic dyes were derived from aniline, but contained no aniline. Aniline is derived from benzene and is reacted with other chemicals to make isocyanates used in products far more common than aniline dyes ever were—polyurethane foams and polyurethane finishes.

—David W. Carnell, Wilmington, N.C.

Why outdoor finishes fail—The article, "Wood Against Weather," by Jim Tolpin (*Fine Woodworking* #100) had some excellent tips on managing wood outdoors. However, the main reason for failure of exterior finishes was never discussed, and I believe the implication that six or seven coats are better than two or three is inaccurate. The critical factor that determines failure of exterior finishes is that water gets under the finish somehow. In other words, the door that's pictured on p. 91 of the article most likely didn't have the finish fail because of some mystical exposure to weather. Rather, the most likely scenario is that the bottom of the door wasn't adequately sealed, or the seal was broken from wear, weather or stripping. Water on the door surface ran down to the lower edge, found the flaw and, by capillary action, ran back up the inside of the lower part of the door. When the sun hit the door, the water heated up, evaporated and lifted the finish off. This is why only the lower part of the finish is damaged. If there were 20 coats of varnish, it still would have lifted off.

Also, too many varnish coats can actually cause a leak because they will crack more easily than two or three coats. This has major practical implications and has helped me maintain the doors and outdoor furniture in our Oregon weather for many years.

—James S. Puterbaugh, M.D., Portland, Ore.

Scratch awl simplified—Regarding "Scratch Awl from Scrap" (*Fine Woodworking* #100, p. 56), some people may not feel comfortable turning metal on a wood lathe or may cringe at the thought of shaping brass with a skew. These people may find the project more enjoyable if they buy a cheap awl with a plastic handle and then remove the handle.

—John Owen, Magnolia, N.J.

Less than perfection—I am writing this letter to comment on the Shaker-style wall clock article by Phil Lowe (*FWW* #101). I find the craftsmanship of his clock appealing but his lack of authenticity in using a battery movement inappropriate.

As a builder of Shaker clocks, I commend Mr. Lowe for using a custom-painted dial, complete with a key-wind hole, but the clock loses its aesthetic value when he uses the battery move-

ment without a pendulum. It shortchanges the legacy of true Shaker craftsmanship and detracts from the Shaker tradition.

If someone is going to go to the effort of creating such a beautiful piece in the Shaker tradition, it is imperative that it be completed as close to the original as possible to maintain a high standard of Shaker ethics. The Shakers believed in perfection in their work, and anything less cheapens the meaning of the Shaker craft. The battery movement is a cheap substitute for an authentic key-wound movement. A key-wound movement gives a clock a real heart.

The only catalog offering Shaker dials at present is Precision Movements (4283 Chestnut St., P.O. Box 689, Emmaus, Pa. 18049; 800-533-2024). Their dials are available in Arabic numerals and Roman numerals. I am selling a Roman numeral dial. Interested persons can contact me at Worth Clockmakers (239 E. Orange St., Lancaster, Pa. 17602; 717-397-0552).

Key-wound movements are available from Butterworth Clocks (1715 Pearlview Court, Muscatine, Ia. 52761; 800-258-5418). The pendulum and other parts needed are available through Merritt's Antiques (P.O. Box 277, Douglassville, Pa. 19518; 215-689-9541) and Timesavers (P.O. Box 12700, Scottsdale, Ariz. 85267; 602-483-3711).

I hope your readers find this information helpful if they desire to build a clock.

—Robert Worth, Worth Clockmakers, Lancaster, Pa.

In defense of diamond stones—With regard to the article "A New Angle on Whetstones" (*Fine Woodworking* #101, p. 72), I have a few thoughts on the subject: I believe Gerald Polmateer was a little dismissive of diamond stones.

The American-made DMT "stones" are mounted on a reinforced plastic base that I have found very stable and rigid. While I agree they are not particularly fine, I find the 600-grit ideal for turning tools. Though I am almost entirely an oilstone addict, I find waterstones better for turning, being less messy from the frequency of sharpening required.

However, my main reason for buying the diamond impregnated stones was to at last have a master surface available to surface all other stones on. This has proved to be a success, and all my other stones are equally flat now. Now I can pass from a fine India to a Washita to a hard White Arkansas and get a consistent polish on the back of large paring chisels and especially plane irons. For me, after nearly forty years, this was a first.

Initially, I used a 325-mesh blue-series hone to flatten all my stones, and I kept them flat and open-pored with the 600-mesh red series. The company makes an extra-coarse 220-mesh black series, and I understand now a fine one at around 1,200-grit. To waterstone users, diamond stones make short work of flattening these soft stones.

—Barry M. Murphy, Herstmonceux, East Sussex, U.K.

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—John Lively, publisher

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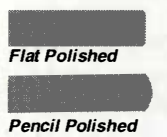

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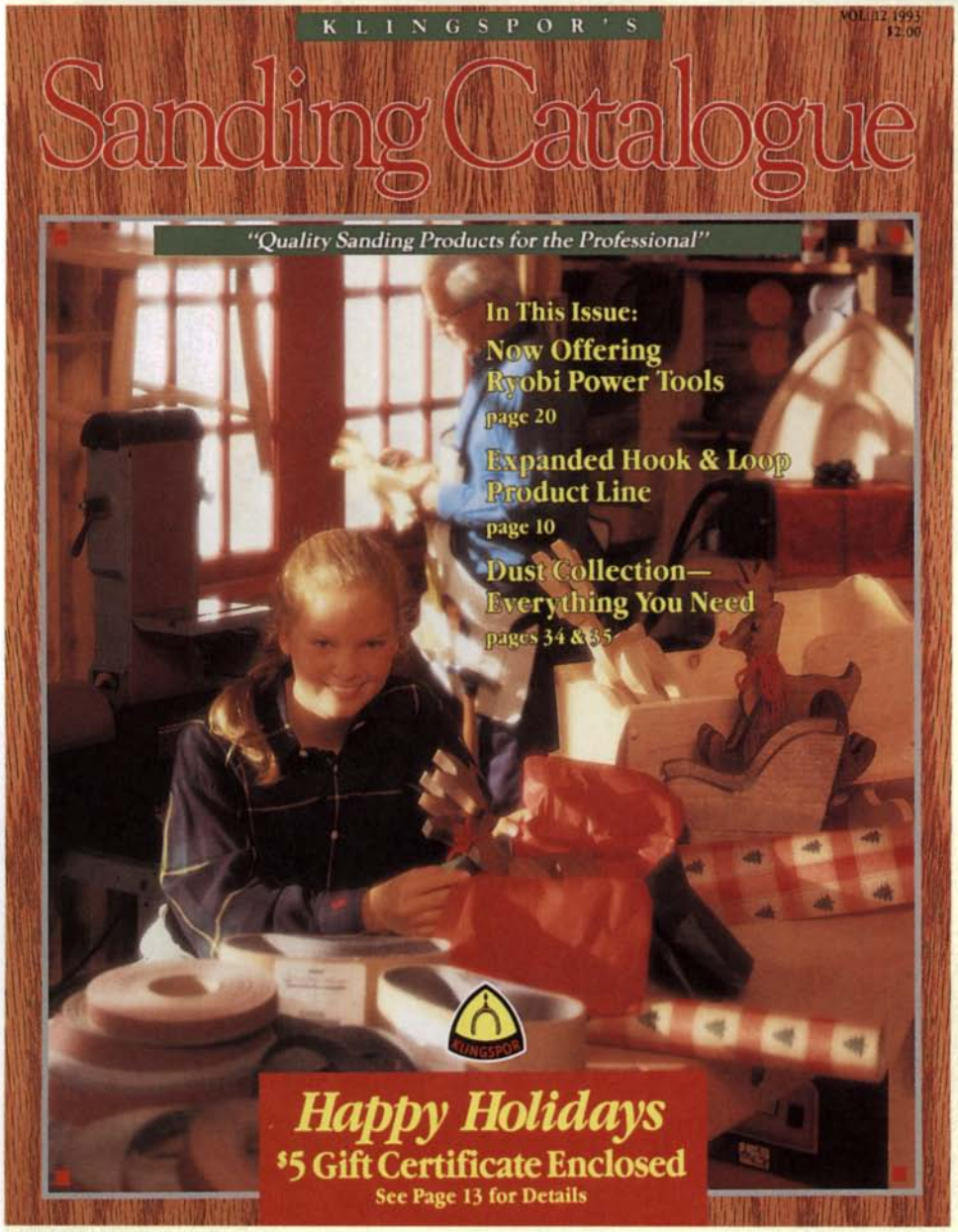

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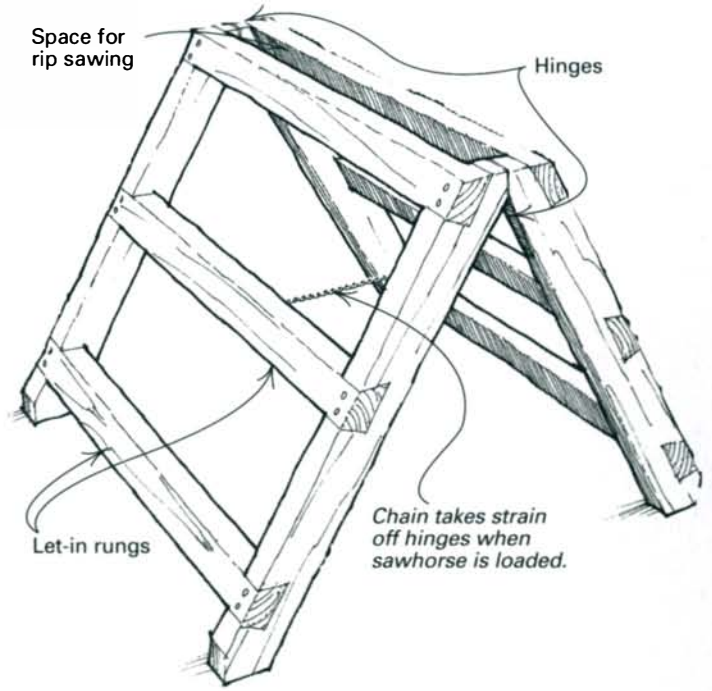
Folding sawhorse



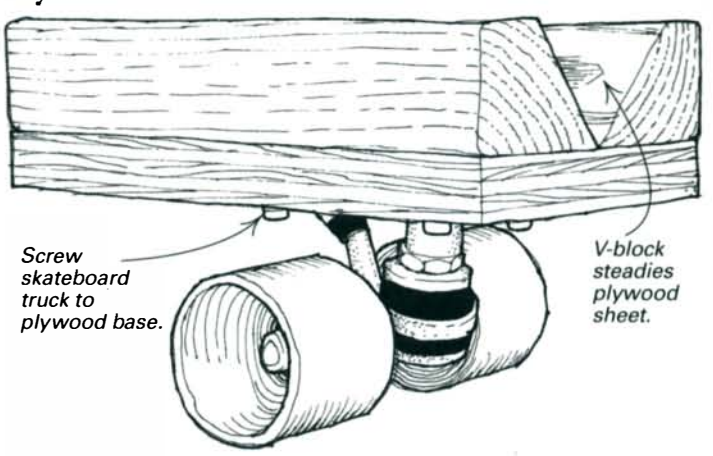
After experimenting with many sizes and shapes of sawhorses over the years, I finally designed and built this folding horse, which is easy to store and transport. When opened, it serves as a steady horse with a ripsaw space at the top. It also doubles as a sturdy step ladder. Two horses can support low scaffold planks or a workbench top. An added bonus is the clean design, which makes the sawhorse attractive and easy to construct.

To make the horse, dress 10 pieces of pine 1½ in. by 3 in. by 30 in. long. Bevel-rip six of the pieces at 30° for the steps. To mark out the notches and angle cuts on the four legs, first make an accurate template of thin plywood. To ensure rigidity, cut the leg notches carefully to receive a press fit. Press the steps into the leg notches with bar clamps, and fasten with countersunk flathead screws. You may wish to round the exposed edges of all pieces to reduce splintering and improve the looks.

Now mount the hinge. This may be easier to do if you remove the hinge pin, mount the hinge halves and then replace the hinge pin after lightly peening for a tight fit. Fasten a suitable chain between the centers of the middle steps to take the strain off the hinges when the horse is used under load.

—H. M. Smith, Napanee, Ont., Canada

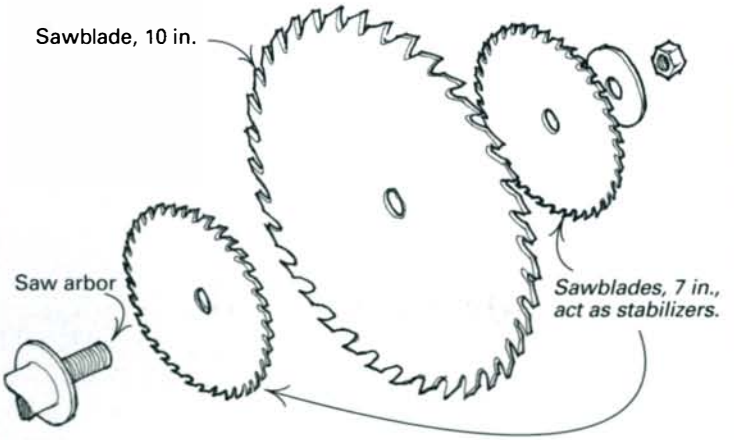
Plywood roller



For the expenditure of a few bucks and a few minutes, you can roll those plywood sheets instead of carrying or dragging them. Screw a couple of beveled 2x4s to a chunk of ¾-in. plywood to make the V-grooved base. Then mount a skateboard truck to the bottom so that the wheels are centered.

—Thomas K. Wilson, San Diego, Calif.

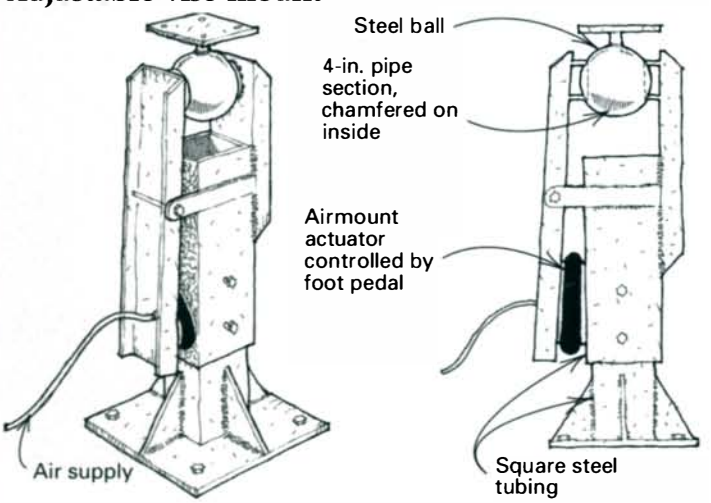
Sawblade stabilizers



When I began experiencing some blade wobble and vibration problems on my tablesaw, I looked into but rejected a set of expensive mail-order blade stabilizers. Later, I noticed a couple of used 7-in. circular sawblades hanging around the shop waiting to be sharpened. I sandwiched my 10-in. tablesaw blade between the two smaller blades to act as a stabilizer. The arrangement solved my blade wobble and vibration problems. I'm sure that smaller diameter blades, which would provide a greater cutting depth, would also work effectively.

—Les Barna, Indialantic, Fla.

Adjustable vise mount



I needed a way to mount and hold sculpted chairs at odd angles while I was working them with a pneumatic drum sander. The device I finally came up with works great for this purpose, and it makes an effective adjustable vise mount or carver's screw mount. For the pivoting head, I used a steel ball made at a ball mill. A bowling ball would probably work just as well. Chamfered 4-in. pipe on either side holds the ball in place, as shown in the drawing above. I welded the stand from sections of heavy-gauge square steel tubing and plate. I then bolted the base plate to the floor.

There are two ways to provide the clamping leverage: a regular bench screw or an Airmount air actuator. The actuator, available through industrial air equipment suppliers (call Firestone Industrial Products at 317-580-2300 for information), is basically just a tire between two steel plates. Add air, and it tightens the grip on the pivoting head. The device is perfect for this application

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2. A single woodworker may submit any number of entries, but each entry must be submitted separately as a complete package with its own entry form. Additional forms are available upon request from The Taunton Press, or you may photocopy the entry form in front of this ad.

3. Please write a short explanation of how and why you designed this piece, what materials and finish you used, any special equipment, hardware or techniques employed and the piece's overall dimensions. This explanation should be no longer than two double-spaced, typewritten pages. If available, include a copy of your design drawings. This may be anything from rough pencil sketches to computer-assisted drafting (CAD) printouts.

4. Each entry must include clear, sharp photographs of the front, back, all sides and any important details. The photo background should be featureless and of a neutral color that does not interfere with the piece. Submissions may include original transparencies (35mm, 2 ¼ in., 4x5, 5x7 or 8x10). We prefer color prints, 3½x5 or larger, which must be accompanied by color negatives. Polaroids and black-and-white negatives or prints will not be judged. Please protect each slide, transparency or negative with paper or plastic. Print your name and address legibly on each 35mm slide mount or on a label attached to the protective sleeve of each transparency or negative.

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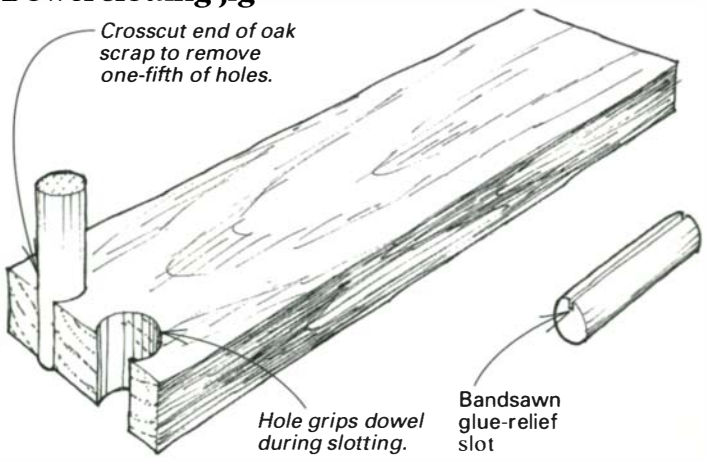
because it exerts tremendous force on the ball (about 1,000 lbs. at 40 psi), and it puts up with lots of angular misalignment. I installed a foot-pedal air valve so that both of an operator's hands remain free to adjust the stand. —*Chuck Waugh, Boring, Ore.*

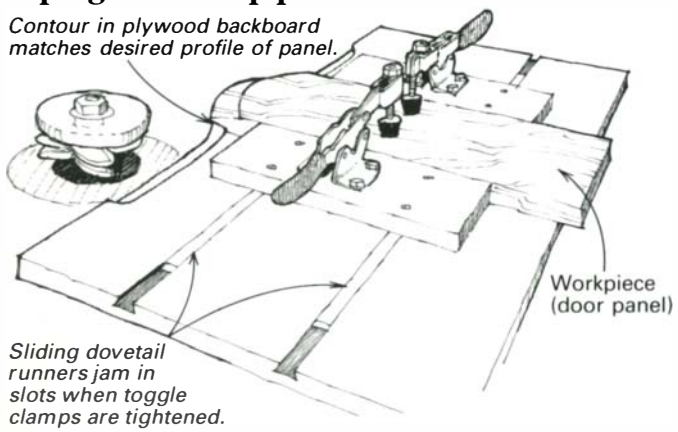
Quick tip: When dowel pins are too tight for comfort, bake the pins in a 200° oven for several hours. The pins will shrink just enough to fit easily during assembly, but during glue-up, they will swell to their original size to make a tight joint.
—*David J. Loy, Columbus, Ohio.*

Dowel-slotting jig



This simple jig has but one purpose: to help in cutting a glue relief slot in regular lumberyard dowels. To make the jig, simply drill a couple of dowel-sized holes near the end of a beefy scrap of oak. Then crosscut the piece removing about one-fifth of the hole, leaving four-fifths to grip the dowel. Now insert precut dowel pins in the proper-sized hole, and push into the bandsaw to slice a shallow slot. —*Steve A. Balla, Bramalea, Ont., Canada*

Shaping curved-top panels



When shaping curved-top panels for cathedral-top cabinet doors, I use the standard approach—a plywood jig with a curved contour cut into its top, which guides along a ball bearing rub collar mounted below the shaper cutter. But for the jig to work properly, you have to eliminate any side-to-side movement in the workpiece as it's being shaped. My original solution to the problem was to use fixed blocks attached to the plywood jig on either side of the workpiece with DeStaCo toggle clamps mounted on the blocks. I would cut filler strips to wedge between the blocks and the workpiece to center the work and to

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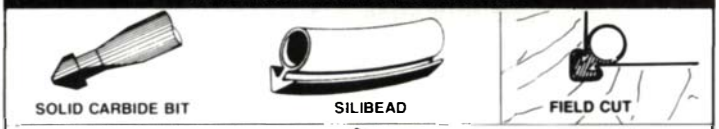

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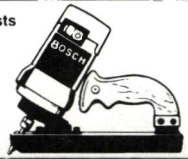

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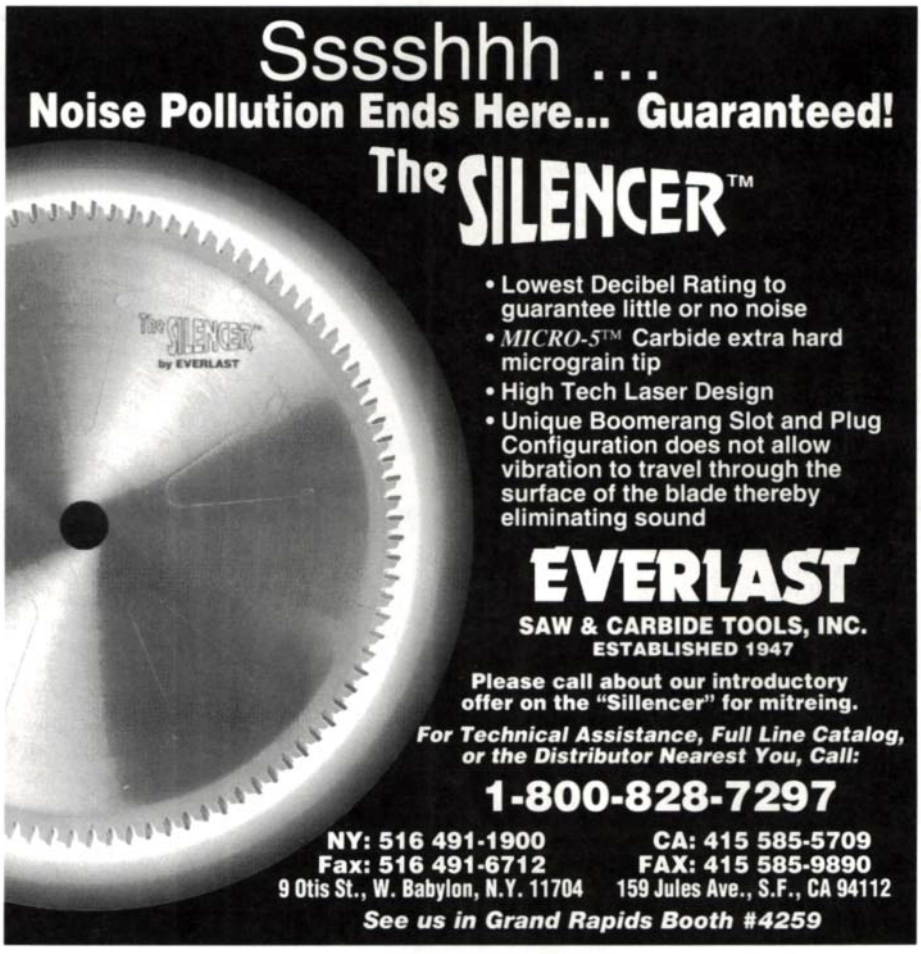

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READERSERVICE NO. 25

keep it tight. As the panel widths changed from door to door, I would cut new filler strips. Any panel that went beyond the capacity of the toggle clamps meant that I had to unscrew the blocks and reposition.

Finally, I redesigned the jig by mounting the plywood blocks to sliding dovetail runners. After centering the workpiece, I slide the blocks into position on either side of the workpiece and toggle the clamps down. The clamping pressure lifts the sliding dovetails, which wedges them into the slots and clamps the whole thing tightly. Then I'm ready to shape.

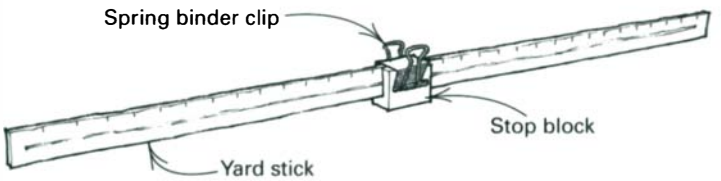
The combination of sliding dovetails and toggle clamps has promise for holding down materials in other applications, too.

–Tom Griffin, Dublin, Calif.

Quick tip: Slip a short length of split garden hose on the wire handles of plastic buckets to make them more comfortable to carry. Wrap electrical tape on each end to keep the hose in place.

–John A. Wilson, Lexington, Mass.

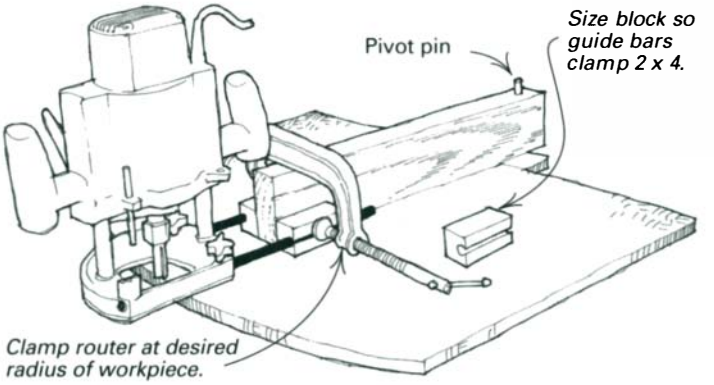
Yardstick stop block



To reproduce measurements that exceed the capacity of your combination square, make a simple stop block for a yardstick. Attach and adjust the block with a spring binder clip.

–Harold D. Rodden, Florissant, Mo.

Router circle-cutting simplified



Although I've seen dozens of methods for routing circles over forty years of woodworking, the method I stumbled on early is still the least complicated and quickest I've seen.

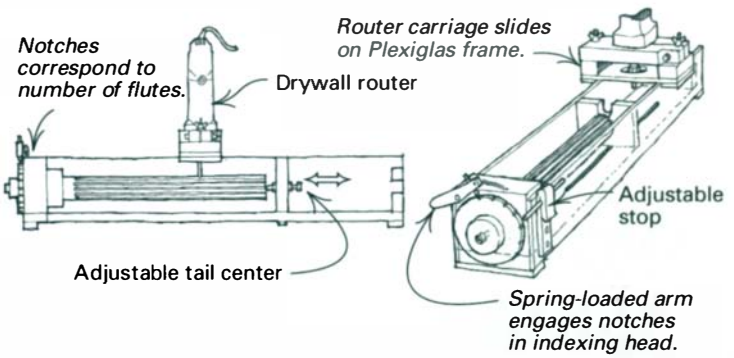
Two small hardwood blocks kept right in the router storage case are the heart of the method. The blocks slip on your router's guide bars leaving a bit of the bar exposed, as shown in the sketch above. When the blocks are in position, the distance between them should be 1⅞ in., the thickness of a 2x4, so that any length ripped from a 2x4 can be used to size the radius of the circle to be cut.

To cut the circle, drill a ¼-in. pilot hole in the 2x4, and use a dowel or ¼-in. bolt on a block as a pivot. Or just drive a nail through the 2x4 if the hole won't show. Adjust the router so the bit is in position; then clamp the 2x4 between the blocks and the guide bars with a C-clamp. The open holes in the blocks allow the pads on the C-clamp to pull up tight on the guide bars with-

out slipping off. With this system, you can rout circles as small as 6 in. to as large as...now let's see, what's the length of a 2x4?

—Tim Hanson, Indianapolis, Ind.

Fluting fixture



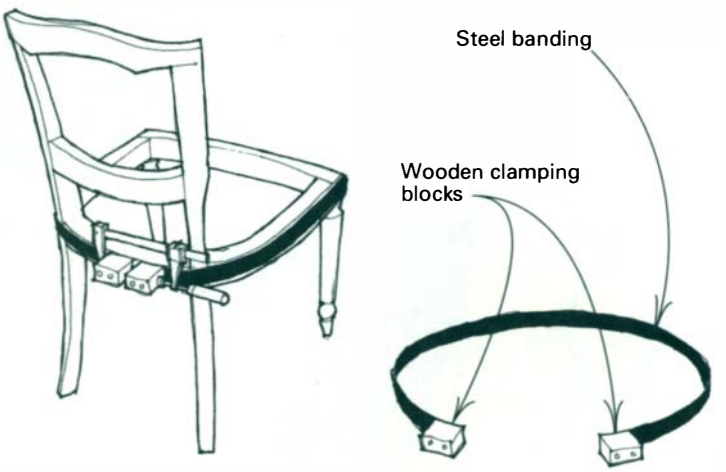
Fluting is an operation that is so seldom required that it does not warrant buying special equipment for the purpose. So when I needed to flute some short columns, I made this fluting fixture from a drywall-trimming router, hardwood scraps and Plexiglas. The construction details shown in the sketch can easily be modified for your particular needs.*—Harry J. Gurney, Taunton, Mass.*

Installing drawer fronts

Installing drawer fronts in European-style cabinetry (where drawers and doors are flush with the surrounding frame) can be tedious. To look right, the drawer front must be centered in the space with a perfectly uniform gap on all sides. This technique makes the installation fast and foolproof. With the drawer box installed in the case, temporarily position the front so that the gap, top and bottom is equal. I use metal rulers of various thicknesses as shims to adjust the vertical spacing. Leaving the shims in place, pull out the drawer front, and apply a couple of beads of gap-filling Super Glue to the back. Give the drawer box a spritz of accelerator. Position the parts together, eyeballing the side-to-side spacing. In about 20 seconds, you can open the drawer and install screws to permanently attach the front.

—Andrew Jacobson, Petaluma, Calif.

Clamping with metal strapping

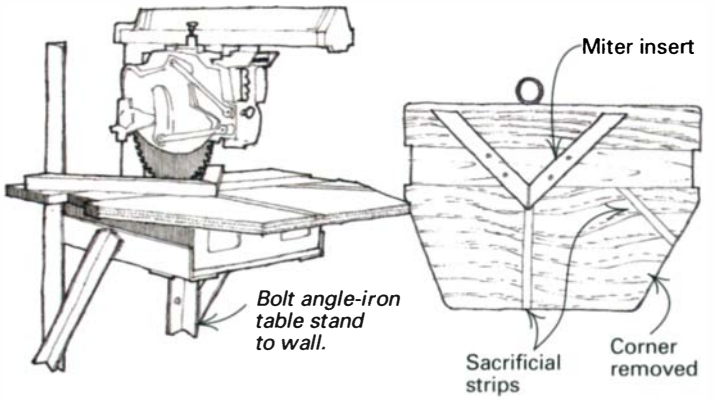


When I needed a large number of expensive webbing clamps for a run of chairs, I improvised this clamp. First retrieve a sup-

ply of metal strapping from the lumberyard scrap bin. Cut the strapping to the approximate length needed. Attach wooden blocks to each end with 3/16-in. bolts and nuts. Use a C-clamp or Quick-Grip clamp to tighten. *–Chris Marley, Kingston, Jamaica*

Quick tip: When repairing antiques or patching veneer, it is often useful to see the repair as you apply clamping pressure. To accomplish this, place a piece of ¼-in.- thick clear plastic between the joint and the C-clamp. Wood glue will not stick to most plastics. *–J. Francis Pfrank, Schaumburg, Ill.*

Radial-arm saw tips



The radial-arm saw is a well-used tool in my workshop, but a few simple modifications have increased its utility even more. The modifications are aimed at reducing the space for the machine itself, increasing the life of the wooden table and making miter cuts easier to make and more accurate as well.

The first idea is deceptively simple—I cut the corners off the front of the wooden table. The saw's table needs to be quite long at the back, near the fence, but the front is rarely used. So losing the corners makes moving the machine a lot more pleasant without affecting its ability to support the timber being cut.

The second idea is more involved because I have thrown away the legs and mounted the machine on the wall 48 in. from the floor using welded up angle-iron brackets as shown. This sounds rather tall, but after the initial "shock period," I have found it easy and pleasant to use. Mounting the machine this way creates valuable space underneath the machine, which I use to store another tool when I need floor space.

To ensure good support underneath the cut, I have routed trenches ¾ in. wide by 3/16 in. deep along both the 90° and 45° cuts. These grooves are filled with well-fitted hardwood strips held in place with double-sided tape. I prepare several pieces of these "sacrificial" strips at the same time and fit a new one when support is particularly needed.

To cut miters, I remove the insert behind the main table and replace it with the fixture shown in the sketch. Leaving the arm in the 90° position, I miter the first piece by holding it against the left fence. The second piece is mitered using the right fence. Even if each angle is not exactly 45°, as long as the fixed angle between the fences is 90°, perfect miters are achieved.

–John Burchett, Copnor, Portsmouth, England

Methods of Work buys readers' tips, jigs and tricks. Send details, sketches (we'll redraw them) and photos to Methods, Fine Woodworking, *PO Box 5506, Newtown, Conn. 06470-5506. We'll return only those contributions that include an SASE.*

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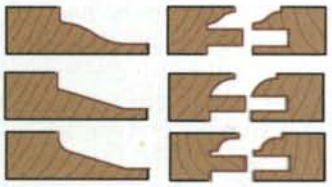

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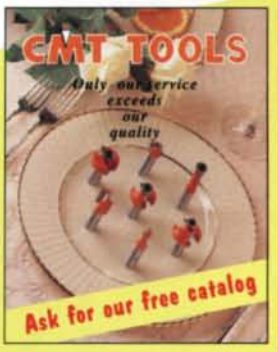

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READER SERVICE NO. 142

Restoring flooded equipment

What steps do I need to take to restore my shop after it has been under water? ***—Millard Upson, St. Charles, Mo.***

Robert Vaughan replies: Flooded equipment has two major problems that must be addressed: mud and rust. Flood mud is a pervasive residue of very fine abrasive silt that gets in everywhere. The thickness of the layers varies according to how muddy the water was. Rust is the other enemy and is probably easier to deal with.

Begin by cleaning the machine as best as possible. Take the machine out, and remove the motor and other electrical devices. Hose the silt off the machine with clean water, and wipe off all the standing water possible. Blow things out with an air compressor if you can, but chances are the compressor was flooded, too. Now you're ready to work. Soak fasteners and shafts with WD-40 or some other good penetrating oil and moisture blocker. Things rust up quickly and disassembly is eminent.

Grease holds the fine abrasive silt very well, so anywhere there was grease, there is now a viscous abrasive compound. Remove and replace all ball bearings no matter how free they feel or how sealed up you think they were. That fine abrasive silt will eventually get to them and may cause other mechanical damage as they fail. Any gearbox must be disassembled and thoroughly cleaned of its existing grease. Shafts that run through bronze bushings should be removed and both shaft and bearing surfaces wiped squeaky clean and then greased. Tables must be removed and their trunnion and worm gears cleaned and greased. All working parts will have that abrasive silt in them, and they should receive your attention to prevent excessive wear.

Motors will have to be disassembled and cleaned, and their bearings need to be replaced. Commercial motor shops "bake out" flooded motors by placing them in an oven at low heat for a period of time to remove the moisture.

Switches should be disassembled and the contact points cleaned thoroughly. If the switch cannot be disassembled, then either replace it or make sure it is thoroughly dry inside (though the abrasive silt will eventually cause premature wear). Magnetic starters should have all rust removed from exposed metal coils. Wrapped wires should be cleaned with a soft brush so not to damage the insulation and short out windings.

A wash tub or bucket of kerosene is a great receptacle for storing small items that can't be taken care of right away. It will stop the etching and corrosion, although it's pretty hard on paint. Prudent outdoor storage is advised for this flammable liquid.

Cleaning flooded equipment is a sloppy mess, and I sympathize with your plight. In times past, I have ignored some of the points of cleaning and have had a 100% failure rate with any detail I did not attend to as I should have.

[Robert Vaughan is a contributing editor to *FWW* and a woodworking machinery rehabilitation specialist in Roanoke, Va.]

Sharpening fine-toothed handsaws

I have been told by Foley, the saw-sharpening company, that equipment that can sharpen handsaws with more than 16 teeth per inch (t.p.i.) is not available. I have a Freud 8-in., 20-t.p.i. dovetail saw. The high price of a good saw makes it a poor value if it cannot be sharpened after it becomes dull. Are all saws with more than 16 t.p.i. just a throwaway tool? Can saws be sharpened that have fine teeth and a narrow set? ***—Thomas L. Burgin, Wichita, Kan.***

Mario Rodriguez replies: Saws with 20 teeth per inch (t.p.i.) can be sharpened. They don't have to be thrown away. Craftsmen sharpened their saws routinely long before Japanese saws with disposable blades arrived.

Many small-toothed saws in the 18 t.p.i. to 22 t.p.i. range have a crosscut tooth pattern but are sharpened straight across at 90° to the sawblade (like ripsaws). The teeth are too small and close together to achieve any bevel on their cutting edges.

To sharpen your saw, you'll need a 4-in., extra-slim, tapered saw file fitted with a handle (available from Garrett Wade Co., 161 Avenue of the Americas, New York, N.Y. 10013; 800-221-2942). Clamp the blade between 2 pieces of 1x2 pine, which serve as "guides" to help you keep track of sharpened teeth and control the depth of cut. Line up the edges of your guides with the base of the teeth. Using your file, lightly pass across each tooth. Each stroke should file the front or cutting edge of a tooth and the back of the adjoining tooth. Every tooth should be brought up to a bright sharp point. When you run your hand lightly over the points, you'll experience some "grab." This indicates the job is done, and your saw is sharp.

[Mario Rodriguez is a contributing editor to *FWW* and a woodworker in Warwick, N.Y.]

Plans for Southwest-style furniture

I am looking for plans or designs for furniture that's typical of that found in the Southwestern United States. Do you know of any sources? ***—Don Hale, Roscoe, Ill.***

Sven Hanson replies: Until recently, the only plans that were available were ones you made yourself by copying designs from a book. William Wroth's ***Furniture from the Hispanic Southwest*** (Ancient City Press, P.O. Box 5401 Santa Fe, N.M. 87502; 505-982-8195) is illustrated with flat front and side views, making it easy to scale—especially if you use an enlarging copier to adjust drawing dimensions to neatly fit your drawing scale.

Recently, designer/author Kingsley Hammett (2405 Maclovia Lane, Santa Fe, N.M. 87501; 505-471-4549) introduced 17 sheets of Southwestern furniture plans encompassing 26 projects. The plans, which sell for $8 each (postage paid), include beds, tables, chests and cupboards; they give specific dimensions yet allow leeway for changes to suit your own needs.

All of these plans are available as a book from Red Crane Books (826 Camino de Monte Rey, Santa Fe, N.M. 87501; 800-922-3392). In the book, Hammett includes additional history, bibliography and construction notes.

[Sven Hanson is a woodworker in Albuquerque, N.M.]

Finishing to emphasize figure

I recently obtained some tiger maple with outstanding figure. I plan to use it for making a corner cabinet. I am unfamiliar with techniques used for staining and finishing this wood. How can I best bring out the figure and finish it? I would like to achieve the gold-brown coloration that I have observed in many Early American pieces. ***—Ken Drews, Phoenix, Md.***

Chris Minick replies: The key to bringing out the figure in your tiger maple cabinet is to color the wood with a dye stain. Unlike pigmented stains, which cover up the wood, dye stains accentuate the subtle highlights and figure of any wood species.

I've had good success enhancing the figure of birds-eye maple with a multi-strip dye-stain process. The overall staining process is relatively simple. But like any new technique, you should practice on scraps until you are comfortable with the results. I use water soluble dyes for staining my projects because the colors are vibrant, and they are fade resistant. Unfortunately, the water in the dye solution tends to raise the grain of the wood. For this reason, I always wet the raw wood with water during my sanding sequence to intentionally raise the fibers. After the wood has dried, I continue with my final sanding (to 220-grit on maple). Once the grain has been raised and sanded flat, it will not raise again during subsequent staining operations.

To begin the staining sequence, I first apply a dilute solution of a black, water-soluble dye to the maple. Keep the wood wet with the dye solution for about five minutes. Then wipe off the excess. Once the stained wood has thoroughly dried (usually overnight), lightly sand the entire surface with 220-grit sandpaper. Light sand-

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ing removes the black stain from the surface of the maple boards but not from the figured areas. Now I apply an antique cherry water soluble dye stain to the piece. When the wood is dry, it is ready to topcoat with finish.

I usually finish my pieces with a waterborne acrylic lacquer like Carver Tripp Safe-N-Simple clear finish, but before topcoating, I seal the stained wood with two coats of shellac (2 lb. cut). The shellac seal-coat prevents the water in the finish from dissolving the water soluble dyes used to color the piece. Sealing the surface is particularly important if you plan to brush on the finish coats. Three coats of finish will usually be sufficient for long-term protection and everyday use.

[Chris Minick is a product development chemist and amateur woodworker in Stillwater, Minn.]

Short-cycling shop motors

I understand "short cycling" (i.e. repeatedly starting a motor that is already up to operating temperature) is asking for trouble because starting current, at five to six times full load current, can damage the motor. Also, large motors may be limited to one start per 30-minute period or once per hour.

I'm concerned about the 3-hp, 240v, single-phase motor on my 10-in. tablesaw. Is it permissible to turn the motor on and off at frequent intervals, such as when making repeated cuts that require measuring or resetting the fence after each cut?

—Bruce Philips, Columbia, S.C.

Edward Cowern rep ies: Repetitive starting of motors can be harmful, but in general, it is more damaging to large motors with high inertia loads than to smaller motors such as those that are normally used in woodworking operations.

Also, it is very unusual for a woodworking motor such as your tablesaw motor to ever get up to working temperature. The reason for this is that most woodworking operations are intermittent. There are a few seconds or minutes of heavy cutting followed by longer periods of either light running (virtually no load) or being stopped.

The repetitive starting will shorten the life somewhat, but the slight reduction would be easily offset by the convenience of reduced noise level and improved safety of not keeping it running. Overall, I would not be concerned about the repetitive starts. A good-quality motor in a woodshop will normally last longer than its owner.

[Ed Cowern is an electrical engineer in Wallingford, Conn., and president of EMS, distributors of Baldor electric motors.]

What are the best carving woods

I'm a carver who has recently relocated to the United States. I've used some cherry and basswood in England, but I wonder if there are other woods popular for working in relief?

—Jeremy Williams, Concord, Mass.

Fred Cogelow rep ies: With regard to suitable North American woods for relief carving, I suspect that a qualified authority might issue a list as long as your arm, however long that should be. Aside from the imported Honduras mahogany, my experience and knowledge are restricted to local species I've personally harvested. Of the timber I've cut and cured, the butternut, black walnut, basswood, cherry, red oak, red elm and poplar have been successfully used for reliefs. I've also tested white pine and seen superlative works executed in the same and some of its subspecies. Some years ago, *Fine Woodworking* featured some outstanding reliefs in alder, which also carves well.

My general observation would be that any wood that carves

well should work for reliefs. The basic questions for the carver ought generally deal with priorities and parameters. Consideration must be given to the intricacy of detail demanded and whether the graininess or natural color of the wood will enhance or diminish the aesthetics of the finished piece. The larger the project, the greater the concern with the hardness, stability and the difficulty or ease with which the particular wood is joined. The questions apply not only to the species considered but to the particular stock available. Those who employ large quantities of basswood generally prefer trees from the northern states where the growth is slower and the lumber slightly denser (I found samples of English lime, which I understand to be the same tree, to be preferable for finer work by virtue of a greater density). In working the more open-grained woods, the pace of growth will have a major influence as to hardness and whether the grain contributes to the final aesthetic or merely serves to obscure the sculpted lines. As a rule, I recommend the lumber from moderately fast-grown trees from harsh climates.

A cautionary note: My own works may have served to increase the popularity of butternut at a most inopportune time. The species is under severe threat from a disease commonly known as "butternut canker." This pathology is generally indicated by a rapid decline in the crown, followed or accompanied by "suckering" from the trunk and main limbs and the eventual rupturing of the bark near the base and dissemination of black fungal spores from those fissures. State and national foresters are looking for individual trees that indicate a natural resistance to the canker, so *FWW* readers who might come across a healthy butternut in the midst of a blighted stand anywhere in its prime natural growing area (generally the upper Mississippi Valley) should notify their local forester. The hope is to graft small branches from such trees to black walnut tree roots to propagate a resistant species. A single tree could mean the difference, and don't bet that someone else will find it. Also, butternuts in decline from other causes should be harvested during the winter to increase the probability of regeneration from the roots.

While lamenting blighted species, it is only appropriate to give some mention to American chestnut, which I believe would be right up there as far as a desirable wood for reliefs, were it not also endangered.

[Fred Cogelow is a woodcarver in Willmar, Minn.]

Here we go 'round the mulberry bush

About a year ago, I acquired some small logs of an unusual greenish wood. I air-dried the logs in my shop for nearly a year. When I milled them up, to my great delight, I discovered that the heartwood is a wonderful greenish-golden color, ranging from lemon yellow (in some of the smallest logs) to olive to gold. (The sapwood, of which there is very little, is a creamy white). When planed, the texture of this wood, especially when quartersawn, is beautiful, shiny and has a depth somewhat like mahogany. It works well in all respects. I hadn't a clue as to what kind of wood it was until recently when I found out that it is mulberry. What do you know about this wood? I have never heard of it being used for woodworking before. ***—D.M. Ball, Fairfield, Ia.***

Jon Arno replies: Your question brings both a smile and a fond memory. Although it was many years ago, my first experience with mulberry was much like yours. A friend gave me a small, freshly cut log, and after ignoring it for a while, I decided to mill it into boards on the tablesaw just to get it out of the way. I was stunned by the beauty of the wood. Its light chartreuse heartwood

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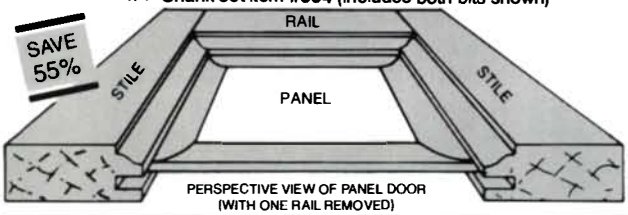

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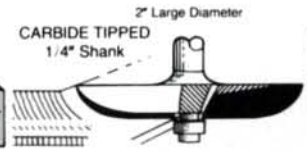

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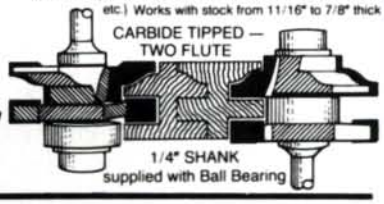

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#903		1/4" Spiral Cutter		1/4"	3/4"	1/2" *	$12.00
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#206		3/8" Cove	3/8" R	1 1/4"	9/16"	1/4"	$13.00
#207		1/2" Cove	1/2" R	1 1/2"	5/8"	1/4"	$14.00
#643		1/2" Cove	1/2" R	1 1/2"	5/8"	1/2"	$15.00
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#214		1/4" Straight	plunge cutting	1/4"	3/4"	1/4"	$ 6.50
#216		3/8" Straight	plunge cutting	3/8"	1"	1/4"	$ 6.50
#474		1/2" Straight	plunge cutting	1/2"	1"	1/4"	$ 7.00
#219		3/4" Straight	plunge cutting	3/4"	1"	1/4"	$ 9.50
#779		3/4" Straight	plunge cutting	3/4"	1 1/2"	1/2"	$10.00
#462		1/2" Bull Nose	1/2" Dia. of Circle		3/4"	1/4"	$16.00
#464		3/4" Bull Nose	3/4" Dia. of Circle		1"	1/4"	$21.00
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#545		Tongue & Groove	Straight	1 5/8"	1"	1/4"	$29.00
#845		Tongue & Groove	Straight	1 5/8"	1"	1/2"	$29.00
#546		Tongue & Groove	Wedge	1 3/16"	1"	1/4"	$29.00
#846		Tongue & Groove	Wedge	1 5/8"	1"	1/2"	$29.00
#450		1/8" Beading	1/8" R	3/4"	3/8"	1/4"	$11.00
#233		1/4" Beading	1/4" R	1"	1/2"	1/4"	$13.00
#454		3/8" Beading	3/8" R	1 1/4"	5/8"	1/4"	$15.50
#455		1/2" Beading	1/2" R	1 1/2"	3/4"	1/4"	$17.00
#500		3/8" Flush	Trimming	3/8"	1/2"	1/4"	$ 7.00
#501		3/8" Flush	Trimming	3/8"	1"	1/4"	$ 7.50
#503		1/2" Flush	Trimming	1/2"	1"	1/4"	$ 8.50
#221		1/2" Flush	Trimming	1/2"	1 3/16"	1/2"	$ 8.00
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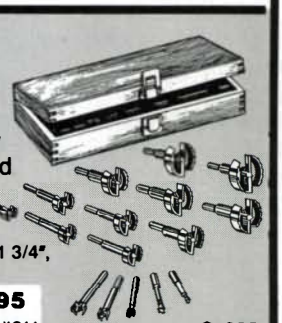

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was streaked with amber ribbons and surrounded by stark white sapwood. Because the first pass through the saw bisected the log almost directly down the center, the wood's rays were exposed as narrow, broken bands running across the grain, and they were as lustrous as mother-of-pearl. Although I have opened up a good many logs since then, some of them exotic and expensive woods, none of them has surprised me in quite the same way.

However, to suggest that mulberry is a secret that only you and I share would be grossly misleading. Actually, it is a fairly popular species among bowl turners who forage and season their own turning blocks. Even though it is a ring-porous wood, mulberry turns very well. And some interesting visual effects can be achieved by orienting the turning block on the lathe to capitalize on the contrast between heartwood and sapwood in the finished bowl. With a specific gravity of 0.59, it is a tough, elastic wood, and every bit as hard to work with hand tools as white oak or sugar maple.

Technically, there are two species of mulberry native to the United States: Red mulberry, *Morus rubra,* and Texas mulberry, *Morus microphylla.* But with the exception that the Texas variety seldom grows more than 20 ft. tall, the two species are quite similar. Red mulberry is far more plentiful and can be found from southern New England, south to Florida and westward into the Great Plains. Little more would have to be said about the taxonomy of mulberry were it not for the fact that several foreign species have been introduced. White mulberry, *M. alba,* the leaves of which are the favorite food of silk worms, was introduced from the Orient during the 17th century. The silk industry never became established here, but the white mulberry is now naturalized in the mid-Atlantic and Southern states. Black mulberry, *M. nigra,* an Old World species with exceptionally large and tasty fruit, has also been widely planted throughout North America. And the paper mulberry, *Broussonetia papyrifera,* is also a popular landscape cultivar especially along the Eastern seaboard.

These immigrant species are all substantially smaller trees with little potential as a source of lumber. But red mulberry can reach 70 ft. in height and up to about 3 ft. in diameter. Knowing this, and knowing how attractive the wood is, begs the question: Why hasn't at least red mulberry become an important commercial timber? I suspect the reason is two-fold. First, this species seldom survives to maturity in that it is not shade tolerant when crowded by other forest trees. Even in urban locations where it does seem to thrive, such as along fence rows, it tends to get cut out when it gets large enough to damage the fence or drop its messy fruit all over the yard. And second, in all my travels, I've never seen a mulberry tree with a straight trunk. With such a crooked growth habit, wide, long boards of this species are rare indeed. As stunningly attractive a wood as mulberry is, it seems destined to remain the exclusive reward of those woodworkers who are willing to go out and forage for it.

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

Dust-collection details

I just read with extreme interest your articles on a cyclone separator and tube filters as a means to improve shop dust collection (see Fine Woodworking *#100, pp. 76-81). I am in the process of setting up a new shop, and I was about to buy a regular dust collector. I had thought a 2-horsepower unit for my home shop would probably be fine. Now, after reading your articles and because my nose tends to rule my life, I am sold on the idea of cyclonic precipitators.*

However, I have a few questions that were not addressed in

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the articles. What is the path of the air flow through the system, and what is the bottom line on putting one of these systems together? Does the approximate cost of the system described by Neil Seely include about $100 for plywood, $200 for the fabrication of a cyclonic precipitator and the cost of an off-the-shelf dust collector, which is then cannibalized for its blower motor? Would it be cheaper to buy a blower and motor separately? Finally, I would like to know about the dangers of explosion that might exist due to cellulose and dust collection.

—Gary Gilbert, Somerville, Mass.

Peter Fedrigon replies: The first step in setting up a dust-collection system for your new shop is to determine the amount of air required by each machine to take care of the wood dust generated. In your small woodshop, it is most likely that you will be running only one machine at a time. Therefore, you should determine the size of your dust-collection system according to the air requirements of your largest machine. This is usually the planer, which can require up to a 900-cubic-feet-per-minute (CFM) blower capacity. In your situation, the 2-hp/1,000 CFM system would probably be best.

For a 2-hp unit, with air usage between 800 and 1,200 CFM, the pipe should be sized to maintain a conveying velocity between 3,500 to 4,500 feet per minute.

The dust/air mixture travels through the system in the following manner: It is first collected at the machine and then conveyed to the cyclone where all but the finest particles are separated from the air. The fine dust/air mix then moves through the fan and on to the filter bags.

The heart of the dust system will run (all costs are approximate) $200 for a cyclone, $350 for a 2-hp dust collector (includes motor and blower) and about $150 for a set of tube filters. Finally, there's the cost of the duct work, collection hoods and plywood you'll need to put the new, improved system together.

The complete system does not have to be set up all in one place. The cyclone and fan could be put outside the shop and the bag filters inside. This would move the noise of the system outside yet return heated or cooled air to the shop. However, adding the cyclone and extra filters will reduce the noise level of the system.

Explosions are unlikely in either the cyclone or the tube filters if these components are sized appropriately for the system. Separation of dust and air in a cyclone occurs rapidly, and the air-to-dust ratio is not high enough to allow for an explosion or fire. Because of the high pre-separation in the cyclone, little dust gets to the tubes filters, and even if there were enough dust, the filters cannot contain an explosion. Static sparks are generally not a factor because the blower motor is statically grounded. The cyclone would also be grounded if it's connected to the blower by metal ducting. Any plastic ducting should be grounded by running a bare copper wire inside the duct.

Blowers with aluminum fan wheels are recommended for woodshops because aluminum is a non-ferrous material, which cannot transmit sparks. Nevertheless, a fire could occur if the wood-dust material is not removed and a high concentration of dust builds up in the bags. Then a static spark from improperly grounded plastic pipe or some other source could ignite the dust. [Peter Fedrigon is a consulting engineer for industrial air filtration systems and owner of Oneida Air Systems in Cleveland, N.Y.]

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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IRON MAN We invented the "Ironman" high-capacity battery, which provides 25%-65% more work and up to 15% more torque than our previous battery without increasing the size or weight. The "Ironman" has one of our highest capacities on the market today, so you get more work out of every charge.

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The 12-volt Panasonic EY6207EQK featured here has a maximum torque of 200 in. lbs. That means it can handle auger bits, hole saws and put big holes in big wood. In other words, heavy-duty work. And most Panasonic Cordless Drills you choose deliver maximum torque at all speeds, so you get accommodate even the smallest bits.

EXCELLENCE IN DESIGN– INTRODUCING PREDATOR

PREDATOR The Panasonic thirst for innovation can now be found in an exciting new series of cordless drill and drivers: the Predator Series. These remarkable compact tools are 25-36% smaller

With a maximum torque of 200 in. lbs., the 12-volt Panasonic EY6207EQK even handles heavy-duty jobs.

(based on cubic dimensions), yet most deliver *more* power than their full-size predecessors. The Predator also weighs less by 7-14%, thereby reducing arm fatigue. In fact, a Predator 12-volt

'ER TOOL

drill weighs less than most traditional 9.6 volt drills. The Predator lets you get into the tight spots without sacrificing power.

All this, combined with a 17-40% smaller battery pack (based on cubic dimensions) and 22-stage clutch, make for an awesome combination of power and precision.

Predator Compact Power Tools are 25% smaller than their full size predecessors.

Nonman high capacity attery provides up to 5% more work and 5% more torque than ur previous battery.

***30-DAY QUALITY SATISFACTION GUARANTEE:**

If you are dissatisfied with any Panasonic Cordless Power Tool for any reason, simply return it to the place of purchase with a dated proof of purchase, in the original packaging, with all accessories, parts and instructions, within 30 days of the date of purchase, for a full refund, or call Panasonic at 201-392-6655. Abuse or misapplication of any power tool voids the guarantee.

THE BOTTOM LINE

Quality, innovation, research and experience—it all adds up to make Panasonic Cordless Power Tools tops in their field.

Seldom has a "you get what you pay for" argument been more convincingly made. And don't forget, should you not find your Panasonic Cordless Tool to be everything we say it is, we'll eat it. Total quality guaranteed. Period.

After all, you don't take risks using a tool, why take risks buying one?

For the dealer nearest you, call: 201-392-6655 (9a.m. to 5p.m., E.T.).

Panasonic
CORDLESS POWER TOOLS
POWER TO SHAPE THE FUTURE

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READER SERVICE NO. 72

READER SERVICE NO. 3

READER SERVICE NO. 57

READER SERVICE NO. 127

WHOLE EARTH ACCESS

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Construction Master III

This next generation building calculator includes new functions for stairs and rafters, making it ideal for building professionals. It works in any dimensional format (including metric) and converts to and from all formats. The stair function automatically determines the number of risers and treads, the heights and widths for any floor to floor drop. CMIII also offers: one button solutions for circle area and circumference; custom function for board feet and material estimation; and it works as a regular math calculator.

#3085

$74.95

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1993 Holiday Woodworking & Construction Catalog

48 pages of high quality tools for jobsite, home, fine woodworking, or shop use. The best selection and the best prices available. Please send $1.00 for postage and handling.

DEWALT

12" Compound Miter Saw

Loaded with features, this new industrial compound miter saw has the cutting capacity of a 15" miter saw and the portability of a 10" saw. The exclusive sliding fence allows you to make 45° bevel cuts up to 7-7/8" wide; will miter cut crown mouldings up to 6-5/8" wide and 5-1/4" high in a single cut; and will make compound cuts up to 45° x 45°. Weighs 38 lbs. #DW705

$358.

12 V Keyless 3/8" Dual Range VSR Drill/Driver Kit w/2 Batteries

Deluxe features include: 11-position Versa-Clutch, pressure activated clutch, ClutchLock, which allows changing from screwdriving to drilling without changing clutch setting. Fan cooled, 140 watt high torque motor.

#DW945DK-2

List $310.

Sale **$175.**

Makita WHILE SUPPLIES LAST!

CORDLESS DRILL KITS WITH FREE EXTRA BATTERY PACK

VSR Cordless Driver/Drill With Keyless Chuck

Our most popular 9.6 volt cordless drill. While supplies last, a free extra battery is included in this kit. #6095DWE

$149.

High Torque Cordless Drill With Improved Keyless Chuck

Improved motor construction gives this 9.6 volt drill 174 in./lbs. of torque while the new keyless chuck features positive lock which helps eliminate loosening or over tightening of bits. While supplies last, a second battery is included free of charge. #6201DWE, List ~~$298.~~

Sale **$169.**

Free Freight On All Portable Tools *in Contiguous USA*

RYOBI

Oscillating Spindle Sander

Perfect for all finish sanding operations when intricate contour sanding and a quality finish are essential.

#OSS450

Introductory Special $189.

RYOBI

NEW! 8-1/4" Benchtop Radial Arm Saw

Patented Control Cut™ variable speed power feed eliminates uncontrolled saw head advance.

#RA202

Sale **$419.**

Milwaukee

10" Miter Saw

This new workhorse of a miter saw is built for professional accuracy and ease of use. With a powerful 15 amp motor, a super smooth rotating table, large capacity, and light weight (32 lbs.) this miter saw is perfect for jobsite use.

#6490

$269.

PORTER-CABLE

NEW Quicksand Random Orbit Finishing Sanders

These new sanders put random orbit efficiency in the palm of your hand and will set new performance standards for finish sanders. Available either with standard pad which uses PSA paper, or in a dustless version which uses hook & loop paper.

#332 Random Orbit Sander **$68.**

#333 Dustless Random Orbit Sander **$78.**

Record

Coronet 5 Speed Wood-turning Lathe

Heavy duty and bulit to last. Rotating head stock allows faceplate turning up to 30" (with optional bowl attached) 48" between centers, 12" diameter over bed.

#CL3/48

*FOB

$949.

FREE 6 Pc. HSS Turning Set w/purchase of CL3

MARPLES

Blue Chip Bevel Edge Chisel Set

This six piece set features hard wearing polypropelene handles, quality Sheffield steel blades, and a wooden stroage box. Includes: 1/4", 3/8", 1/2"", 5/8", 3/4"" & 1" sizes.

#444SB6

$44.

Record

Professional Woodworking Vises

Three sizes available, all with a quick release mechanism that allows the front jaw to slide quickly and easily to and from the workpiece.

#52ED 7" (with retractable dog) **$89.**

#52-1/2ED 9" (with retractable dog) **$109.**

#53E 10-1/2" (without dog) **$125.**

FREE 16" Speed Clamp Included With Every Vise Purchase! (Offer expires 1-31-94)

Folding Roller Stand

Features a 2" diameter x 11" wide steel roller with sealed-for-life bearings. 20" - 40" adjustable height, non-slip rubber feet, and legs that pivot and collapse. Stable, rigid and a must for every shop.

#RPR400S

Sale **$37.95**

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FREE FREIGHT ON ALL PORTABLE TOOLS IN CONTIGUOUS USA

Elu WOODWORKING TOOLS BY BLACK & DECKER

1/4 Sheet Dustless Palm Grip Sander

High speed (14500OPM) and small orbit (1/16"), plus a durable, low vibration design adds up to long hours of production sanding that is fast and smooth. #2714, List ~~$94~~.

Sale $59.

PORTER-CABLE

Variable Speed Dustless Belt Sander

Now you can have the power and performance of the model #352 with the added benefits of variable of variable speed. Variable speed offers increased sanding flexibility and better sanding results on all materials.
352VS, List $280

Sale $175.

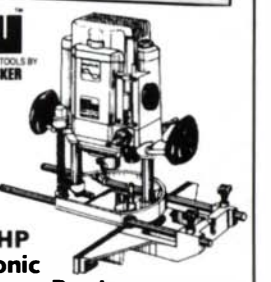
AEG

6" Electronic Variable Speed R/O Sander

The motor's integrated turbine vacuums dust through the pad and straight into the dust bag. Powered by a 400 watt motor with 8000-11000 opm, this tool will handle all of your sanding and polishing needs.
#TXE150 List $208

Sale $159.

Elu WOODWORKING TOOLS BY BLACK & DECKER



2-1/4 HP Electronic VS Plunge Router

One of the finest routers available. Features: full-wave electronic speed control which is infinitely variable from 8000 to 20000 RPM and is maintained constantly under load by electronic feedback circuitry; soft start; rack and pinion depth adjustor, micro-adjustor and easy to read magnified scale; 12 amp] motor. #3338, List ~~$475~~.

Sale $255.

Elu BLACK & DECKER

Biscuit Joiner

This new biscuit joiner from Elu combines ergonomics with performance. Lightweight and powerful, it is designed for versatility with a standard tilting fence and rack and pinion adjustments. Comes with carbide blade, dust bag, and steel carrying case. #3379K

Sale $229.

24" Omnijig Dovetail Machine

Designed for rapid production routing-out of half-blind and other dovetail joints for furniture and woodworking applications. The unit accepts stock up to 24" wide and from 1/2" to 1" thick. #7116

Sale $299.

New from the makers of ZIP RIP: Zip Rip Perfomer

In addition to the Zip Rip Fence System, the performer also includes an industrial quality table saw stand with an adjsutable outfeed roller support assembly which can be set up with or without the stand. This entire system can be quickly assembled or disassembled. Please specify table saw model to be fitted. (Makita 2708, Ryobi 8T2500, or Delta 34-330)

$259.

BOSCH

3050VSRK	3/8" Cordless Driver/Drill, 2 bat.	$139.
3051VSRK	Cordless Driver/Drill w/keyless chuck	$145.
1003VSR	3/8" VSR Drill, 0-1100 RPM	$85.
1021VSR	3/8" H.D. VSR Drill, 0-1100 RPM	$105.
1194VSR	1/2" VSR Hammer Drill	$159.
1347AK	4-1/2" Mini Grinder Kit 5/8" -#11 spindle	$108.
1348AE	5" EFC Mini Grinder, 5/8" -#11 spindle	$118.
11212VSR	3/4" VSR SDS Bulldog Rotary Hammer	$198.
11214VS	1-3/4" EFC VS Rotary Hammer	$629.
1121SDVSR	3/4" Dustless Bulldog VSR SDS Hammer	$299.
11304	Brute Breaker Hammer	$1229.
11305	Demolition Hammer	$689.
3258	3-1/4" Planer	$137.
1942	Heavy Duty Heat Gun	$78.
1604A	1-3/4 HP Router	$139.
1604K	1-3/4 HP Router Kit	$165.
1606	1-3/4 HP D-Handle Router	$158.
1608LX	Laminate Trimmer w/Deluxe Guide	$109.
1608T	Tilt Base Laminate Trimmer	$105.
1609	Offset Base Laminate Trimmer	$125.
1609K	Installers Trimmer Kit	$179.
1609KX	Deluxe Installers Trimmer Kit	$229.
1615EVS	NEW! 3-1/4 HP EFC VS Plunge Router	$265.
1272D	3"x24" Dustless Belt Sander	$189.
1273D	4"x24" Dustless Belt Sander	$198.
1273DVS	4"x24" VS Dustless Belt Sander	$193.
1370DEVSK	6" VS Random Orbit Sander w/Access.	$299.
3270D	3"x21" Dustless Belt Sander	$148.
3283DVS	5" Dustless Random Orbit Sander	$105.
1581DVS	VS, Var. Orbit Jigsaw, Dustless	$179.
1581VS	VS, Var.Orbit Jigsaw. D-Handle	$145.
1582VS	VS, Var.Orbit Jigsaw w/CLIC	$145.
1632VSK	VS Panther Recip. Saw Kit	$145.
1655	7-1/4" Circular Saw	$118.
1420VSR	VSR Drywall Driver, 0-4000 RPM	$88.

DELTA

34-761	10", 1-1/2 HP Unisaw	*$1300.
34-763	10", 3 HP Unisaw, 1 PH	*$1590.
34-764	10", 5 HP Unisaw, 3 PH	*$1590.
34-781	10", 1-1/2 HP Unisaw/Unifence	*$1539.
34-782	10", 3 HP Unisaw/Unifence, 1 PH	*$1779.
34-783	10", 5 HP Unisaw/Unifence, 3 PH	*$1779.
31-730A	6" Belt/12" Disc w/Electricals	*$1069.
37-350A	8" Long Bed Jointer w/Electricals	*$1399.
43-375	3 HP HD Two-Speed Shaper	*$1685.
28-283	14" Bandsaw w/Encl. Stand, 3/4 HP	*$709.
34-445	10" Contractor's Saw w/Unifence	*$759.
37-154	6" Long Bed Jointer w/Electricals	*$1059.
11-090	32" Radial Bench Drill Press	*$285.
11-950	8" Bench Drill Press	*$145.
11-990	12" Bench Drill Press	*$209.
14-600	Hollow Chisel Mortiser	*$469.
17-900	16-1/2" Drill Press	*$339.
22-540	12" Portable Planer	$409.
22-661	13" DC-33 Planer	*$1109.
23-700	Wet/Dry Grinder	$170.
28-245	14" Bandsaw w/stand, 1/2 HP Motor	*$529.
31-460	4" Belt/6" Disc Finishing Machine	$145.
32-100	Plate Joiner	$265.
33-055	Deluxe Sawbuck w/Legs	$589.
33-990	10" Radial Arm Saw	*$585.
34-444	10" Contractors Saw, 1-1/2 HP	$615.
36-220	10" Compound Miter Saw	$238.
36-755	10", 2 HP Tilting Arbor Saw	*$909.
40-560	16", 2-spd Scroll Saw	$195.
40-640	20" Bench Scroll Saw	$325.
43-355	1-1/2 HP, 3/4" Shaper	*$675.
43-505	1/2" Bench Router/Shaper	$279.
46-700	12" VS Wood Lathe	$419.
50-179	Dust Collector	*$329.
31-280	Sanding Center Belt/Disc Sander	$749.
14-070	14" Floor Drill Press	*$279.
33-060	Sidekick Frame & Trim Saw	$399.
37-070	6" VS Jointer	$259.
28-180	8" Bench Bandsaw	$169.
37-280	6" Jointer	$349.
23-700	6" Bench Grinder	$69.

Call For Quotes On Machines Not Listed

Milwaukee

6546-1	Cordless Screwdriver, 2-spd	82.
0222-1	3/8" VSR Drill, 0-1000 RPM	108.
0224-1	3/8" Magnum Holeshooter, 0-1200 RPM	114.
0230-1	3/8" Pistol Drill, 0-1700 RPM	112.
0234-1	1/2" Magnum Holeshooter, 0-850 RPM	119.
0239-1	VSR Keyless Chuck Drill	125.
0379-1	1/2" Close Quarter Drill	145.
0567-1	Drain Cleaner Kit	235.
1676-1	Hole Hawg Kit	247.
3002-1	Electrician's Rt. Angle Drill Kit	197.
3102-1	Plumbers Rt. Angle Drill Kit	197.
3107-1	VS Right Angle Drill Kit	199.
5192	Die Grinder, 4.5 Amp	175.
6140	4-1/2" Angle Grinder	99.
6141	5" Angle Grinder	109.
5362-1	1" TSCR Hawk Rotary Hammer	319.
8975	Heat Gun	59.
5680	2 HP Router	219.
5936	4"x24" Dustless Belt Sander	228.
6010	1/2 Sheet Finishing Sander	119.
6016	1/4 Sheet Finishing Sander	52.
6126	6" Random Orbit Sander	125.
6215	16" Electric Chainsaw	172.
6365	7-1/4" Circular Saw	120.
6377	7-1/4" Wormdrive Saw	175.
6460	10-1/4" Circular Saw	259.
6507	VS Sawzall w/Quik-Lok	132.
6511	2-spd Sawzall	129.
6527	VS Super Sawzall w/Quik-Lok	164.
6750-1	VSR Drywall Driver	93.
6754-1	VSR Magnum Drywall	114.
8911	9 Gal. Wet/Dry Vac, H.D. Steel	329.

SKIL

2735-04	3/8" VSR 12v Cordless Drill Kit, w/2 Bat.	$135.
2736-04	3/8" VSR 12v Cordless Drill Kit, w/2 Bat., Keyless Chuck	$137.
6520	3/8" VSR Drill, 3.5 amp	$44.
6635	3/8" VSR Drill, 5.0 amp	$99.
6650	1/2" VSR Drill, 5.0 amp	$109.
9611	4-1/2" Disc Grinder	$65.
5510	5-1/2" Trim Saw	$114.
5660	8-1/4" 60° Circular Saw	$145.
5825	6-1/2" Wormdrive Saw	$159.
77	7-1/4" Wormdrive Saw	$145.
5860	8-1/4" 60°Wormdrive Saw	$169.
3810	10" Miter Saw	$225.

freud

LM72M008	8"x24T Rip	$38.
LM72M010	10"x24T Rip	$39.
LU73M010	10"x60T AT8	$42.
LU81M010	10"x40TTCG	$39.
LU84M008	8"x40T Combination	$44.
LU84M011	10"x50T Combination	$40.
LU85M008	8"x64T ATB Fine Cut Off	$49.
LU85M010	10"x80T ATB Fine Cut Off	$59.
LU85M014	14"x108T ATB Fine Cut Off	$105.
LU85M015	15"x108T ATB Fine Cut Off	$105.
LU87M008	8"x22T Thin Kerf	$43.
LU87M010	10"x24T Thin Kerf	$44.
LU88M008	8"x48T Thin Kerf	$47.
LU88M010	10"x60T Thin Kerf	$45.
LU91M008	8-1/2"x48T Miter Saw Blade	$42.
LU91M010	10"x60T Miter Saw Blade	$59.
LU98M010	10"x80T TCG	$68.
TK103	7-1/4"x16T Decking Blade	$17.
TK203	7-1/4"x24T Framing Blade	$18.
TK204	8-1/4" x24T Framing Blade	$23.
TK303	7-1/4"x40T Finish Blade	$23.
TK304	8-1/4"x40T Finish Blade	$24.
TK406	10"x60T Cut Off Blade	$35.
TK906	10"x50T Combination Blade	$32.
SD308	8" Dado Set	$117.

DEWALT

DW945K-2	12v Cordl.,Keyless, 2 batteries	$175.
DW100	3/8" VSR Drill, 4 AMP	$68.
DW106	3/8" VSR Drill, Keyless	$75.
DW124K	1/2" Right Angle Drill, 8 AMP	$299.
DW270W	Drywall Screwdriver w/50' Cord	$127.
DW280K	Screwdriver Kit	$117.
DW290	1/2" Impact Wrench	$175.
DW705	12" Compound Miter Saw	$358.
DW306K	VS Recip, Saw Kit 8 AMP	$159.
DW318K	VS,VO Jigsaw Kit	$148.
DW402	4-1/2" Minigrinder, 6 AMP	$94.

AEG

H85E75S	3"x21" VS Belt Sander	$179.
VSRE500K	5" VS Random Orbit Sander Kit	$149.
VSRE600K	6" VS Random Orbit Sander Kit	$155.
85PE100K	VS, Var.Orbit Jigsaw Kit	$159.
OFS50	1 HP Plunge Router	$139.
SKS300	Compound Miter Saw	$539.
PH38	1-1/2" Rotary Hammer	$399.
SSPE800	VS,VO Reciprocating Saw	$159.

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SKIL

77	7 1/4" WORM DRIVE CIRCULAR SAW	$145
1605-02	BISC JOINER W/CS & GLUE SYSTEM	125
1875	2 1/4 HP EVS PLUNGE RTR W/BIT SET	174
2736-04	12V VSR KYLS W/15 PC BIT SET	135
2976-02	3 3/8" CRDLS TIL CTTR, 12V W/H20 BTL	159
2977-02	3 3/8" CRDLS CIRC SAW KIT, 12V	144
3330	16" SCROLL SAW W/FREE SUPRTWIST	135
3370	4" BLT 6" DISC SNDR W/SUPRTWIST	135
3380	8" DRILL PRESS	135
3400	10" TABLE SAW W/FREE CARB BLADE	179
5657	7 1/4" CIRC SAW W/6 FREE CARB BLDS	112
7484	5" RANDOM ORBIT SANDER 10,000 RPM	99
5860	8 1/4" WORM DRIVE SAW	172
9410	4 1/2" DISC GRINDER	59
3810	10" MITER SAW W/FREE CARB BLADE	204

Milwaukee

0228-1	3/8" DRILL, VSR, 3.5 AMP, 0-1000 RPM	102
0234-1	1/2" 0-850 RPM MAGNUM DRILL	119
0375-1	3/8" 0-1300 RPM CLOSE QUARTER DRILL	127
0406-1	9.6V KYLS CDLS DRILL KIT W/2BAT, CS	169
0407-1	SAME AS ABOVE BUT 12 VOLT	174
5371-1	1/2" MAGNUM HAMMER DRILL KIT W/CS	185
5397-1	3/8" PISTOL HAMMER DRILL KIT	140
5680	2 HP ROUTER, 12 AMPS, 26,000 RPM	199
6008	1/3 SHEET FINISHING SANDER	119
6010	1/2 SHEET FINISHING SANDER	119
6016	1/4 SHEET FINISHING SANDER	54
6017	1/4 SHEET DUSTLESS FINISHING SANDER	55
6125	5" RANDOM ORBIT SANDER	112
6126	6" RANDOM ORBIT SANDER	115

Milwaukee

6127	5" RANDM ORBIT SANDER DSTLS W/CASE	146
6142	4 1/2" GRINDER KIT W/CASE, 5/8"-11 SPNDL	112
6365	7 1/4" CIRCULAR SAW, 13 AMP	120
6368	7 1/4" CIRC SAW W/CASE & CT BLADE	137
6369	7 1/4" CIRC SAW W/BRAKE & CT BLADE	145
6490	*NEW* 10" MITER SAW	249
6507	VAR SPEED SAWZALL W/BLADES & CSE	143
6508	SAME AS 6507 BUT W/PERMANENT CRD	143
6511	2 SPEED SAWZALL W/BLADES & CASE	137
6527	SUPER SAWZALL W/BLADES & CASE	168
6528	SAME AS 6527 BUT W/PERMANENT CRD	169
6540-1	CRLDS SCREWDRIVER KIT	91
6543-1	SCREWDRIVER 0-1000 RPM, REV	131
6767-1	SCREWDRIVER KIT 5 AMP W/CASE	129

BOSCH

ALL BOSCH ROUTER BITS ARE 40% OFF OF LIST PRICES!

1001VSR	3/8" 1100 RPM DRILL	79
1021VSR	3/8" 1100 RPM DRILL HEAVY DUTY	99
1023VSR	1/2" 550 RPM HVY DUTY DRILL	109
1024VSR	3/8" MIGHTY MIDGET 1050 RPM DRILL	108
1025VSR	1/2" MIGHTY MIDGET 600 RPM DRILL	117
1194VSR	1/2" VSR, 2 STAGE HAMMER DRILL	140
1194VSRK	SAME AS ABOVE W/METAL CASE	159
1195VSR	3/8" VAR SPD REV HAMMER DRILL	124
1272	3" X 24" BELT SANDER	175
1272D	3" X 24" DUSTLESS BELT SANDER	183
1273	4" X 24" BELT SANDER	182
1273D	4" X 24" DUSTLESS BELT SANDER	195
1273DVS	4" X 24" VS DUSTLSS BELT SANDER	199
1347AK	4 1/2" MINI GRINDER W/CASE	99
1370DEVSK	6" VS DSTLS RNDM ORB SNDR KIT	259
1420VSR	DRYWALL DRIVER, 4.8 A, 0-4000 RPM	84
1581VS	TOP HANDLE JIG SAW, VS	144
1581DVS	SAME AS ABOVE BUT DUSTLESS	167
1582VSC	CLIC BARREL HANDLE JIG SAW, VS	144
1582DVS	SAME AS ABOVE BUT DUSTLESS	167
1600	2 1/4 HP "D" HANDLE ROUTER	258
1601	1 HP ROUTER	104
1602	1 1/2 HP HANDLE ROUTER	134
1604	1 3/4 HP ROUTER	134
1606	"D" HANDLE 1 3/4 HP ROUTER	169
1608	LAMINATE TRIMMER	84
1608U	UNDERSCRIBE TRIMMER	117
1609K	INSTALLERS KIT WITH 3 BASES	173
1609KX	DELUXE INSTALLERS KIT W/4 BASES	197
1613	1 3/4 HP PLUNGE ROUTER	163
1613EVS	2 HP VAR SP PLUNGE ROUTER	183
1614	1 HP PLUNGE ROUTER	127
1614EVS	1 1/4 HP VAR SP PLUNGE ROUTER	148
1615EVS	3 1/4 HP VAR SP PLUNGE ROUTER	243
1655	*NEW! 7 1/4" CIRCULAR SAW*	109
3050VSRK	9.6V, VSR CRDLS DRILL W/2 BAT, CS	134
3256	3 1/4" PLANER	136
3282DVS	5" VS DUSTLESS RANDOM ORBIT	99
11203	1 1/2" ROTARY HAMMER W/STOP ROT	429
11304	THE BRUTE BREAKER HAMMER	1189
11305	DEMOLITION HAMMER	639

SKIL HOLIDAY GIVE AWAY SALE!

Biscuit Joiner Model 1605-02

Purchase the Skil biscuit joiner with case and receive a *FREE* gluing system and 100 new GRABBER clampless biscuits!

OUR PRICE $125.00

Top Gun 12V Cordless Driver Drill Kit w/2 Batteries & Keyless Chuck Model 2736-04

Purchase this Skil Cordless Drill Kit and receive a *FREE* 15 piece Bit Driver Set!

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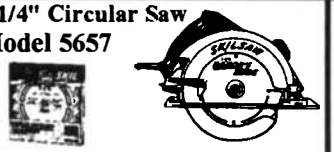

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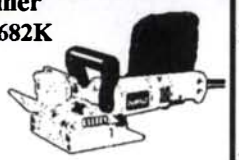

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DW280K	SCREWDRIVER KIT	117
DW290	1/2" IMPACT WRENCH	174
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DW305K	RECIP SAW, VAR SPD, 8.0 AMP	159
DW306K	RECIP SAW, VAR SP, 8.0 AMP	155
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DW431	3" X 21" DUSTLS BELT SANDR, V SP	182
DW510K	1/2" HAMMER DRILL KIT, 5.4 AMP	165
DW610	1 1/2 HP ROUTER, 9 AMP	147
DW614	1 1/4 HP PLUNGE ROUTER	143
DW615	1 1/4 HP PLUNGE ROUTER, VAR SP	158
DW624	3 HP HVY DUTY PLUNGE ROUTER	245
DW625	3 HP HVY DTY PLUNGE RTR, VAR SP	275
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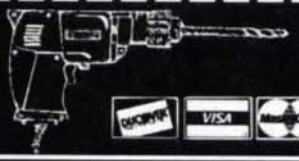

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Dining Table Has Tilt Top

Legs with sliding dovetails support pedestal for strength and maximum legroom

by Nigel Martin

***Practical and versatile,** this pedestal table, shown here in cherry with ebony stringing, can be made with a round or oval top, and the simple design will play as well in the den as the dining room.*

The straightforward, uncluttered design of this dining table lets it fit as comfortably in a kitchen as in a formal dining room, and with its tilting top, it can be stowed against a wall in a room with multiple uses. Over the years, I've made it in cherry, as shown in the photo above, as well as chestnut, ash, elm and oak, with different finishes and detailing depending on the setting and the customer.

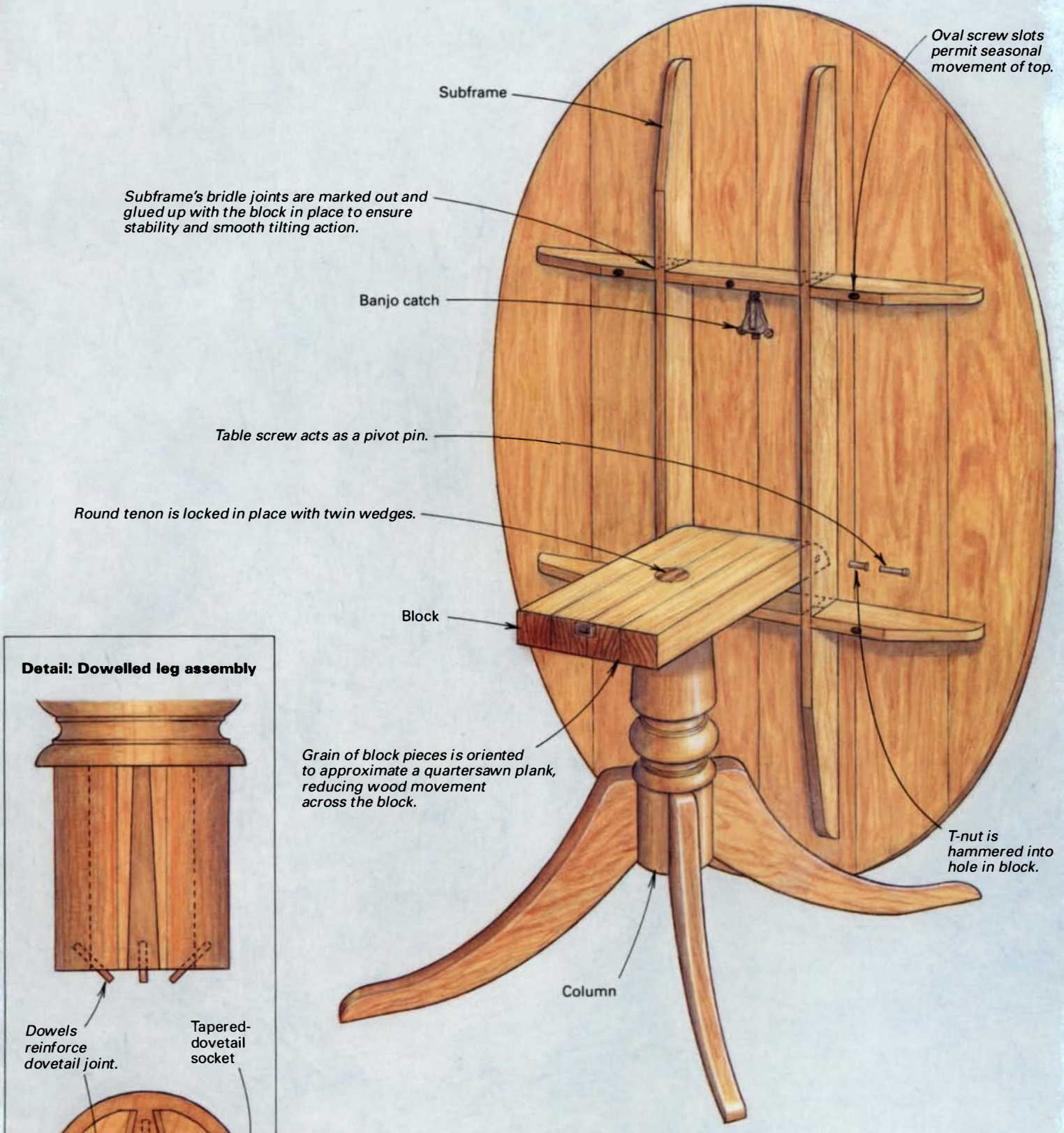
I think round and oval tables provide the most sociable seating arrangement, but they concentrate more knees in less space. That's why a pedestal base, with its yards of extra legroom, is such a good match for a rounded-top table. For reasons of balance and stress, a central pedestal base won't pair as well with large rectangular tops whose corners can become powerful levers. Even with a rounded top, the leg joints in a pedestal are subjected to enormous stresses. To resist those stresses, I join the legs and column of this table with tapered sliding dovetails, a very strong, self-locking joint, which I reinforce with toenailed dowels, as shown in figure 1 on the facing page.

Start with a drawing

I begin each table by making a full-scale, cross-section drawing on a sheet of ⅛-in. Masonite painted white to show up my lines. I draw the column, one leg, the block and a section of the top. As I build, I make notes on the Masonite and end up with all my information in one place, making for easy referral and reuse. I let the bottom edge of the Masonite be my floor line and draw in the top of the table 29 in. above that. I work downward from there, sketching in the block and the contours of the column. When I've established the bottom line of the column, I can determine the splay of the legs. For maximum stability, the tips of the legs should extend

Photo this page: Tony Freeman-Cosh

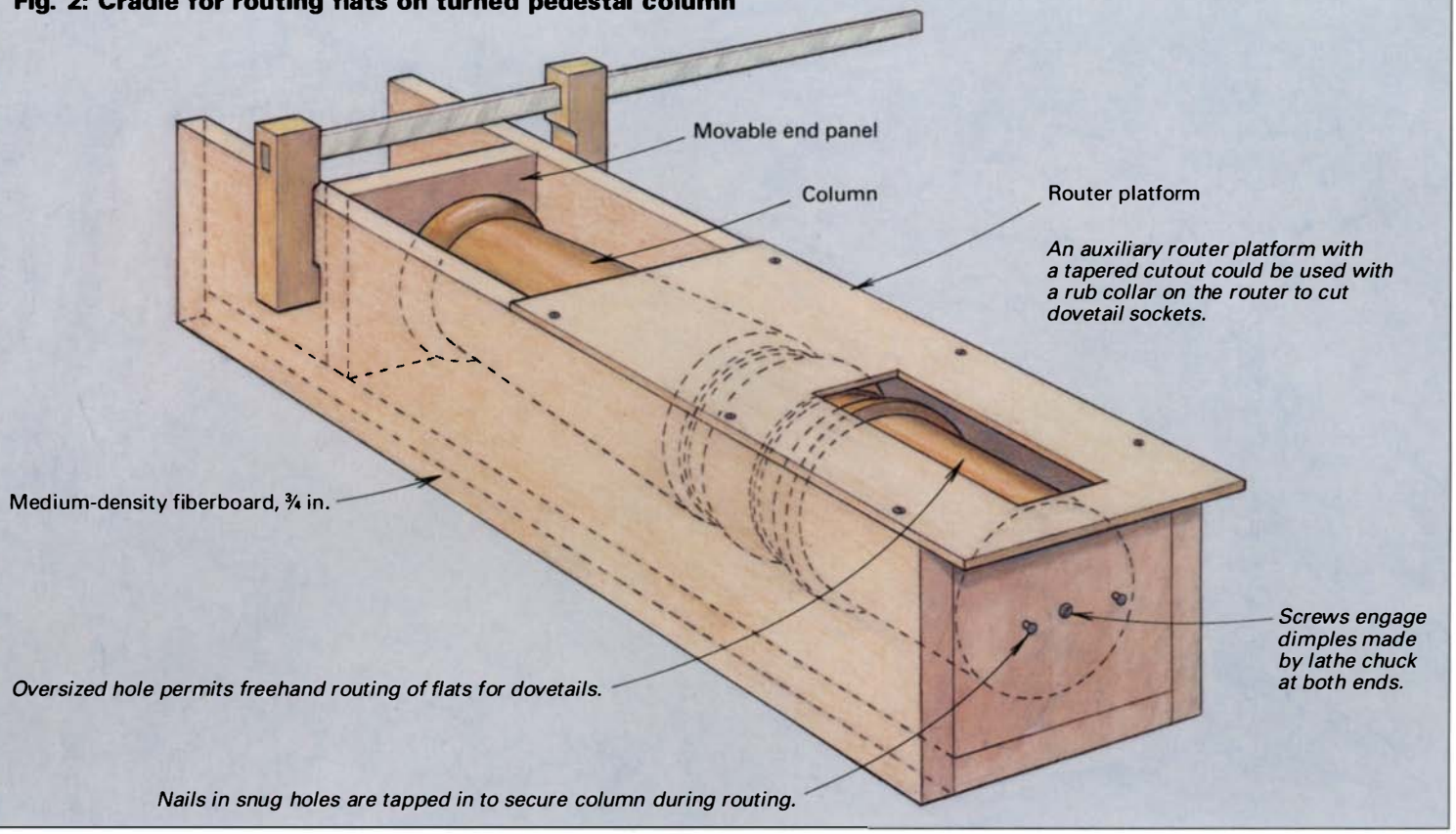
Fig. 1: Making a tilt-top pedestal table



Detail: Doweled leg assembly

Drawings: Lee Hov

Fig. 2: Cradle for routing flats on turned pedestal column



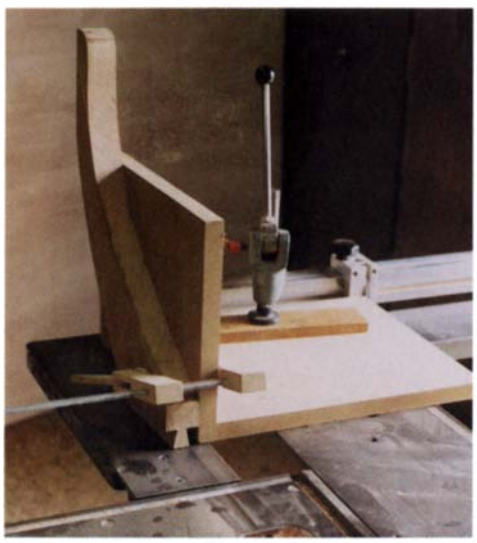
out as far as possible. I locate the tips about 2 in. inside the rim of the tabletop. For a table with a round top, this can be accomplished on the cross-section drawing, but for an oval-topped table like this one, I draw a top view to locate the tips and then transfer the measurement of the leg span to the cross section. When I have located the tip of the foot, I draw the curve of the leg back up to the column.

Doing the legwork

Once I am happy with the shape of the leg, I make a tracing of it and then a template, adding an inch for the dovetail pin. I lay out the legs on planed stock, being careful to minimize short grain, and cut them out on the bandsaw. I clean up the bottom of the foot and the butt of the dovetail pin with a plane, making sure that they're at right angles to the sides of the leg. I fair the curves with a spokeshave and finish up with a scraper and sandpaper.

Dovetail pins—I use a simple jig clamped to the sliding table of my tablesaw to cut the tapered dovetail pins on the legs, as shown in the photo at right. A similar setup would work equally well with a miter gauge or a sliding crosscut carriage instead of a sliding table. I find that an 11° blade tilt is about right for this joint, providing excellent locking without excessive flair. To produce the appropriate taper for a 6-in. pin, I set the fence of the sliding table to 4°. I clamp the leg to the upright of the jig, making sure the butt of the dovetail is flat on the saw table. When I've cut one cheek on all four legs, I swing the fence on the sliding table to 4° the other way and then repeat the process to cut the other cheek.

Now I'm ready to make the shoulder cuts. I remove the jig, return the blade to vertical and then set the rip fence ⅞ in. from the blade (with the kerf, I'm cutting 1 in.). I lay the leg on a wedge-shaped piece of wood (whose angle corresponds to the taper of the dovetail) and clamp it to my sliding table. I push the leg through the sawblade with the butt of the pin against the rip fence, making a perfect tapered dovetail, which requires no further handwork. The shoulder cut could also be made without the wedge beneath the leg; the sawblade would be set lower so it cut only to the widest point of the pin's neck and then the finish cut could be quickly made with a handsaw. With the legs shaped and the pins cut, I turn to making the column.



Low-tech tenoning. *A jig made from two scraps of fiberboard simplifies cutting the pins of the tapered sliding dovetails for the author's table.*

Preparing the pedestal

Unless I have a suitable 6-in.-sq. billet, I laminate the pedestal column from two or three pieces of stock. I cut the billet long by about 1 in. to allow for truing cuts on the lathe at each end. After turning a cylindrical blank and squaring the ends, I mark the spinning piece with pencil lines wherever changes in the profile will occur. To transfer these transition points from the drawing, I first trace the column's profile onto a piece of white poster board. Then I strike square lines out to the edge of the cardboard from each transition point on the column. Where each one of these lateral lines meets the edge of the cardboard, I make a tiny V-notch with a pocketknife to hold the tip of a pencil.

Photos except where noted: Nigel Martin

My bead and cove designs vary, but I always turn a 2-in. round tenon at the top of the column to join the block that supports the tabletop and a 6-in. cylinder at the bottom for the leg joints.

Dovetail sockets—The first step in cutting the dovetail sockets, or housings, is creating flat areas where each leg will join the column. You could cope the shoulders of the pins to match the radius of the column, but that's more difficult and, in most cases, will actually reduce the strength of the joint. I cut the flats with a router riding on an adjustable cradle jig that holds the column, as shown in figure 2 on the facing page. Once I have cut the flats, I mark out the sockets from the pins (numbering mating pins and sockets). After a cup of coffee, it's time to remove the waste from the dovetail sockets. I use my hollow chisel mortiser and the setup shown in the photo at right. You could also use a bit in a drill press or even a hand-held drill to remove most of the waste and finish up by hand.

Fitting the joints—Here's the moment of truth—the dovetail should slide right up to within ¼ in. to ½ in. of the end of the socket. If the top of the leg is within ¼ in. of the end of the socket, you are probably safe to tap it gently home. When the joint is home, there should be no gaps between the shoulder and the flat on the column. If the leg is much more than ¼ in. from the end of the socket, remove it, and rub a soft leaded pencil on all surfaces of the pin. Then reinsert it, and remove it once more. Pencil marks will be transferred to the socket, so you can identify the high spots and pare them away with a chisel.

Chopping the leg sockets—*Three tapered shims hold the column in register as a hollow-chisel mortiser cuts the cheeks of the dovetail sockets.*

Once the fit of each leg is satisfactory, I smear a little yellow glue on all surfaces of the socket and tap the pin home. It is important not to overdo it with the glue: If you use too much and glue gets carried toward the shoulder, you could get a hydraulic lock that will prevent the leg from being driven home or even split the column. Once the legs are glued in, the column can be set down on the floor. No clamps are needed. When the glue dries, I reinforce the joint with dowels driven at 45° from near the center of the bottom of the column out into the butts of the dovetail pins.

Block building

I glue up the block from 2-in.- or 3-in.-wide pieces with their grain oriented so that together they approximate a quartersawn plank (as shown in figure 1 on p. 53). The hole to mate with the round tenon on the top of the column can be drilled with an expansive-type bit in a drill press, or it can be turned outboard on the lathe. I round over the top edge at one end of the block to provide the clearance the tabletop needs to move through 90°. At this point, I fit the block on the pedestal without glue and set it aside. Then I turn to the table's subframe.

Subframe fit is key

For the stability of the table, it's essential that the block fit snugly between the two long rails of the subframe. To ensure a good fit, I do both the marking out and gluing up of the subframe's bridle joints with the block secured in position. I use table screws at one end of the block, where they function as pivot pins, and a single banjo catch at the other end, as shown in figure 1 on p. 53. If the table is to have a fixed top, I replace the banjo catch with a second pair of table screws. Hardware for both fixed and tilt-top pedestal tables is available from Garrett Wade, 161 Avenue of the Americas, New York, N.Y., 10013; (800) 221-2942.

After gluing up the subframe, I do any necessary trimming on the edges of the block until it moves smoothly within the frame, and I glue the block to the pedestal. It's critical to orient the block accurately on the column because this will determine the relationship between top and feet. To make the match, I take the just-glued (but with no tenon wedges) pedestal and block assembly and lay it on its side on the tablesaw. When the tips of two feet as well as the whole length of one edge of the block are on the table, the two parts are in alignment. Then I drive wedges into precut slots in the pedestal's round tenon.

Top it off

The top is the final component to be made. I glue it up in one hit, placing the clamps alternately above and below the top to even out clamping forces. I use urea formaldehyde glue here instead of yellow glue, which has a tendency to creep slightly and form tiny bumps along the joint lines. A few biscuits in the edges of the boards keep them in alignment. I handplane the top flat, first using a jack plane across the grain and then a really sharp smoothing plane with the grain. I try to achieve as good a finish as possible with a smoothing plane and then go straight from that to 220-grit or 320-grit sandpaper. If the wood has been kind to me, I don't sand at all. Somehow the surface of wood seems to have more clarity and character when it has been planed than when it has been sanded.

I do all the planing and any but the finest sanding before cutting out the top. It's easier to hold the top between bench dogs with the edges and ends of the boards straight, and I also avoid tearout of the finished edge when planing cross-grain. After plotting out the oval or circle, I cut to the outside of the line with a jigsaw and refine the edge with a block plane. Marking out and fairing up the curves of the top could be done just as well with a template and router, but because I have already filled my garage with templates, I prefer to do it by hand.

With the top finished, I screw the subframe to it, allowing for movement across the top's width by slotting the holes in the frame members that span it.

The finishes you could put on this table are as varied as its uses, from French polish in the formal living room to penetrating oil in the kitchen. My favorite finish is oil because it is easy to apply, protects the wood well and, over a period of time, it develops a beautiful sheen. □

Nigel Martin is a professional cabinetmaker in Norfolk, England.

***Twenty-three 12v and 13.2v drill/drivers were evaluated** for this article. The drill/drivers pictured here are (clockwise from upper left) AEG ABSE 15, Black & Decker 2661, 2665 and 2765, Bosch 3054 VSRK, DeWalt DW945, DW947 and DW948, Freud EDS 120 and EDS 132, and Hitachi DS10DVA. Black & Decker 2661, DeWalt 947 and 948, and Freud EDS 132 are 13.2v models.*

Powerful Cordless Drill/Drivers

Convenience and feel are key for these 12v and 13.2v units

by Vincent Laurence

What's a woodworker need a cordless drill for anyway with 110v outlets all around the workshop? Can't a corded ⅜-in. drill bore all the holes and drive all the screws you need? But how can you live without a cordless drill? There's that installation where you don't want to drag a ratty old extension cord across a client's 16th-century Persian rug. Then there's drywall to hang in the shop (or, more likely, in the house) without tripping over a cord. Or maybe you just need to screw together a jig, and every receptacle in the shop is occupied.

Cordless drills have come a long way since Black & Decker introduced the first in 1961. They didn't really catch on until the mid-'70s, and even then they were underpowered, the batteries didn't last that long and they took forever to charge. But they were cordless, so what could you expect? More of a novelty than a reliable standby, those drills still attracted a good bit of interest because of their promise of convenience.

Both expectations and performance soon changed. The standard voltage increased from 7.2v to 9.6v, giving the tools more power. At the same time, advances in battery and charger technology shortened the charging time enough to make them viable as real tools: A cordless drill wasn't just a toy for around the house anymore. In just a few years, cordless drills transformed job sites and cabinet shops across the country, forever altering the way we work.

Now, manufacturers have upped the ante once more by introducing 12v drill/drivers. And there are even a few 13.2v models. Where does it end? How much power do you need? And what

Photos these two pages: Susan Kahn

***Rounding out those drill/drivers evaluated are the following** (clockwise from upper left): Makita 6211D, 6311D and 6911D, Metabo 0126, Milwaukee 0401-1, Panasonic EY6205EQK, Panasonic EY6207EQK, Porter-Cable 852, 853 and 854, Ryobi TFD-220VR and Skil 2736. All three Makitas, the two Panasonics and the Hitachi (facing page) are T-handled models.*

kinds of features are important on one of these portable powerhouses? I decided to take a look at what was available and to try to make some sense of the field.

What to look for in a cordless drill/driver

In comparing these powerful drill/drivers, no single specification or characteristic was significant enough by itself to warrant a buying decision or to exclude a particular model from consideration. Rather, deciding which unit is best for you should be based on an assessment of your needs and work style. Against that, you should weigh such factors as the length of time it takes a battery to charge, whether you want a conventional keyed chuck or one of the newer keyless chucks, whether a particular tool's speed range (or ranges) and clutch type suit the kind of work you do and how well-balanced and comfortable the tool feels to you. All the information on each drill/driver is in the chart on pp. 58-59. I compiled the information both from what the manufacturers provided and from my own experience trying out each tool, drilling holes, driving screws and charging and discharging the batteries of each numerous times. I'll explain why I did what I did, what it means and why I included each of the various items in the chart.

Drilling holes and driving screws

I wanted to see what these drills were made of in a tougher-than-actual-use situation, so I decided to bore huge (1½ in.) holes in hard maple (using a spade bit) and to drive 3-in. drywall screws into the same stock without predrilling. My intention was to quantify how many of these holes each drill could bore and how deeply, as well as how many screws each could drive before the drill ran out of juice. Now, woodworkers have little occasion to use spade bits, and no one in his right mind would *not* predrill hard maple for a 3-in. screw, but I was looking for the limits of these drills' capacities.

The first drill I used drove 20 screws without flagging, snapping roughly a third of them and stripping the heads of a few more (see the photo on p. 61). Then I tried another drill with the 1½-in. spade bit; the bit just kept cutting as long as I leaned into the drill and kept my finger on the trigger, as shown in the photo on p. 60. I tried a third and a fourth drill and got similar results.

After seeing that, I drove half a dozen screws with each drill and chucked the spade bit into each of them for a run into the maple. None bogged down in the least. I concluded that any of these units is as tough as any woodworker should need a cordless tool to be. (Of course, if you need to drill a monster hole or drive a huge lag bolt into an oak beam for some reason, a corded ½-in. hammer drill is the appropriate tool.) So I shifted my attention to comparing how long a battery charge would last for each of these drills.

Charge length

A dead battery means a useless tool. If it takes longer for a battery to charge than it does for you to go through a second battery, then you're out of luck. To get a relative idea of how long these drills would last on a full charge, I charged and discharged each of them fully at least three times and averaged the times of each discharge. All units were run at their high-speed range (if they had two ranges) and on the highest torque setting, usually indicated as the drill mode. I monitored them carefully with a stopwatch and removed the spring clamps I used to keep their triggers depressed as

soon as the chucks stopped rotating so not to damage the battery.

The results were surprising. The times varied greatly, from a low of 14 minutes and 20 seconds for the Makita 6211D to a high of 57 minutes and 20 seconds for the Metabo 0126. As you might expect, units made by the same manufacturer had similar performance. For example, the times for all of the Porter-Cables were within a couple of minutes of each other, as were the times for the three 12v Black & Deckers and DeWalts. But I was surprised that the Black & Decker and DeWalt 13.2v models lasted less than half as long as their 12v kin. By comparison, Freud's 13.2v model actually lasted longer than its 12v model. I asked the Freud representative, Jim Brewer, about this, and he explained that the drive trains and motors for the two Freud units are essentially identical: Because the power source is the only difference between the two, the unit with the 13.2v battery lasts longer.

Brewer explained that the factors contributing to the widely varying battery discharge times between different units are many: Factors include the current draw and efficiency of the motor, the type of gearing and the efficiency of the gear train, how much power is lost to the electronic variable-speed circuitry and, of course, the quality of the cells used by the manufacturer for the battery pack. So while it's not often you'll need to run a drill at full speed continuously (perhaps only occasionally for buffing, flap-sanding or taking a wire wheel to a rusty old machine), the times turned in by the drills do offer some comparative information.

Charging time and battery life

Battery charging times ranged from 10 minutes or so for the Metabo to approximately an hour for the majority of the units tested. The quicker the charger restores the battery to full power, the less you need to worry about how long a charge will last and the more useful the tool. Even with the Metabo, though, I'd want to

12v and 13.2v drill/drivers compared

Manufacturer and model ▲	Battery discharge time ❑ min:sec	Battery charging time ◆	Projected battery life in charge cycles ■◆	Weight in lbs.	List price ★❍	Balance and feel ✚
AEG ABSE 15	36:00	1 hr.	approx. 300	3.8	$403, $90	Below average. Handle doesn't fit hand well.
Black & Decker 2661▼	18:45	1 hr.	2,000	5.8	$453, $56	Below average. Nose heavy.
Black & Decker 2665	46:00	1 hr.	2,000	4.5	$282, $51	Average. Slightly nose heavy.
Black & Decker 2765	45:35	1 hr.	2,000	4.5	$298, $51	Average. Slightly nose heavy.
Bosch 3054 VSRK ●	42:20	12 min., 1 hr.	1,000 with 1 hr. charger, 3,000 with 12 min. charger	3.5	$326 ✖, $67	Above average. Best of non T-handled models. Light and well-balanced.
DeWalt DW945	42:55	1 hr.	2,000	4.5	$295, $57	Average. Slightly nose heavy.
DeWalt DW947 ▼	20:35	1 hr.	2,000	4.9	$380, $63	Average. Slightly nose heavy.
DeWalt 948 ▼	18:45	1 hr.	2,000	6.3	$469, $63	Below average. Nose heavy.
Freud EDS 120	35:15	1 hr.	3,000	4.1	$380, $92	Average to above average. Slightly nose heavy. Handle fits hand well.
Freud EDS 132 ▼	41:10	1 hr.	3,000	4.2	$415, $97	Average to above average. Slightly nose heavy. Handle fits hand well.
Hitachi DS10DVA	25:10	1 hr.	500-1,000	3.9	$328, $84	Above average. Good balance and weight. ✧
Makita 6211D	15:05	1 hr.	800-1,100	3.7	$322, $61	Excellent. Well-balanced, comfortable. ✧
Makita 6311D	14:20	1 hr.	800-1,100	4.3	$336, $61	Excellent. Well-balanced, comfortable. ✧
Makita 6911D	23:00	1 hr.	800-1,100	4.0	$369, $61	Best of lot. Near perfect balance, size, shape and finish. ✧
Metabo 0126	57:20	10 min., 1 hr.	1,000 with 1 hr. charger; 3,000 with 10 min. charger	4.5	$438, $90	Average. Slightly nose heavy. Handle fits hand well.
Milwaukee 0401-1	46:35	1/2 hr.	500-1,000	3.75	$314, $76	Average. Slightly nose heavy.
Panasonic EY6205EQK	54:30	15-20 min.	500	4.1	$353, $100	Above average. Well-balanced. Handle fits hand well. ✧
Panasonic EY6207EQK	40:20	15-20 min.	500	4.4	$436, $100	Above average. Well-balanced. Handle fits hand well. ✧
Porter-Cable 852	47:55	1 hr.	1,000	4.5	$280, $69	Average. Slightly nose heavy.✧
Porter-Cable 853	46:05	1 hr.	1,000	4.5	$280, $69	Average. Slightly nose heavy.✧
Porter-Cable 854	47:55	1 hr.	1,000	4.5	$290, $69	Below average. Nose heavy.✧
Ryobi TFD-220VR	38:45	1 hr.	500	4.6	$365, $74	Average. Slightly nose heavy.✧
Skil 2736	38:20	1 hr.	1,000	3.9	$249, $68	Average. Slightly nose heavy.

Notes:
▲ Model numbers are for tool only and will be different in most cases for the kit.
❑ No load on tool. In high-speed range with maximum torque setting; rounded to nearest 5 seconds.
◆ According to manufacturer.
■ Charge cycle = 1 charge, 1 discharge
★ For kit and for extra battery. Actual selling price is typically 20% to 50% lower than list.

have an extra battery. For the price of a battery—even the most expensive—it's just not worth having to wait.

That said, there's another advantage to a short charging time, according to several of the manufacturer's representatives with whom I spoke. Batteries gradually lose their ability to take and hold a charge. The factor most responsible for that degrade, according to the Metabo and Bosch representatives, is the heat generated by the charging process. The quicker the battery charges, the less the heat buildup and the longer the battery life. I used Metabo's 10-minute charger while working on this article, and the quick charging time was a real pleasure. But the manufacturer's promise that battery life increases from approximately 1,000 charge cycles (a charge cycle is one charge and one discharge) to 3,000 with this charger is an even better reason for someone to consider a drill/driver with a quick-charge system (see the chart)

As I was finishing this article, I received a fax from Black & Decker announcing their new Univolt Universal Express charger, which charges not only their own batteries but most other manufacturers' batteries (2.4v to 13.2v) in 13 minutes and is supposed to triple battery life as a result. I was also told by the Bosch representative that Bosch has a 12-minute charger due out in October 1993 that will triple battery life.

A couple of competitors expressed skepticism when I asked them about company X's claim that its charger would triple battery life by charging batteries in just 10 minutes. One of them, Freud, has a one-hour charger-and-battery system that it claims is also good for 3,000 cycles. So the jury may still be out on the quick-charge systems.

What's all this battery and charge talk mean? It depends on how frequently (and for how long) you need to use a cordless drill and on how important economy is to you. If you'll be using the tool in your shop and only occasionally for short periods, charging time

Chuck type and size	Clutch type (number of torque positions)	Speed range(s), in rpm	Brake	Comments
Keyless, 1/2 in. Rohm, steel and plastic	11 position: 10 and a drill mode	2 ranges: 0-370, 0-1,100	No	Has spotlight in front of trigger.
Keyed, 3/8 in. steel	Single position, fixed	2 ranges: 0-700, 0-1,500	No	—
Keyed, 3/8 in., Jacobs Multicraft, steel	22 position	2 ranges: 0-400, 0-1,300	No	—
Keyless, 3/8 in., Jacobs, plastic and steel	22 position	2 ranges: 0-400, 0-1,300	No	Same as DeWalt 945. In screwdriver mode chuck turns only under load.
Keyless, 3/8 in., plastic	19 position	2 ranges: 0-500, 0-1,100	Yes	Two other models available in October, 1993: keyed and keyless models with mechanical clutch.
Keyless, 3/8 in., Jacobs, plastic and steel	22 position	2 ranges: 0-400, 0-1,300	No	Same as Black & Decker 2765.
Keyless, 3/8 in., Jacobs, plastic and steel	Single position, fixed	Single speed range: 0-1,200	No	—
Keyless, 1/2 in., plastic	Single position, fixed	Single speed range: 0-450	No	—
Keyless, 3/8 in., Rohm, knurled steel, with chuck lock for changing bits	6 position: 5 and a drill mode	2 ranges: 0-375, 0-1,300	Yes	—
Keyless, 3/8 in., Rohm, knurled steel, with chuck lock for changing bits	6 position: 5 and a drill mode	2 ranges: 0-400, 0-1,400	Yes	—
Keyless, 3/8 in., plastic	6 position: 5 and a drill mode	2 ranges: 0-400, 0-1,600	Yes	—
Keyless, 3/8 in., Makita, plastic	6 position: 5 and a drill mode	2 ranges: 0-370, 0-1,150	Yes	—
Keyless, 1/2 in., Makita, plastic	6 position: 5 and a drill mode	2 ranges: 0-370, 0-1,150	Yes	—
One-touch, quick-collar retaining system (takes hexagonal bits)	Single position, fixed	Single range: 0-1,800	Yes	Is an impact tool, like many pneumatics: 2,500 impacts/minute.
Keyless, 3/8 in., Metabo, plastic with rubber outer collar	6 position: 5 and drill mode	2 ranges: 0-300, 0-850	Yes	—
Keyless, 3/8 in., plastic	6 position: 5 and a drill mode	2 ranges: 0-350, 0-1,000	No	Keyed version also available.
Keyless, 3/8 in., Matsushita, plastic †	6 position: 5 and a drill mode	2 ranges: 50-350, 150-1,000	Yes	—
Keyless, 1/2 in., Matsushita, plastic †	6 position: 5 and a drill mode	2 ranges: 50-350, 180-1,300	Yes	—
Keyed, 3/8 in., Porter-Cable, steel	6 position: 5 and a drill mode	2 ranges: 0-350, 0-1,000	No	—
Keyless, 3/8 in., plastic	6 position: 5 and a drill mode	2 ranges: 0-350, 0-1,000	No	Keyless version of Porter-Cable 852.
Keyed, 1/2 in., Porter-Cable, steel	6 position: 5 and a drill mode	Single range: 0-350	No	—
Keyless, 3/8 in., plastic	6 position: 5 and a drill mode	2 ranges: 0-400, 0-1,300	Yes	—
Keyless, 3/8 in., Jacobs Hand-Tite, rubber	5 position: 4 and a drill mode	2 ranges: 0-600, 0-1,650	No	Keyed units also available.

❍ Except where noted, kit consists of drill/driver, case, one battery and charger.
✚ Drill accommodates right- and left-handed users equally, except as noted.
▼ 13.2v model
● German equivalent tested: GBM 12 VESP.
✖ Standard kit has two batteries, one hour charger.
✧ Forward-reverse switch, speed-range switch and/or torque setting ring are awkwardly positioned for left-handed users.
† Chuck has hole for lock release rod in case chuck locks shut.

is probably not all that important to you. But if you're using a drill/driver primarily on site for installations, then charge time and battery life may be critical to your choice of unit. Even so, battery life, charging time and charge length are just a few characteristics to consider in the overall calculus of choosing a tool.

Comfort: balance and feel

If you don't like the way a tool feels, how it's balanced, how your hand fits around the handle, then you're going to be less inclined to use it. And a tool that sits unused, gathering dust or is used only with resentment or frustration is no bargain at all. For me, once I'd become convinced that any of the tools was up to the job, this was the most important part of the tool evaluation. It's also an aspect of the tools that you can't compare through the mail or at any one tool distributor or home center because each place only carries so many brands. Being able to use 23 drill/drivers next to one another and to compare balance and feel from one to the other while driving screws, drilling holes and carrying them around was a learning experience.

Aesthetic judgments can creep into the supposedly rational process of choosing a tool, but I surprised myself by being won over to the T-handled style drill/drivers, which I'd always considered ugly and sci-fi-ish. The Panasonic, Makita and Hitachi units were by far the most comfortable, well-balanced and pleasant to use (for a right-handed person). Other woodworkers may be less sensitive to balance and feel than I was, but the four colleagues who came by the shop while I was evaluating these tools all had virtually identical responses to all the drill/drivers at either end of the spectrum in the chart (anything but an average rating).

Another consideration in evaluating how a tool feels is whether you're left-handed or may have to use the drill in your left hand occasionally. Most manufacturers have attempted to make their drills equally suitable for use in either hand, but some manufacturers have succeeded better than others. For example, most units have the forward-reverse switch located conveniently for either right- or left-handed use, but many of the drills locate torque-setting scales on the left side of the unit. If you're left-handed, the numbers can be awkward to read. For more specific information on whether a particular unit is lefty-friendly, see the chart.

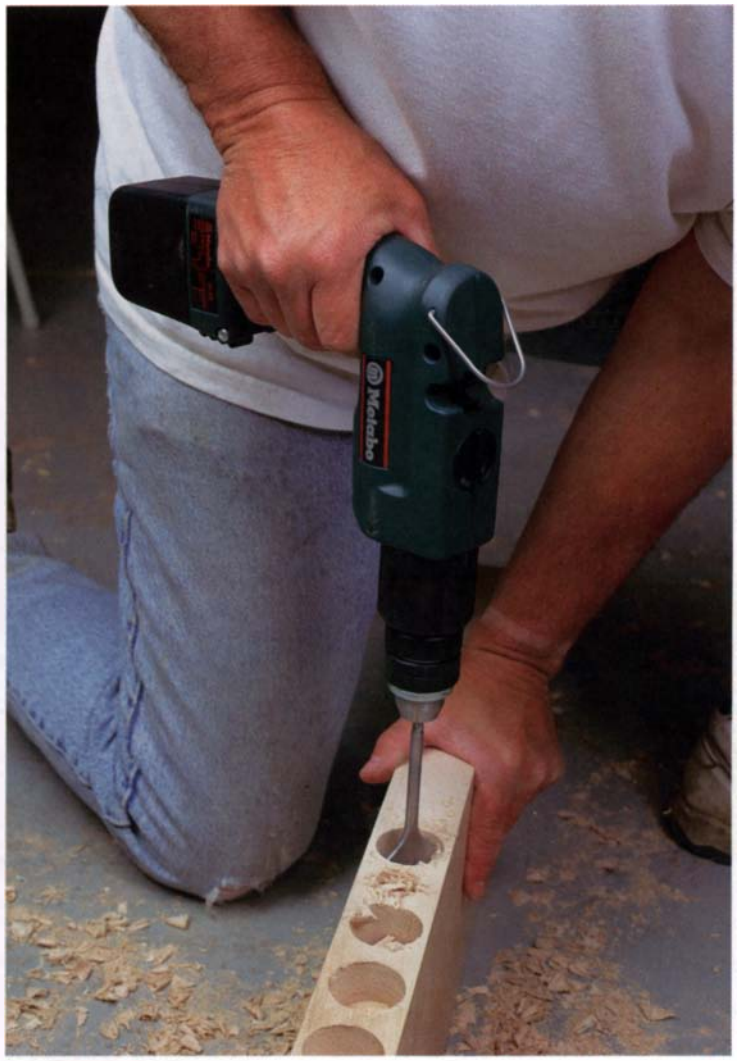
Clutch type, speed range, electric brake

Whether a tool had five torque settings or 22 didn't seem that important to me. Similarly, the specifics of the speed ranges didn't seem to make much difference: As long as it had a low gear, the drill worked fine. What I did find to be important is that a drill/driver have some adjustability. If you can't adjust the speed range or the torque setting, you're going to get dramatically different results in hard maple than in pine. And while you may be able to compensate for a particular tool's idiosyncrasies, anticipating how much pressure to apply and when to apply it, you'd have been better off to have purchased a more versatile tool in the first place.

An electric brake is irrelevant in most drilling situations, but it can be a very useful feature when you're driving screws, particularly in drywall or in a soft wood.

A word on chucks

A chuck is a chuck is a chuck...or so I thought before working on this article. Though I've come to prefer keyless chucks, I was frustrated by the experience of getting a bit stuck in one of the plastic models which, unfortunately, have become the norm (see the chart). The manufacturer's instructions for chucking a bit are to hold the inner ring fast while twisting the outer sleeve to the right by hand. But the reality is that a huge number of users close these keyless chucks under power, which is what I did. I chucked the bit just fine, but when I tried to remove the bit, it wouldn't release.



***A 1½-in. spade bit** was chucked into each of the drills and driven into hard maple to see what the drills were made of. All drills continued to drive the bits as long as the trigger was depressed.*

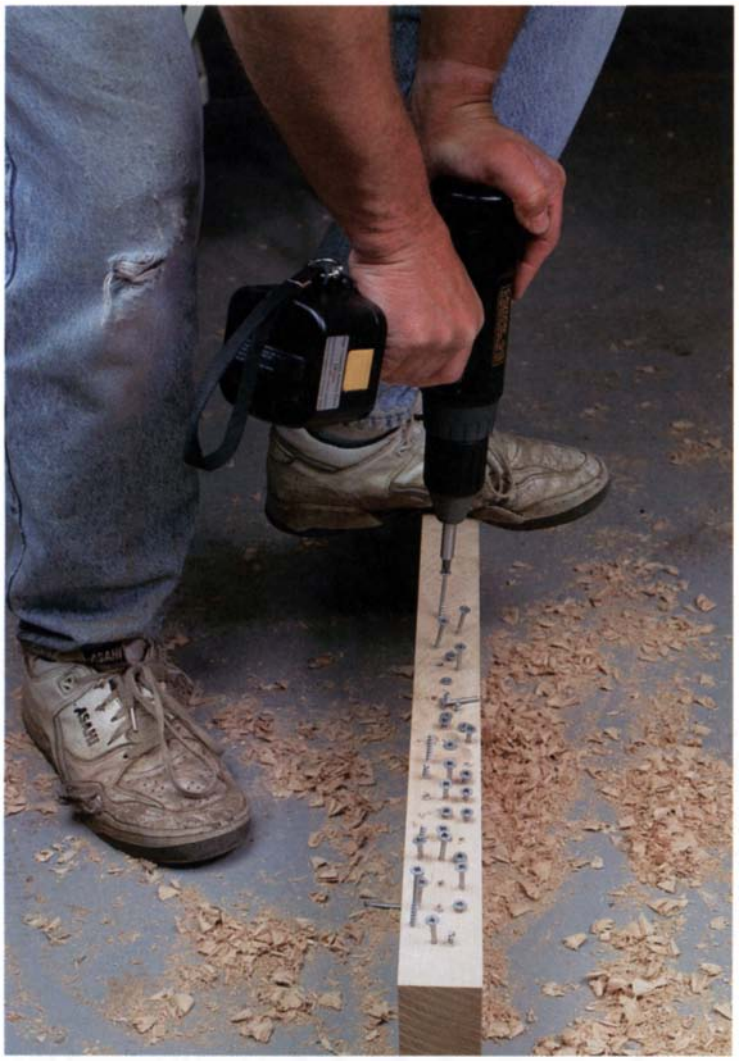
At first I tried to release the chuck by hand, but the plastic used for all of the molded plastic chucks is quite hard, so my hand suffered some abuse. Next I tried clamping the bit in a shoulder vise and using a pair of Vise-Grip pliers on the chuck ring, but I still couldn't release the bit. I called the manufacturer for advice (I was referred to the manual) and was about to return the drill, but I decided to try to release the bit one more time. I wrapped both the chuck ring and sleeve in a flannel shirt, clamped the sleeve in the vise and then used the Vise-Grips on the ring. This time I was successful. The experience taught me to appreciate the subtleties of chuck design.

The knurled-steel chucks allow easy chucking and equally effortless removal of bits. Other good alternatives included a knurled steel outer sleeve on the AEG chuck, the keyed chucks (which work fine, though they take a bit longer to use), a plastic chuck like the offending one but with a hole for a "lock-release" rod (both Panasonics), a soft rubber outer sleeve on the Metabo and, best of all, an all-rubber Jacobs Hand-Tite chuck on the Skil.

Which would I buy?

One platypus in this drill/driver crowd, both in terms of chuck and of overall operation, is the Makita 6911D. The only one of its kind (12v) marketed in this country, it's not a conventional drill/driver but rather a cordless impact driver. It was the unit that most nearly

Photos these two pages: author



Every one of the drills was able to bury 3-in. drywall screws into hard maple, as long as a screw didn't snap or become stripped. Many did. Drills were run in the low-speed (high-torque) range.

became an extension of my hand because of balance and comfort. Unfortunately, it has only one speed range and no torque adjustment, not to mention no standard chuck (just a one-touch, quick-collar retaining ring, which takes hexagonal bits). If Makita added a standard chuck and some adjustability to this unit, or balanced and streamlined their other offerings, they might have sold me. Still, the other two Makita units, the 6211D and 6311D, were better balanced and more comfortable than any of the other units tested (for a right-handed person), and they had plenty of guts and a good range of adjustment. Their only liability, a serious one, is their showing in the battery discharge trial: The Makita's batteries ran out of gas considerably sooner than any of the other units.

The Hitachi and the Panasonic units were nearly as comfortable as the Makitas, actually a pleasure to use. And while the Hitachi's time is considerably better than any of the Makita's, either of the Panasonics is even better in that regard, making them probably my favorite overall.

Of the non-T-handled models, I found the Bosch to be the most comfortable, with both Freuds not far behind. One of the reasons for the Bosch being so comfortable is its weight—it's the lightest of all those evaluated, and it's quite a noticeable difference. Also, both the Bosch and the Freuds are equally well-suited for left- or right-handed use.

The Metabo wasn't particularly comfortable when held in a regular pistol-style grip, but with thumb and forefinger wrapped along its length in a groove seemingly provided for that purpose, it seemed a lot lighter than its 4.5 lbs. and considerably better balanced. Many of the other drills have similar grooves, but none seemed as natural a place for my hand. I have to admit being seduced by the 10-minute charger, so that may have colored my perception. But the Metabo is also high on my list of favorites.

In truth, any of these tools is quite good, considerably more powerful than the 9.6v models that preceded them and better designed for the most part. The only models I really didn't like were the DeWalt 948, the Black & Decker 2661 and the AEG ABSE 15. The DeWalt and Black & Decker were just too heavy, with most of that weight in the nose. These tools are more like hammer drills than drill/drivers, and for that purpose, I'll take a corded tool any day. The AEG, complete with a small light just forward of the trigger for use in dark spaces, is a nice tool in every way, well-thought out with one critical exception. I just couldn't hold the drill comfortably. The handle widens just below the trigger, so you're left with forefinger and middle finger on the trigger and ring finger and pinky trying to figure out where to hang out.

Thus far I haven't mentioned cost. Mostly, that's because I believe in buying the best and buying once. Your priorities may be different than mine, so I have provided all the information that seemed relevant in the chart on pp. 58-59. Still, buying a tool is ultimately a very subjective, personal decision. Assess your needs, come up with a short list by reading everything you can find on the tool and by talking to friends who have made purchases already, and then get your hands on as many models as you can before you buy. □

Vincent Laurence is an associate editor of Fine Woodworking.

Sources of supply

Atlas Copco Electric Tool Inc. (manufactures the AEG line), Three Shaw's Cove, PO Box 6003, New London, CT 06320-1777; (203) 447-4600

Black & Decker (U.S.), Inc., U.S. Power Tools Group, 701 E. Joppa Road, Towson, MD 21286; (800) 762-6672

For Bosch: S-B Power Tool Co., 100 Bosch Blvd., New Bern, NC 28562; (800) 334-4151

DeWalt Industrial Tool Co., PO Box 158, 626 Hanover Pike, Hampstead, MD 21074; (800) 4339258

Freud, Inc., 218 Feld Ave., High Point, NC 27264; (919) 434-3171

Hitachi Power Tools U.S.A. Ltd., 3950 Steve Reynolds Blvd., Norcross, GA 30093; (404) 925-1774

Makita U.S.A., 14930-C Northam St., La Mirada, CA 90638; (714) 522-8088

Metabo, 1231 Wilson Drive, PO Box 2287, West Chester, PA 19380; (800) 638-2264

Milwaukee Electric Tool Corp., 13135 West Lisbon Road, Brookfield, WI 53005; (414) 781-3600

Panasonic Co., 2 Panasonic Way, 4A-3, Secaucus, NJ 07094, (201) 392-6655

Porter-Cable Professional Power Tools, 4825 Highway 45 North, PO Box 2468, Jackson, TN 38302; (901) 668-8600

Ryobi America Corp., 5201 Pearman Dairy Road, Anderson, SC 29625; (800) 525-2579

For Skil tools: S-B Power Tool Co., 4300 W. Peterson Avenue, Chicago, IL 60646; (312) 794-6600

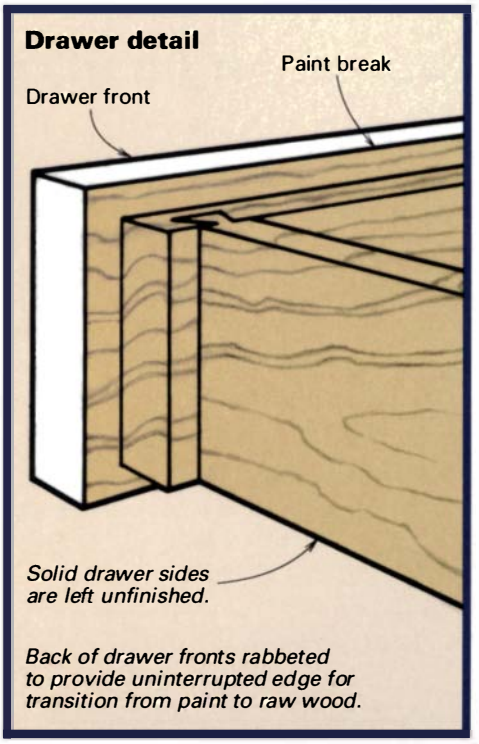
Paint-Grade Cabinets

Preparing wood for a demanding finish

by Lars Mikkelsen

Picking paint as a furniture finish is not just a matter of shuffling color swatches. *As Lars Mikkelsen discovered when he built these cabinets, painted work requires design decisions, materials and preparation different from clear-finished work.*

Most of us who work in wood love its color, grain and texture, and we usually build to show off these characteristics. So when a client called and asked me to make a built-in stereo and display cabinet that had to be painted high-gloss white, as shown in the photo at left, I hesitated a little. But when I saw his house and the room the cabinet was to go in, it was obvious to me that paint was what this job called for. It is a modern house, sparsely furnished, with light-filled rooms defined by strong geometric forms. It was an excellent setting for a built-in cabinet that blends architectural and furniture detailing, and a good place for paint. Once I had accepted the logic of a paint finish, and also had accepted the job, every subsequent move I made was affected by the choice of finish—from decorative and structural decisions through selection of the materials to construction and sanding.



Planning for paint

There are all grades of paint finishes, and it's important to have a clear idea of what you are aiming for before you begin. I talked with the client at length about the level to which the painting should be done. We wanted something well above the average wall-and-trim job, but taking it to the level of a grand piano would have made the cost of the prep work and the painting prohibitive. So we agreed to try for something in between: A bit of grain texture might show under careful inspection, but the overall impression should be clean and unblemished. With an understanding of what we both expected, I was ready to begin.

When designing for a clear finish, the color and grain of the wood are often the central point. A big, flat panel can be spectacular if the grain is right, and curved grain along a focal axis can pull a piece together and make an otherwise very plain design a thing of beauty. All this is lost when you paint. What you gain in return is beautiful clean shadow lines, undisturbed by grain pattern and texture. Paint emphasizes the volume of intersecting planes, and I took advantage of this in the design of the cabinet. The piece was to be built into an alcove formed by a series of sharp-edged, squared-off arches that stepped out into the room. I adapted this step pattern for the cabinet's detailing, echoing and altering the step motif, playing off it without exactly reproducing it. I would have designed differently for a clear finish because the distinctive geometric patterns and proportions I settled on would have seemed cluttered and confused had they not been painted.

I try to design built-in furniture that looks truly built-in, like the beautiful buffets so often found in Victorian houses. Thinking of trim as an important design element contributes greatly to the integrated look that I always seek. It's easy, when designing built-in cabinets, especially painted ones, to fall into the trap of making misplaced kitchen cabinets. I try my best to avoid this by developing detailing that will give the piece a look of permanence, of belonging where it stands.

Because the piece was to be fairly big, I broke it down into four components that could be easily transported and assembled on site. I used a raised frame detail all around and between the major components. I applied these trim strips when the cabinets were set in place. This not only covered seams and edges but underscored the visual theme of the cabinet.

To take advantage of the strong shadow lines, I made all the doors and drawers inset—flush with the surrounding surface—and free of exterior hardware. With inset doors and drawers, an even gap is always important, but when a black gap line is contrasted with white paint, small discrepancies become obvious to even the untrained eye. And I was making the tolerances small, so I needed hardware with fine adjustment. I wanted concealed European hinges for the doors and chose Grass 1006 hinges on 20mm mounting plates. I picked the 1006 because it's relatively small; I was advised, though, that it won't work with inset doors that are any thicker than ¾ in. The doors are held closed and sprung open with Hafele touch-latches. For the drawers, I used Accuride full-extension slides and 1041 Flexa-Touch pushers. I purchased my hardware from Capitol Hardware, 1519 Riverside Ave., Paso Robles, Calif., 93446; (805) 238-7669.

I wanted the doors painted on both sides, but for the drawers, I wanted only the fronts painted, leaving the solid-maple drawer boxes unfinished. This posed the problem of where to make the transition from painted surface to raw wood. I solved it by running a rabbet around the inside edge of the drawer front, establishing a clean, uninterrupted line for the painter to tape off, as shown in the drawing above.

Materials to fit the finish

The materials I chose for this job were determined largely by their paintability. I needed something without open pores or great differences between hard and soft grain because such differences would telegraph through paint. I ended up choosing poplar for the solid wood and shop birch plywood. Both are relatively inexpensive, mill well and require minimal preparation for painting. Other choices for solid wood could be maple, birch or alder. The main reason I chose poplar over the others was the ease with which it can be milled. For sheet goods, medium-density fiberboard is a possible choice; it paints nicely, but is extremely heavy to haul around and, therefore, easy to damage.

Stereo speakers were to be housed behind the top doors on ei-

How to pick your painter

To prequalify a painter for a difficult finishing job, I would recommend asking to see what he considers his finest work. I'd also ask him to explain in detail just how the finish will be achieved. I'd have him prefinish one door panel using the materials and finish specified for the job. The client would approve that sample for color, gloss, smoothness of finish and durability, and then it would be used as a job standard. I have often volunteered to do this when the situation warranted it, or when the client was unfamiliar with my work. □

Dave Hughes is a professional finisher in Los Osos, Calif. For a description of how he painted Lars Mikkelsen's cabinet, see p. 64.

Photos: Sandor Nagyszalanczy; drawings: Rob Mihaley

Spraying an opaque finish on furniture

by Dave Hughes

Ask any painter familiar with high-quality finishes and he or she will tell you that furniture-grade paint finishes are far more demanding than natural wood finishes. The simple reason is that the opaque surface of the paint highlights any defects or irregularities in grain and texture. Surfaces must be sanded, caulked, puttied and re-sanded several times, and still some rubbing out and polishing may be required to achieve satisfactory results. The deeper the color and higher the gloss, the more demanding the process. With so many variables to be controlled, a patient, methodical approach is essential in applying opaque finishes.

Now, try to achieve that flawless finish inside a client's home, with kids, dogs and neighbors dropping by for a look...to be candid, I didn't have too much enthusiasm for attempting the on-site finishing of Lars Mikkelsen's cabinets until I saw them for myself. They posed a real challenge, both technically and logistically, and that is what got me involved.

On any on-site job, you have to take particular care to cover and to mask off all adjacent surfaces and any parts and hardware that won't be painted. The tape I use is 3M's Longmask, a fine-creped blue tape with high tack that leaves no residue. I rub it down with a fingernail, and it provides an excellent edge seal, allowing no paint to creep underneath. With oil-based finishes, the tape can be pulled up when the paint is dry. With latex, which has greater bridging capacity, I score a line along a straight edge with a razor blade before removing the tape.

Good lighting is also critical for a top-quality paint job. Natural light is always best, but when I do use lamps, I place them far from the work to minimize glare.

The cabinets on Lars' job were already sanded quite smooth when I began work on them, but I always count on a certain added amount of time for re-sanding, puttying and caulking because you can't really see the surface in detail until that first coat goes on. I have found it is best to fill all you can easily see; then apply a first coat of primer, and repair any small areas you have missed. The essential thing is to catch all of these before entering into the final-coats phase. This careful, methodical filling and sanding is where the patience factor really tells. For a fine finish, you must spend a certain amount of time just *looking* at every piece.

Lars had removed the doors, and I fitted each one with two small finish nails in the top and bottom edges (as shown in the drawing above) to act as stands for spraying, handling and drying. Then I set up a makeshift booth in the garage to spray the doors and drawers.

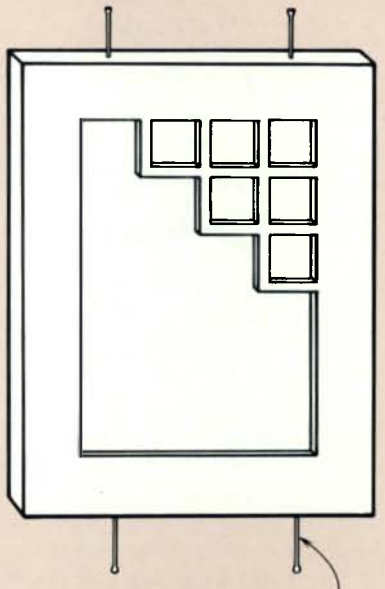
The primer I sprayed was Sherwin-Williams Hi-Build Lacquer Wood Surfacer reduced about 35% with medium-fast lacquer thinner. I used a high volume, low pressure (HVLP) spray unit, which, with its portability and reduced overspray, is particularly well-suited to on-site work. I used the HVLP unit with a Capspray fine-finishing gun.

After spraying two coats of lacquer wood surfacer, I lightly sanded all surfaces with 400-grit wet-or-dry sandpaper that I first broke in on the backs of doors or bottoms of cabinets where dry-fall overspray accumulates. I turn the paper over and use the paper backing to abrade the knife-edges of doors, drawers and trim to avoid burning through the finish.

The third coat of primer was a final fill-coat, not really sanded, but rubbed with the back of sandpaper for smoothness. Before every operation, I used a static-free tack-rag and blew the surfaces off with the air line on the spray gun. I allowed four hours between coats of primer because that's how long it took to spray a coat on the case and all the parts. But a lacquer undercoat is generally dry and ready to sand in 45 minutes to an hour, depending on the weather.

I applied two finish coats of Benjamin Moore Ironclad fast-dry industrial enamel, which has superior leveling-out characteristics and fast set-up time. The short tack time is critical when finishing on-site to minimize dust settling onto the finish. I thinned the enamel with about 30% xylol solvent and sprayed it at orifice settings between .006 and .009, something less than half the opening you would use to paint an ordinary wall.

Ready for paint



Finish nails act as stands and handles during finishing.

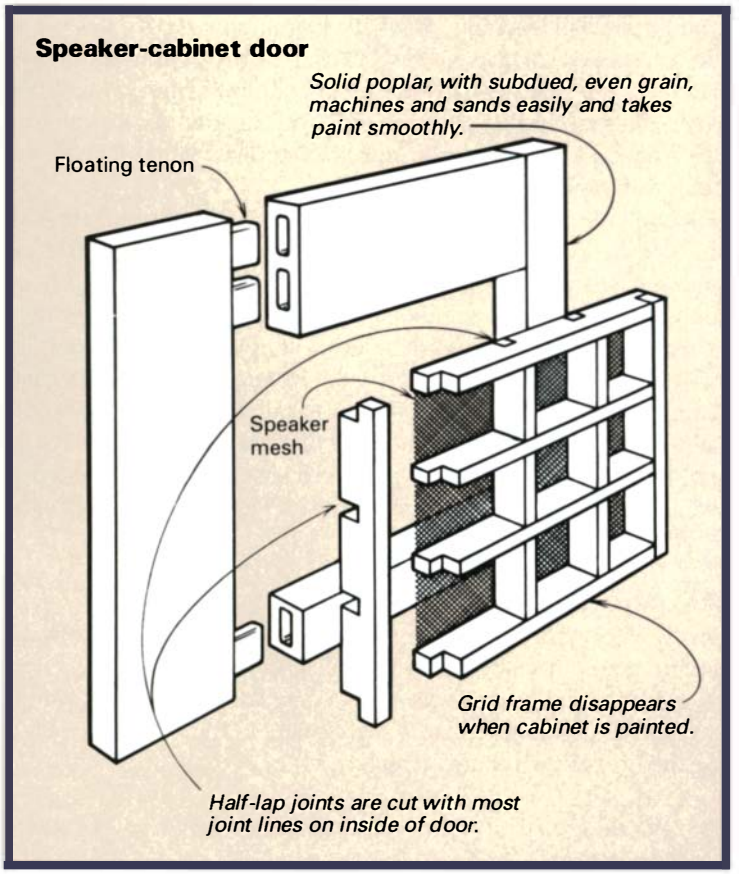
I alternated between vertical, horizontal and conical spray patterns as I worked to suit the intricate detailing on the cabinet doors, with the spray pressure just high enough to atomize the enamel. The Capspray gun enables me to spray in a cone pattern about the diameter of a pencil—it's practically an airbrush at that setting—which worked beautifully in the square decorative recesses of this cabinet. For the doors and frames, I switched to a 6-in. to 8-in. horizontal fan pattern.

A single coat was actually a two-step process. On the doors, for instance, I laid down a light tack-coat initially to cover the surface, rotated and tack-coated the back, and then flipped and rotated back for a full flowing coat. This method allows me to see how the material is performing and adjust viscosity, spray pattern, pressure and fluid levels before committing to a full coat. It also lets me lay down more material in one coat. I sanded lightly between coats of enamel with broken-in 600-grit paper, wiped down with a tack rag and allowed 24 hours between coats. I applied a third coat to all the doors and countertops.

When the final coat on the doors had dried hard, I removed the nail stands, puttied the holes and touched them up with two coats applied with an artist's brush. This was the only brushwork on the job.

After spraying the final coat, I took a few days away from the job before returning to do a final inspection and any necessary buffing out or touching up. The hiatus gave me some perspective and also let the finish cure hard and reach its final sheen. If you do any small repairs before the final sheen is reached, you may find they stand out later, looking either too glossy or too dull. I repair tiny blemishes by rubbing out with rottenstone or #00000 steel wool or buffing with alcohol and a tightly woven cotton cloth. A slow, hard rub with a coarser abrasive will give a matte finish while a fast, light stroke with a finer grit will yield a glossy one. By carefully adjusting the amount of pressure and the type of polishing compound, feathering out any touch-up areas and matching the sheen to the surrounding surface, you can approach a showroom finish with an on-site application. —*D.H.*

Nail in the rail—*The author shoots brads through the frame of the door to keep it from shrinking away from the panel, which could crack the paint and expose unfinished wood.*



ther side and the center door below. I made open-grid panels for those doors and covered them on the inside with sheets of metal speaker mesh (available from better stereo outlets). The mesh was painted to the same color as the cabinet and was easy to cut and install with small screws.

Joint selection

Both the finish and the siting of the cabinet were factors in my selection of biscuits for its major joinery. Using biscuits alone on a freestanding piece that could take a lot of abuse over the years might not be a good idea; but once a built-in is in place and attached to the walls, there is not much stress on the joints. So I felt this technique would be amply strong. Because the sides of the cabinet would be hidden when it was put in place, I used screws to draw the joints together while the glue set. I lipped all the plywood with ¾-in. by 1⅛-in. strips of solid poplar that I biscuited, glued and nailed on. It saves a lot of time to nail the wood on rather than clamping it, and the spackled nail holes disappear under the paint. I also find that with nailing, I can locate the lipping exactly, but with clamps, the strips are a bit more difficult to control.

Though the carcase of a built-in does not take much abuse and you can use some shortcuts in its construction, this is not true for the doors and drawers. They need to be made with the same strength and care as for any freestanding piece. I made the drawer sides of solid wood, and then I joined them to the fronts with sliding dovetails.

I joined the stiles and rails of the doors with loose tenons. The mortises for these tenons I can cut with great precision on my mortise fixture (see *FWW* #92, p. 55). The solid doors have a ¼-in. birch-plywood panel sitting in a groove. It is important that this panel never move in the groove, and thus expose unpainted wood, so I nailed it in with a few brads, as shown in the photo at left. The steps in these doors are strips of solid poplar ½ in. wide by ¼ in. thick, half-lapped and glued in place. The open grids for the speaker cabinets are made with ½-in.-wide by ¾-in.-thick pieces of solid poplar, half-lapped at every joint, as shown in the drawing below. Had these doors been left clear, I probably would have mortised the end of each crosspiece of the grid into the stiles and rails. But because no grain would show, I made the grid as an independent unit with a frame of its own, with all half laps, and then glued up the stiles and rails around it.

Paint prep

It would be hard to find someone who really loves filling and sanding, but the job can be made easier and less tedious by doing as much as possible as you build. For many parts, it's much simpler and quicker to do the prep work before assembly. I carefully filled and sanded the plywood panels in the solid doors before glue-up. On all the pieces of lipped plywood for the carcase, I sanded the wood flush to the plywood with a belt sander that I slowed down with an electronic speed control. The slow speed makes this operation much easier and safer. Next I inspected all the pieces carefully and then filled and sanded any little cracks or dings that might show up later. Remember that paint really magnifies these blemishes.

When the carcases were assembled, I applied white latex caulk to all the many corners whether I could see a seam or not. I used spackle for any joint or surface that would be sanded. All this filling must be done carefully because even a hairline crack will show horribly once the paint is on. To achieve clear, crisp lines and joints, it is important to press caulk into the cracks but immediately remove all excess, leaving interior corners square rather than forming a little cove of caulk. To do this, I laid down as small

Even with end grain, it's best to scrape off most of the spackle. *If necessary, apply a second time rather than build up a thick layer. Do a last round of filling when the piece has been primed. The layer of finish will highlight any imperfections.*

Fill every corner, whether you can see a seam or not. *For long runs, caulk is best, but in tight quarters, like the door panel grids, the author uses spackle because it's less messy. With a freshly filed putty knife, he removes 95% of the filler he lays down.*

a bead of caulk as possible. Then I used a putty knife that I had filed down so that it came to a knife edge and its corners were sharp and square. I probably removed 95% or more of the caulk that I applied. I don't worry about small smears of caulk or glue, but all protrusions should be removed.

After gluing up the doors, I caulked all around the groove and panel joint, cleaning it up with my putty knife. I filled the seams between the grid pieces with spackle, as shown in the bottom photo. When there's a long run to fill, it's easier to lay down a bead of caulk, but in tight spaces like the grids, caulk will make a mess. It is important to work methodically at this, so as not to miss any of the little seams. Then I took all the doors to be thickness-sanded. Some cabinet shops offer this service, and it is very worthwhile. It saves time while doing a superior job, keeping everything wonderfully flat, resulting in a beautiful, clean reflection of light when painted.

At this point, all parts had been made, filled and sanded, and all I needed to do in the shop was to fit the doors and drawers in their openings. Before fitting anything, I assembled the four individual carcases, screwing them together and shimming them as needed to get everything straight, flat and square. I glued my shims in place so that they would stay on one of the carcases. That way, when I later assembled the carcases on site, I was sure to get them exactly the way they were when I fitted the doors and drawers, saving a lot of frustration and awkward planing. I then sanded everything down to 180-grit with my random-orbit sander and broke all sharp edges by hand-sanding, creating a small roundover. A roundover always looks nice, but when painting, it is absolutely essential because paint will not adhere to sharp edges and a dark line will appear.

Installation

Now the moment of truth. No matter how many times I have done installation, it is still stressful until everything is in place. This time everything went smoothly, and the major components were quickly set and screwed together. I then shifted the unit around a bit in the wall opening to get all side margins as even as possible. I removed all doors, drawers and hardware, numbering all the hinges so that I could put them back where they came from. This makes re-installation much faster because almost no fine-tuning is needed. I left the drawer guides in place and then covered them with tape.

Though this is the point when I hand a job off to the painter, I always make certain to return when the piece has been primed. With the first coat on, previously unnoticed flaws can readily be seen, and it is the last chance to repair them without having to repaint everything. (For a detailed description of what went into the painting of this piece, see the box on p. 64.) In this case, there was nothing for me to do at the priming stage because the painter had already done any filling that was needed. I always insist on rehanging the doors and hardware myself: This is not a painter's job, and he or she cannot be expected to do it so that the doors fit properly.

The payoff

Finally, everything was done, and I could see the piece the way I had imagined it while doing the design. I was hoping my client would be as happy as I was. I got a clue when I returned for my check and found the furniture rearranged. Before, it had been facing the fireplace, and now it all faced the cabinet. □

Lars Mikkelsen is a professional cabinetmaker living in Santa Margarita, Calif.

Inlay Bandings Dress Up Your Work

Simple techniques produce intricate details

by Gary Straub

The simplest and most prevalent form of inlay is with strips of wood (bandings) as borders, but many woodworkers shy away from using inlay bandings, thinking it too difficult a process. Though some bandings can be time-consuming and difficult to make, many are not. Inlay bandings range from simple string inlay (a thin strip of contrasting wood) to exceedingly complex creations with hundreds of pieces comprising a geometric design. I'll discuss the basics of making bandings and then the specifics of a few different types (see the top photo on p. 68).

To understand the process of making bandings, you need to see the banding three-dimensionally. Bandings are not made individually but rather as a board that will be sliced into many identical strips (see the photo below). The simplest of bandings, a solid strip of wood, is perhaps the easiest way of getting a feel for making banding. To make 10 bandings for a large tabletop, I wouldn't just randomly select 10 thin pieces of wood. Instead, I'd select a board I liked and cut 10 consecutive strips from it. This way, each of the 10 bandings is virtually identical, and the grain pattern—however subtle—is repeated around the table. This technique is the same for any type of banding. For strips that consist of more than one piece of wood, though, you have to make a board, and to do that, you have to know how big to make it.

Sizing the banding

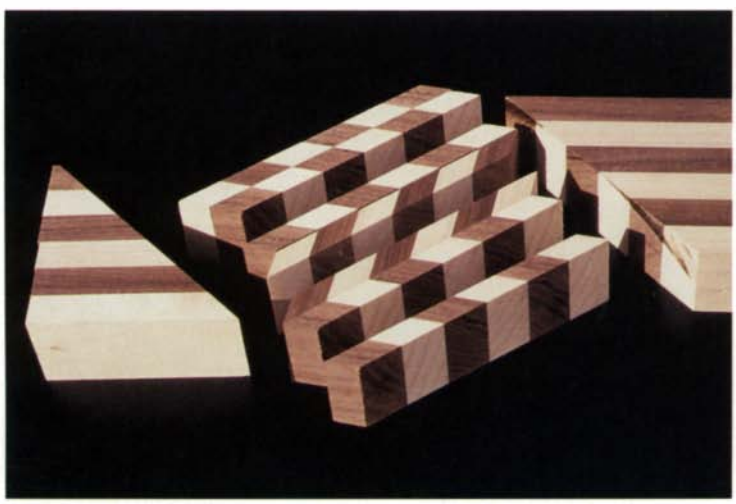
First decide how wide to make the face of the banding. Commercially available bandings come in a myriad of widths, from less than 1/16 in. to well over an inch. The right width of banding will depend on the style and scale of your project. I always try to match a banding width to one of my router bits, so I can easily use my plunge router to make an accurate groove for the inlay. If you need a banding that doesn't correspond to any available bits, two passes with a smaller bit will give you any width you like.

Commercial bandings are 36 in. long, but I make mine to fit the piece I'm inlaying. I usually make the board a little longer than the shortest measurement of the piece. For example, for a tabletop 40 in. by 80 in. with banding 1½ in. from the edges, I'd make the banding about 38 in. long (40 in. less 1½ in. at either end is 37 in.). On something small, though, like a box top, I sometimes make the

***Inlay bandings are sliced from a board** that has been made for that purpose. Cutting bandings on the bandsaw results in less waste than cutting them on the tablesaw. It's also much safer on the bandsaw because there's no danger of kickback or of the blade binding.*

An infinite variety of inlay bandings is possible. *Your imagination is the only limit. As a rule, though, you should be sure borders of bandings consisting of a number of different woods contrast with the wood into which you're inlaying them. How these seven samples were each made is discussed in the text.*

When gluing up straight from the saw, *the author always uses the tablesaw outfitted with a good-quality finish blade.*



Cutting laminations at an angle *and combining them imaginatively give you a whole other range of possibilities for bandings.*

banding as long as a side and an end combined. Of course, I often have to splice pieces together to get the length I need, but the idea is to create a length that neither falls just shy of a corner nor is so long that it's a pain to make.

The board's depth is determined by how many pieces you want to get out of it. Because I make only custom, one-of-a-kind furniture, I usually make the board just deep enough for the piece I am working on, plus a little extra in case of mistakes. To figure the depth, I add the thickness of the banding (I make mine 3/32 in. thick) and the width of my bandsaw's kerf (1/16 in. for the 3/8 in., 8 teeth-per-inch blade I use to resaw the bandings) and multiply that sum times the number of pieces I'll need, plus a couple of extras.

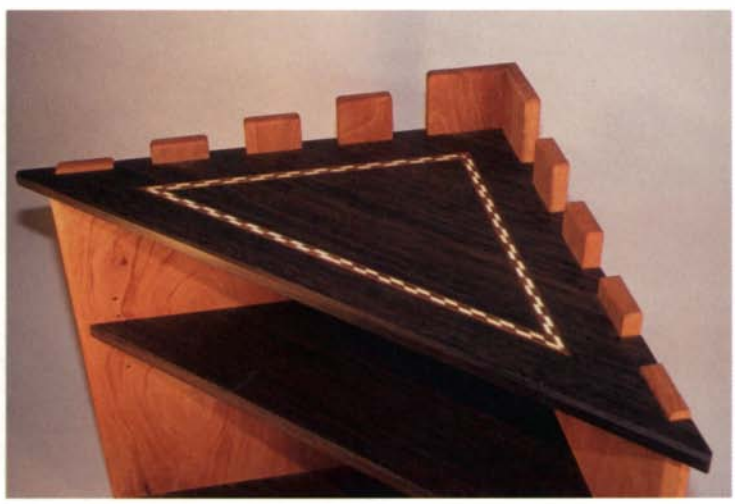
Designing and making banding

The next most simple type of banding after a plain strip of wood is a solid strip with a border of contrasting wood on each side (see samples 2 and 3 in the top photo). I resaw the three pieces to approximate thickness and then run them through the planer to exact thickness—a 1/2-in. center with 1/8-in. borders in the case of the two bands pictured. My planer goes down to 3/32 in., so I don't need to rig up any special fixtures. Next I apply Titebond yellow glue and clamp the three pieces together with a thick board on each side to help distribute the clamping pressure. I use C-clamps set every 2 in.

A variation on this design, which looks more complicated than it is, is sample 5 in the top photo and in the photo on p. 67. Instead of using one wide center strip, I resawed and planed two thinner strips of walnut and used a piece of dyed veneer (available from most veneer suppliers) in the center. Then I drilled centered holes on the drill press and took a dowel smaller than the diameter of the drilled holes to spread glue inside each hole, one at a time. Finally, I hammered home dowels I'd sized exactly by forcing them through a drill-bit gauge's 1/64-in. hole.

The geometric patterns in samples 6 and 7 in the top photo are similarly easy to make. There's just one more step in the process, and a visualization leap you have to take. I started by laminating three pieces each of maple and walnut, 1/2 in. by 3/4 in. by 14 in. Then I jointed one side (of alternating maple and walnut) and planed the other to make them uniform after gluing. I cut the block into 1/2-in. strips at 45° across the grain (see the photo at left) on the tablesaw. I always use a tablesaw outfitted with a finish blade to cut pieces that will be glued up without surfacing. I used the resulting blocks to make banding 7 in the top photo.

There are a few tricks to working with diagonal pieces. To get



The author's wenge and mahogany shelving unit *incorporates some of his own inlay banding, adding more visual interest.*

Photos: author

length, you'll need to butt sections together. To do this, square up the end pieces, so you can more easily clamp the whole thing together lengthwise. Cut the two border pieces slightly shorter (⅛ in. or so) than the total length of the diagonal pieces. Apply yellow glue to the inside of both border pieces and to the juncture of every pair of diagonal strips. Clamp loosely across the width every few inches with C-clamps, and squeeze the diagonal pieces together with a bar or pipe clamp. Now tighten the C-clamps.

Strip 7 in the top photo on the facing page and the one I used in the shelving unit in the bottom right photo on the facing page was made using this same technique, except I cut the diagonal strips at ¼ in. and reversed them on top of each other, making a four-piece lamination instead of three. I also used plastic-resin glue instead of Titebond because it takes more time to set, which is helpful when you're gluing several pieces at once. Many banding designs are possible with this method, using the same building blocks (see the bottom left photo on the facing page). I made banding 4 in the top photo on the facing page to create a similar look but without using a glued-up lamination. I used a piece of zebrawood that I cut on the diagonal, but this method will work with any wood that has prominent vertical stripes.

Sawing the bandings

Before cutting a board of banding into inlay strips, I first joint one edge, making sure it's square. Then I mark the top (perpendicular to the face) with a *V* to keep track of the order in which strips are cut. I cut the strips on my bandsaw (see the photo on p. 67). I prefer the bandsaw for cutting strips because there's less waste and because it's much safer than trying to cut the 3/32-in. strips against the fence on a tablesaw—an operation you shouldn't consider. After I've cut a board into bandings, I put rubber bands around the pack to keep them from distorting until I'm ready to use them. □

Gary Straub is a professional woodworker living in Columbia, Mo.

Preparing, cutting and inlaying bandings

***A small miter box and a Japanese backsaw** work well for cutting miters at corners and for splicing the banding. A Western-style backsaw also works just fine.*

***An inverted block plane with a very sharp blade** is just the thing for shaving off tiny curls to get a piece of oversized banding to fit.*

Inlaying bandings into a surface is only a matter of routing a groove the same width as the banding and gluing the banding in place. The tools needed are minimal, and the technique is basic.

The first thing I do is mark the corners where the outside edge of the bandings will go, so I'll know where to stop the router. The simplest way to do this is with a marking gauge. I use a gauge I've modified to accept an ordinary #2 pencil.

I chuck the correct router bit into my plunge router and set the depth of cut by using a drill bit 1/64 in. or 1/32 in. narrower than the thickness of the banding as a gauge. Setting the router on a flat surface, I lower the router bit until it just touches the surface. Then I put the drill bit between the depth-adjustment rod and the stop post. I lower the rod snugly against the drill bit and lock the rod in place. This method is accurate and leaves the banding just proud: It's easier to take off a little excess banding than it is to bring down the entire surface around the banding.

I put the edge guide on the router and set the distance using the marks that I penciled at each corner. Then I plug in the router and rout the groove all around, using my pencil marks as stop points.

If the banding goes in farther than my edge guide will allow, I use a Tru-Grip Clamp 'n' Tool guide (available in many woodworking catalogs) to guide my router. A straightedge and C-clamps also work. I determine where to place the guide by fastening it to a piece of scrapwood and routing a test groove. Then I measure from the edge of the groove to the guide to get my distance setting. Once I've routed the grooves, I square off the outside corners with a sharp chisel.

I start inlaying by cutting a miter on one piece (see the photo at left) and fitting it into a groove with the mitered point touching the end of the groove. Next, if the piece extends past a corner at its other end, I mark where the next miter will be, indicate with a line the direction of the miter (so I don't cut it the wrong way) and I cut it. Then I put the mitered piece on top of the next piece to be cut, moving it around until I find a match. I mark it, cut it and continue to the next piece.

Where I need to splice pieces together for longer banding strips, I use either a butt joint or a miter, depending on the banding pattern. When inlaying bandings with geometric patterns, I sometimes reverse the pattern in the middle so that the corners will meet properly and be symmetrical.

If the banding is too tight for the groove, I just run it over a block plane mounted upside down in my vise (see the photo at right). If I need to take more than one pass, I alternate edges to keep the banding symmetrical. If I cut a piece too long or if a miter is slightly off, I use a sharp chisel to pare off a sliver.

Once I've cut and fit all the pieces, I glue them in. I use Titebond, only putting glue down for one piece at a time and making sure there are no dry spots. I force the banding down with the side of a round mallet, squeezing out any excess glue, always working from the middle out and pressing hard. After the last piece is in, I roll it all again. If the fit is good, the bandings do not need any clamping. By tapping my fingernail on the banding all the way around, I can find any spots where the banding isn't all the way down. Once the glue is set, I scrape off the excess glue and handplane the bandings flush with the surface using a finely tuned plane with a very sharp blade. Now the piece is ready for final sanding. —*G.S.*

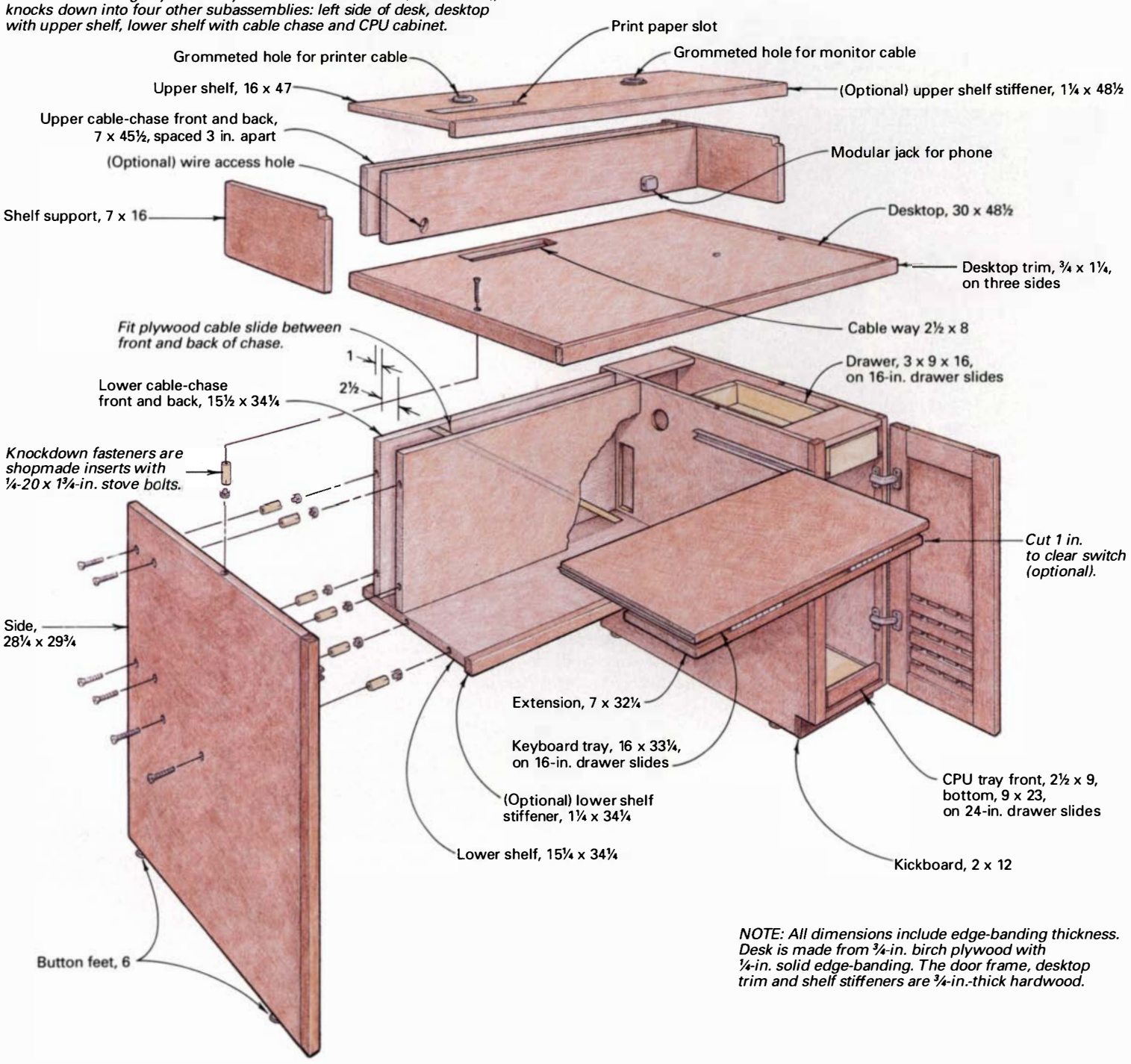
Knockdown Computer Desk

Edge-banded plywood and screw-together hardware make it simple and strong

by David Tuttle

Computer desk assembly

The heart of the computer desk is the CPU cabinet (see detail A). The desk, which has a sliding keyboard tray and fold-out extension (see detail B), knocks down into four other subassemblies: left side of desk, desktop with upper shelf, lower shelf with cable chase and CPU cabinet.



NOTE: All dimensions include edge-banding thickness. Desk is made from ¾-in. birch plywood with ¼-in. solid edge-banding. The door frame, desktop trim and shelf stiffeners are ¾-in.-thick hardwood.

When I bought my computer, I knew that I'd have to build a desk for it because the computer's main component, the central processing unit (CPU), was housed vertically in a tower case that wouldn't fit on my old desk. Besides that, the old desk took up too much space, and it couldn't be broken down easily for transport or storage. Furthermore, it had no place for wiring, and I didn't want to look at a bunch of tangled cords and cables.

So I designed a computer desk with a top work surface, a side cabinet for an upright CPU, a pull-out tray for a keyboard and mouse and an upper shelf for a monitor (see the photo at right). Because my wife and I would be using the desk for both office work and studying, I included wiring provisions for a printer, modem and phone/fax. I also added a lower shelf to hold books and software, and I made a fold-out extension for spreading out documents and for using a joystick (see detail B below). To reduce costs, I built the desk using edge-banded plywood—also good for its strength and durability. And to make the desk knockdown, I made threaded inserts to fasten the parts together (see the box on p. 73).

Since I made my first desk, I've built three others, each time making improvements. Before I tell you how I built the latest desk, I'll talk about the requirements for a computer's CPU.

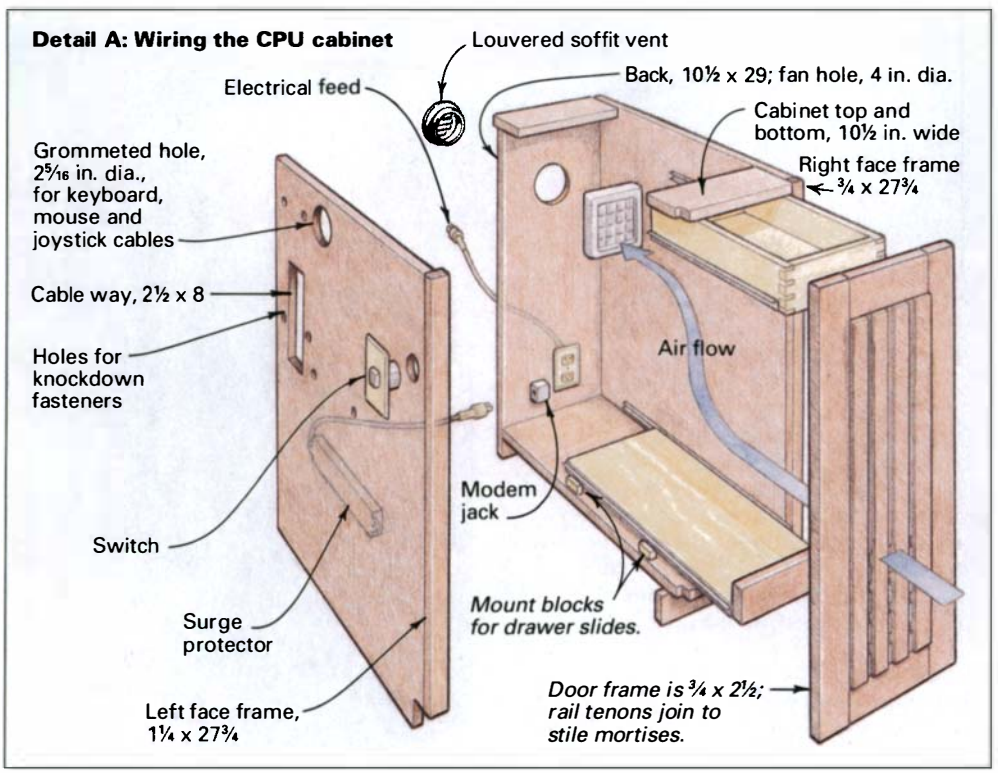
***Outfitted for the information age,** this computer desk breaks down for transport or storage, has a power switch and is wired for a monitor, printer, phone and fax. Roll-out trays allow access to the keyboard and to the central processing unit (CPU).*

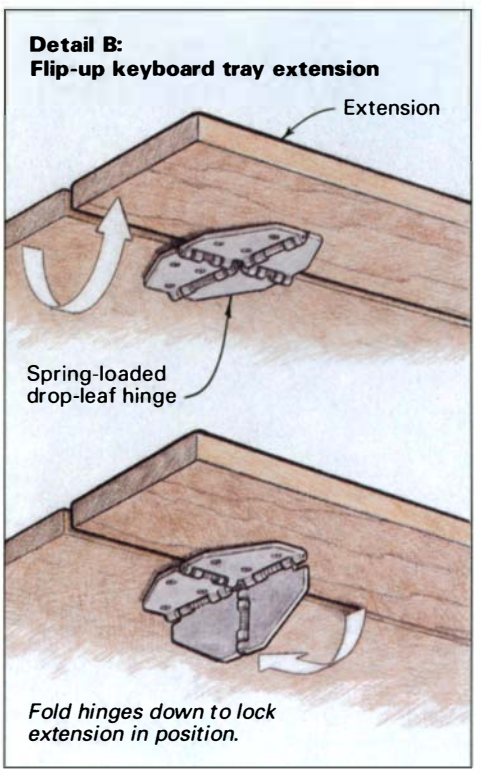
CPU cabinet

The core of my computer desk is the side cabinet for the CPU. I installed a bottom tray on drawer slides, so I can pull out the CPU to get to the wires in back. I also mounted a small drawer in the top of the case. The cabinet will house a tower case or a standard PC unit standing on edge (check your manual to see if this is safe for your unit). Drawing detail A below shows the setup that will accommodate most units. However, for large tower CPUs, you may have to eliminate the top drawer.

Component cooling and computer hardware—The CPU cabinet has a muffin fan at the rear for exhaust air, and a grid of intake holes in the front door admits cool air to the CPU. To cover the fan opening, I used a 4-in.-dia. louvered soffit vent, which I bought at my building-supply store. I formed the intake holes by cutting dadoes into the door's panel (see drawing detail A below).

You should purchase all the wiring and computer-related hardware ahead of time because it will determine the sizes of the openings to cut. You can pick up a fan and the wiring accessories, such as switches and cable, at your local Radio Shack (or at most computer-supply stores). While you're at it, buy several cable grommets and a print-paper slot (Doug Mockett & Co. Inc. P.O. Box 3333, Manhattan Beach, Calif. 90266). And you'll need a few work boxes, receptacles and connectors (any electrical-supply store should have them). I bought wire-holding clips at my hardware store. (The clips are also found at auto-parts stores.) The final computer-related items you may need are a surge protector, a longer keyboard cable (the ones furnished with most systems are too short) and speaker cable if you have a multimedia





Photos: Alec Waters; drawings: Heather Lambert

computer. For more information about computer-desk requirements, see *FWW* #77, p. 32; *FWW* #82, p. 70; and *FWW* #92, p. 52.

Constructing the desk

Aside from the CPU cabinet, the desk consists of a side, a top, two cable chases (places to run wires) in the back, a keyboard tray (and extension) and upper and lower shelves. You can cut out all these parts from less than two and a half 4x8 sheets of ¾-in. plywood. I chose birch-veneer plywood because it looks nice either stained or finished natural and costs one-third the price of cherry veneer plywood. Mark out the plywood parts in light pencil, cut them out, and stack them in their subassemblies and in order.

Next rip out 40 lineal feet of 5/16-in.-thick edge-banding from straight-grained cherry or birch. Joint the strips to 13/16 in. wide. Then plane the rough side of the strips to ¼ in. wide. Also, prepare stock for the drawer, door stile and rails, face frame, kickboard, top edges and for shelf stiffeners.

Edge-banding and solid trim—Cut the banding pieces about 4 in. longer than the part you're edging. Spread glue down one edge of the plywood, and begin tacking about 3 in. from one end. Make sure the strips are proud of the plywood on both sides. Usually I tack the strips with my pneumatic nail gun (see the photo at left below), placing brads every 6 in. or so. If I hammer them, I'll go back to set the brad heads. Later, I fill over the heads.

Using biscuits and glue (see the top right photo), attach the desktop's solid trim, the shelf stiffeners and the front face frames of the desk and CPU case. Clamp up each subassembly, and leave them to dry overnight. The next day, trim all the edge-banding and solid strips to length. I use an offset dovetail saw for this, following the plywood edge as a guide. Next trim all the banding to width using a ½-in. flush-trimming bit and router jig.

Routing openings and installing inserts—You could cut all the round holes for cable passes, fan and switch with a sabersaw, but you'll get a cleaner hole if you use a circle-cutting router jig with a ¼-in. mortising bit, as shown in the bottom right photo. Be sure to round over the holes for cables if you're not using grommets. To rout out the rectangular holes, use a fence, or clamp a guide parallel to the edge of the plywood.

After you've made all your threaded inserts, as described in the box on the facing page, it's time to drill all their holes. Bore the ½-in.-dia. holes 1¼ in. deep using a doweling jig (see the bottom photo on the facing page). Next glue and tap in the dowels along one edge of each of the parts. Allow them to dry an hour before you turn them over to glue the inserts in the opposite edges.

Making the door and pre-finishing parts—Prepare the door-frame parts, including mortises and tenons, but before you assemble the frame and panel, cut dadoes for the air-intake holes near where your CPU's grill will be (see detail A on p. 71). I learned this intersecting-dadoes trick from a friend, Malcolm Ford. You can

A plate-joined strip of hardwood *trims the CPU cabinet side (above). The biscuits strengthen the joint and keep the pieces aligned during assembly.*

Glued and tacked edge-banding—*To protect the desk's plywood sides, lower shelf and keyboard tray, Tuttle edge-bands the exposed edges (left). After tacking a band's ends, he uses a pneumatic gun to nail along the length. Once the glue is dry, he trims the banding even with the plywood using a router and flush-trimming jig.*

Tuttle made a circle-cutting jig *(right) to rout holes for the desk's wiring grommets and for the CPU cabinet's exhaust vent.*

cut the dadoes either with a router or a tablesaw, but be sure to plow out only half the thickness of the panel on each side.

Sand all the parts with 120-, 180- and then 220-grit paper, and dust everything off. It's a good idea to stain and finish the parts while they're flat and unassembled. That way, you won't have to reach into tight corners or scrape away finish drips. Use sanding sealer and a topcoat or two of polyurethane, which offers the best protection against scratches and spilled coffee.

Assembly and wiring—Plate join the CPU cabinet together; then put the cable chases and top together. Add the drawer and button feet to the sides, and install the special table-leaf hinges (Lee Valley Tools, 1080 Morrison Drive, Ottawa, Ont., Canada) for the extension tray, if you want one. Then hang the door using Euro-style self-closing hinges with rubber stoppers. Install the electrical boxes for the switched receptacles, and secure the wires with the plastic clips. Finally, cover the exposed heads of the knockdown fasteners with plastic caps (also carried by Lee Valley Tools).

To ready the desk for your computer, it's wise to run the printer and monitor cables and cords first. It takes some patience to thread all of them through, but the slide-out CPU shelf makes this much easier. Be sure to leave some slack in the cables and cords, and then tuck them out of sight in the case. □

David Tuttle is studying pastoral care near Winnipeg, Man., Canada. He also runs a furnituremaking and repair shop.

Drilling holes for threaded inserts—*With masking tape wrapped around a bit to mark the depth, the author uses a doweling jig and a cordless drill to bore holes for the knockdown fasteners. Next Tuttle will coat each hole with glue. He'll tap the inserts into the holes (T-nuts first) until the dowel ends are flush.*

A dowel-drilling fixture *clamps to a drill-press table to hold dowels vertical and steady while their ends are bored for T-nuts (foreground). The fixture's arm, which has a fixed half and a hinged half, grasps a cut dowel as the spindle is lowered. Next Tuttle will slice the dowel end to accept the T-nut prongs.*

Shopmade threaded inserts

The first time I assembled the desk, I used zinc threaded inserts. But with just average wear and tear, the joints failed. This was because the inserts pulled out of the fir/spruce core of the plywood too easily. Not only that, the inserts' ¼-20 threads were coarse and unsightly, and some of the soft threads stripped off.

On the next desk I built, I still wanted the joints to be knockdown, yet handle the stress. So I chose a shopmade variation of a threaded insert. I learned how to make the fasteners from a drawing table project in *Tage Frid Teaches Woodworking—Book 3: Furnituremaking* (The Taunton Press). The inserts consist of drilled out hardwood dowels, screws and 10-24 threaded T-nuts. The 1-in.-long dowels provide enough gluing area, so the inserts aren't likely to tear out of the plywood edges.

To make your own threaded inserts (15 are needed for the desk) begin with ½-in.-dia. hardwood dowel stock. I make my own dowels using Ken Well's jig (*FWW* #90, p. 79). Drill a few ½-in. holes in some scrap, and then test-fit the dowel to be sure it fits snugly in your bit's holes. Cut about twenty-five 1-in.-long dowels.

Drilling dowel ends is difficult because the bit wanders off center in end grain. To solve this problem, make a holding jig for your drill press like Tage Frid's (see the photo above). I found the jig works well at boring ¼-in. holes through short dowels. Even so, plan to lose a few dowels due to misalignment or grain defects; I wound up tossing out four or five.

Once you have approximately 20 bored dowels, take T-nuts and, one at a time, straighten their three prongs. Place one in each hole, and lightly tap them to mark the ends. Remove the nuts, and with a dovetail saw, make kerfs for the prongs. (Don't try to mass-produce inserts by sizing prongs from only one T-nut. The prongs are not all exactly the same.) As you saw, tilt the blade so that you match any remaining slope in each prong. Tap in the T-nuts to their mating dowels. Again, plan to lose a couple of dowels; even with the kerfing precautions, I ended up having a few dowels split. When you're done, you should have enough 10-24 threaded inserts for the job. —*D.T.*

A 1/2-in. shank machinist's end mill easily routs grooves, dadoes and mortises. Although designed for machining metal, end mills work effectively in both hardwoods and softwoods and will chuck right into your router. As shown in the inset close-ups, end mills come in many shapes and sizes. Different styles include (top left to right): four flute (for finer cuts), two flute (for faster, rougher cuts) as well as (bottom left to right) four-flute center cutting (for plunging) and ball center (for veining).

Milling and Drilling, Machinist Style

Metalworking tools transported to the woodshop

by Grant Beck

I found the ad interesting. It described a "new" router bit with a spiral flute design that lifted the shavings up and out of the work. It promised to cut finer and burn less than conventional router bits. The picture was equally interesting because it showed what looked like an end mill, just like the ones I've had for years in my machinist's chest...my *other* toolbox.

While machinist's tools, such as end mills, were designed for working metal, there's no problem at all using them for woodworking. In fact, these metalworking wonders often cut smoother and with less vibration than their woodworking counterparts. Traditionally, machinist's tools have been expensive, which partially explains why woodworkers have shied away from them. But, in recent years, a flood of inexpensive, imported machinist's tools have become available through catalog sales companies, such as Enco Manufacturing Co. (5000 W. Bloomingdale, Chicago, Ill. 60639; 800-860-3400) and MSC Industrial Supply Co. (151 Sunnyside Blvd., Plainview, N.Y. 11803-1592; 800-645-7270). These outlets put high-quality machinist's tools in reach of the small shop and amateur woodworker. In this article, I will introduce you to end mills, boring heads, slotting saws, combined drill/countersinks, and T-slot clamps, all useful for milling and drilling wood.

Photos: Sandor Nagyszalanczy

End mills

End mills come with shanks that can range in size from ⅛ in. to 1¼ in. in increments of 1/16 in., but the ones of most interest to woodworkers are those with ¼-in. and ½-in. shanks to fit standard router collets. The cutting portion varies in diameter and length up to about 1 in. dia. with a 2-in. cutting length (for a ½-in. shank bit). The number of flutes can be one, two, four or up to six for the largest sizes (see the photos on the facing page). The increased number of flutes has the same effect as more teeth on a sawblade: the higher the number of flutes, the smoother the surface of the cut. Single-flute end mills are designed for faster stock removal.

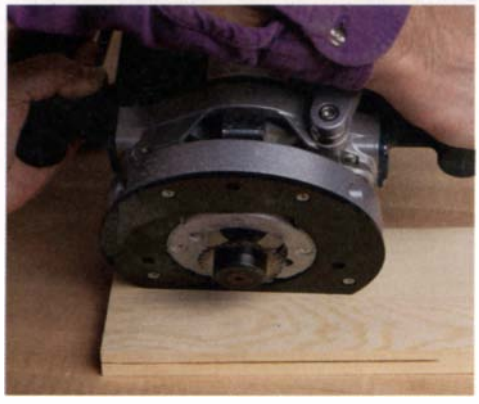
Double-ended end mills are also available, but I'd avoid using these because they might damage the router collet. Most end mills are straight and usually have a dead spot in the center of the cutting end, so be sure to order a center-cutting end mill if you want to use one with a plunge router. You can also find bits that have a 1° to 3° taper for friction-fitting parts. Other shapes include round-ended (called ball center) and radius-cutting end mills (for rounding over edges).

It's the geometry of an end mill's flutes that allows it to cut so well. Standard router bits with straight-edged tips contact the wood square on. The edge removes a full-width chip on each pass and leaves faint concave milling marks. The spiral flutes of end mills cut with an angled slicing action, starting at the bottom and progressing upward. Because only a small part of each flute is in contact with the wood at any time, the slicing action leaves a cleaner surface and takes less physical effort, reducing router vibration. Also, the spiral carries chips up and out of the cut, especially great if you're using an end mill for milling deep mortises.

The cutting edges of high-speed steel (HSS) end mills are not as hard and durable as carbide, but this isn't entirely bad: Carbide tips cut with a shearing action, like a pair of scissors while HSS end mills are ground to a sharper edge that cuts like a knife. When used properly, they should stay sharp as long as good carbide-tipped bits. When end mills finally do become dull, they can be sharpened. If they get nicked, they can be reground. The cost of either operation generally runs about half the cost of a new cutter. Check with your supplier for a good sharpening service, or look in the yellow pages.

You can use an end mill just as you would a regular router bit for grooves, dadoes or mortising for joinery or hardware mounting. You can also use them in a drill press if yours is capable of high enough rpms. Rabbets can also be done, but because end mills don't accept pilot bearings, you'll need to use a router fence to guide the cut. The key to good performance is to match the router rpm with the diameter of the bit. Smaller bits (⅛ in. to ¼ in. dia.) work just fine at full router speed, which is typically 20,000 to 25,000 rpm. Larger bits—from about ½ in. to 1 in. dia. perform best in variable-speed routers at lower rpms (about 5,000 to 10,000).

End mills require a bit more care than standard router bits. They are more brittle, and the sharp edges can chip by being dropped or stored in a drawer or box where they can collide with other end mills. Store them in the box or tube they came in or in a block drilled to hold them with the flutes covered. Covering the flutes protects them from damage and protects you from getting cut. (End mill flutes are sharp enough to cut skin if you brush against them). So always handle end mills by the shank, and be sure to wear gloves or to use a rag to protect your fingers when inserting into a collet.



***Enlarging holes precisely** is a task for a boring head. After drilling a pilot hole, a boring bit is fitted (boring bit set shown in background), and the boring head is offset using a threaded-dial mechanism to produce the hole.*

***A slotting saw can cut a thinner slot** than most regular sawblades and comes in thicknesses from 1/64 in. to 3/16 in. Slotting saws fit into a special arbor with a ½-in. shank that can be chucked directly into a router.*

Boring heads

There are many times when I've needed an exact-sized hole but didn't have the right drill bit or hole saw on hand. This is a perfect application for using a boring head in the drill press, as shown in the top photo. Boring heads are not intended for drilling holes, only for enlarging them to a precise size. First a starting hole should be drilled or sawn close to the finished size. Next the boring head is fitted with an appropriate-sized boring bit. For small holes, a smaller bit is fitted into the head's center hole. When a large hole must be made larger, a bigger bit can be fitted into an offset hole

***Drill and countersink a shallow hole at the same time** using a combined drill/countersink bit. The thick, sturdy shanks on these double-ended bits allow them to drill without deflecting, so you can accurately place holes even when drilling into angled surfaces.*

***T-slot clamps hold stock firmly on the drill press,** and they slide directly into slots machined into tables on many drill-press models. With a scrap block of wood under the back of the clamp, irregularly shaped pieces can be held.*

in the head. Even bigger holes are made by using a boring bar in the head's horizontal hole. A threaded dial mechanism in the head allows adjustment of the bit offset to be increased precisely to the exact-sized hole you want.

As a general rule, the larger the hole you are cutting, the slower the speed of the drill press; you shouldn't exceed 3,000 rpm for most holes over 1 in. dia. Also, clamping the work to the drill-press table is a must. If the hole you are boring goes all the way through the work, be sure to clamp a scrap board under it so the boring bar does not run afoul of the table.

Slotting saws

Most woodworkers have at one time needed to cut a precise-width slot as a track or a groove but found that they didn't have a sawblade thin enough for the job. This is precisely what slotting saws (also called slitting saws) are good for. Slotting saws are basically small sawblades that range in thickness from .008 in. (as thick as three sheets of paper) to .185 in. (about 3⁄16 in.). Sizes increase in increments of only .002 or .003 in. (the thickness of a single sheet of paper), so you can cut a slot of practically any size. Smaller slotting saws are between 1 in. to 2½ in. dia. and fit on a special ½-in. shank arbor that will run in a variable-speed router or a drill press. Larger saws range from 2¾ in. to 8 in. dia. and in thicknesses from 1⁄32 in. to 3⁄16 in. (increasing by increments of 1⁄64 in.). These sawblades typically have 1 in. arbor holes, so you'll probably need bushings to make the blade fit your tablesaw's arbor.

Used in the drill press with a guide fence or in a router, as shown in the bottom photo on p. 75, slotting saws can aggressively cut clean-bottomed narrow grooves, especially in softer woods. The smaller blades, under 3 in., will work well between 5,000 and 10,000 rpm at depths up to ⅜ in. The larger blades can handle up to ¾ in. deep, but don't try to use one as a cutoff saw. There is no set to the teeth, and taking a deep cut will produce a lot of burning, especially in hard or resinous woods.

Like end mills, slotting sawblades are made from HSS, designed to cut milder steel. That means they are sharp and will hold their edge for a long time, but it also means they are brittle. While they will hold up very well in normal use, abuse can easily break the thinner ones in two.

Combined drill/countersinks

These versatile HSS bits are often used by machinists as pilot drills to accurately place larger holes. Because the body of the drill is thicker than the drill itself, the bit doesn't wander, even if the surface is angled. Combined drill/countersinks are also good for drilling thin materials while simultaneously countersinking for the head of a flathead screw (see the top photo at left). When working in thick softwoods, drill/countersinks can create a shallow pilot hole for the screw as well as countersink for the screw head. Combined drill/countersinks are available in sizes from 3⁄64 in. to 5⁄16 in. (the diameter of the drill itself). A further advantage is the bits are double ended, so you can reverse them in the chuck if one end dulls or breaks.

T-slot clamps

Most of the milling and drilling tasks a machinist does require the work to be bolted down securely. Even though milling wood isn't as demanding as milling metal, the forces generated are high enough that you should always use heavy clamps before trying any of the procedures described above. If your drill-press table has T-slots, special machinist's clamps (see the bottom photo) can make holding down your work a lot easier. If your table doesn't have slots, it is fairly easy to rout T-slots in a scrap piece of plywood (preferably Baltic birch), and then clamp or bolt the plywood to your table.

Slot clamps, which are available individually or in sets, are tightened down with a wrench. Normally, you can finger tighten the nut, and then give it a one-half to three-quarter turn with a wrench. Because they're designed for applying terrific pressure, be careful not to over-tighten them and damage the wood. By putting a machinist's steel step block (or a scrap block of wood) under the back end of a clamp, you can hold almost anything, even irregularly shaped pieces. For extra-thick stock, you can join a longer stud to the clamp with coupling nuts, and use a spacer block to get the clamping height you need. □

Grant Beck is a millwright living in West Jordan, Utah.

From three-view drawing to bill of materials to cutting list, *step-by-step organization can all but eliminate measurement errors. By taking care of the calculations and accounting up front, you can concentrate on attaining accuracy and perfecting technique.*

Organize Your Projects

Reduce errors and ease construction with a bill of materials and cutting list

by Jim Tolpin

Once you have a clear vision of a woodworking project, either through concept sketches or from measuring an existing piece, the next step is to create a bridge between the idea and the actual construction. This means defining your vision on paper with working drawings, usually a three-view (orthographic) projection (see *FWW* #101, p. 78).

I use these drawings to generate a bill of materials, which functions both as an order sheet and as a data base from which to develop the cutting lists—one for solid stock and one for sheet stock, if any. These lists show the number, the size and the detailing of every piece of wood that goes into the project. Sometimes I also make graphic representations of the cutting lists to help me determine the most efficient use of the stock (see the photo above). Last, I cross-check carefully from the drawing to the bill of materials to the cutting lists to make sure that they all agree.

Once you have accurate cutting lists in hand, you can begin the actual construction process by laying out the components. When all the parts are marked on the stock, it's clear sailing—no more knitted brow and clenched teeth. You can leave behind all that left-brain, analytical thinking and enjoy the process of cutting, shaping and assembling the components.

Creating a bill of materials

To ensure that all the parts of a project will be accounted for in the bill of materials,

Photos: Vincent Laurence

and later in the cutting lists, create a referencing system. On the three-view drawing, label each component with a circled letter. You needn't bother to label separate identical components, such as four legs of an end table (as long as they're all made from the same material). To make organizing the bill saner, especially with large, complex projects, label the largest components first, working your way down to details such as moldings and drawer parts. Be sure to place material under the appropriate stock heading—solid or sheet—and add a notation for species if you're using more than one kind of wood.

As you list each item in the bill of materials, add a second circle around the letter on the drawing. When all the letters are double-circled, you'll have accounted for every component. Double-check by comparing the number of items on your bill of materials against a count of components shown in the drawing.

When listing widths and lengths of components on the bill of materials, be sure you've taken any joinery into account. It's easy to overlook the extra length you'll need for tenons or the width for tongues when joining boards with tongues and grooves. If your three-view drawing does not specify the sizes of these joints, lay them out on a full-scale drawing. Unless you note otherwise, assume that the length of the components runs with the grain of the wood.

Bill of materials to cutting lists

Develop the cutting lists directly from the bill of materials, collating the components by function and then by dimension. Establish a heading for thickness first, and then create subsidiary columns for each width (see the photo on p. 77). Under the appropriate width, write in the length of each piece. If the components aren't simply square-sided (without profile), add a cross-sectional graphic next to the length. If there are a number of identical parts, make tick marks to the right of the length to indicate how many. Don't confuse yourself with numerals here. As with the bill of materials, list the largest pieces first, double-circle the letter symbol on the bill once you transfer it to the cutting list and double-check by comparing the number of components on your bill of materials and cutting list.

If I have a lot of components to cut out of sheet stock, I make a graphic cutting diagram (scaled drawings of 4x8 panels) on which I juggle the layout of the components to get the most out of each sheet. I account for sawkerfs, and I pay attention to grain by book-matching pairs of doors or cutting a bank of drawer faces from a single section of a sheet, for example. To make the panels easier to handle, I try to arrange the components so that the first cuts are full-length rips, giving me lighter stock to deal with when crosscutting.

Laying out on solid stock

With the cutting lists completed and double-checked against the bill of materials, you're ready to lay out the components on the boards. As you bring each previously thicknessed board to a leveled pair of sawhorses, set them down so that most defects face up. Mark the locations of any defects from the underside of the board onto the visible face with chalk. Always "waste" a minimum of an inch at each end of a board when squaring it, and take off more if splits are obvious.

If the board rocks on the leveled sawhorses or bows significantly, it's probably best used for short components. Try to lay out components to make the most efficient use of a board. Work around knots and other defects, keeping an eye out for grain matches and striving for an overall pleasing look for the visible faces of a project. Finally, try to arrange the layout so the offcuts are long lengths; shorter, wider offcut pieces generally make less useful stock for future projects.

Use a piece of chalk or a timber crayon to mark out the pieces on the stock. Lay out pieces ½ in. long at this point and at least 3/16 in. wide. It's easier to remove wood later than it is to add it back. Leave pieces even wider if you know the stock tends to curve as it's ripped. As you locate each component on the boards, pencil in a tick mark to the left of the length notation on the cutting list. When the tick marks on the left equal those on the right, all the pieces of this width and length have been accounted for.

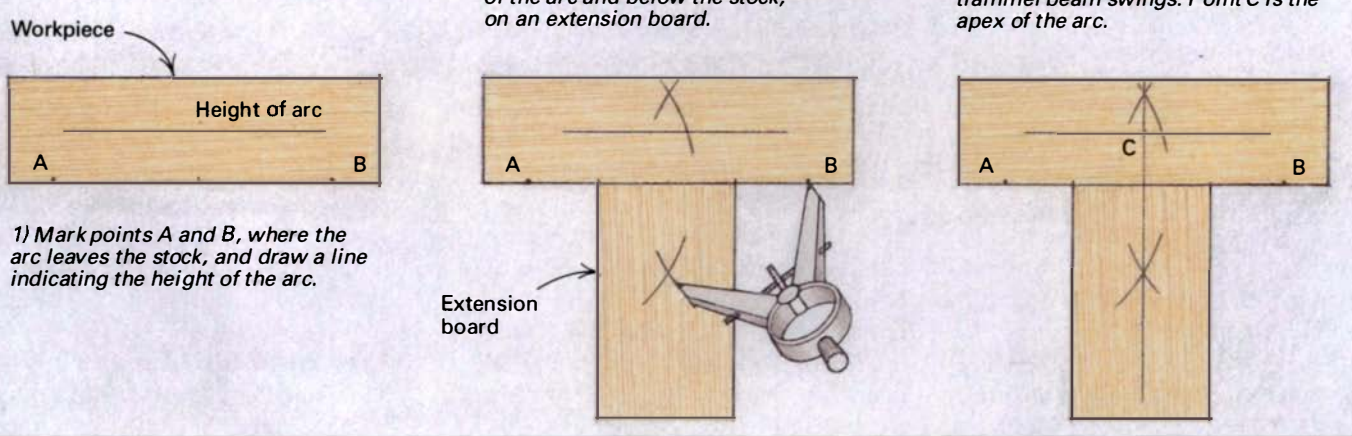
Laying out sheet stock

Panels are a lot easier to lay out than boards. Stock sizes are uniform, edges are straight, and except for occasional shipping damage, defects are negligible. If you're going to cut panels on a tablesaw and your rip fence and crosscut box are accurate and reliable, there's no need to transfer the layout from the graphic cutting diagram to the stock. Simply set the rip fence or stop on the crosscut box to the measurements on the cutting list, and make the cuts. Label each component along an edge with a marking pen, and put a second circle around the symbol denoting that component on the cutting diagram.

Joinery and complex shapes

Once you've cut out all the components, it's time to lay out for joinery, assembly positions and for any shaped (non-rectilinear) components. I don't use measurements to do this, though, because for me, placing my faith in numbers at this stage is an invitation to disaster. Instead, I use a

Fig. 1: Drawing an arc



Drawings: Vince Babak

***A pounce wheel is useful** for transferring layout information either directly to the stock, if you only want one piece of that design, or onto template material, such as ⅛-in. lauan plywood or Masonite, if you want a more permanent record to reproduce the piece later.*

***Bending a batten** to points along a curve is the best way to lay out long, gentle curves. For fair curves, use a square batten.*

full-scale drawing. Then I either transfer it directly to my stock using a pounce wheel, a small, gear-like wheel designed for this purpose (see the photo above) or I make a template. When using the pounce wheel, I follow the wheel with a light chalk dusting or with a pencil line to make the impressions left by the wheel more visible. If there's a chance I'll want to make a piece again, I make a template; if I know a piece is a one-off, I just pounce onto the stock.

To transfer the shape of a complex or irregularly shaped component, such as a scalloped table apron, I always use a full-scale template. To make the template, I tape vellum tracing paper (available at art supply stores) over the area of the full-scale drawing containing the component and trace its shape with a #2½ pencil. Then I pounce the pattern onto a piece of ⅛-in. lauan plywood. I bandsaw this pattern to within 1/16 in. of the line, and then use rasps, files and sandpaper to finish the job. I can use this plywood pattern to reproduce the component indefinitely. A set of templates representing each component contains all the information I need to reproduce a project; it's a durable, accurate and highly efficient way to keep this information at hand.

Laying out a curve with a batten

To draw a fair curve, whether on a full-scale drawing, a template or directly on the stock, use a batten held to a series of points along the curve (see the photo at right). I make battens from clear, close-grained wood. Old-growth fir or spruce is ideal, though nearly any knot-free, straight-grained stock will do. Cut the batten square to keep the curve fair—from ⅛ in. for tight bends to ¾ in. for long, gentle curves.

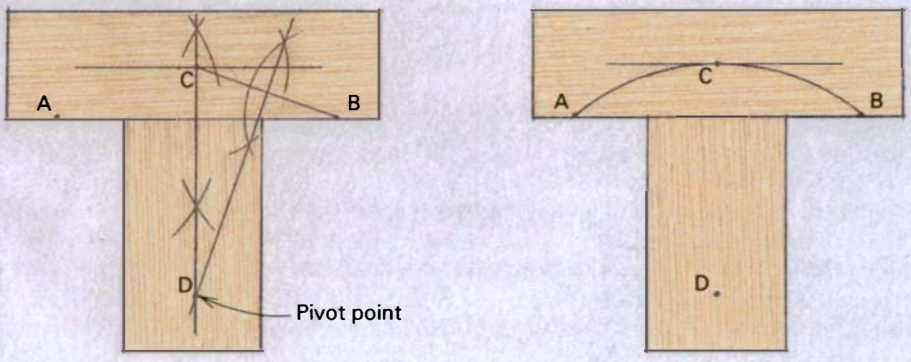
To determine a few points along the curve, draw a 1-in. grid pattern over the area of the full-scale drawing containing the curve. Draw the grid on actual stock or on template stock. Determine where the curve intersects the grid lines on the drawing, and transfer those points to the grid on the wood. When working from a scaled drawing, draw the grid on the drawing at the same scale, lay out the curve at scale and transfer it to the wood.

Set finish nails at those points, and bend the batten stock to touch each nail. Prevent the stick from breaking by applying the bending force from near the end of the batten rather than just beyond the points you've marked. Where necessary, sandwich the stick between two nails to hold it in place. At the ends of the curve where the batten leaves the board, add extension boards to which you can fasten the free ends of the batten. Don't let the protruding ends just run straight. That would cause the curve on the board to go out of fair between the points marked on the stock.

Before drawing in the curve, eyeball it. You can readily see if it's a sweet, fair curve. Don't hesitate to let your eye overrule a marked point to make it fair.

4) Repeat steps 2 and 3, except swing from B and C instead of A and B. Where this new line (perpendicular to the segment between B and C) intersects the line you drew in step 3 is the pivot point for the arc you wish to draw.

5) Set compass or trammel to the distance between D and A (or B). Swing arc through A, B and C.



Drawing an arc with a compass

If a curve is nothing more than an arc (a portion of a circle), you can use a compass or a trammel beam to draw it. The only trick is finding the center of the circle—the pivot point for the compass or the beam. It's not difficult to do, but it's not exactly intuitive either, hearkening back to high-school geometry, which may not be all that fresh in your mind anymore. Figure 1 at left shows you how.

Laying out rounded corners

Unofficially, I draw in rounded corners by reaching into my pocket, taking out a fist-

ful of change and using a coin as a round template: A penny produces a ⅜-in. radius arc; a quarter produces about a ½-in. arc and a half dollar gives you a ⅝-in. arc. For larger radii, I've even rummaged through my finish supplies for cans with a radius close to what I wanted.

Officially, and when I'm out of change or fed up with using out-of-round cans that leave a ring of old paint or oil on the wood, I use a marking gauge and compass to draw in a rounded corner quickly and accurately (see the near right photo). I set the marking gauge to the radius I desire and run the gauge along each edge of the wood to the corner. At the intersection of the lines, I place the pivot point of my compass, which I've set to the same radius as the marking gauge, and I draw in the rounded corner.

***Laying out round corners** is easy with marking gauge and compass. Set both for the same radius, mark intersecting lines with the gauge, and you have a pivot point.*

***Centering rules and regular rules** are both useful for locating centers. They can also be used for establishing regular intervals across a board's width.*

Laying out equal divisions

Sometimes, when laying out a piece of furniture, you need to divide a board into parts of equal width, whether halves, thirds or more parts. Centerlines are often needed to locate joint cut lines or assembly positions. Multiple divisions are needed to locate the parts of certain joints, such as dovetails. Components that are to be located evenly between two points, such as chair slats, must be laid out so they end up with equal spacings between them. The process can seem complicated, but with certain layout tools and just a little bit of arithmetic (the first and only time I'll burden you with number crunching), these tasks can be made a lot easier.

The simplest way to find a centerline across the width of a board is to use a centering rule, a rule that reads both to the right and to the left of a 0 at the center of the straightedge (see the photo at right). To find a center point, you need only position the rule so that the same number appears over each edge, and the 0 will indicate the center point.

A standard rule can be used to locate any number of equal divisions across a width. Let's say that you want to divide an 11-in. board into four equal pieces. To do this, lay the rule on the board with the 0 point over an edge. Then set the 12 (a multiple of 4) on the other edge of the board (see the photo above). In most cases, you'll have to angle the rule to do this. Now just mark your division lines (here, 3, 6 and 9), and then extend or transfer them, using a marking gauge (or a combination square if

Turning chaos into order

by Ed Speas

Amateurs sometimes resist structure in their woodworking, thinking, "It's my hobby, my relaxation, my fun." But there's nothing relaxing about making mistakes and nothing fun about building ugly furniture. I was taught to build furniture following a specific procedure. Since learning and following this procedure, my furniture has been nicer-looking and better-built. Moreover, the process itself is more enjoyable now. I've eliminated much of the stress and anxiety that are the products of an incomplete vision of a finished piece and the path to it. Don't let the structure of this procedure scare you off. It's not meant to dictate every move you make or steal the enjoyment out of your work but rather to turn chaos into some type of order. Here's what I do:

1. Design: You need a design, whether your own or someone else's. Don't be afraid to sketch it out—you don't have to be an artist. Just get something on paper, so you can see the design rather than just imagining it.

2. Working drawings: These are simply orthographic line drawings (see *FWW* #101, p. 78), which include front and side views, an overhead view and any sectional drawings needed. Now is when you start to assign dimensions to each part. These drawings don't need to be pretty; they just need to be accurate. A full-sized working drawing is best because it's easiest to judge proportions from, and you can also use it to determine angles and tapers for machine setups.

3. Mock-ups and models: This is a step that everyone should follow though few do. A scale model is great—at least you get a three-dimensional feel for how a project will look, but a full-sized mock-up is best. Use any cheap, easy-to-work material like particleboard, scrapwood or even cardboard. Nail it, screw it or use hot-melt glue—whatever is fast and easy. Just make sure that the dimensions are accurate. This is your last opportunity to make any significant changes.

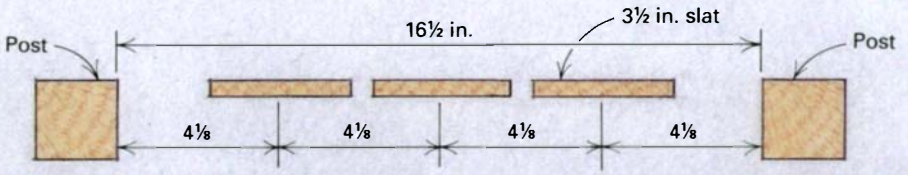
4. Cutting list: This lists every part in your project with its description, width, thickness and length. Be sure to include any practice pieces you might need to use for setting up jigs, setting bit heights and the like. It's much easier to prepare these along with the actual parts than to try to duplicate them exactly later.

5. Selection: Now decide which piece of wood to use for each part. Start with the

***An effective and cheap centering scribe** can be made from a piece of scrap wood, two dowels and a drywall screw, as the author demonstrates above.*

Fig. 2: Spacing components evenly between two points

If components are centered on equal division lines, spacing won't be equal.



To space components evenly, use this formula:

$$S \text{ (spacing between components)} = \frac{D \text{ (distance between posts)} + W \text{ (width of slat)}}{N \text{ (number of spaces between slats and posts)}}$$

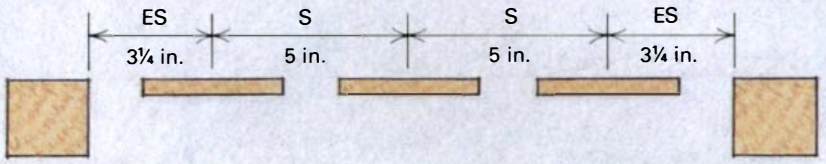
$$S = 16\tfrac{1}{2} + 3\tfrac{1}{2} \div 4 = 5$$

$$S = 5 \text{ in.}$$

Spacing between posts and outermost slats (end spacing, or ES) is determined by subtracting half the width of one slat from the spacing determined with the above formula.

$$ES = 5 - (\tfrac{1}{2} \times 3\tfrac{1}{2})$$

$$ES = 3\tfrac{1}{4} \text{ in.}$$



the end of your board is square).

To draw centerlines over the length of a piece of stock, I made a simple centering marking gauge, consisting of two dowels, a little block of scrap and a common drywall screw (see the photo above). When using the gauge, it's important to keep the dowels tightly against both sides of the stock. A nice feature of this type of gauge is that the centerline remains true even if the stock changes in width along its length.

Now for the math. To determine the centerlines of a number of components spaced evenly between two points, it's necessary to know how many components you want to fit in the space and how wide the space is. Let's assume you want to space three chair slats evenly between chair posts that are 16½ in. apart (see figure 2 above). Add the width of one of the slats (3½ in. in this case) to the width of the space between the posts (16½ in.) for a total of 20 in., and then divide this sum by the total number of spaces (4) between slats and posts: 20 in./4 = 5 in. Now mark the centerlines of the outside slats at 5 in. less half the width of a slat (1¾ in.), or 3¼ in. from the post. Mark the centerline of the middle slat at 5 in. from the centerlines of the two outside slats. □

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

most visible parts, and use the nicest-looking wood where it will count. Work your way down to the parts that show little or not at all. Spending a little extra time now will have a great effect on how the finished piece looks. Don't be afraid to waste a little material to get the look you want—it's worth it.

Now you're ready to make sawdust: You know exactly how the piece will look and how you're going to build it.

6. Preparation of stock: After rough-cutting all of the parts with a bandsaw or jigsaw, it's time to mill or prepare stock (see *FWW* #102, p. 74). This consists of flattening one face and edge on the jointer, getting the stock to the desired thickness with a thickness planer and cutting to width and length with a saw.

Preparation of stock is not exciting, but it's important that you take your time and do it right. Quality furniture begins with parts that are flat, square and true.

7. Mark out and cut joints: If you're cutting joints by hand, mark out the joinery now. If you're cutting the joinery with a machine, now is the time to set up your jigs and stops, using the practice pieces you have already prepared.

8. Shaping: After cutting the joints, do any shaping required. This could mean rounding over edges, tapering legs, hogging out a seat or almost anything else. Whenever possible, cut all your joinery before you alter the shape of the part. Jigs and fences are much easier to set up for straight and square stock than they are for tapered or curved parts.

9. Finish inside surfaces: Inside corners can be difficult to finish and not much fun. It's much easier to apply the finish to the parts while they're still separate than after they're assembled. Also, glue squeeze-out on raw wood can create finishing problems. If the surfaces are pre-finished, simply let the squeeze-out dry, and pop it off with a sharp chisel. Glue will not stick to the finish.

10. Subassembly: Chances are you'll have a subassembly or two to take care of before final assembly. Each one will usually create more inside surfaces that should be finished before moving to the next step. For example, a pigeon-hole unit's outside surfaces need to be finished before the unit is installed because it would be much more difficult to finish when it's tucked into a secretary or rolltop desk—particularly where its edges meet the inside walls of the main piece.

11. Final assembly and finishing: By now, there should be very little finishing to do. Glue and clamp the piece together, finish the outside and stand back to admire a job well-done. □

Ed Speas works wood in Ballground, Ga.

Hidden Compartments

Secrets of 18th-century furniture revealed, giving clues for modern makers

by William Sayre

Photos: Amanda Merullo/courtesy of Historic Deerfield, Inc.

***The secret compartments hidden** within the elegant lines of this bombé desk and bookcase will challenge any would-be thief. The compartments shown in the photo on the facing page are typical of those found in other pieces of this period.*

***Nine hiding places revealed**—The secret compartments in this 18th-century bombé desk and bookcase (left) include small drawers disguised as moldings and a pull-out central safe called a prospectus (also shown on the front cover) with its two document compartments. The prospectus pulls out to reveal three additional secret boxes. These boxes drop down through the desktop into a compartment hidden behind the top drawer of the lower chest of drawers. To provide security for valuables kept in the home, 18th-century furnituremakers frequently included secret compartments such as these. Their ingenuity in making room for these hiding places and keeping them secret adds to their mystique.*

"Is there not one little drawer in your soul, my sweet reader, which no hand but yours has ever opened, and which [no others] suspected? What does it hold?"
—Oliver Wendell Holmes, 1809-1894

Secret compartments have intrigued humans for as long as we've needed a secure place to hide our valuables. The Egyptians incorporated secret compartments in the pyramids. The English Tudors used false floors between upper and lower rooms in their 16th-century buildings. The Tudors even included hiding places in their furniture by adding false backs to wardrobes and by putting sliding panels under beds. The need for secure storage for coins, jewelry and important papers, such as promissory notes, deeds and wills, increased with the rise of the wealthy merchant classes of England and America during the 17th and 18th centuries.

Today, some of these compartments aren't so secret anymore, having been revealed by wood movement, wear or overuse of certain techniques. But even so, we should remember that in their time these compartments functioned well. We can study the techniques of our forefathers to discover methods of disguise and pitfalls to avoid, thus enhancing our own furniture, adding interest and providing security for valuables.

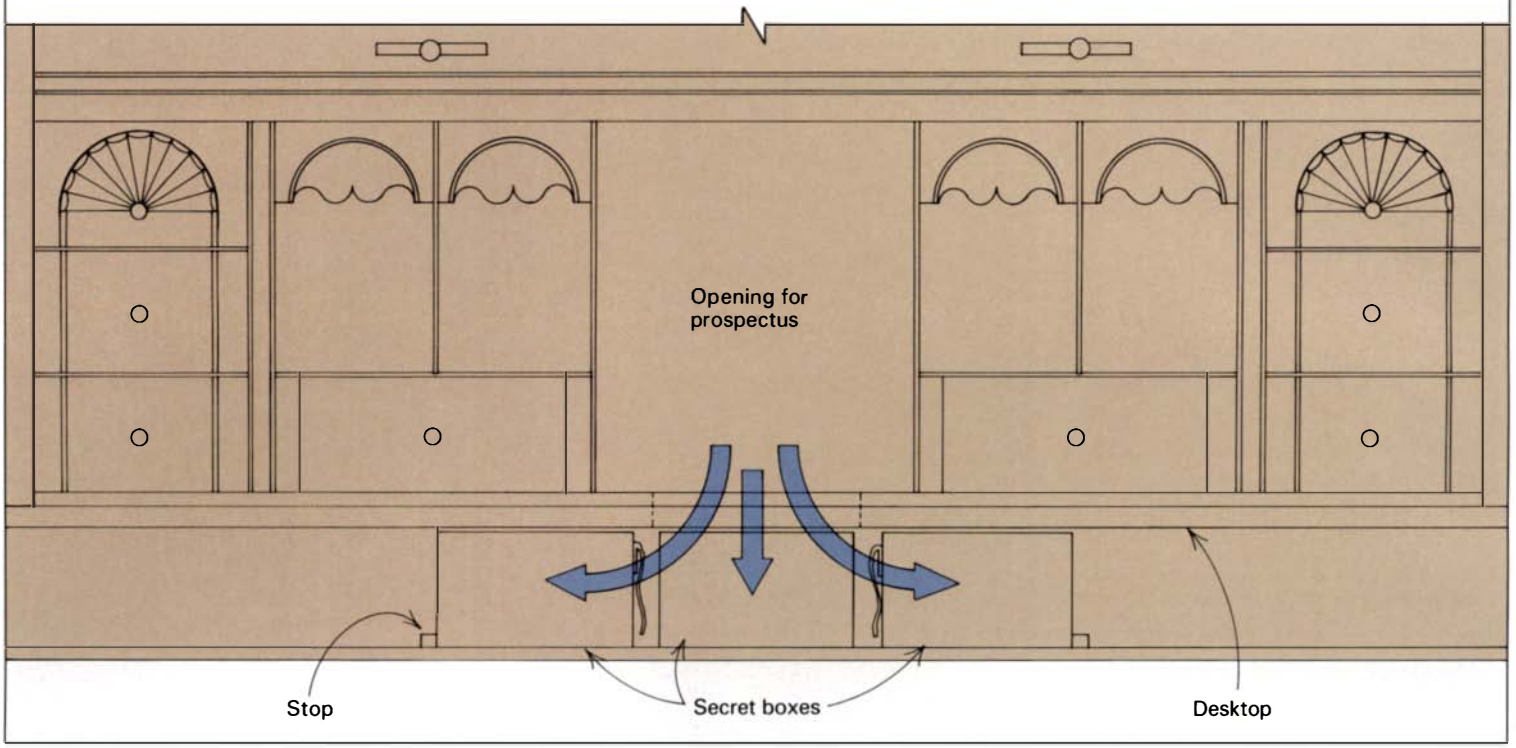
Historic Deerfield is a wonderful place to start such a study. Located in the fertile Connecticut River Valley, Deerfield was a magnet to the early settlers of western Massachusetts in the 1660s. Twice destroyed by Indian attacks, Deerfield today encompasses a museum of 13 Colonial and Federal period houses with distinguished collections of silver, ceramics, textiles and furniture.

Nine compartments in one piece

One of the most important objects in the Deerfield collection is a bombé desk and bookcase with its characteristic swelling of the lower half of the carcase. The piece was made in Boston for a member of the Ames family around 1770 (as shown in the photos

Secret compartments

Boxes that drop down through the desktop sit on a shelf hidden behind the top drawer in the bombé desk and bookcase. The top drawer is 3 in. shallower than the rest to accommodate the shelf.



on pp. 82-83) This combination office, library and security vault has nine hidden compartments built into it; some are commonplace, but others are quite clever.

Upon opening the central writing section, secured with lock and key, a would-be thief is confronted with a dazzling array of architectural details, pigeonholes, drawers and a locked central door covering the prospectus, which is an 18th-century term for the bank of drawers in the center of the writing section, as shown in the front cover photo.

Pulling on the arches above each pigeonhole (see the photo on p. 82) reveals the first series of compartments. The arches are in fact fronts of four small concealed drawers, readily accessible and hidden by a commonly used device: deception.

Behind the prospectus door are another three small drawers. The complete prospectus slides out by removing the top drawer and releasing a hidden latch through a hole in the top of the prospectus, as shown in the front cover photo. On the back of the prospectus are two small vertical document drawers.

However, our clever but unknown cabinetmaker did not stop there. At the back of the prospectus' opening, hidden where a flickering candle would throw deep shadows, lies a small panel flush with the floor of the compartment. Removing this panel reveals a space behind the top drawer of the lower case that holds three small boxes, as shown in the photo on p. 82 and in the drawing above. The three boxes lie on a hidden shelf. The only sign of the compartment's existence is that the top drawer and the second drawer of the lower case differ in depth by about 3 in., a fact easily missed by a person in a hurry.

Variations on a similar theme

Another example of "security" at Historic Deerfield is the Marsh desk, a Boston-area, block-front desk and bookcase made for the Rev. John Marsh of Wethersfield, Conn., about 1775 (see the top two photos on the facing page). Although the layout of this piece is similar to the Ames' desk, the hidden compartments are different. The prospectus is fixed, but pilasters are attached to removable secret document drawers at either side, as shown in the photo at right. This technique of pilasters as drawer fronts was commonly used in furniture of this period, some using imitation book spines instead of the half columns.

Behind two of the other small drawers lies another secret place. If you pull out the outer, lower drawers and pry at the seams on the floor inside the drawer compartments, out slide drawers attached to false bottoms. Two-hundred years of prying has now made this seam quite visible. An access hole through the desktop would let you push the false bottom out from the drawer below, reducing wear and tear and helping to maintain the secret of the hiding place.

Hiding compartments behind molding

The Gerrish family's high chest of drawers, made in the Newbury, Mass., area during the second quarter of the 18th century, shows yet another technique for hiding a secret compartment. A drawer hidden behind the cornice molding at the top of the cabinet, as shown in the bottom photo on the facing page, holds important documents and is one of the most common methods used for this type of storage. An access hole from below provides the means to push the drawer out.

After many years of use, the lower edge of the drawer front has worn away, exposing a gap when closed. A better drawer support system, such as side-hung drawer runners, would prevent this wear and safeguard the molding's secret.

Adding 18th-century ideas to modern furniture

The general techniques used in these pieces of 18th-century Massachusetts furniture provide inspiration for today's designers. The central problem is to find a space, large or small, within a structure and to provide access to it in an unexpected way. Within case

Drawing: Maria Meleschnig

***The secrets of this block-front desk and bookcase** are not easily discovered because the maker used detail lines to hide the gaps where the compartments fit into the carcase.*

***Two document compartments and two smaller compartments** for coins or jewelry are easily accessible from the front of this block-front desk. Unlike the bombé desk and bookcase, the document compartments simply slide out. The small boxes are well-disguised because they have an extended bottom that appears to be a built-in part of the desk. But because the fit was so snug with no provision for lifting the box out, it has become worn and readily shows something is behind or under this piece.*

***Hiding compartments behind moldings** was fairly common. Here the cornice molding hides a document compartment, but drawers can hide behind base moldings or waist moldings as well.*

goods, there are ready-made places behind drawers, moldings and other decorative elements. Don't overlook those spaces that can be hidden with false floors and backs, such as drawers or section dividers and even false walls of the cabinet itself. Other potential hiding places are hollow devices such as finials, behind bracket feet and even the hardware itself.

Most important to remember when designing for secret compartments is to make a precise fit and to allow for wood movement. Conceal seams by placing them at normal detail lines, as seen in the top photo of the pilasters on the Marsh desk and bookcase. Design to prevent wear spots that might occur from using the compartments; they should be easily removable so wear spots aren't created when prying them out. And try to make the compartments as accessible as possible. If the entire piece needs dismantling to get to a secret compartment, it will not be useful. Another neat trick for maintaining a secret compartment is to use a hidden latch to secure the compartment and to prevent it from moving around. I have seen compartments that released by pushing on a certain spot on a board, by waving a magnet over a hidden iron latch and by pushing on the divider between pigeonholes. Certainly your imagination is the only real limit. □

William Sayre designs and makes fine custom furniture and instructs full-time students at his studio in Easthampton, Mass.

Setting Jointer Knives

All you need are a few simple tools and an inexpensive dial indicator

VIDEO TAKES
SEE PAGE 89

by Robert M. Vaughan

A jointer can perform only as well as the condition of its knives. This means, of course, that the knives must be sharp. But even if the knives have been properly sharpened, they won't cut wood cleanly and consistently unless they are set correctly in the machine.

The most frustrating aspect of setting a jointer knife is that it will raise slightly as the lock-shim is tightened. To help set the height, I've tried straightedges (see the photo below) and magnetic knife-setting fixtures but with little success. This is because the geometry of the knife-holding assembly dictates that the setscrews, when snugged, will raise the knife in the cutterhead (see the drawing on p. 89). But by using a dial indicator (see the photo at left on p. 88), I can see how much the knife raises when tightened to anticipate this movement. I then reset the height to compensate for the effect.

The principles I use to set jointer knives apply to all jointers, though not to most jointer-planers. Using an 8-in.-wide jointer as a reference, I'll explain how I set knives in the machines I frequently repair for high schools and production shops. But first, I'll talk about sharpening and balancing the knives.

Getting sharp and balanced knives

I have had only marginal success when I tried honing jointer knives myself. Some woodworkers, to extend the use of installed knives, will hone a secondary bevel on them while they're still in

Conventional jointer-knife-setting wisdom calls for setting the knife edges level with the outfeed table. To do this, raise each knife into position, and then slightly snug its lock-shim. However, if you set the height with a magnetic fixture or with a straightedge, as shown here, there is a drawback: Because of cutterhead geometry, final tightening can raise the knives somewhat unpredictably above the height you've established.

the machine (see *FWW* #102, p. 52). While the procedure works fine for limited operations, such as surfacing figured stock, it won't work if the knives have been worn too much. So for the time and hassle it saves, I prefer regular knife grinding by an experienced sharpener. Professional shops charge about 35 cents per inch of blade to put on a straight, hair-shaving edge. The knives should come back from the sharpener equal in size and in weight. If they're not, you risk causing an out-of-balance cutterhead. To avoid this, I always weigh the knives on a sensitive scale before I install them. If needed, I grind off some steel from the ends or from the backs of the knives until I have a balanced set.

It's a good idea to keep a spare set of honed and balanced knives to use while you're waiting for the original set to be sharpened. Order the knives directly from the machine's manufacturer because after-market knives are often slightly bigger or smaller than the factory knives. Occasionally, new knives produce streaks on the stock. Don't worry. This is normal and should disappear shortly. If your razor-sharp knives have a wire edge, carefully remove it with a stone. While you're at it, you can bevel the ends of the knives, so you'll get smoother rabbet cuts with your jointer.

Determining outfeed height and safe knife size

I always set the tip of the knives at the exact height and parallel to the top of the outfeed table. Check your jointer's manual to see how far above the head the knives should protrude. Generally, the heel of the knife bevel should be about 1/16 in. above the cutterhead (see the drawing on p. 89). If the heel is below the cutterhead, you are inviting chips to get compacted there. The knife tip should also extend 1/16 in. or so above the lock-shim chipbreaker. Set the outfeed table to allow for these measurements. For jointers without adjustable outfeed tables, you may want to set the knives .002 in. proud of the table to allow for the quick edge wear that commonly occurs after sharpening. If your cutterhead has jackscrews, be sure that the knife lifters don't stick above the arc of the knives (see the drawing detail on p. 89).

What if you suspect your knives are too narrow? A good rule of thumb is the bottom of the knife, when properly placed against the lock-shim, should not be visible through the setscrew holes. Reject the knife if you see the bottom edge (or if you don't see any knife at all). You want the holes to be filled with knife so that they get full pressure from the screws. Also, to avoid distorting the cutterhead, you want to remove and reset only one knife at a time. It doesn't take a lot of torque to snug the lock-shims. To get a feel for this, loosen a couple of the correctly installed lock-shim setscrews; then re-tighten them to their same positions while you note how much pressure it takes to return it to the original spot.

Preparation

Before you install the knives, pull the jointer's plug, and place it in clear view (see the photo at right on p. 88). Next remove the fence, guard and dust-collector boot. Then clean up the work area to keep dust out of the cutterhead and to make dropped parts easier to find. Get a stool so you'll save your back (see the photo above), and plan to replace the knives in one session. Number each knife slot on the cutterhead with a felt-tip marker so that you will have a reference later. Check the cutterhead for any play. It should be tight from side to side but revolve freely. Also check to see that the pulley is snug. If you have an adjustable outfeed table, lock it securely in its ways.

About the dial indicator—A dial indicator is the best instrument I've used to set jointer knives. An imported indicator with magnetic base (available from Enco Manufacturing Co., 5000 W. Bloomingdale Ave., Chicago, Ill. 60639; 800-873-3626 or J&L Industrial, P.O. Box 7604, Charlotte, N.C. 28241; 800-262-6650) costs about $25. Though not as durable as the machinist-grade indicator I use in the field, the cheaper model serves well in a woodshop. I hacksawed off the reduced-diameter end of my indicator's arm, so I could rotate the dial to face me. To go with the indicator, I recommend you buy a 3/8-in.-wide convex replacement tip. The tips, which are sold by machine-shop suppliers for about $3.50, spread out the contact area on a sharp knife edge.

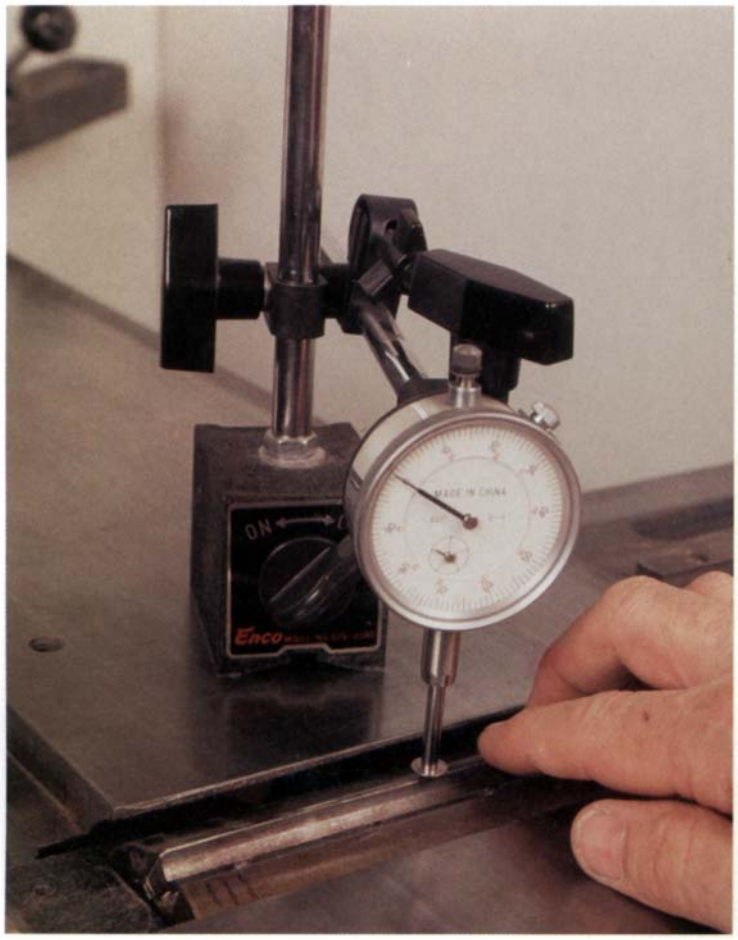
***Jointer preparation** involves clearing the area and getting comfortable. Tools the author has gathered for the job include a dial indicator, a toothbrush for cleaning parts and an extension pipe to apply torque to his custom-ground setscrew wrench.*

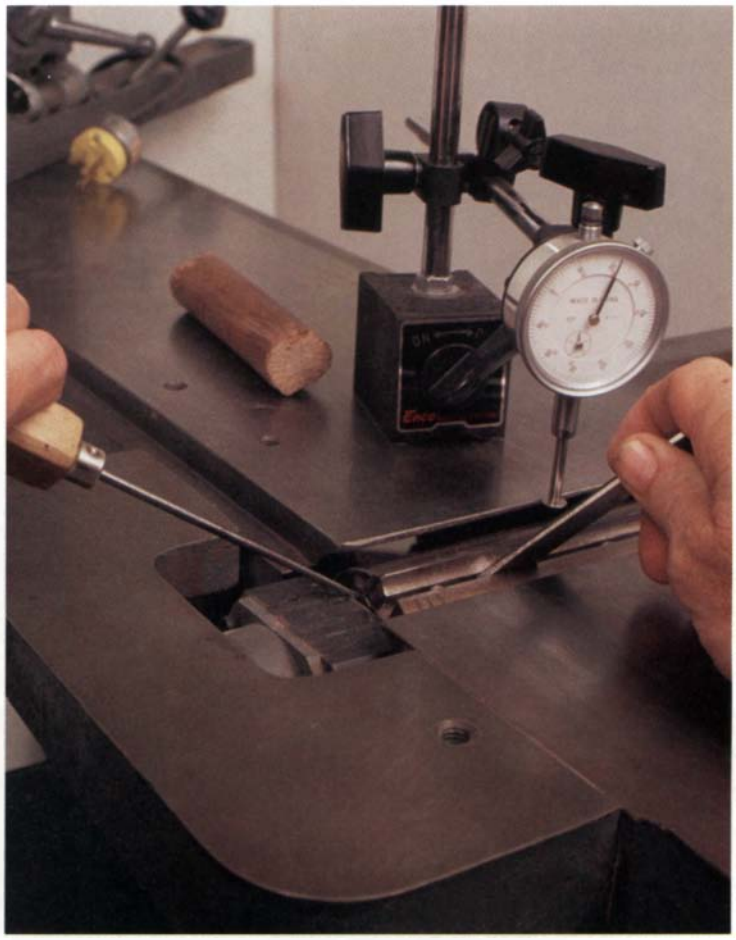
Other tools you'll need—The next important item for the job is a thin wrench to slip in the knife slots and to snug the lock-shim screws. I ground my own wrench from an old planer blade (see the photo at right on p. 88). It's also helpful to use a wrench extension (I use a piece of copper pipe) to keep your knuckles out of knife-slicing territory.

About 40% of the jointers I service have knife lifters and jackscrews that raise and lower with an Allen wrench (see the photo on the facing page). For the rest of the jointers, I stick an ice pick between the bottom of the knife and its slot and pry the knife up (see the photo at right on p. 88). When prying up a knife, make sure the setscrews are only tight enough to keep the knife from falling out as the cutterhead is rotated. To knock a knife down, I use a wooden block. If a little more force is needed, I tap the block with a plastic-headed mallet (see the photo on p. 89).

To clean sawdust out of the knife slots, I use an old toothbrush (see the photo above). I use a piece of emery cloth and some solvent to loosen pine pitch and light rust. It's also handy to have some fine sandpaper to remove any burrs from the lock-shim.

Photo facing page: Gary Weisenburger; photo this page: Alec Waters





Calibrating the indicator—Set the indicator's magnetic base on the outfeed table, but leave the magnet off so you can slide the base. Locate the arm so the plunger tip brushes the top of the cutterhead. Set the fine-adjustment knob so the dial's hand moves a few thousandths as you move the base back and forth perpendicularly to the head. When the plunger is over the cutterhead's top dead center (TDC), the gauge will be at its maximum reading. Carefully move the arm, so the tip touches the outfeed table. Zero the gauge by turning the dial. Your datum is now at the plane of the top of the outfeed table. While you're setting knives, you should periodically recalibrate the instrument in case you lose zero.

Setting the knives

After I remove one of the old knives, I loosely install a sharp knife in the cutterhead approximately in its proper position. In a nutshell, here's how I use the dial indicator:

1. With the indicator calibrated, I slide its base on the outfeed table to the far (fence) end of the cutterhead.
2. I swing the indicator's plunger over the cutterhead and find its TDC by moving the base forward and backward.
3. I hold the base position with one hand once I've found TDC.
4. I rotate the cutterhead backward until the knife edge is under the tip (see the photo at left above) and then adjust the knife height, so the dial shows it is about 0.002 in. below the outfeed table. While snugging the screw, I check that the tip of the knife raises to the intended height (the reading should approach zero). Then I repeat this at the other (rabbeting) end of the cutterhead.
5. Working my way down the knife, I adjust its height (by prying or tapping down) over each lock-shim setscrew, so when the screw is tightened, the knife edge is even with the outfeed table. By rocking the cutterhead back and forth, I make sure I'm reading TDC.
6. I go back and evenly torque all the setscrews. It is important to get uniform pressure (and stresses) throughout the head, so I use the wrench extension, which gives me a better feel for this.
7. I rotate the cutterhead and remove the next knife. I roughly position another sharp knife and repeat the above sequence.
8. With all the knives in place, I double-check that their edges are level with the outfeed table. I then use the indicator to set the infeed table at the height of the outfeed table. If necessary, I readjust the pointer of the depth-of-cut gauge to read zero.

For an average 6-in. or 8-in. jointer, it takes about 1½ hours to set knives with an indicator the first time. After that, you'll be doing it in 45 minutes. Although the job is tedious and exacting, you'll soon be hearing the sizzle of sharpness and precision, instead of the drumming of a single knife against your stock.

Correcting crooked and nicked knives

Occasionally, a knife will be ground with a slight bow in it—usually low in the middle. You can correct the concave shape by deflecting the knife into position. You'll actually be snaking it (we're talking a few thousandths of an inch here) up or down at the screws. To do this, zero and lock the knife in the middle of the head. With the setscrew on one end snugged just slightly, tap down and tighten the lock-shim as you move along the knife. Go to the other end, and repeat the procedure. Similarly, you can correct a convex knife by snugging the ends and then knocking down the knife's middle section.

If you hit a nail with a fresh set of knives, no big deal. All you have to do is reset two of the nicked knives. Just slide and lock one to the left and the other to the right to erase the nick. □

Robert Vaughan is a contributing editor to Fine Woodworking, *and he rehabilitates woodworking machines in Roanoke, Va.*

Photos except where noted: author

***Vaughan uses a dial indicator** with a convex-tipped plunger when he's setting jointer knives (far left). After calibrating the indicator to zero on the outfeed table (where the magnetic base is located), he moves the instrument, so he can read the knife height at its maximum arc over each setscrew. To keep track of where he is, Vaughan marks the knife's slot number on the cutterhead.*

***Anticipating the effect of knife tightening**—On jointers without jackscrews, like this old Rockwell (center), Vaughan pries knives with an ice pick. Setting the edge 0.002 in. shy of the correct height, he snugs up the setscrew using a thin wrench. Note that the disconnected plug, draped over the fence, is always in plain view.*

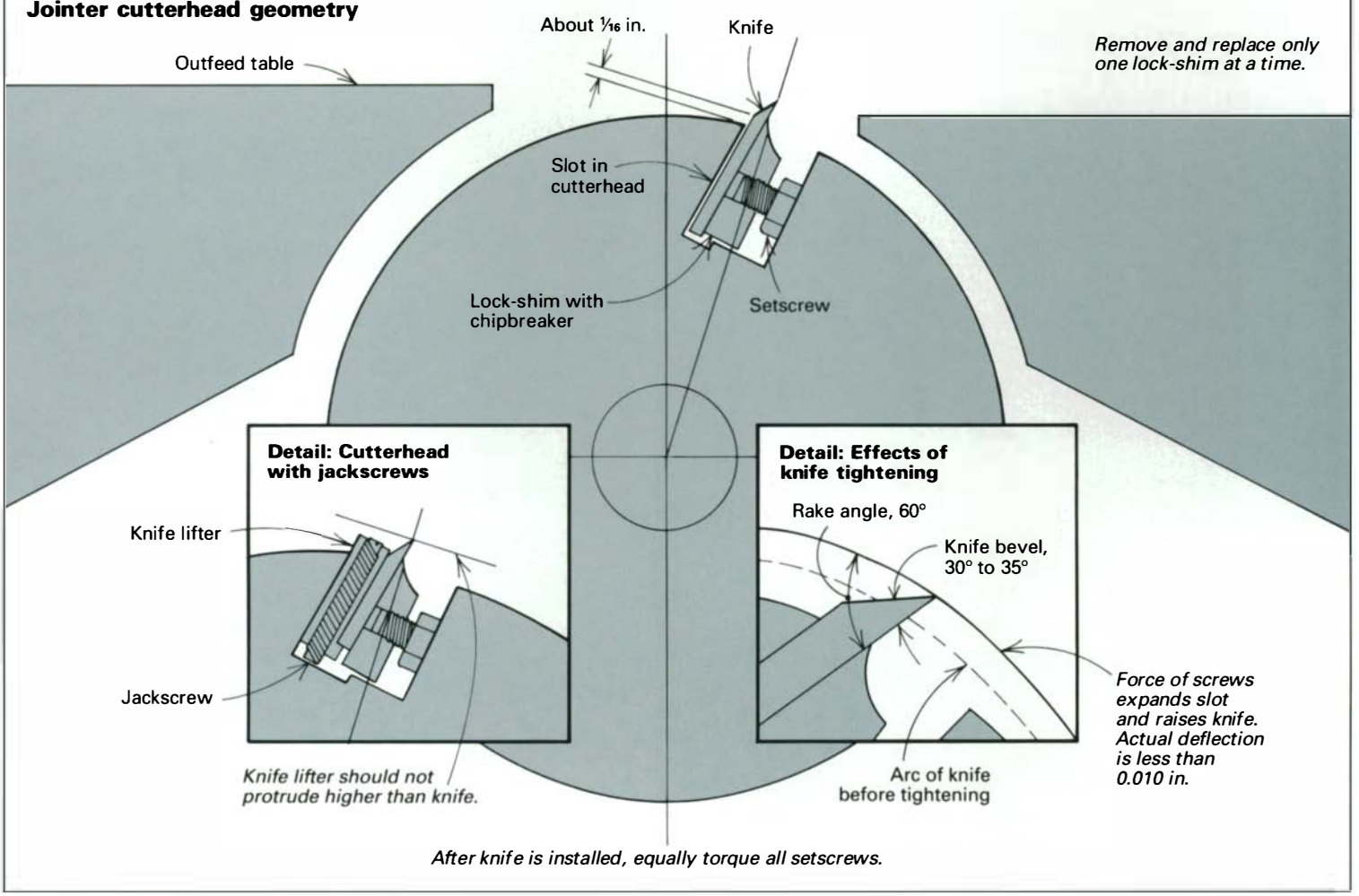
***Resetting jointer knives**—By tapping a wooden block with a mallet, Vaughan lowers a slightly snugged knife whose edge is just above the outfeed table (near left). Next he moves the indicator's plunger back over the knife to recheck the height. After he has worked his way down the length of the knife, he uses the extension and wrench to torque each screw equally but not forcefully.*

Video: Installing jointer knives

"I can't remember ever feeling more anxious than the first time I sharpened and set my jointer's knives, which had worn as dull as marbles," said Robert Vaughan. At the time, he had only a poorly written owner's manual to go by. He would have gladly paid for the chance to look over someone's shoulder to watch knives being safely installed. A 25-minute (VHS) videotape companion to this article will let you do just that. To order, call (203) 426-8171, or send a check for $10 to The Taunton Press Order Dept., Jointer Knives 011034, P.O. Box 5506, Newtown, Conn. 06470.

—Alec Waters, assistant editor

Jointer cutterhead geometry



Drawing: Maria Meleschnig

Carve Decorations with Your Router

Shopmade jig and templates guide consistently accurate cuts

by Driscoll A. Nina

***Carved decorations on this antique Victorian washstand** presented the author with a real challenge when he wanted to make three copies for his children. To overcome his lack of carving experience, the author used a bushing-guided router and slotted acrylic templates to produce remarkably quick and crisp details.*

Many Victorian pieces were embellished with carved decorative details on stiles, rails and drawer fronts. These carvings add interest and can really dress up an otherwise plain piece. Such was the case with the washstand shown in the photo below. The piece had been in my family for 60 years, and I wanted to reproduce it for my three children. The case work was fairly simple as discussed in the story that follows on p. 92. But because I have no carving experience, I was afraid that instead of creating a beautiful focal point for the washstand, I would create an eyesore.

To compensate for my inexperience, I developed a series of templates to direct a router equipped with a guide bushing. By precisely controlling the router's path, the templates made it easy to accurately duplicate the details on each of the reproductions. The same process will produce a variety of carved details and can be used to create designs with inlaid stringing.

To power my cutting bits, I used a Foredom flexible-shaft hand grinder (with a #44 hand piece) housed in a shop-built Plexiglas router base. The Plexiglas is strong, easy to machine and provides a clear view of the cutting operation. This setup makes a compact, maneuverable unit that is easy to control, but any small router or laminate trimmer with a guide bushing installed in the base would do the job.

Template-routing tips

The templates are easy to make. The process includes transferring the design to heavy poster board, which serves as an edge guide for routing the acrylic templates. Although the design could be routed directly from the poster-board edge guides, it would be difficult to properly align each cut, and there is a greater chance for error because the router can drift away from the guide.

A separate template is made for each line of the design to avoid intersecting lines. Intersecting lines on a template create an area at the junction of the lines that is larger than the guide bushing. The purpose of making a template with a slot the guide bushing follows is to constrain the router, so it cannot wander from the cut. The enlarged area of an intersection makes router control more difficult, and if the router wanders, it will ruin the crisp detail of the original design. As you gain experience, you can add more elements to a template, but I still recommend not including intersecting lines on one template.

After all the long, flowing design lines are template-routed, the leaves and the

Photos: Charley Robinson

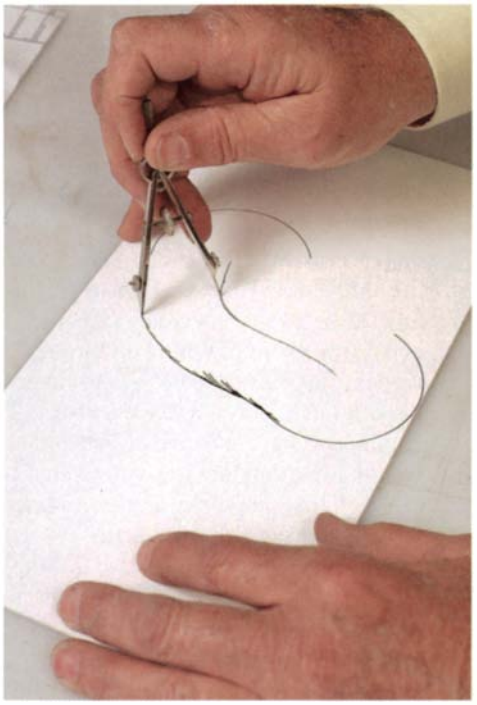
flower petals are then created freehand with some specially ground cutters.

An edge guide helps cut templates

As an example of template-routing, I'll go through the steps required to reproduce the design on the washstand's backsplash. This design required seven individual templates, one for each flower stem or branch.

To get an exact copy of the design, I made a pencil rubbing of the original backsplash. A pencil rubbing is made by laying a piece of paper over the design and gently rubbing the entire area with the broad side of the pencil's point.

From the rubbing, I transferred one stem of the design to a piece of poster-board using carbon paper. The next step was to create the path that the edge of the router base must follow to cut this stem. To do this, I set a compass to the radius of the router base and swung a series of arcs about ¼ in. apart along the length of the stem, as shown in the top left photo. With this technique, arcs of the design must be greater than the radius of the router's base. I drew a full 180° arc at each end of the stem. I connected the high points on all the arcs with a smooth flowing curve that blended into the 180° arcs at each end. Then I cut along this line with a sharp knife going around the end arcs and cutting away the concave side. The outside piece of the poster board becomes the edge guide for routing the acrylic template.



***A poster-board edge guide** is made by using a compass to describe the path of the edge of the router's baseplate as the bit follows the pattern. Cutting out the center section leaves a guide for routing the slotted templates used to carve the decorations.*

***Routing acrylic templates**—The author holds the router firmly against the poster-board guide to rout an acrylic template. A separate template is needed for each flower stem or branch in the design.*

***Registration marks are drilled** through all the templates after they have been aligned with the pattern. Two registration dots are made on the wood through holes in the pattern. Lining up the template's holes with the dots precisely positions each template when routing the design.*

Making the templates

I've found the ⅛-in.-thick acrylic plastic sold for reglazing storm doors makes great templates. The material cuts easily on a tablesaw with a sharp plywood blade, and any incidental chipping can be controlled by using a zero-clearance saw-table insert. All the template blanks should be 4 in. to 5 in. larger than the overall design size. Don't skimp. The extra space allows room for adding registration marks, maneuvering the router and clamping the template and material to your work surface.

To make a template, I lay the edge guide on one of the pieces of acrylic and fasten both guide and acrylic to a waste backup board, as shown in the top right photo. With all secure, I cut the template with a two-flute, center-cutting end mill extended enough to pass through the acrylic. The end mill should be the same diameter as the outside diameter of the guide bushing that will be used with the template.

A plunge router can be placed in the poster-board edge guide, plunged through the acrylic and guided from one end to the other while holding the edge of the router base firmly against the poster board. To rout the slot with a non-plunging unit like mine, I held the router base against the end of the poster-board guide with the router tilted, so the cutter didn't contact the acrylic. Holding the router firmly with it set on high speed, I gradually lowered the cutter into the acrylic. The router will tend to twist when the bit hits the plastic, so be ready for it. It might be easier, and perhaps a little safer, to drill a starting hole for the router bit, but the hole must be precisely located to avoid any irregularities in the stem.

I hold the router so that the shavings blow away from the edge guide, as shown in the top right photo. This helps keep the chips from getting between the edge guide and the router and affecting the accuracy of the cut. At the end of the cut, I stop the router before removing it from the cut. I repeat the process for each of the lines on the design, and then I clean up any irregularities in the slots with a file for a smooth, free-flowing curve.

When all the templates were cut, I stacked them on top of the original pattern, aligning each template with its corresponding line. I held the stack in place and drilled two 1/16-in.-dia. registration holes, in opposite corners, through all of the templates and the pattern, as shown in the bottom right photo.

Router-carving the designs

To lay out the design on the backsplash, I position the pattern, and then I make a couple of dots on the board through the registration holes. To accurately position the templates, all I have to do is align the dots on the board with the drilled registration marks. Other design features, such as leaves or petals that aren't routed, also can be marked with holes in the appropriate template.

To cut the stem design in the backsplash, I line up the first template with the registration marks and clamp it in place. Then with a 1/16-in.-dia., roundnose end mill in the router, I tilt the router so the guide bushing begins to enter the slot. I start the router and carefully lower the bit into the

***Adding details**—A key-seat cutter ground to 45° carves the leaves and petals. Handle the cutter carefully, and be sure it has stopped before you put it down.*

work. I try to keep router pressure against one edge for the smoothest curves, but even if I goof, the slot will keep me from getting too far off track. Again, I turn off the router before removing it from the cut, and I repeat the process with the balance of the templates.

Freehand cutting leaves and petals

When all the stems have been template-routed, I add the dots to mark the leaf and petal locations. Although it's not necessary, a line connecting each leaf's dots may help line up the cutter for carving the leaves. I carved the leaves with a 1⅛-in.-dia. key-seat cutter (available from MSC Industrial Supply Co., 151 Sunnyside Blvd., Plainview, N.Y.; 800-645-7270) that I had ground to 45° at a local millwork shop (Razor Sharp Grinding, Route 724, Pottstown, Pa. 19464; 215-326-2866). This unguarded cutter turning at high rpms can be dangerous, so be careful with it. Do not put it down until you have shut it off, and it has come to a complete stop.

With the cutter mounted in my regular Foredom hand piece, I line up the axis of the cutter with the center line of the leaf equidistant from each end and then lower the cutter gently into the wood, as shown in the photo above. The trick here is to keep the hand piece parallel to the surface. A slow feed rate will practically eliminate any tendency for the hand piece to jump when the bit hits the wood. A 3/16-in.-deep cut makes a pretty good leaf, but the cutter can be carefully moved back and forth for a longer leaf. At 12,000 rpm to 15,000 rpm, the sharp teeth of this cutter make a clean cut with little effort, but the direction of rotation should be away from the stem slots to avoid tearing out chunks of wood. □

Driscoll Nina is a woodworker in northern Chester County, Pennsylvania.

Modern tricks for building a Victorian washstand

Small size, nice proportions, ample storage and clean design made the Victorian washstand shown in the photo on p. 90 a family favorite. To eliminate the squabbling over who was going to inherit the piece, I decided to make a copy for each of my three children. I made my copies of white oak, same as the original. These units were also commonly made of red oak, ash and walnut. Keep in mind, however, that the carved detailing will be less pronounced with darker woods and finishes.

I came up with the template-routing technique discussed in the main article to reproduce the carvings accurately because I had to do each design three times, and I was not adept at freehand carving. The technique produces remarkably quick, crisp carvings.

The actual building of the washstand is straightforward, as shown in the drawing on the facing page, and should present no problems. I used three types of joints: mortise and tenon for the stiles and rails, dovetails for the top rail and drawers and biscuit joinery for the drawer guides and top.

Construction tips: The drawer guides should be the same length or slightly shorter than the side rails (not including side rail tenons). Otherwise, the drawer guides will prevent the corner posts from drawing up snugly to the end of the side rails, leaving a gap at this joint. The drawer guides are biscuit joined to the corner posts, and the drawer runners are later screwed to the guides. The drawer runners also serve as kickers for the drawer below the runner. Kickers prevent the drawer from tipping down while it's pulled out. I fasten my runners through vertically slotted holes, so I can easily make adjustments to align the drawer face with the carcase. I can also position the runners slightly higher than a drawer's lower rail to prevent the drawer from rubbing against it and wearing away the finish. And the runners can be adjusted to compensate for wear to either the runner or to the bottom edge of the drawer side.

When it comes time to assemble the side panels, you'll wish you had three hands because everything goes together at once. The top and bottom rails, the center stile, the side panels, all the drawer guides and the corner posts are all glued together in one assembly. A dry run, assembling the whole unit before gluing, is highly recommended. Or wait for a helper, so you don't end up in a jumbled pile of partially glued parts.

The floor is supported by cleats screwed to the back and front bottom rails, as shown in the drawing. I set the cleats so the floor sits ¼ in. proud of the front rail and acts as a door stop. The floor, which must be notched to fit around the corner posts, is a lot easier to install if made in two pieces.

The vertical partition is made up of as many pieces of ⅜-in.-thick pine as is necessary to reach just below the bottom of the top drawer. These pine pieces simply slide into their retaining grooves.

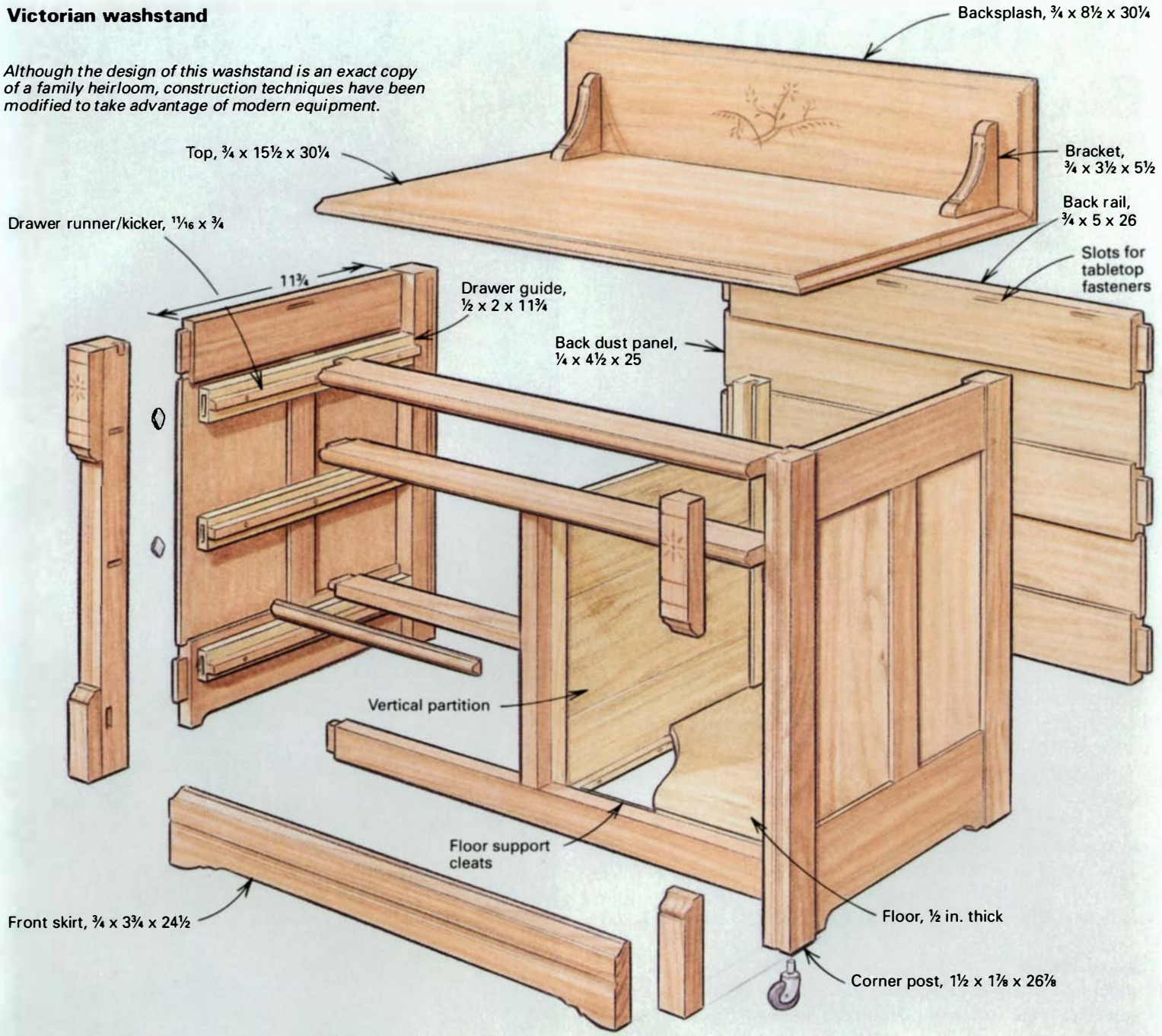
The backsplash, top and brackets are screwed together. This top assembly is held to the cabinet by tabletop fasteners (available from The Woodworkers' Store, 21801 Industrial Blvd., Rogers, Minn. 55374-9514; 612-428-3200). These fasteners screw to the underside of the top and have a tab that fits in a slot in the carcase. The slip fit of the tab in the slot allows the top to expand and contract without affecting the carcase. A biscuit joiner makes quick work of cutting the carcase slots.

Molding profiles: I've gotten by for many years without a shaper even though I've done several projects like this washstand that include lots of detailing. My secret is to use a variety of machines, depending on the job, and custom-ground cutters. For beading and molding on the corner posts, drawers, door and front skirt, I had cutters ground for a molding head that mounts on my tablesaw. If you don't have a molding head or don't want to go to the trouble or expense of custom-grinding knives, the same profiles also can be done using a scratch stock.

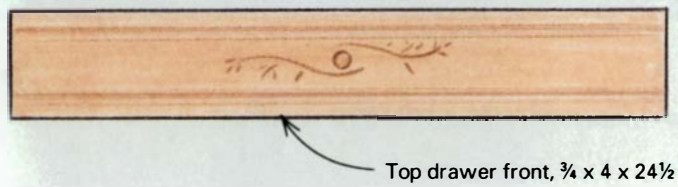
I modified a spade bit, as shown in the drawing, to cut the circle patterns on the drawers. However, if you do use a modified spade bit, heed these cautions: First, use a drill press (there is no way that you can hold this cutter in an electric hand drill); second, cut the shank as short as possible while still leaving enough to fully chuck the bit; and third, clamp the wood securely to the drill-press table. This job can be done more safely, albeit more slowly, with the proper sweep gouge to make the circle and a small chisel to cut the dome-shaped center. *—D.N.*

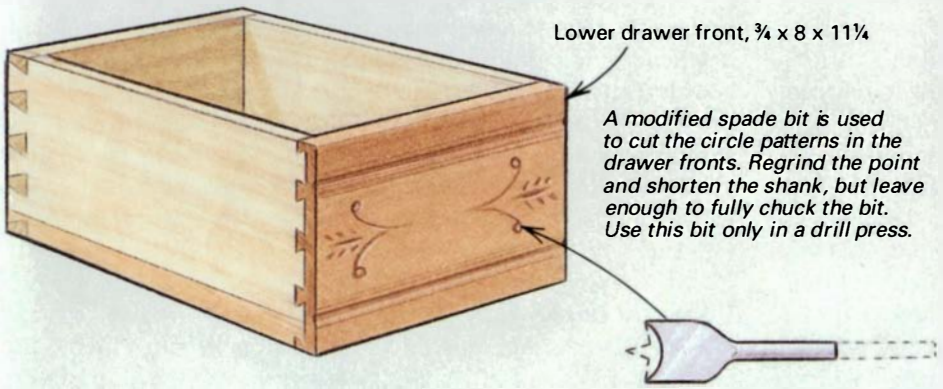
Victorian washstand

Although the design of this washstand is an exact copy of a family heirloom, construction techniques have been modified to take advantage of modern equipment.



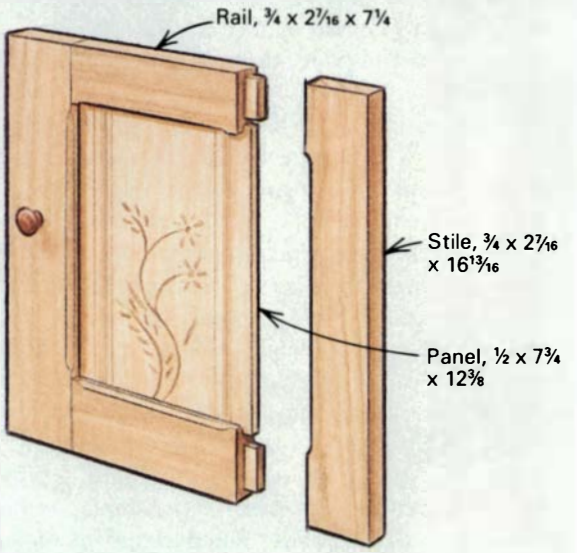
Detail: Drawers





A modified spade bit is used to cut the circle patterns in the drawer fronts. Regrind the point and shorten the shank, but leave enough to fully chuck the bit. Use this bit only in a drill press.

Detail: Door



Drawing: Bob La Pointe

Exposing Your Back Side

Cabinet backs made to be seen

by Christian Becksvoort

***A frame-and-raised-panel back** makes this cabinet, built by Rick Longenecker of Covington, Ohio, look good from any view. The mortised-and-tenoned frame strengthens the carcase and lets the raised panels expand and contract without affecting the carcase.*

The back panel of a lot of case goods is an afterthought, quickly screwed into place before pushing the carcase against a wall where the back is never seen again. But for freestanding pieces or glass-front display cabinets, the back can become the center of attention. When a cabinet back has to play an up-front role, there are a variety of traditional techniques for installing backs that work well. I'll discuss how these techniques have been adapted to contemporary pieces and present an overview of my method of installing a frame-and-panel back.

On display or hidden away, a back serves some important functions. It adds strength and racking resistance, which is most important for open cases and those with adjustable shelves. On closed carcases, the back keeps the contents in and dust, dirt and foreign objects out. When the back is exposed, it should be visually appealing, as shown in the photo at right. And, finally, a back that is square, will automatically square the carcase when it's installed.

Board backs

Traditionally, narrow cabinets often had single board backs. Most often, they were set into rabbets in the sides and top, as shown in figure 1 on the facing page. Nailed into place, the back provided strength and racking resistance while still allowing the wood to move. Rarely, single board backs were set into grooves in the carcase before assembly. A variation of this type of back, that includes two boards separated by a center stile, is shown in the photo at left on the facing page. Done properly, this method provided a dust-proof, virtually air-tight closure that was also visually attractive. But because space must be left between the carcase and the board to allow for expansion and contraction, this method doesn't provide as much racking resistance for the case.

On wider cabinets, individual boards were joined in a variety of ways, such as shiplap, tongue-and-groove or spline joints (see figure 2). The shiplap is easy to make but has a major drawback: If adjacent boards bow in opposite directions, the joint opens, allowing in dust, dirt and light. Nailing shiplapped boards to a fixed center shelf can overcome this problem, as shown in the photo at right on the facing page. The tongue-and-groove joint solves the problem of warping boards by interlocking the tongue of one board to the groove of its adjacent board. A minor drawback to both the tongue and groove and the shiplap is that they consume ⅜ in. to ½ in. of the board's width for the overlap. When making a 4-ft.- or 5-ft.-wide walnut back, this loss to the overlap can prove costly. The spline joint, which is easier to cut than either the shiplap or the tongue and groove, eliminates the waste by butt-joining boards with thin strips that can be ripped from waste.

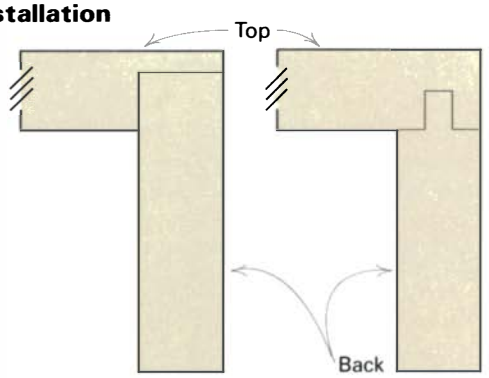
Whichever method is used, the boards must be allowed to move. They cannot be glued into place but, instead, must be nailed into the rabbet. However, individually nailed boards don't offer much racking resistance and shouldn't be used on large, empty cabinets, especially those without integral face frames.

Plywood backs

Plywood is flat, thin, attractive, has negligible movement and comes in 4x8 sheets. Because it doesn't move, plywood can be

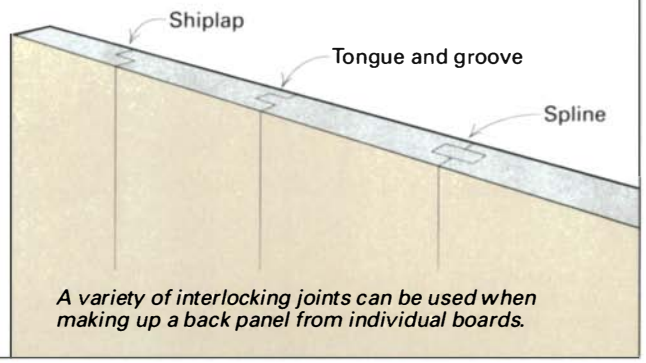
Photo this page: Rick Longenecker

Fig. 1: Back installation



Carcase backs are usually installed in a rabbet after carcase assembly (left), but they can also be installed in a groove in the carcase during assembly (right).

Fig. 2: Back panels from individual boards



A variety of interlocking joints can be used when making up a back panel from individual boards.

Photo: John Thoe

***A raised panel captured in grooves in the carcase** effectively seals the cabinet against dust and light. Although attractive, this type of back doesn't strengthen the carcase as much as a frame glued into a rabbet. (Cabinet built by John Thoe of Seattle, Wash.)*

Photo: Chuck Fuhrer

***Shiplapping**—Framing shiplapped boards is stronger than nailing the boards directly into the back rabbet. Nailing through the boards into a fixed shelf further strengthens the beautiful back on this cabinet built by Ron Layport of Pittsburgh, Pa.*

glued into rabbets to provide the ultimate in racking resistance. Yet plywood, too, has minor drawbacks. Unless grain direction is irrelevant, it can't be used on pieces wider than 4 ft., and it comes only in a limited variety of species. Also, plywood's thin veneer faces make it difficult to repair nicks, dents and scratches.

Frame-and-panel backs

This brings me to my favorite back, the frame and panel, shown in the photo on p. 96. Built just like a door with stiles, rails and panels, it has all the qualities I require for a back: strength and racking resistance, air and dust-tightness, solid-wood construction of the same species as the rest of the cabinet and a pleasing appearance that enhances the overall look of the cabinet. Small cases usually get a single panel frame. Tall cases can have two or three stacked panels. Low, wide pieces may require several side-by-side panels. And large pieces like wardrobes may have stacked and side-by-side panels (see the photo on p. 96).

A frame-and-panel back can include some features of other back styles. For instance, individual boards can be set into a mortised-and-tenoned frame (see the photo above right). This maintains the look of the traditional, individual-board back while adding to its strength. Another alternative is to use ¼-in.-thick plywood for the panels. Because the plywood is recessed into the frame, the panel is protected from most nicks and scratches.

But I prefer to use solid-wood panels in frames. This gives me the most flexibility regarding the species of wood used as well as

Drawings: Matthew Wells

Fig. 3: Mortised-and-tenoned back frame

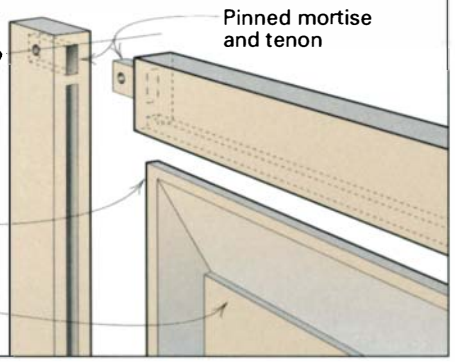
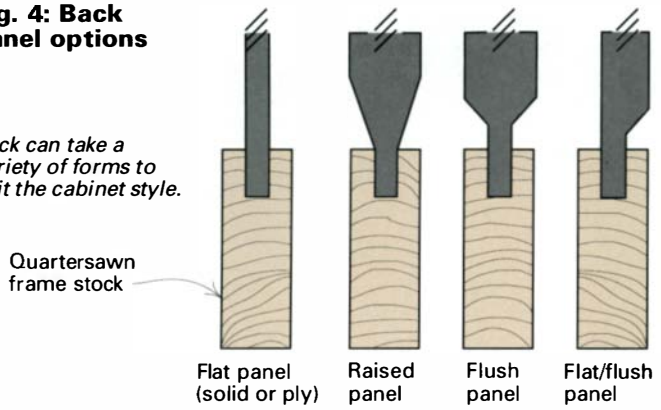


Fig. 4: Back panel options



***A frame-and-panel back with flush panels** is built like a door with stiles, rails and panels and is glued into a rabbet in the carcase. It provides racking resistance and keeps dust and air out.*

the style of the panel. Like doors, backs can have a variety of panel styles to suit the style of the cabinet, as shown in figure 4. Although my first choice is usually a flush panel, I've used several different panel styles. Other options include ¼-in.-thick, solid flat panels, a variety of raised-panel styles or combination panels with a flat face on the interior and a raised panel face on the exterior. Non-wood materials, such as stained or translucent glass, melamine, slate or composition panels covered with leather or velvet, also can be used for panels.

Building a frame

I like to use ⅝-in.-thick stock for the frames in all but the smallest cases. This thickness represents a good compromise between strength and weight. Frames ¾ in. thick add too much weight, especially on large cases, and ½-in.-thick frames yield weak mortise-and-tenon joints. I use narrow, quartersawn stock for the frame members to reduce wood movement. Quartersawn stock moves roughly half as much as plainsawn stock. By keeping the frame members 1¼ in. to 1¾ in. wide, the overall movement is limited to under 3/64 in. (for quartersawn cherry) no matter how wide the back. This amount of movement is easily handled by the compression of the wood fibers and will not push apart the carcase or break the rabbet joint.

If the bottom rail of the frame is not captured in a rabbet, as shown in the photo below, it, like all other secondary stiles and rails, can be made as wide as desired. A wider bottom rail allows larger mortise-and-tenon joints and makes a stronger back frame. The mortises and tenons are glued and pinned, but the panels are free to float in the frame grooves. A loose wood panel can be anchored to prevent it from rattling in the groove. Center the panel in its frame, and then drive a 20-gauge brad through the frame and the panel tongue, centered at both the top and bottom of the panel.

Installing the back panel

Before installing the assembled back frame and panel into its rabbet in the completed carcase, I trim the panel assembly square to fit snugly into the rabbet, using the tablesaw, jointer and a block plane. The carcase rabbet should be 1/32 in. deeper than the thickness of the back because it is easier to trim the back edge of the carcase flush with the back panel than to sand the entire back panel flush with the sides. To make it easier to slide the back frame into the rabbet, I chamfer the edge along the inside face of the frame with the block plane. I also mark the locations of all the carcase's fixed dividers and shelves and the bottom, so I can nail through the back frame into these components to further strengthen the carcase. Just prior to installation, I sand the back panel to 320-grit on the inside face and ease all the sharp edges.

Finally, I glue the back into place, spreading glue thinly on both faces of the rabbet as well as the edge of the back. After forcing the back into the rabbet, I clamp top to bottom first and then side to side. There should be no gaps between the back frame and the rabbet. Because the back has been squared, it will automatically correct a minor out-of-square carcase as the back is clamped into place. When the glue is dry, I remove the clamps, drill holes at the previously marked dividers, shelves and bottom and nail the back with 4d finishing nails. I countersink the nails about ¼ in. and then plug the hole with small, ⅛-in.-sq. pegs of the same species wood as the carcase. I trim the end-grain plugs flush, plane the carcase flush to the back, sand the entire back to 320-grit and, again, ease all frame and panel edges. □

Christian Becksvoort is a contributing editor to FWW *and a custom furnituremaker in New Gloucester, Maine.*

Photo this page: author

Guy Perez routs a tenon using a shop-built jig. *Unlike jigs that require an operator to move control levers and machine, Perez's jig fixes the work, which lets him rout with two hands.* ***The back of the jig*** *(inset) reveals a carriage that guides both vertical travel (rods through bushings) and horizontal motion (rails captured by bearings). The router's plunge mechanism sets depth of cut.*

Turn a Router into a Joint-Making Machine

Jig and templates tackle involved joinery

by Guy Perez

I often turn to my router for joinery tasks. With a fence and straight bit, the router makes quick work of mortise-and-tenon joints. And for most projects, the consequent problem of either rounding the tenon or squaring the mortise is relatively minor. However, I recently made a crib with 44 slats that required 88 mortise-and-tenon joints. This daunting task prompted me to build my own version of the fancy joint-making machines I had often admired but had never been able to afford. I based the jig around my joinery needs and the funds I had to work with. And I confess that I arrived at much of the design during some less-than-inspirational philosophy seminars.

The jig I built operates somewhat like the commercially available machines, such as the Matchmaker or the Multi-Router, which cost from around $600 to over $1,500. With my jig, the work stays fixed, which means I can move the router with two hands (see the top photo at left) instead of having to manipulate the workpiece, router and control levers. This makes the jig especially useful at routing the edges of large stock because it's much easier to move the cutter past a piece rather than the other way around. I can also position a template quickly and accurately relative to the stock, which eliminates much of the trial and error that's required to set up some joint makers.

In addition, the jig's templates are mounted above the router (see the inset photo at left), which makes them easy to see and keeps them away from the dust. Finally, the templates interchange quickly, and their holders easily adapt to different joinery, such as mortises and tenons, finger joints and dovetails.

Constructing the jig

Although it may look complicated, my joint-making jig was fairly easy and inexpensive to build (around $160, depending on the amount of work you have done by a machine shop). Basically, the jig is a plunge router mounted horizontally in an upright, linear-motion (X-Y) carriage, which is secured to a frame and table. A following device copies patterns secured by a template holder. I simply clamp the stock to the table, and trace the template with the follower as the router cuts the joint.

As shown in the drawing on p. 98, the jig has five subassemblies: an X-Y carriage, a wooden frame that has a platform and a table, a horizontally adjustable template holder, a vertically adjustable follower, and a fence and hold-down to position and clamp stock. I sized the frame to suit

Photos except where noted: Alec Waters

my joinery needs, and then I built the rest of the jig around this.

To construct the carriage, you could buy the aluminum bar and flat stock from a metal supplier, but I picked up scrap aluminum for under 70 cents per pound. I cut all the aluminum pieces to length on my tablesaw fitted with a carbide blade. Then knowing that I needed a few large holes in the pieces that I couldn't bore with my hand-held drill, I took the aluminum to a machine-shop equipped with a CNC mill/drill. The shop performed the work for only $30. Shops with conventional equipment gave me quotes around $100.

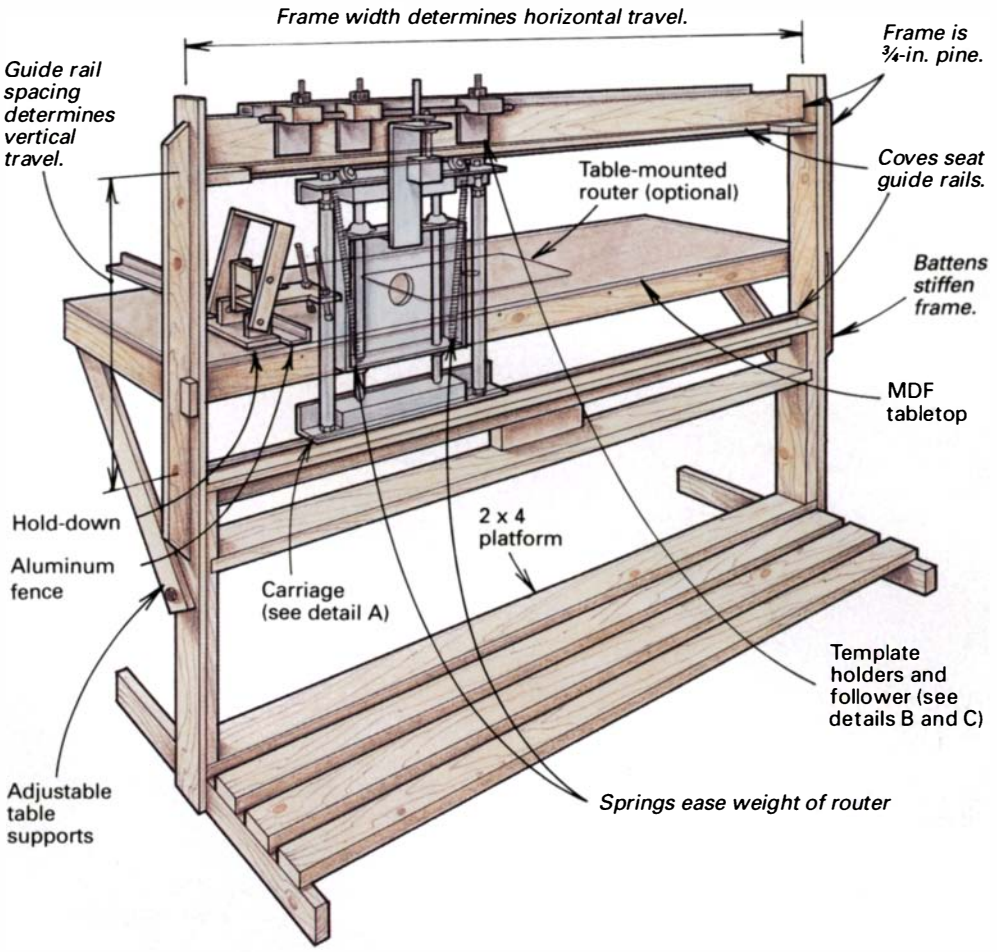
Carriage—The X-Y carriage consists of two major components: a vertical router carrier and a horizontal roller assembly. The router carrier holds the router and provides up-and-down movement by means of four bronze bushings that ride on two ⅝-in.-dia. steel guide bars. Not expecting ever to have to rout more than 2-in.-thick tenons or dovetails, I allowed just 3½ in. of vertical travel. I mounted the bronze bushings in self-aligning pillow blocks made of stamped steel. The blocks are available from Northern Hydraulics, P.O. Box 1499, Burnsville, Minn. 55337; (800) 533-5545; or you could use linear-motion bearings, which are carried at most bearing-supply shops. The vertical bars are fastened to the horizontal roller assembly, which relies on four pairs of precision roller-skate bearings for motion. The bearings are bolted to ¾-in. aluminum-angle brackets. These bearing brackets are fastened to 1½-in. aluminum angles so that the bearings are oriented 45° on either side of two horizontal steel rails (see drawing detail A). The bearings and rails work similarly to the guide system I used in a sliding saw table (see *FWW* #101, p. 51). I used 41-in.-long rails, which allow for 28 in. of horizontal travel.

The router carrier is made from four lengths of 1½-in. aluminum angle riveted together at the corners. I used thicker, ¼-in. angle for the upper and lower pieces of the carrier because they support the bronze bushings. A ⅛-in.-thick aluminum plate mounted between the angles serves as a base for the router and stiffens the assembly. To keep the overall size down, I made the router carrier as small as possible, leaving just enough room for the router base to fit easily between the guide bars. Because the alignment of the bronze bushings is critical, I had their clearance and mounting holes professionally machined.

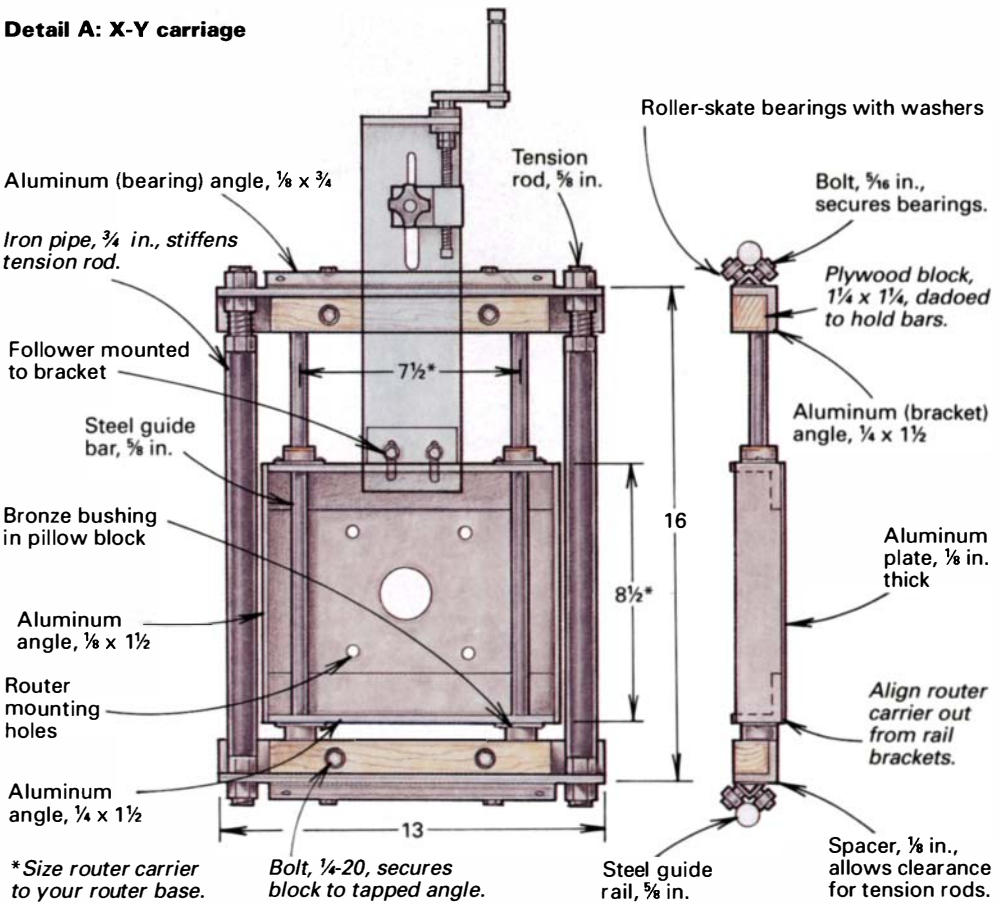
I connected the bearing-bracket assemblies with two ⅝-in.-dia. by 18-in.-long

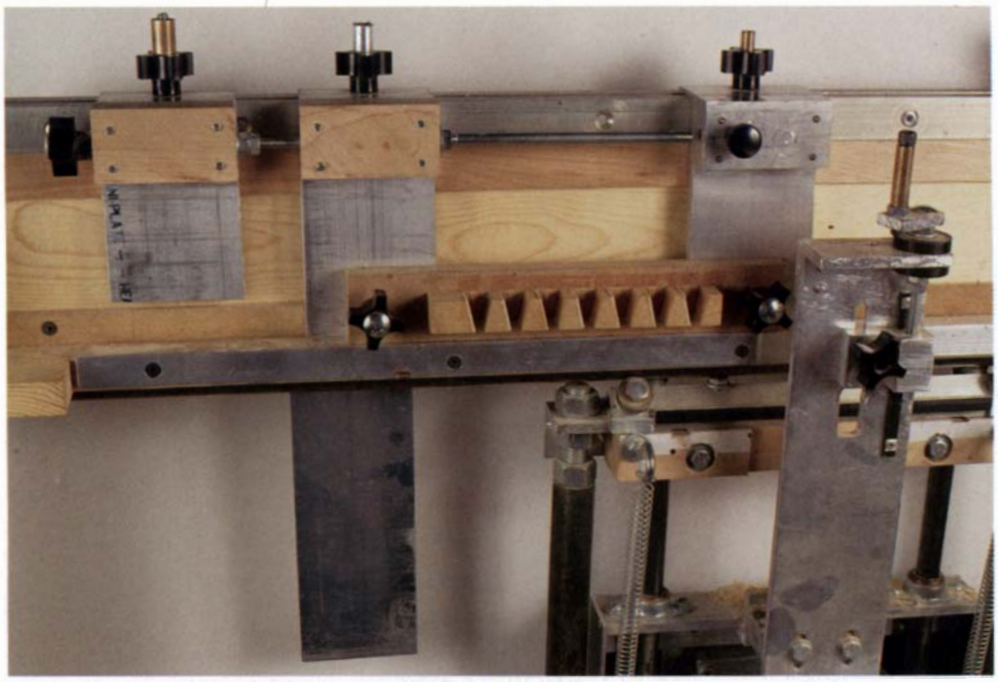
Router jig assembly

The router travels via linear-motion guides. A stylus traces the pattern while the router's plunge mechanism controls depth of cut. With workpiece clamped to table, operator stands on platform and moves router with two hands.



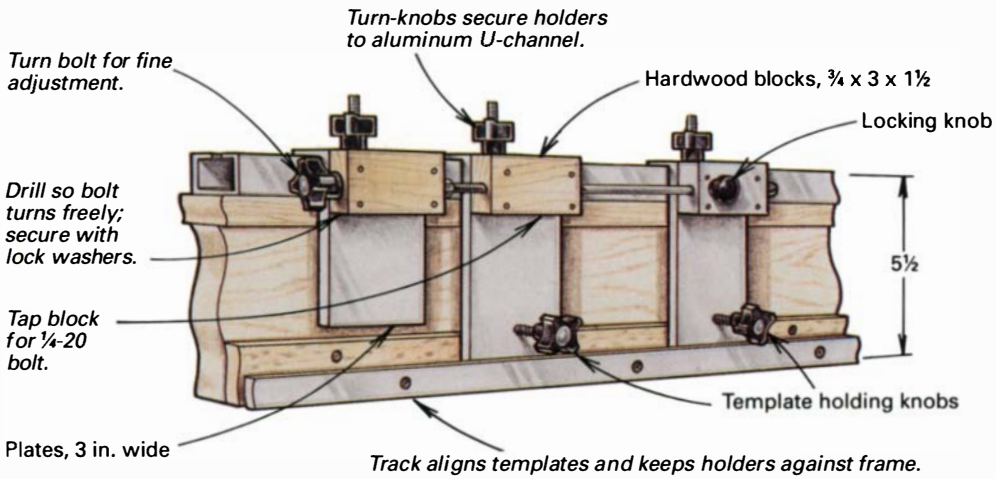
Detail A: X-Y carriage



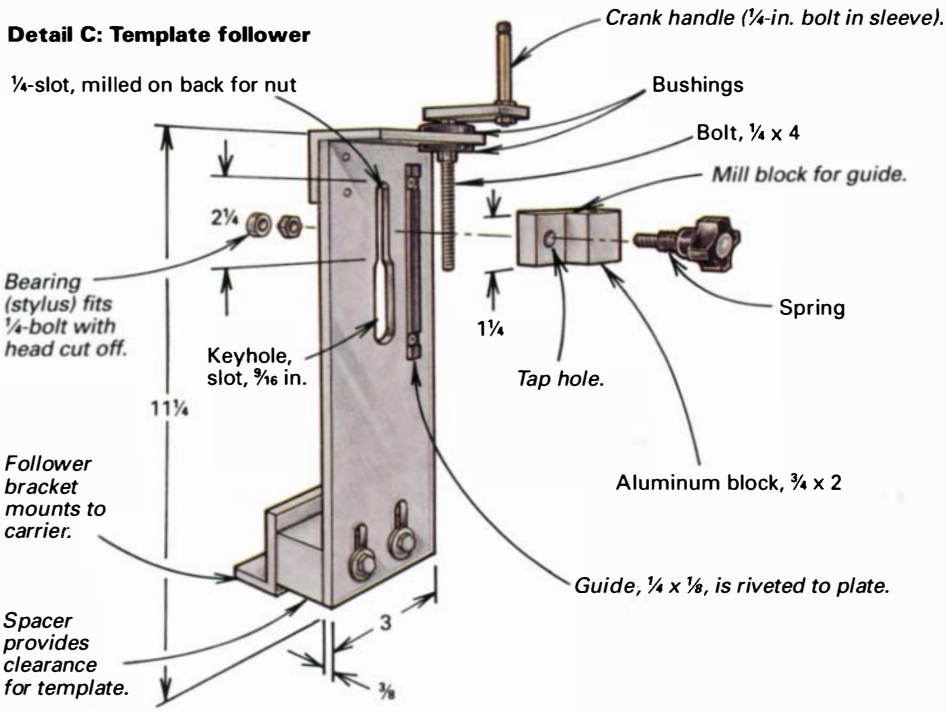


***A pattern to follow**—With a template bolted in place, the jig is ready to rout dovetail pins. The template holders (top) are adjustable left and right. The template follower (right) is height adjustable.*

Detail B: Template holder



Detail C: Template follower



Drawings: David Dann

threaded steel tension rods. The tension rods are stiffened by slightly shorter lengths of ¾-in. iron pipe. I had to cut some of the aluminum angle away so that the inside upper tension-rod nuts could turn freely. This allows just enough room to adjust the carrier for a tight fit to the guide rails. I secured the vertical guide bars to the horizontal brackets with two ¾-in. plywood mounting plates. I cut the bar-aligning dadoes from a single piece and ripped the two mounting plates from it.

Frame and table—After assembling and mounting the horizontal bearing brackets to the router carrier, I set the tension rods to allow for ½ in. of adjustment either way. Holding the guide rails in place, I measured the outside distance to determine the inside height of the frame. I subtracted ¼ in. from the rail's out-to-out dimension to allow for cove cuts in the frame for the rails. I located the coves so the front of the carrier rides proud of the frame to provide clearance for machining longer stock. The frame width is determined by the length of the horizontal guide rails.

I initially built the frame from ¾-in. pine and later added battens to stiffen the frame. I think a 6/4 hardwood frame would be better. Also, I soon discovered that the frame provides a ledge for chips to build up on, so if I were to build the jig again, I would turn the frame boards on edge and cut bevels on either side of the lower guide rail.

The table is made of pine with a medium-density fiberboard (MDF) top, which can be slid away from the carriage to allow clearance. I also cut holes and slots in the table, so I could mount an aluminum fence and a shopmade hold-down (see the box on p. 101). In the extra table space, I made a cutout for a vertical router (see the photos on p. 97). The lower braces support the table and keep it square to the carriage.

Template holder and follower—When I designed my machine, I was concerned with providing a way to hold the template and allowing crude lateral adjustments. And I knew that the follower should be rigid and height-adjustable. For setup, I initially relied on a cut and nudge method: Take a trial cut, estimate the error and nudge either the template or follower to compensate. But it didn't take long to pro-

duce a pile of waste-tenons that way.

To remedy this situation, I introduced screw-driven adjusting mechanisms into both the template holder and the follower (see drawing details B and C on p. 99). The template holders consist of three brackets constructed from ¼-in. aluminum plate and 1½-in. angle. The brackets can be individually locked to a guide track by turn-knobs (available from The Woodworkers' Store, 21801 Industrial Blvd., Rogers, Minn. 55374-9514, 612-428-2199).

The two right brackets are joined by a rod that adjusts for different-sized templates, and both are tapped for ¼-20 screws to mount the templates. The left bracket is fitted with a free-turning bolt that connects it with the template holders. Locking the left bracket only and turning the adjustment bolt moves the template .05 in. perturn. Recently, I got my hands on some FastTrack aluminum extrusions (available from Garrett Wade Co., 161 Avenue of the Americas, New York, N.Y. 10013; 800-221-2942), which when combined with their micro-adjuster and two micro-blocks made a nearly ready-to-use template holder.

For the template follower, I had to add a means of inserting the bearing into the mortise template, so I devised a keyhole-shaped slot (see the photo on p. 99). After the follower bearing is slid into the narrow slot, it can then be cranked reliably, up or down, into position.

Routing mortises and tenons

Unlike the Leigh dovetail router jig, which uses adjustable templates, my jig has interchangeable templates. I make my templates from scraps of medium-density fiberboard (see the bottom left photo) because it is dimensionally stable, wears well and is easy to work. I make the mortise template first and then shape the tenon template to fit snugly into a test mortise. This is necessary because of the bearing system I use. Instead of ball bearings, I used a bronze bearing that slips on the ¼-in. follower shaft. I matched a ¼-in. mortising bit to a 5/16-in. bronze bearing. This combination produces mortises that are slightly smaller than the template, so I fit the tenons to the mortise rather than to the template.

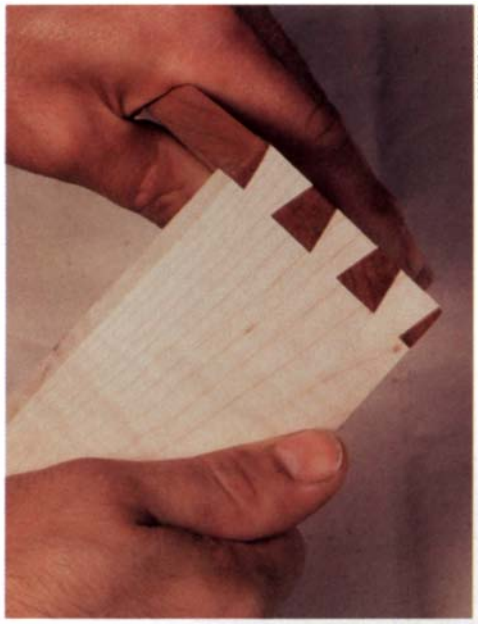


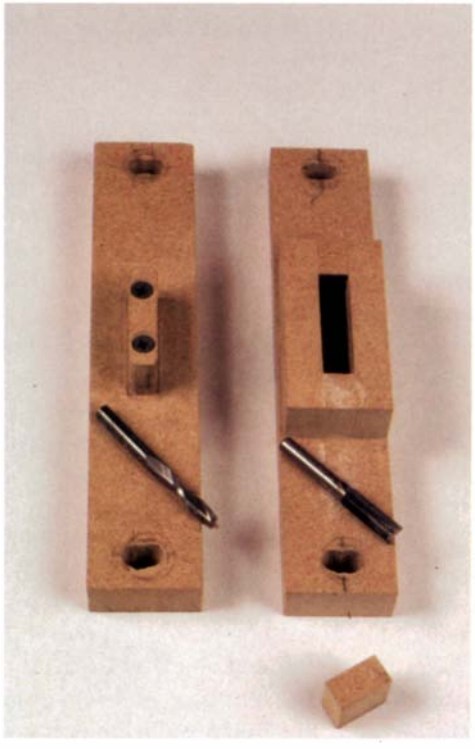
Photo: author

***Machine-cut joint speaks for itself—** Perez holds a drawer corner of oiled cherry and maple, dovetailed with his router jig. The jig cuts uniform dovetails or asymmetrical ones, if a hand-cut look is desired.*

I usually eyeball the position of the template by first marking the stock, clamping it in place and then positioning the template holder and follower so that the router bit just grazes my layout lines. Then I'll take a shallow test cut and measure the location with dial calipers. When I cut the stock, the surfaces that will be exposed are face down. I adjust the horizontal position by locking the left template bracket and turning the adjustment screw to move the template. I measure with my dial calipers to compensate for exactly half of the initial error. A similar technique adjusts the follower vertically.

When cutting mortises, the end of the stock bears against the router carrier. The edge is clamped against the fence with the hold-down. An aluminum plate fastened to the upper frame and scribed with a vertical indicator line marks the center of the cut. To lay out my mortises, I mark their center and align them with the indicator.

To cut the tenons, I bolt on a tenon template and change over to a ½-in. straight bit. I climb-cut the first pass, which virtually eliminates any tearout and provides a very clean shoulder line. I complete the cut by merely following the template until no more shavings are produced. The X-Y carriage isn't stiff enough to entirely resist deflection, so I have learned merely to follow the template rather than force the follower bearing against it. I test-fit each piece immediately after machining, and



***Matching templates and bits—**As a sample of his jig's versatility, the author displays mated templates and corresponding bits. For adjustment, the mortise-and-tenon pattern (left) has a screw-on tenon and a mortise-shortening insert. The pin-and-dovetail templates produced the joinery examples above. When indexed by the tail pattern, the jig can also cut finger joints; simply swap a straight router bit for the dovetail bit.*

I correct a too-tight fit by exerting a little more force during the cut.

Routing dovetails and pins

My joint-making jig handles through-dovetails (see the top photo on the facing page) as easily as it does mortises and tenons. But making a set of dovetail templates is a bit more involved. The main trick is getting the spacing of the pin template to exactly match that of the tails. The tail template is really just a spacing guide, resembling half of a finger joint. In addition to getting the spacing and cut angle right, the pins of the template must be left full enough to ensure a tightly fitting joint. Also, by making the template at least twice as wide as the thickness of the stock, you can adjust the fit of the joint simply by changing the vertical position of the router bit on the stock. Because the height is relative to the template, it's easy to adjust the vertical position of the follower.

I've adapted Mark Duginske's method for cutting dovetail templates on the tablesaw (see *FWW* #96, p. 66). I use a set of wooden blocks to establish the spacing of the dado cuts. After cutting the tail template, I use the same set of blocks to machine the pin template. With this method, you can also make templates for non-uniformly spaced joints as long as you number and order both templates.

Always cut the tails first, using whatever dovetail bit the template is designed for (see the bottom right photo on the facing page). I place a piece of stock flat against the router carrier to set the depth of cut, extending the bit just proud of the piece, and clamp the stock face down. I adjust the template holders horizontally and position the cut so the outside tails are equidistant from the edges of the board.

I fit my router with a straight bit for machining the pins. I mount the template and position the stock so that the inside of the joint faces down. This arrangement ensures that once everything is adjusted, slight variations in stock thickness will not affect the joint's fit. The fit is determined by the distance between the follower and the bit—smaller distances will yield tighter joints and vice versa. With a test piece clamped in place (and the router unplugged), I position the follower so that the bit is just below the workpiece when the follower first contacts the bottom of the template. From here, I make test cuts and raise the follower. □

Guy Perez is studying political philosophy in Madison, Wis. He also builds furniture for his family and friends.

A shopmade hold-down

I originally used Jorgensen adjustable bar clamps to hold down workpieces on my joint-making jig. But I soon found the repeated tightening and loosening of the clamps to be time-consuming and a real blister maker. I also dismissed the idea of using toggle clamps because of their small size. Instead, I constructed my own clamp using scraps of hard maple, a piece of medium-density fiberboard (MDF) for a base, ⅝-in. threaded rod, dowels, screws and an assortment of ⅝-in. bolts (see the photos on p. 97).

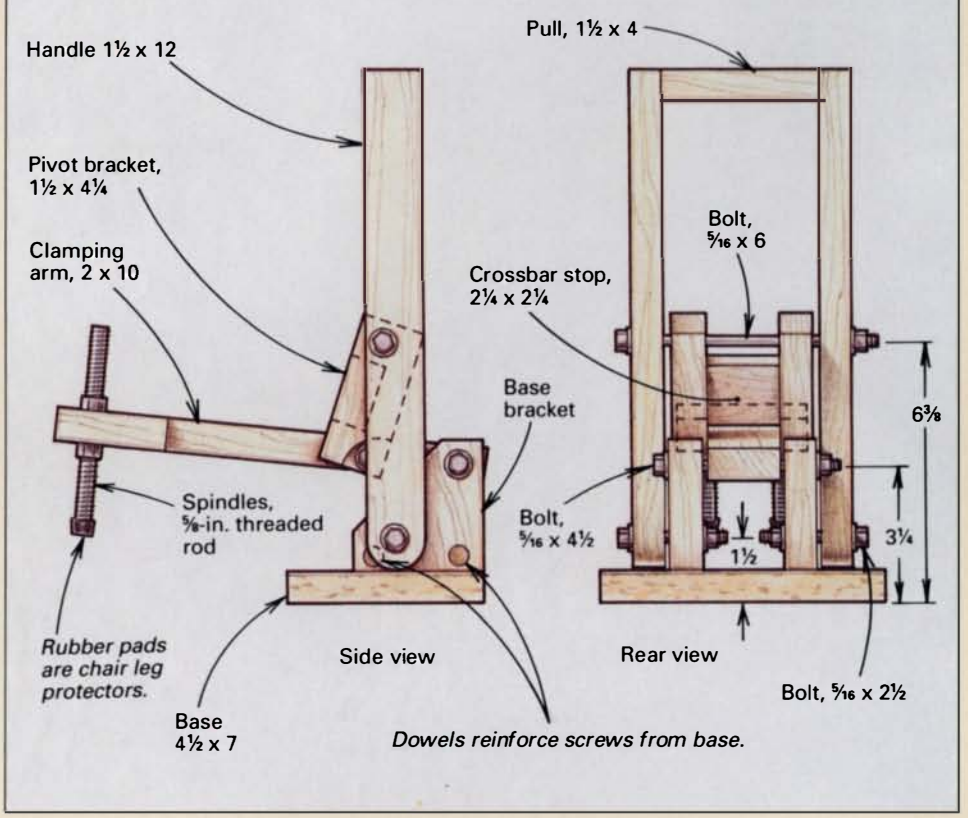
Building a hold-down is straightforward once you understand the basic operating principle. In the vertical clamp shown in the drawing below, the handle provides leverage to the clamping arm by means of a pivoting bracket, which is fixed between the arm and handle. The clamp locks in place when the handle's pivot point is pulled forward of the arm's pivot. But because clamping pressure diminishes as the arm pivot travels past the initial locking point, a travel-limiting stop is needed. The trick is in placing the stop so that the clamp locks down and exerts sufficient pressure. I arrived at a good balance (favoring clamping strength) by positioning and paring the block (crossbar) until I was satisfied with the locking action.

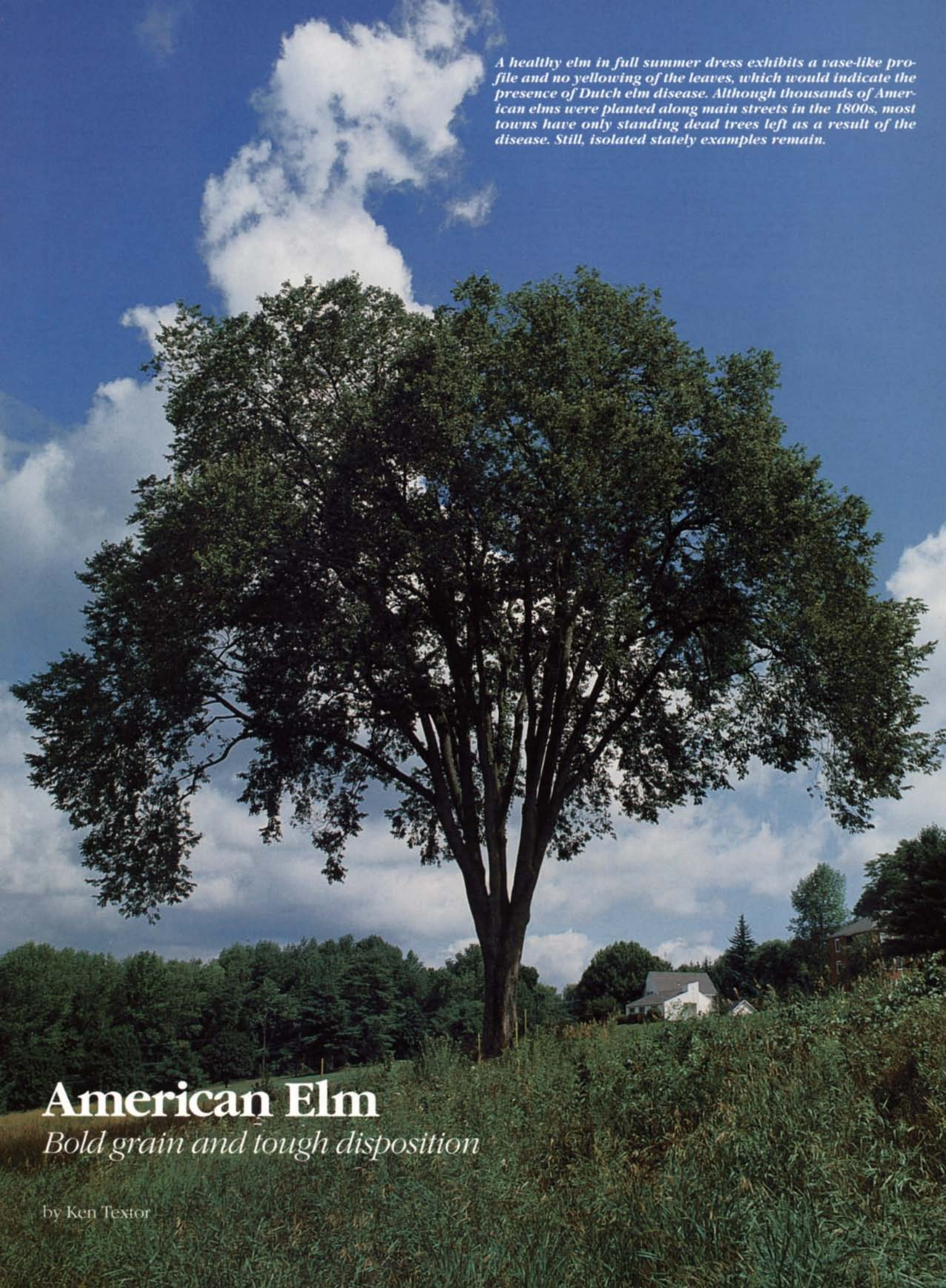
Because the forces in the hold-down are mostly vertical, I oriented the grain of the base bracket up and down to prevent splitting. However, because the bracket is screwed to the base, it's possible that the drywall screw could pull out of the bracket's end grain. To counteract this, I reinforced the base brackets with hardwood dowels. Holes drilled through the base enable me to bolt the hold-down to my jig's table. A pair of adjustable spindles with clamping pads resist any side-to-side movement of the workpiece. The spindles are two lengths of ⅝-in. threaded rod with top and bottom nuts. Rubber cap protectors (available at most hardware stores) serve as the pads.

I use my oversized toggle clamp almost exclusively as a hold-down for my router jig, but I sometimes use it as a helping hand when I am power-sanding or freehand-routing. The clamp exerts a lot of down pressure, and I can quickly reposition the stock. The greatest virtue of the clamp, however, is its sheer size. Its long reach and big handle make the clamp truly a pleasure to use in repetitive operations. *—G.P.*

Shopmade hold-down

All parts are ¾-in. maple, except base which is ¾-in. MDF.





A healthy elm in full summer dress exhibits a vase-like profile and no yellowing of the leaves, which would indicate the presence of Dutch elm disease. Although thousands of American elms were planted along main streets in the 1800s, most towns have only standing dead trees left as a result of the disease. Still, isolated stately examples remain.

American Elm

Bold grain and tough disposition

by Ken Textor

When the elms on our property started dying, tree experts and woodworker friends suggested that we cut them down and burn them. "They're not even much good for firewood," one neighbor advised. But I couldn't accept that. Our seven towering elms had stood vase-like and majestic for more than 100 years (see the photo on the facing page), and it seemed a crime to cart them off as scrub brush.

Thus began my long and lively affair with American elm (*Ulmus americana*), a wood so steeped in American history, so versatile and so attractive that it's hard to believe it's still undervalued and overlooked. I've used the wood in everything from boatbuilding, to simple containers, to flooring. And I was pleasantly surprised at how handsome the wood looks in cabinets and furniture. To put elm in perspective, it's best to look at its early American uses.

Colonial encounters with elm

When the Pilgrims landed, elms were as common in North America as oaks and maples. American elm was one of a half dozen elm species that reminded the immigrants of similar trees of their homelands. But the "new" elm was definitely bigger, and it was a better wood source.

Elms were soon cleared from the land and put to work. American elm (also known as gray elm, white elm or water elm) was found to be extremely resistant to wear and splitting. Perhaps there's no equal in these departments, as anyone who has tried splitting elm for firewood will attest. Because of these qualities, farmers used elm to make tool handles and barn implements, such as milking stools, grain bins, troughs and coopered items. Elm was a particularly good choice for barn floors because it resisted hoof wear. I'm told it's still highly prized by the Amish for wagon wheel hubs. Because elm is such a tough hardwood, it was also used for utilitarian pieces, like the step in the photo below.

Interestingly, elm became an American icon not so much for its versatility as for its political significance. In pre-Revolutionary War Boston, a giant elm stood as a rendezvous for the rabble-rousing Sons of Liberty who planned their redcoat taunting in its shade. One night, the redcoats summarily chopped the tree down and defied the colonists to do something about it. Angry residents vowed to nurture new "Liberty Trees" with British blood. One hundred years later, during the nation's centennial celebration, every self-respecting patriotic town planted elms along its Main Street.

Elm's variety and decline

My elm trees were among those planted during the centennial. Unfortunately, in the intervening years, the American elm met a foreign invader far more dangerous than British soldiers: Dutch elm disease (see the story on p. 105). It alone was, and still is, responsible for destroying millions of trees, making the tree and its lumber today almost as scarce as chestnut.

A forester told me there are still a number of elm stands in the Midwest. But whether they're true American elm is unclear. Lacking a microscope, I found that color is the best way to tell American elm from the more common slippery and winged elm species. American elm is light brown to brown while slippery and winged are more distinctly red. There are also four other varieties of elm: cedar, wych, English and rock. For more on these varieties, see R. Bruce Hoadley's book, *Identifying Wood* (The Taunton Press).

Challenges in milling elm

There was no scarcity of wood when my elms died. Of the seven trees sent to the sawyer, nearly 2,000 bd. ft. of lumber came back. Logs 48 in. dia. were common, but there were some problems.

Many sawyers were reluctant to mill elms, particularly if they were border trees. Several sawyers told me that line trees often have old iron nails and wire embedded in them that could endanger millworkers or destroy sawblades. I resolved this to the satisfaction of at least one sawyer by passing a metal detector over the log beforehand. But there were other problems.

Trees grown in the open have more inherent stresses than trees grown in the forest. This is because winds constantly sway open-grown trees back and forth, building tension into the fibers. Wind shakes were evident in my elms, which had lined a salt marsh on the Maine coast. During sawing, many of my planks took on a significant sweep, cup or split long before they started drying.

Properties and appearance

With an average specific gravity of 0.50, American elm is quite dense compared to white pine (0.35) but less dense than other hardwoods like black walnut (0.55). Stability is not elm's strong suit. When dried to 6% moisture content, its approximately 3½% radial shrinkage and roughly 7½% tangential shrinkage are moderately high, making elm susceptible to warping and checking. I dried my elm planks in the barn for two years, and a few deformities became more pronounced while others disappeared.

Once stable, elm is fairly easy to saw, rasp, sand and bore. When it's cut, the wood exhibits a distinctive barn odor. Elm works well

***Elm's interlocking grain** makes splitting and surfacing difficult. The grain reverses in cyclic spirals as you move outward in a log. The inherent stresses in a cupped board will often cause it to crack as it's passed through a planer due to roller pressure. This board was flattened with a handplane.*

Photo: author

***Toughness and resistance to wear** make elm particularly well-suited for simple, traditional pieces, such as this step or footrest. Early American farmers valued elm for utility items like milking stools and other barn implements. It's not uncommon to find antique tables and wagon-wheel hubs made of elm.*

Photo facing page: Jonathan Binzen

in steam-bent applications, glues nicely and resists splitting when nailed or screwed. The wood's weakest properties are its surfacing and shaping qualities. For jointing and cutting dadoes, you're best off using sharp blades and high-speed power tools.

Interlocking grain—Elm is hard with coarse, interlocking grain that causes tearout while surfacing. But it's exactly these difficulties that give elm its striking figure, especially on pieces of crotch. Waves of light latewood pores create zigzag patterns on the tangential surface. Elm's interlocking grain is formed when successive layers of wood grow first in left-hand spirals, then in right-hand spirals. For more on this, see R. Bruce Hoadley's book, *Understanding Wood* (The Taunton Press). Add the tension of growing in the open, and a trouble-free pass through the planer becomes a luxury. In fact, when planing problems develop, I usually achieve a better surface using a handplane or scraper.

Once planed, elm shows its beauty. The grain displays a tweed or herringbone look on flatsawn lumber (see the top photo on p. 103). Moreover, the grain captures light and refracts it like a hologram. This iridescence livens up its otherwise muted light-brown tones. Occasional darker brown streaks (mostly found in trees infected with Dutch elm disease) break up the color uniformity.

Naturally, with all my newfound inexpensive lumber (it cost 25 cents per bd. ft. for sawing), I felt free to try elm in all kinds of applications. I found elm turned very easily. The wood came off in smooth, small shavings. However, the surface did need sanding to be smooth. Likewise, carving went fairly well though the twisting grain has to be respected with sharp tools.

Elm's workability shortcomings and a 10% to 20% waste factor did not prevent me from using it in furniture and kitchen cabinets (see the photo at left below). In addition, I found elm particularly well-suited for use in small, open boats. When steamed, the wood bends easily and without the splitting that often occurs with oak. Although elm is rated only slightly resistant to decay, a sailboat that I built with elm approximately 10 years ago shows little sign of rot (see the top right photo below).

***Random-slat cabinets allow elm's grain patterns** full rein. The iridescent figure comes alive under a clear varnish, especially on the upper-cabinets. To help combat wood movement from Maine's wide humidity shifts, Textor stiffened the door backs with battens.*

***Decent bending characteristics** convinced the author to use elm to frame his sailboat. Discovering that early boatbuilders used elm nearly as much as oak, Textor replaced the vessel's ribs and her transom with elm. Paint and marine varnish help protect the wood against the elements.*

***Elm furniture, when shellacked or varnished,** often takes on an amber hue. In the case of this baby's changing table made by Tico Vogt, subtle brown streaks and herringbone grain patterns are visible through the finish.*

Photos except where noted: Alec Waters

Availability and finishing

Once I had used my entire stock of elm, I started looking around for more. It was a tough search (see the sources of supply box). Most lumberyard stock comes from dying elms bordering old farms. Elm is more plentiful in the Midwest than in the East, but it is not as widely distributed as oak and maple. Elm usually costs two to three dollars per bd. ft.

Finishing elm requires care. Because of its open grain, the surface of elm may need filling. But I found filling cut down on the wood's iridescence. Instead, I prefer one coat of an oil-based varnish over several coats of shellac. The shellac seals the surface and, with only one varnish coat, yellowing is minimized. If you prefer an amber look, you can finish with several oil/varnish coats, as shown in the bottom right photo on the facing page.

Despite American elm's decline, it may make a comeback. For now, there are plenty of dead trees waiting to be harvested. □

Ken Textor is a writer, boatbuilder and sailor in Arrowsic, Maine.

Sources of supply

Badger Hardwoods, Route 1, Box 262, Walworth, WI 53184; (800) 252-2373

Colonial Hardwoods, 7953 Cameron Brown Court, Springfield, VA 22153; (800) 466-5451

Groff & Hearne Lumber, 858 Scotland Road, Quarryville, PA 17566; (800) 342-0001

Heidler Hardwood Lumber, 2559 S. Damen Ave., Chicago, IL 60608; (312) 847-7444

Maurice L. Condon Co., 250 Ferris Ave., White Plains, NY 10603; (914) 946-4111

Willard Brothers Woodcutters, 300 Basin Road, Trenton, NJ 08619; (609) 890-1990

(Veneer only)

Albert Constantine & Son, 2050 Eastchester Road, Bronx, NY 10461; (800) 223-8087

Certainly Wood, 11753 Big Tree Road, East Aurora, NY 14052; (716) 655-0206

Dutch elm disease: cause and cure

Stories of American elm and Dutch elm disease are inextricably entwined. But as for the disease's name, it is somewhat misleading. For their part, Dutch scientists were among the first to research the disease and come up with possible cures when it arrived in Europe from Asia in the late 19th century. In any case, some progress has been made on two fronts: developing a treatment for infected elms and developing a disease-resistant hybrid of American elm.

The disease is actually a fungus carried from tree to tree by a beetle. The insect and the fungus arrived in the United States in the 1920s by way of a shipment of European elm logs that were bound for American sawmills. In the bark of those imported logs were eggs of the European elm bark beetle. When the eggs hatched, Pandora's box was opened.

The fungus (ceratocystis ulmi) gets into the water-transporting layer of the tree's bark and cuts off the supply of water to the leaves. Various strains of the disease evolved and a particularly virulent strain went after American elms.

Treatment by trimming and spraying: If you catch an elm in the early stages of the disease, you can usually save it. Premature yellowing leaves near the tree's crown signal the presence of the disease. Such limbs should be cut out right away. Once trimming is done, you should have the upper reaches of the tree sprayed with an insecticide to kill the beetles and their eggs. Simultaneously, you should have fungicide injected into the water-carrying layer of the tree at its base. (Only licensed tree surgeons should carry out these operations because of the chemicals involved.)

If the disease is caught early, vigilant treatment often succeeds, but any trees beyond saving should be cut down and disposed of. If not, the trees will breed more beetles and more fungus that will likely kill off neighboring trees within a mile or so.

Disease-resistant hybrids: The Elm Research Institute (ERI), founded in 1967 by arborist John P. Hansel, began a massive education program run in cooperation with the Boy Scouts and other organizations. The institute has developed the American Liberty elm, which is identical to the American elm in appearance, growth habits and hardiness.

The Liberty elm is ideal for urban sites because, once established, it tolerates pollution, drought and salt. The trees have also survived repeated injections of Dutch elm disease. A sapling-planting program called Johnny Elmseed has been under way for several years. For more information on elm preservation, write ERI, Elm St., Harrisville, N.H. 03450 or call (800) FOR-ELMS (367-3567). *—K.T.*

Elm-lined Gillet Ave. *as it appeared in Waukegan, Ill., in the summer of 1962 before the trees were ravaged by Dutch elm disease. Identified in 1932, the disease is actually a beetle-borne fungus.*

Like a cancer of the tree world, *Dutch elm disease spread unchecked, destroying millions of American elms. This photo was taken from the same spot as the photo at left just 10 years later.*

Photos this page: courtesy of Elm Research Institute

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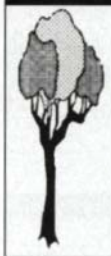

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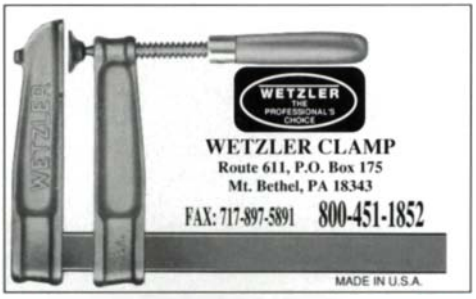

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ROBLAND X310 combination saw, jointer, planer, shaper, mortiser. 4 yrs. old. Excellent condition. (612) 567-2119. (MN)

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Model	Description	List	Sale
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23-680	6" Bench Grinder 1/4 HP	86	75
23-880	8" Bench Grinder 1/2 HP	151	115
23-980	10" Bench Grinder 1 HP	275	249
11-950	8" Drill Press	199	144
14-040	14" Drill Press	400	335
40-150	15" Hobby Scroll Saw	179	115
28-160	10" Hobby Band Saw	210	139
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	288	204
31-080	1" Belt/5" Disc Sander	134	89
40-560	16" 2 speed Scroll Saw	266	178
23-580	5" Bench Grinder 1/5 HP	62	52
11-990	12" Bench Drill Press	276	209
11-090	32" Radial Drill Press w/stand	399	294
43-505	1/2" Bench Router/Shaper	399	275
36-220	10" Compound Mitre Saw	350	228

SUPER SPECIAL
22-540 12" Bench Top Planer ..... Sale 389

NEW TOOLS BY DELTA

33-060	NEW "Side kick" Miter saw	499	365
14-070	NEW 14" Floor Drill Press	450	345
40-640	NEW 20" Bench Scroll Saw	466	305
23-675	NEW 6" Grinder/3 x 24 Belt Sander	141	105
50-075	NEW Dust Collector/Sweeper 3/4 HP	360	245
36-090	NEW 10" Sidekick Miter Saw	293	215
37-070	NEW 6" var. speed Bench Jointer	330	255
20-150	NEW 14" Abrasive cut-off saw	375	219
28-180	NEW 10" Bench Band Saw	232	165
46-700	NEW 12" var. speed Wood Lathe	548	435
14-650	NEW Hollow Chisel Mortiser	361	289
28-190	NEW 12" Band Saw	465	375

DELTA STATIONARY

34-761	10" Unisaw 1-1/2 HP	1715	1345
36-755	10" Tilting Arbor Saw 2 HP	1264	935
33-990	10" Radial Arm Saw	818	615
37-280	6" Motorized Jointer	488	389
37-154	DJ15 6"Jointer with 3/4 HP motor	1420	1089
50-179	3/4 HP 2 stage Dust Collector	483	335
50-181	2 HP Dust Collector	885	629
34-670	10" motorized Table Saw	511	395
34-985	1/6 HP Stock Feeder	698	539
34-444	Table Saw complete with 1-1/2 HP motor & stand	812	615
33-890	12" Radial Arm Saw 1-1/2 HP	1720	1375
43-355	1/2" & 3/4" Shaper 1-1/2 HP	964	709
17-900	16-1/2" Floor Drill Press	441	389
34-080	10" Mitre box ..... Xtra Special		198
33-055	Sawbuck complete w/legs	865	595
34-330	8-1/4" Table Saw 13 amp	343	234
36-540	10" Table saw	210	168
32-100	Stationary Plate Jointer	645	259
36-040	8-1/4" Compound Mitre Saw	224	159
40-601	18" Scroll Saw w/stand and blades	942	745
28-560	16" Band Saw 1/2 HP 3 wheel	456	410
70-200	20" Drill Press	1049	810
34-915	30" Delta Unifence	385	228
34-897	50" Delta Unifence	525	285
28-245	14" Band Saw w/open stand 1/2 HP	698	575
36-380	10" Table Saw - XL10	550	415

DELTA REBATES!

The following Delta tools have a $50.00 rabate!
Price shown is before rebate.

28-283	14" Band Saw with enclosed stand	910	735
34-445	34-444 Saw with 30" unifence	1200	815
34-445B	34-444 w/Beis. 50" Comm saw fnc	1300	995
22-661	13" Planer with 2 HP motor	1436	1175

Planer has **$75.00 rebate**-price shown is before rebate

EXCALIBUR Fences & Tables

TT45R24L	24" Fence	369	310
TT45R50L	1250" Fence	399	318
EXSLT30	Sliding Table - 40" crosscut	599	489
EXSLT60	Sliding Table - 62" crosscut	745	599

BIESEMEYER FENCES

B-50	50" Commer. Saw Fence	345	298
T-SQUARE 52	52" Homeshop Fence	279	238
T-SQUARE 40	40" Homeshop Fence	259	208
T SQUARE 28	28" Homeshop Fence	249	198

DAVID WHITE

LP6-20	Sight Level package - 20x	310	198
L6-20	Meridian Level - 20x	290	189
LT8-300	Level Transit - 26x	650	449
LT8-300P	above Level w/optical plum	769	534
LT6-900	Level Transit - 20x	389	254
LTP6-900	above Level with tripod & rod	601	369
ALT6-900	Automatic Level - Transit - 18x	549	389
ALTP6-900	above level w/9066 tripod and 7620 rod	600	475
AL6-18	Automatic level - 18X	439	325
ALP6-18HD	above level w/tripod and rod	550	375
AL8-25	Automatic Level - 25X	829	619
AL8-22	Automatic Level - 22X	599	405

ACCU-MITER

18-34	Professional Mitre Gauge	149	140

JORGENSEN CLAMPS

STYLE 35 ALUMINUM BAR CLAMPS

Model	Size	List	Sale	Lots of 6
3524	24"	27.10	17.45	99.45
3536	36"	29.07	18.65	106.25
3548	48"	31.95	20.59	117.35
3560	60"	35.58	22.99	129.95
3572	72"	38.47	24.95	142.00

ADJUSTABLE HANDSCREW KITS

Model	for Jaw Length	List	Sale	Lots of 6
J-04	4"	7.38	4.85	27.99
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

ADJUSTABLE HANDSCREWS

Item#	Jaw Length	Opening Capacity	List	Sale	Box of 6
#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

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

Item#	Bar 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

STYLE 36 - STYLE 37 CLAMP W/E-Z HOLD

Item#	Bar Length	List	Sale	Box of 6
3606	6"	18.95	11.75	65.95
3612	12"	20.09	12.49	69.95
3618	18"	21.95	13.65	76.95
3624	24"	27.08	15.45	85.95
3630	30"	29.42	16.85	95.95
3636	36"	35.09	18.25	103.95

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

Item	Bar Length	List	Sale	Lots of 6
4512	12"	30.07	19.39	109.99
4518	18"	31.73	20.45	116.99
4524	24"	33.55	21.75	123.99

PONY CLAMP FIXTURES

Model	Description	List	Sale	Lots of 12
50	3/4" Black Pipe Clamps	13.61	7.89	84.99
52	1/2" Black Pipe Clamps	11.37	6.50	69.50
53	Double 3/4" Pipe Clamps	38.50	24.45	274.00

STEEL "I" BAR CLAMPS

Model	Size	List	Sale	Lots of 6
7224	24"	31.46	16.99	98.00
7236	36"	33.77	17.99	103.00
7248	48"	37.12	19.99	114.00
7272	72"	42.71	26.79	149.95

PRAZI BEAM CUTTER

PR-7000	12" beam cutter for worm drive saws	149	124

SKIL

4540	Jig Saw v/spd adjust. straight line	126	85
4560-02	Var. spd Jig Saw auto-scroll w/cse.	144	95
4580-02	Var. spd & vari-orbit Jig Saw w/cs	162	105
7102	"Sandcat" 2-1/2" x 16" Belt Sander	74	57
7313	3" x 18" Belt Sander	84	65
7521	3" x 21" var. speed Belt Sander	238	149
7575	1/4 sheet Palm Sander	74	54
7576	above Sander with bag	80	58
1605-02	Biscuit Joiner with case	221	129
2735-04	12 volt cordless Drill with charger, case, and 2 batteries	249	132
2736-04	2735-04 w/keyless chuck	269	135
7484	5" Random Orbit Sander	153	104
5250	2-1/4 HP Circular Saw	81	65
5350	2-1/3 HP Circular Saw	100	75
5750	7-1/4" Circular Saw drop foot	254	159
3810	10" Mitre Saw 15 amp	359	205
3810K	3810 w/60 tooth carbide blade	Sale	229
5825	6-1/2" Worm Drive Saw	257	159
5660	NEW 8-1/4" 60° Circular Saw	230	144
5510	5-1/2" Circular Saw	165	110
77	7-1/4" Worm Drive Saw	257	144
77:04	7-1/4" Worm Drive Saw Kit complete with case 24 tooth carbide blade & adjustable rip fence	292	189
5860	NEW 8-1/4" 60° Worm Saw	282	168
5790	10-1/4" Circ. Saw 15 amp	472	289
5657	NEW 7-1/4" Circ Saw - pivot foot	205	114
5525	NEW 6-1/2" Circ Saw - big capacity	173	99
3400	10" Table Saw - Bench Top	270	179
3330	16" Scroll Saw - Bench Top	205	135
3370	4" Belt/6" Disc Sander - Bench Top	205	135
3380	8" Drill Press - Bench Top	205	138

HITACHI TOOLS

Model	Description	List	Sale
C7SB	7-1/4" Circular Saw	216	118
C7BD	7-1/4" Circular Saw with brake	235	124
K10001	Hitachi Steel case for above saws		14.99
M12V	3 HP variable speed Router	477	229
TR12	Plunge Router 3 HP	355	174
F1000A	12" Planer/6" Jointer	2774	1549
P12R	12-9/32" Planer	1425	719
P12RA	12-9/32" Planer/6-1/8" Jointer	1880	915
C10FA	10" Deluxe Mitre Saw	553	299
C12FA	12" Mitre Saw	600	315
C8FB	8-1/2" Slide Compound Saw	1026	599
FREUD LU91M008	8-1/2" carb. blade 48 tooth	68	43
C15FB	15" Mitre Saw	773	635
FREUD LU85M015	15" carb. blade 108 tooth	145	105
F20A	3-1/4" Planer 3.4 amp	179	98
G12SA	4-1/2" Grinder 6.9 amp	147	88
DS10DVAK	12 volt cdls Drill Kit w/2 batt	383	199

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
NV45AB	Coil Roofing Nailer 7/8" - 1-3/4"	740	395
NV83A	Coil Nailer2" - 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
N3824A1	1" Stapler 16 ga. 1/2" - 1-1/2"	626	335

QUAL-CRAFT JACKS

2200	Pump Jack	79	55
2201	Pump Jack Brace	30	19
2203	Pump Jack guard rail holder	31	21
2204	Work Bench & rail holder combo	53	39
	Buy any 6 (can be assorted) deduct additional 10%		
2601	Wall Jack	167	105
	Lots of 4 deduct additional 10%		

WEDGE SMART LEVEL

SM-PR2	2 FT Level with sensor and case	120	88
SM-PR4	4 FT Level with sensor and case	150	105
SM-PR6	78" Level with sensor and case	180	139
SL209	NEW 9" Torpedo Level w/sensor	69	45
SL224	NEW 2 FT Level with sensor	79	55
SL248	NEW 4 FT Level with sensor	95	65

AEG POWER TOOLS

VSRE500K	V/spd 5" Random Sndr w/cse	279	149
VSRE600K	V/spd 6" Random Sndr w/cse	284	155
HBSE75S	3" x 21" variable speed Belt Sander	299	168
ABSE15S	1/2" cdls 12 volt Drill complete w/cse	389	179
FSPE100	Barrell Grip v/spd Jig Saw	265	145
BSPE100K	Top Hdle v/spd Jig Saw w/cse	275	148
EZ560	3/8" cordless 7.2 volt Drill 2 speed	205	135
OFS50	1HP Plunge Router	299	135
TXE150	New 6" var/spd Rand Orb Sander	220	145
SKS300	NEW 10" Compound Mitre Saw	999	499

DREMEL TOOLS

3950	Moto Tool Kit with bits & case	129	79
3952	Super Moto Tool Kit with accessories	145	95
1671	16" Scroll Saw - 2 speed "Best buy"	278	169
1695	NEW 16" var. speed Scroll Saw	398	219
290	Electric Engraver with point	24	16
8508	Cordless Moto Tool Kit with case	104	59
1731	5" Disc\1" x 30" Belt Sander	178	114

FEIN

Msx636	Oscillating Triangle Sander	Sale	185

PONY

LPN672	Air Palm Nailer with glove	Sale	94.99

BOSTITCH AIR NAILERS

Model	Description	List	Sale
N80S-1	Stick Nailer	Super Sale	348
N12B-1	Coil Roofing Nailer	845	405
N60FN-2	Finishing Nailer 1-1/4" - 2-1/2"	625	335
T50S4-1	Decking & Sheathing Stapler	595	345
MIIIFS	Flooring Stapler 15 ga	895	525
N100S	Stick Nailer 2" - 4"	895	555
T31	Brad Nailer 5/8" - 1"	270	145
CWC1001	HP Pancake Compressor	445	289

SENCO AIR NAILERS

SFN1	Finishing Nailer 1" - 2"	377	269
SFN2	Finish. Nailer 1-1/2" - 2-1/2"	571	375
SN325	Nailer 1-7/8" - 3-1/4"	665	425
SLP20	NEW Pinner w/case 5/8" - 1-5/8"	399	269
SKS	Stapler 5/8" - 1-1/2" - 1/4" crown	351	245
SPS	Stapler 1" wide - 3/4" - 1-1/2" length	460	299
M2	Stapler 1/16" wide - 1-3/8" - 2" length	490	345
SN70	NEW HD Framing Nailer 2" - 3-1/2"	625	475
	Not available in all states		

PASLODE IMPULSE GUNS

IM250	Trimpulse 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	595
IM-200-S16	Impulse Siding Stapler - drives 16 gauge staples at 3/4" - 2" lgths	849	629
402500	Extra battery	Sale	38.95
402502	No-Mar Work contact element	Sale	19.25
	Paslode Nailers not available in MN, WI, IA		

REMINGTON POWER FASTENING TOOLS

75707	476 Power Hammer with case	35	28
77550	480 Power Driver with case	169	104
78480	482 Multi Driver with case	369	235

We stock all Power Loads and Fastening Pins

PORTA NAILER

401	Porta Nailer complete	265	198
501	Face Nailer complete	265	195
1000	Genuine Porta Nails 1000 Qty		15.89
5000	Genuine Porta Nails 5000 Qty		71.50
10,000	Genuine Porta Nails 10,000 Qty		121.85

SIOUX TOOLS

8030	New 3/8" variable speed Drill	238	139
8000	3/8" var/spd close quarter Drill	201	123
690	5" Air Random Orbit Sander	139	132
690V	690 with vacuum pick up	250	155
690VV	690 w/NEW venturi dust collection	281	175
658	5" Air Random Sander - dual action	261	155

LAMELLO BISCUIT JOINTERS

TOP 10	"Simply the Best"	699	545
STANDARD 10	"Professionals Choice"	499	399
COBRA	NEW Biscuit Joiner	Special	299
MINICOL	High quality glue applicator	Sale	23.40

RECORD WOODWORKING VISES

Model	Jaw Width\Opening		List	Sale
53E	10-1/2"\15"	Quick release	189	109
53P	10-1/2"\15"	Plain Screw	174	109
52D	7"\8"	Quick release w/dog	137	85
52-1/2D	9"\13"	Quick release w/dog	175	105

ALFIT DRAWER SLIDES

DS14	14" (350mm)	4.80	3.55
DS16	16" (400mm)	5.10	3.65
DS18	18" (450mm)	5.40	3.75
DS20	20" (500mm)	5.60	3.85
DS22	22" (550mm)	5.80	3.95

BLACK & DECKER

Model	Description	List	Sale
1166	3/8" Drill 0-2500 rpm 4 amp	105	65
4011	1/4 sheet Palm Sander	86	59
2600	3/8" Drill rev. 0-1200 rpm 4.5 amp	149	89
1180	3/8" Drill rev. 0-1200 rpm 5 amp	197	114
1321	1/2" Spade handle Drill 450rpm 7 amp	307	174
1349-09	1/2" Timberwolf Drill 2 speed	513	274
2037	Drywall Gun 0-4000 5.0 amp	184	98
2038	Drywall Gun 0-2500 rpm 5 amp	184	99
2054	Tek Gun 0-2500 5.0amp	282	152
2050	Tek Gun0-900 5.0 amp	283	158
2660	Drywall Gun 0-4000 4.5 amp	149	78
2665K	3/8" cordless 12V Cyclone Drill	294	159
2750	4-1/2" Grinder 10,000rpm 6 amp	156	83
3157	Orbital var. speed Jig Saw 4.5 amp	231	145
1703-1	10" Mitre Saw w/73-770 blade&bag	329	185
79-032	Workmate 200	121	79
79-033	Workmate 300	140	89
79-034	Workmate 400	177	109
1180	3/8" Drill rev. 0-1200 rpm 5 amp	192	110
2694	7-1/4" Super Sawcat Circ Saw	275	144
2695	8-1/4" "Super Sawcat" Circ Saw	308	158

Piranha Carbide Tooth Saw Blade

Model #	Diameter	# Teeth	List	Sale
73-718	8	22	20.95	10.95
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	9.85
73-757	7-1/4	40	32.87	16.89
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
73-715	5-1/2	16	14.39	7.99
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

ELU by Black & Decker

3338	2-1/4 HP Plunge Router var. speed	448	255
3304	1 HP variable speed Plunge Router	307	158
3375	3-1/8" Universal Planer 7.2 amp	329	155
3380	Biscuit Jointer with case	569	248
4024	3"x21" variable speed Belt Sander	338	175
4029	4"x24" Belt Sander	519	239
4015	1/2 sheet Sander 3.0 amp	220	129
3339	NEW 3 HP var. speed Plunge Router	500	275

READER SERVICE NO. 16

KIT SPECIALS

SAW KITS

Model	Description	Special Sale
1581VSK	Bosch Top handle Jig Saw with case & 30 Bosch blades	175
1582VSK	Bosch CLIC barrel grip Jig Saw with case & 30 Bosch blades	175
TS254K	Ryobi 10" Mitre Saw with accessory kit and Black & Decker 73-770 60 tooth blade	259

SANDER KITS

7334K	Porter Cable 5" Random Orbit Sander w/case & 1 roll 100X & 1 roll 150X discs	159
7335K	Porter Cable 5" v/spd Rndm Orb Sander w/case & 1 roll 100X & 1 roll 150X discs	169
7336K	Porter Cable 6" v/spd Rndm Orb Sander w/case & 1 roll 100X & 1 roll 150X discs	175

CORDLESS DRILL KITS

9852K	Porter Cable 9852 Drill Kit Includes: extra Porter Cable battery	185
9853K	Porter Cable 9853 keyless Drill Kit Includes: extra Porter Cable battery	185
9855K	Porter Cable 1/2" cordless Drill Kit. Includes: extra Porter Cable battery	219

BISCUIT JOINER KITS

555K	Porter Cable Plate Biscuit Joiner with case & 1000 assorted biscuits	195
JS100K	Freud Plate Biscuit Joiner with case & 1000 assorted biscuits ($30.00 Rebate)	185
JM100KK	Ryobi Plate Biscuit Joiner with case and 1000 assorted biscuits	242
1605-02K	Skil Plate Biscuit Joiner with case and 1000 assorted biscuits	149

DEWALT

Model	Description	List	Sale
DW944K-2	3/8" 9.6V cordless drill kit w/2 batteries	277	154
DW945K-2	3/8" 12V cordless drill kit w/2 batteries	298	169
DW364	7-1/4" Circ. Saw with brake, 13 amp	275	145
DW306K	8.0 amp Recip Saw with case var. speed	282	155
DW610	1-1/2 HP 2 handle Router	270	148
DW411	1/4 sheet Palm Sander, 1.7 amp	97	58
DW705	12" Compound Mitre Saw	658	358
DW704	12" Mitre Saw	560	299
DW100	3/8" Drill, 4 amp, 0-2500 rpm, rev	116	68
DW250	4.5A Drywall Gun, 0-4000 rpm, rev	162	88
DW947K	3/8" 13.2 volt cordless Drill Kit	380	205
DW318K	Top Handle Jig Saw with case	258	144
DW254	4.5A Drywall Gun, 0-2500 rpm, rev	162	88
DW402	4-1/2" Grinder 6 amp	158	94
DW682K	New Biscuit Joiner with case	428	225
DW614	NEW 1-1/4 HP Plunge Router	250	144
DW615	NEW 1-1/4 HP Electronic Plunge Router	290	158
DW624	NEW 3 HP Plunge Router	440	245

SUPER SPECIAL
DW625 NEW 3 HP v/spd Plunge Router **Sale** 269

DW675K	NEW 3-1/8" Planer with case	280	159
DW430	NEW 3" x 21" Belt Sander	290	165
DW431	NEW 3" x 21" variable speed Belt Sander	320	182

RYOBI

Model	Description	List	Sale
JP-155	6-1/8" Jointer/Planer	648	305
TS-254	10" Mitre Saw	420	209
TS-254K	above Saw with access. kit & B&D 73-770 carbide blade	510	259
AP10	10" Surface Planer 13 amp	794	379
RE600	3 HP Plunge Router var speed	465	215
BE321	3" x 21" var. speed Belt Sander	290	138
SC160	NEW 16" Bench Scroll Saw	282	139
TFD172VRK	9.6 volt cordless Drill Kit w/2 batteries	292	154
TFD222VRK	12 volt cordless Drill Kit w/2 batteries	325	172
JM100K	Biscuit Jointer with case	453	215
RS115	4-1/2" v/spd Random Orbit Sander	136	78
BT3000	NEW 10" Table Saw with stand	1204	539
W660C	BEST BUY 7-1/4" Circ Saw 13A	184	88
TSS220	8-1/2" Slide Comp. Saw	966	445
TS260	10" Compound Mitre Saw	486	239
BE424	4" x 24" var. spd Belt Sander	376	179
TR30U	3/4 HP Trimmer	170	85
DS1000	NEW Detail Sander	90	44
S550	1/6 sheet Palm Sander	82	54
RS112	Palm grip Random Orb Sander	90	55
AP12	NEW 12" Bench Planer	884	410
JS45	NEW Top Hdle Jig Saw v/spd	98	69
TDS4000K	NEW 12V Drywall Gun kit 2 spd	368	215
RA202	NEW 8-1/4" Bench Radial Arm Saw	695	395
BS900	NEW 9" Bench Band Saw	298	175
IDV28	NEW 28 Gal. Industrial Dry Vac	198	119
OSS450	NEW Oscillating Spindle Sander	298	175

WERNER LADDERS

Introducing a full range of Werner brand ladders at discounted prices! Werner ladders - A name you can stand on.

WOODEN STEP - TYPE IA- 300# RATING

Model	Size	Weight(lbs)	Sale
W394	4'	21#	53.95
W395	5'	26#	55.95
W396	6'	32#	66.95

ALUMINUM STEP - TYPE 1A- 300# RATING

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

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#	82.00

ALUMINUM FLAT STEP TYPE 2- 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.

Model	Size	Working Length	Weight(lbs)	Sale
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

Buy any 3 ladders(can be assorted) deduct additional 5% Prepaid Freight and best prices too!

PANASONIC

Model	Description	List	Sale
EY6205BC	Variable speed 12 volt Drill with 15 minute charger & case	353	179
EY6205EQK	Same as EY6205BC but comes with NEW **Ironman** battery	368	189
EY6200BC	2 speed 12 volt Drill D-handle with 15 minute charger & case	336	178
EY6282EQK	Var. spd 9.6 volt Drill with 15 min. charger, case, and NEW **Ironman** battery	315	168

Ironman Battery = Battery has 40% more life and 20% more torque!

Model	Description	List	Sale
EY62821DKW	9.6 volt Drill Kit w/2 batteries	275	158

SUPER SPECIAL
EY6181CRKW **NEW** 9.6V **PREDATOR**
Compact Drill Kit with 2 batteries - 10% more power than EY62821DKW ..... **Sale** 158

EY6900BC	NEW 12 volt Hammer Drill variable speed with 15 minute charger	396	205
EY6207BC	NEW 12 volt 1/2" Drill w/keyless chuck variable speed with 15 minute charger, battery & case	420	222

Most Tools In This Ad Shipped Federal Express for $9.00!

SEE NEXT PAGE FOR MORE SPECIALS!

PORTER CABLE

ROUTERS

Model	Description	List	Sale
630	1 HP Router 6.8 amp	230	129
690	1-1/2 HP Router 10 amp	255	138
9690	690 Router w/steel case	305	148
691	1-1/2 HP Router D handle	280	149
695	1-1/2 HP Router/Shaper	390	215
696	Heavy Duty Shaper Table	225	129
100	7/8 HP Router	185	104
5060	"Stair Ease" Stair Templet	225	139
5061	"Stair Ease" Hard Wood Templet	235	145
5008	Dovetail Template kit	130	85
5009	Mortise & Tenon Jig	75	48
693	1-1/2 HP Plunge Router	315	169
6931	Plunge Router Base	125	77
5116	16" Omni-Jig	465	255
7310	5.6 amp Laminate Trimmer	160	92
7312	5.6 amp Offset Base Lam Trimmer	225	125
7319	5.6 amp Tilt Base Lam Trimmer	180	109
97310	Laminate Trimmer Kit complete	355	195
7518	3-1/4 HP 5 speed Router	495	264
7519	3-1/4 HP 2 handle Router	430	229
7536	2-1/2 HP 2 handle Router	355	198
7537	2-1/2 HP "D" handle Router	375	208
7538	3-1/4 HP Plunge Router	430	234
7539	3-1/4 HP var. spd Plunge Router	495	268

DRYWALL GUNS

7399	Drywall cutout unit 5.6 amp	140	89
43218	3/16" bit for 7399 unit	Sale	6.50
6645	New 0-2500 Drywall Gun 5.2 amp	195	114
6640	0-4000 Drywall Gun 5.2 amp	190	114
2640	0-4000 Drywall Gun 4 amp	140	89

SANDERS

Model	Description	List	Sale
351	3"x21" Belt Sander without bag	270	140
352	3"x21" Belt Sander with bag	280	154
360	3"x24" Belt Sander with bag	350	194
361	3"x24" Belt Sander without bag	330	184
362	4"x24" Belt Sander with bag	365	198
363	4"x24" Belt Sander without bag	345	188
503	3"x24" Belt Sander w/bag Worm Drive	645	344
504	3"x24" Belt Sander Worm Drive	625	334
330	1/4 sheet Palm Sander $10 rebate	105	62
7400	NEW 7" Vertical Grinder 12 amp	250	149
7401	NEW 7" Polisher 8 amp	260	159
7403	NEW 6" Power Paint Remover 8 amp	280	175
7402	NEW 7" Vertical Disc Sander 8 amp	250	149
505	1/2 sheet Orbital Pad Sander	225	118

RANDOM ORBIT SANDERS

7334	5" Pad 6000 rpm	221	119
7335	5" Pad var. speed 2500-6000 rpm	241	129
7336	6" Pad var. speed 2500-6000 rpm	246	137
73333	Dust Collection Kit	Sale	24.50

SAWS

315-1	7-1/4" Top handle 13 amp Circ. Saw	220	122
9315-1	315-1 comp. w/case & carbide blade	250	139
617	7-1/4" Pushhandle Circ. Saw 13 amp	220	119
9617	617 comp. w/case & carbide blade	250	142
368-1	8-1/4" Top handle Circ. Saw 13 amp	270	149
314	4-1/2" Trim Saw 4.5 amp	250	139
9314	above Saw with case	275	154
345	6" Saw Boss 9 amp	190	104
9345	345 comp. with case & carbide blade	220	124

BISCUIT JOINER

Model	Description	List	Sale
555	Plate Biscuit Joiner with case	320	168

SUPER SPECIAL
556 555Joiner w/5556 tilt fence .... **Sale** 175

5554	1000 Assorted Biscuits	Sale	29
5553	1000 #20 Biscuits	Sale	29
5552	1000 #10 Biscuits	Sale	29
5551	1000 #0 Biscuits	Sale	29

PLANERS

320	Abrasive Plane 3 amp	235	129
9118	Porta Plane w/carbide cutter & case	380	209
9652	Versa-Plane w/carbide cutter & case	550	304
9367	367 Planer with case	250	144

DRILLS

7556	1/2" Right Angle 330/700rpm Drill w/cse	375	219
666	0-1200 rpm 3/8" var. speed Drill 4 amp	230	129
9614	1/2" D handle Hammer Drill w/case	355	205
7557	3/8" variable speed angle Drill	340	185
97751	1/2" var. speed Hammer Drill w/case	265	155
2620	3/8" HD var. speed Drill 0-1000 rpm	180	99
6611	New 3/8" Drill 0-1000 rpm 5.5 amp	210	118
6614	New 1/2" Drill 0-750 rpm 5.5 amp	220	122
6615	New 6614 with keyless chuck	220	122

JIG SAWS

7549	Top handle Jig Saw	260	145
7649	Barrel-grip Jig Saw	260	155

RECIPRO SAWS

Model	Description	List	Sale
9627	Recipro Saw 2 speed 8 amp	255	139
9629	Recipro Saw variable speed 8 amp	265	148
9637	Full var/spd Recipro Saw 8 amp	265	145
9647	TIGER CUB Recipro Saw	205	117

NEW TOOLS

9852	12 volt 3/8" Drill w/cse 0-400/0-1000 rpm	280	149
9853	9852 with keyless chuck	210	155
9855	12V 1/2" Drill w/cse 0-350/0-1000 rpm	335	184
8500	12 volt battery for above Drills	69	39
9841	9.6 volt cordless Drill Kit with 15 minute charger, battery, & case	309	168
9840	9.6 volt cordless Drill Kit with 1 hour charger, 2 batteries, & case	289	158
8400	9.6 volt battery for above Drills	65	39
332	Palmgrip Random Orb Sander	116	64
333	above Sander with dust bag	131	68
334	333 sander with PSA pad	131	74
352VS	3" x 21" Belt Sander w/bag var. speed	295	159
7116	24" Omni-Jig	530	294
1700	Heat gun 750° - 1000°	110	69
550	Pocket cutter with case	330	178
7700	10" "Lazerloc" Miter saw	634	339
1400	14" abrasive cut-off machine	372	215
310	Production Laminate Trimmer	250	145
312	Production Offset Laminate Trimmer	295	168
410	Underscribe Trimmer	266	154

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MAKITA

CORDLESS

Model	Description	List	Sale
6070DW	3/8" var. speed rev. Drill 7.2 volt	128	74
6071DWK	3/8" variable speed rev. Drill with removable battery 7.2 volt	216	110
5090DW	3-3/8" Paneling Saw 9.6 volt	270	149
6010DWK	3/8" Drill Kit 7.2 volt	182	99
6010SDW	3/8" Drill 7.2 volt - 3 Hr charge	99	59
4390DW	9.6 volt Recipro. Saw Kit	258	148
ML900	Incandescent Flashlight 9.6 volt	Sale	37
5600DW	6-1/4" Circular Saw 10.8 volt	494	265
6010DL	3/8" Drill with flashlight 7.2 volt	230	118
6891DW	Drywall Gun 0-1400 9.6 volt	270	144
4300DW	Jig Saw Kit comp 9.6 volt	261	145
6710DW	Cordless Screwdvr Kit 7.2 volt	212	115
T220DW	New cordless Stapler Kit 9.6 volt	370	188
DA391DW	3/8" angle Drill Kit 9.6 volt	312	162
6012HDWE	2 speed Drill Kit with 2 batteries	255	129
6092DW	Variable speed Drill kit - no clutch	257	138
6093DW	Variable speed Drill Kit complete	283	139
6093DWE	6093DW Drill Kit with 2 batteries	296	145
6095DW	6093DW Kit with keyless chuck	291	135

SUPER SPECIAL
6095DWE 6095DW Drill Kit w/2 batteries **Sale** 139

6201DWE	NEW 9.6V Drill Kit with 2 batteries	310	155
6211DWE	12V "Mac Pak" Drill Kit w/2 batteries	342	168
6011DW	NEW 12 volt Drill Kit	314	165
632007-4	9.6 volt Battery	48	30
632002-4	7.2 volt Battery	40	28

ROUTERS

3606	2 Handle Router 1 HP	180	105
3620	1-1/4 HP Plunge Router w/case	220	129
3601B	1-3/8 HP Router	288	158
3612BR	3 HP Plunge Router round base	383	175
3612BRA	3612BR Router with brake	524	179

SANDERS

BO4510	1/4 sheet Pad Sander	106	54
BO4530	6" Round Sander	117	59
BO4550	1/4 sheet Pad Sander w/bag	98	54
9035	1/3 sheet Finish Sander	129	69
9045B	1/2 sheet Finish Sander	266	139
9045N	1/2 sheet Sander with bag	288	148
9900B	3"x21" Belt Sander w/bag 7.8amp	297	172
9901	3"x21" Belt Sander w/bag 6.7amp	278	155
9924DB	3"x24" Belt Sander with bag	329	159
9401	4"x24" Belt Sander with bag	378	205
GV5000	5" Disc Sander	173	69
9207SPC	7" Sander-Polisher 1500-2800 rpm	443	245
BO5000	NEW 5" Random Orbit Sander	120	68

GRINDERS

9514B	4" Grinder 4.6 amp	111	65
N9501B	4" Grinder 4.0 amp with case	168	89

SAWS

Model	Description	List	Sale
5007NBA	7-1/4" Circ. Saw w/electric brake	263	129
4200N	4-3/8" Circular Saw	252	148
JR3000V	Var. speed Recip. Saw w/case	252	135
9820-2	Blade Sharpener	394	195
JV2000	Var. speed Orbital Jig Saw	302	165
5005BA	5-1/2" Circular Saw	250	138
4301BV	Orb var. speed Jig Saw 3.5 amp	292	159
5402A	16" Circular Saw 12 amp	743	395
LS1440	14" Mitre Saw	969	429
2414	14" Cut-off Saw AC/DC	403	218
4320	Var. spd economy Jig Saw 2.9 amp	141	89
5008NBA	8-1/4" Saw w/electric brake	316	188
5201NA	10-1/4" Circular Saw 12 amp	688	359
LS1030	10" Mitre Saw	428	209
LS1020	10" Mitre Saw 12 amp	630	339
2708W	8-1/4" Table Saw w/carb blade	585	289
2711	10" Table Saw with brake	1067	558
4302C	Variable speed Orbital Jig Saw	351	189
5077B	7-1/4" Hypoid Saw	281	138
5007NB	7-1/4" Circular Saw 13 amp	232	115
5007S	5007NB with square cutting guide	283	144
LS1011	10" slide Compound Saw	946	498
5820	7-1/4" Circ. Saw w/brake 7.5 amp	210	119
5012B	11-3/4" electric Chain Saw 11.5A	255	145

PLANERS

2012	12" portable Bench Planer 12amp	959	495
N1900B	3-1/4" Planer with case	232	129
1911B	4-3/8" Planer 7.5 amp	309	139
1100	3-1/4" Planer with case 6.8 amp	478	259
1805B	6-1/8" Planer w/case 10.5 amp	768	409
2030N	12" Planer/6" Jointer	2861	1999
2040	15-5/8" Planer	2167	1599
410	Dust Collection Unit	596	315

DRYWALL GUNS

6800DBV	0-2500 rpm 3.5 amp	180	89
6801DBV	0-4000 rpm 3.5 amp	180	89
6805BV	0-2500 rpm 4.8 amp	214	109
6820V	0-4000 rpm 5.2 amp	171	92
6802BV	0-2500 rpm Screwdriver 4.8 amp	223	115

DRILLS

6402	3/8" Drill 0-1200 rpm 5.2 amp	199	105
6404	3/8" Drill 0-2100 rpm 2.8 amp	112	59
6510LVR	3/8" Drill 0-1200 rpm 3.5 amp	168	88
6302	1/2" Drill 0-550 rpm 5.2 amp	228	114
6013BR	1/2" Drill 550 rpm 6 amp	280	138
6301LR	1/2" D-handle 550 rpm 5.2 amp	281	145
DA3000R	3/8" angle Drill 0-1400 rpm	314	155
6300LR	1/2" right angle 550 rpm 5.2 amp	401	205
DA6300	1/2" angle Drill 2 speed 7.5 amp	472	239
HP1030W	3/8" v/spd Hammer Drill w/cse	210	119
HP2010N	3/4" v/spd Hammer Drill w/cse	335	175

BOSCH

ROUTERS

Model	Description	List	Sale
1608	5.6 amp Laminate Trimmer	154	88
1608LX	same as above w/trimmer guide	175	110
1608T	5.6 amp tilt base Trimmer	175	105
1609	5.6 amp offset Base Trimmer	220	119
1609K	Laminate Installers Kit w/1609	315	175
1608U	Underscribe Laminate Trimmer	208	124
1609KX	Same as 1609K&Underscribe base	369	209
1600	2-1/4 HP Router D handle	411	259
1601A	1 HP Router 25,000 rpm	175	105
1602A	1-1/2 HP Router 25,000 rpm	229	149
1603	1-1/2 HP D handle Router	252	155
1604A	1-3/4 HP 2 handle Router	249	137
1604AK	same as above w/case & access.	299	169
1606A	1-3/4 HP D handle Router	273	168
90300	3-1/4 HP Router-Heavy Duty	558	355
1613	NEW 1-3/4 HP Plunge Router	290	164

SUPER SPECIAL
1613EVS 2 HP v/spd Plunge Router **Sale** 178

1614	NEW 1 HP Plunge Router	225	128
1614EVS	NEW 1-1/4 HP v/spd Plunge Router	260	149
1615	NEW 3 HP Plunge Router	395	228
1615EVS	NEW 3 HP var. spd Plunge Router	460	244

SAWS

1581VS	Top handle Jig Saw	275	138
1582VSC	CLIC Barrell Jig Saw	275	138
1581DVS	Dustless Top handle Jig Saw	295	168
1582DVS	Dustless CLIC Barrell grip Jig Saw	295	168
BC	Bosch metal case for above Jig Saws	34	32
BBA	30 of Bosch's best Jig Saw blades	27.99	
1632VSRK	Recip Saw 8.4 amp Orb var spd	225	145
1655	NEW 7-1/4" Circ. Saw	285	114

SUPER SPECIAL
1581VS or 1582VSC with Bosch steel case and 30 Bosch Blades **Sale** 175

PLANERS

Model	Description	List	Sale
3272	3-1/4" Planer 4.2 amp	155	88
3272K	3272 Planer with case	169	99
3258	3-1/4" Planer w/blade guard 5.7amp	247	139
3258K	3258 Planer with case	273	154

SANDERS

1272	3"x 24" Belt Sander	325	199
1272D	3"x 24" Belt Sander with bag	340	185
1273	4"x 24" Belt Sander	339	205
1273D	4"x 24" Belt Sander with bag	359	195
1273DVS	Var. speed 4"x24" Belt Sander	380	198
3270D	3"x21" Belt Sander w/bag 5 amp	270	148
3283DVS	5" Random Orbit Sander	169	95
3283DVSK	above sander w/discs and case	199	119
1370DEVS	6" Random Orbit Sander	391	219
1289D	1/4 sheet Sander with bag	98	59

DRILLS

1195VSR	3/8" var. speed Hammer Drill	211	125
1194VSR	1/2" var. speed Hammer Drill	259	145
1194VSRK	Same as above with case	287	169
11212VSR	"Bulldog" 3/4" SDS Rotary Drill	370	198
11304	"The Brute" Breaker Hammer	2055	1175
11305	Demolition Hammer 10 amp	1099	649
3050VSRK	9.6 volt cdls Drill Kit w/2 batteries	256	138
3051VSRK	3050VSRK with keyless chuck	266	145
1021VSR	3/8" Drill 4.8 amp 0-1100 rpm	189	105
1022VSR	3/8" Drill 4.8 amp 0-1100 rpm	195	109
1023VSR	1/2" Drill 4.8 amp	205	109
1942	Heat Gun 600° - 900°	115	74
11310EVS	Demolition Hammer	819	475
11220EVS	1-1/2" Spline Hammer Drill	819	459
11210VSR	3/4" Rotary Drill var speed	335	185
1420VSR	Drywall Gun 4.8 amp 0-4000 rpm	160	88

GRINDERS

1347AK	4-1/2" Grinder with case & access.	175	108
1348AE	5" Grinder 8.5 amp	209	118

MILWAUKEE

RECIP SAWS

Model	Description	List	Sale
6527	Super Sawzall variable speed 8 amp with case & Quick Loc Cord	309	164
6528	6527 with Wired Cord	305	168
6511	2 speed Sawzall with case	244	135
6507	"The Original" Sawzall with case	259	139
6508	Var. speed w/case-Wired Cord	255	144

CORDLESS

0399-1	12V cordless variable speed Drill with battery, charger, & case	309	165

SUPER SPECIAL
0407-1 Same as 0399-1 but with keyless chuck and 2 batteries **Sale** 168

0395-1	9.6 volt cordless Drill with case	284	158
0219-1	9.6 volt cordless Drill with case	309	175
6539-1	Screwdriver 190 rpm	127	75
6540-1	6539-1 with bits & case	162	95
6546-1	Screwdriver 200 & 400 rpm	138	82

SAWS

6215	16" Chain Saw	321	179
6365	7-1/4" Circular Saw	214	122
6367	above Saw - double insulated	209	128
6366	6365 Saw with fence & blade	224	127
6368	6365 Saw w/fence, blade & case	244	139
6377	7-1/4" Worm Drive Saw	324	182
6378	8-1/4" Worm Drive Saw 15 amp	334	185
6256	Variable speed Jig Saw 3.8 amp	259	139
6405	8-1/4" Circular Saw 13 amp	254	149
6460	10-1/4" Circular Saw 15 amp	459	265
6232	4-3/4" Band Saw w/cse v/spd	480	279
6175	14" Chop Saw 15 amp	499	279
6369	NEW 7-1/4" Circular Saw w/brake	259	145
6490	NEW 10" Mitre Saw	444	265

HAMMER DRILLS

5399	1/2" D-handle Hammer Drill Kit	325	188
5397-1	3/8" var. speed Hammer Drill Kit	250	138
5371-1	1/2" var. speed Hammer Drill Kit	375	185
5377-1	5371-1 w/keyless chuck	375	185
5348	1-1/2" Rotary with case 500 rpm	905	520
5353	Eagle 1-1/2" Rotary Hammer w/cse.	935	495
5365-1	HAWK 1" SDS Rotary Hammer with case and bits	600	324

ROUTERS

5660	Router 1-1/2 HP 10 amp	345	184
5680	Router 2 HP 12 amp	355	198

DRYWALL GUNS

Model	Description	List	Sale
6754-1	0-4000 4.5 amp	192	108
6749-1	0-2500 5.2 amp	214	124
6750-1	0-4000 5 amp	168	95
6747-1	0-2500 rpm 5 amp	186	107
6767-1	Screw Shooter Kit	229	135

DRILLS

0224-1	3/8" Drill 5.2 A magnum 0-1200 rpm	215	116
0225-1	Above drill with keyless chuck	203	119
0234-1	1/2" Drill 5.2 A magnum 0-850rpm	229	122
0235-1	above Drill with keyless chuck	229	128
0244-1	1/2" Drill 5.2 A magnum 0-600rpm	229	123
0222-1	3/8" Drill 3.5 amp 0-1000 rpm	189	107
0228-1	3/8" Drill 3.5 amp 0-1000 rpm	186	104
0230-1	3/8" Drill 3.5 amp 0-1700 rpm	209	115
0375-1	3/8" close quarter Drill	229	128
0379-1	1/2" close quarter Drill	260	145
3102-1	Plumbers rt angle Drill Kit 500rpm	375	209
3002-1	Electricians rt angle Drill Kit 600rpm	375	209
1676-1	HD Hole Hawg with case	479	255
3107-1	1/2" v/sp rt angle Drill Kit 0-500 rpm	385	209
3300-1	1/2" v/spd rt angle Kit 0-850rpm	339	189
3202-1	D handle rt angle w/cse 350 rpm	375	205

BELT SANDERS

5925	3" x 24" with bag 10 amp	440	239
5936	4" x 24" with bag 10 amp	440	248

SANDERS

6125	5" Rand Orbit Sander 10,000 rpm	200	119
6126	6" Rand Orbit Sander 10,000 rpm	205	125
6127	5" Random Orbital Sndr dustless	260	145
6008	1/3 sheet Orbital Sander	209	116
6010	1/2 sheet Orbital Sander	214	124
6016	1/4 sheet Palm Grip Sander	95	55
6017	6016 Sander with dust bag	97	58

GRINDERS/POLISHERS

5455	7"/9" Polisher 1750rpm	245	138
6145	4-1/2" Grinder 10,000 rpm	165	99
6142	4-1/2"Grinder 10,000rpm w/cs & acces	204	124
6098	7" Sander/Grinder 8000 rpm	325	185

MISCELLANEOUS

8975	Heat Gun 570° & 1000°	96	59
8977	Var temp Heat Gun 212° - 1000°	128	75
8980	8975 Heat Gun w/case, air reduction, hook, deflector, & spreader nozzles	145	92
9068	1/2" Impact Wrench with case	438	269

FREUD

INDUSTRIAL SAW BLADES

5/8" bore - All Blades are Carbide Tipped

Model	Description	Teeth	List	Sale
LU72M010	General Purpose 10"	40	69	39
LU81M010	General Purpose 10"	40	78	44
LU82M010	Cut-off 10"	60	93	49
LU84M011	Combo 10"	50	78	42
LU85M010	Super Cut-off 10"	80	115	59
LM72M010	Ripping 10"	24	69	39
LU73M010	Cut off 10"	60	84	45
LU87M010	Thin Kerf 10"	24	72	39
LU88M010	Thin Kerf 10"	60	88	48
LU85M015	Mitre Saw blade 15"	108	175	105
LU91M010	Compound Mitre Blade	60	88	54
LU98M010	Ultimate 10"	80	128	68
LU89M010	Non-Ferrous metal 10"	72	104	58
SC-001	Blade Stabilizers (pair) for 5/8" arbor		Sale	12.99

STACKED DADO SETS

SD306	6" Dado - Carbide	215	112
SD308	8" Dado - Carbide	230	119

"TK" BLADE SERIES

TK203	7-1/4" Framing - 24 tooth	31	18
TK206	10" Framing - 24 tooth	39	25
TK303	7-1/4" Finishing - 40 tooth	38	23
TK306	10" Finishing - 40 tooth	47	28
TK903	7-1/4" Combo - 30 tooth	33	19
TK904	8-1/4" Combo - 35 tooth	36	23
TK906	10" Combo - 50 tooth	53	30
TK204	8-1/4" Flat - 24 tooth	31	19

MISCELLANEOUS

FB107	7 piece Forstner bit set w/cse 1/4" - 1"	92	57
FB100	16 piece Forstner bit set w/cs 1/4"-2-1/8"	338	184
94-100	5 piece Router bit door system w/cse	320	163

CHISEL SETS

WC104	4 piece Chisel set with case 1/4" - 1"	65	48
WC106	6 piece Chisel set with case 1/4" - 1"	87	58
WC110	10 piece Chisel set w/cs 1/4" - 1-1/2"	143	88

POWER TOOLS

EB100	Edge Banding Machine	409	209
CE82	3-1/4" Planer with carbide blades	245	135
EDS1321	3V Cordless Drill Kit	415	205
EDS1201	2V Cordless Drill Kit	379	189

The folowing tools have a $30.00 rebate thru 1/15/94
Price shown is before rebate.

JS100	Biscuit Jointer with case	334	159
FT2000E	3-1/4 HP Plunge Router var. speed	410	198

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F410	10" - 40 carbide teeth	95	54
F810	10" - 80 carbide teeth	135	76

New Super Dados

SD506	6" carbide w/case & shims	292	165
SD508	8" carbide w/case & shims	344	194

NEW QUIET BLADE

NEW SUPER DADO

SEE PREVIOUS 2 PAGES FOR MORE SPECIALS

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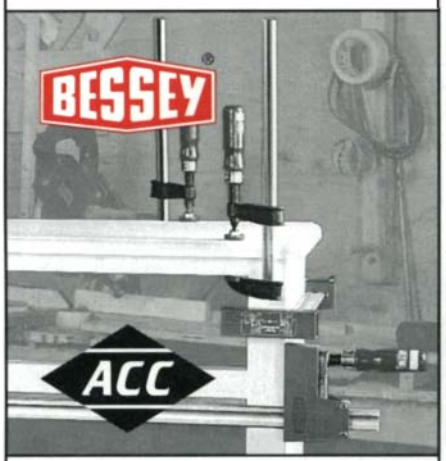

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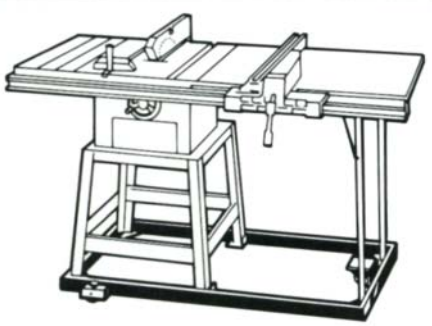

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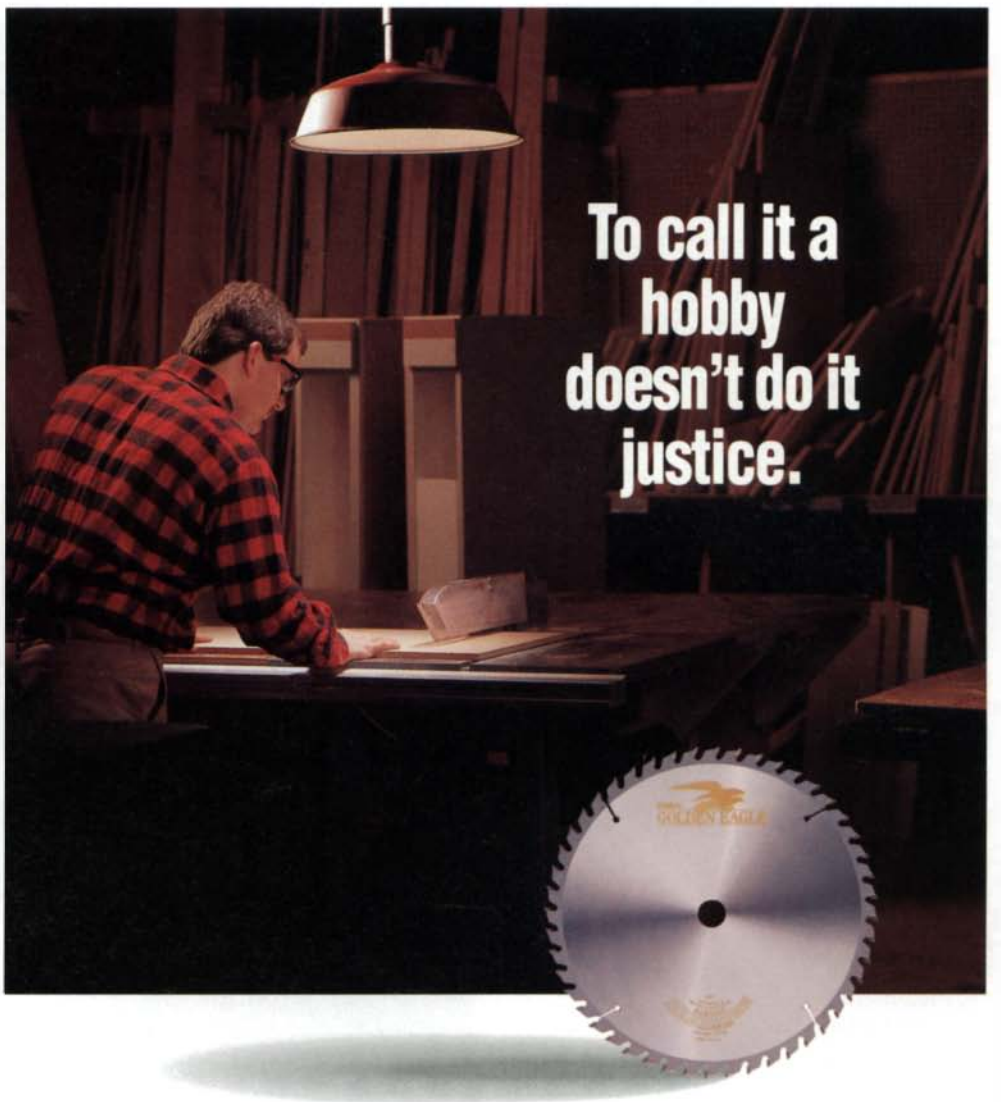

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READER SERVICE NO. 43

Versatile wet grinder

***The Tormek SuperGrind 2000** (left) will put an even hollow grind on a tool quickly, but won't overheat the steel, because the aluminum oxide wheel travels through a water trough.*

The Tormek SuperGrind 2000, a new wet grinder manufactured in Sweden, is the finest grinder I've seen to date. The unit consists of one 220-grit aluminum oxide wheel and one leather-faced honing wheel mounted on an arbor that's housed in a heavy-duty, enamel-coated steel frame (see the photo at right). I tested a 220v model, but both 110v and 220v models will be available by the time this goes to print, according to the distributor.

At a base price of about $370, the unit is not cheap. You can buy a Taiwanese grinder for less than $50. And similar looking wet grinders are available for a little over $100. So how can any grinder be worth what the Tormek costs? Well, it's a bit like comparing a Volvo to a Yugo. Either will do the job (at least at first), but there's a difference in quality, precision and durability that argues forcefully against the cheap alternative. The Tormek is easy to use, it produces straight, even bevels quickly and dependably, and it's built to last a lifetime.

It's easy to draw the temper out of a chisel, gouge or plane blade on a regular grinder, even one with a relatively low-speed 1,725-rpm motor. And most of the motorized waterstones on the market are mounted horizontally, which produces a flat, rather than a hollow, grind. The Tormek overcomes both of those conditions by mounting its 2-in. by 10-in. wheel vertically and spinning the wheel through a water trough at only 90 rpm. The aluminum oxide stone cuts fairly quickly, especially considering the speed at which the wheel is turning, but the temperature of the tool steel, even right at the tip, never rises much above room temperature. Also, because the Tormek's wheel spins toward the tool, the tool's edge isn't drawn out, which would result in a weaker, more easily dulled edge.

I sharpened more than two dozen chisels and plane blades over a two-week period and was impressed with the Tormek. It took me a couple of chisels to get used to the nuances of adjusting the tool-holding jig for a square cut (half a twist of one of the clamping knobs will shift the bevel angle noticeably), but once I had the hang of it, I was able to grind a perfectly square hollow-ground bevel in just a couple of minutes. All of a sudden, I found myself enjoying the sharpening process.

There are a whole range of accessories that go with this grinder (prices are approximate): two knife jigs ($27 and $38), a scissor jig ($35), the straight-edge jig (standard), a gouge jig ($13), axe jig ($11), planer-blade jig ($125), a two-sided stone grader for changing the coarseness of the stone ($18), a stone truing tool ($55), honing compound for the leather wheel (standard), an angle-setting pattern (the Angle Master, standard) and one of the best owner's manuals I've seen for any tool (also standard). The four standard items are the most useful of the lot, and with the addition of the stone grader, they are all you need to get started.

The Tormek SuperGrind 2000 is available from Garrett-Wade (161 Avenue of the Americas, New York, N.Y. 10013; 800-221-2942) and Woodcraft (210 Wood County Industrial Park, P.O. Box 1686, Parkersburg, W.Va. 26102-1686; 800-225-1153). Other dealers will also be carrying it in the future; to find out if there's a dealer near you, contact Peter Systems (14205 West Wisconsin Ave., Elm Grove, Wis. 53122; 414-785-3534). *—Vincent Laurence*

Hand-forged adze and inshave

***The hand-forged adze** at left is made in Sweden for Country Workshops. It's an efficient tool for not only removing a lot of material but leaving a silky smooth finish.*

I like tools designed and made by craftsmen. The craftsman not only understands the materials, techniques and problems associated with making tools but his goal is generally to produce the best tool he can for the job at hand. It's not just to maximize profit, as is so often the case when a tool idea originates with an engineer who is not a woodworker, and it has to be approved by cost-control types. That's why I was glad to have the chance to review the adze and inshave made for Drew Langsner and his Country Workshops. Because the tools were designed by tool-making craftsmen for their brethren who work wood, my expectations were high.

I wasn't disappointed. The tools are beautiful, with dark, faceted surfaces, which serve as testimony to the carefully placed, purposeful blows of the smith, brightly polished razor-sharp cutting edges and practical, unfussy wooden handles.

The adze, made by Hans Karlsson, a Swedish toolmaker, is used to carve out hollows, particularly chair seats. It has good weight, is balanced and easy to control—an important consideration when you're hewing to a line. I use an adze primarily for hogging out Windsor chair seat blanks, and I use a two-handed swing, controlling the direction of the adze with my right wrist and braking my swing with my left hand. Even though I tested the longer-handled version of Langsner's two adzes, I still found the handle a little short for a comfortable stroke. But that is highly subjective; it may be perfectly comfortable and natural for someone else.

When I used the adze on a pine blank, I

Photos except where noted: Vincent Laurence

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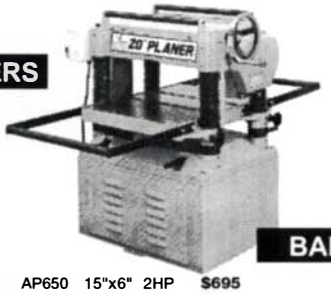

AP650	15"x6"	2HP	$695
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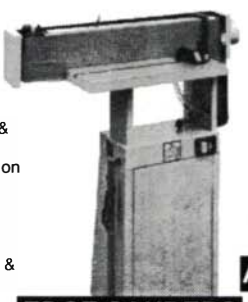

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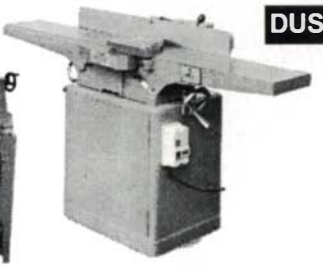

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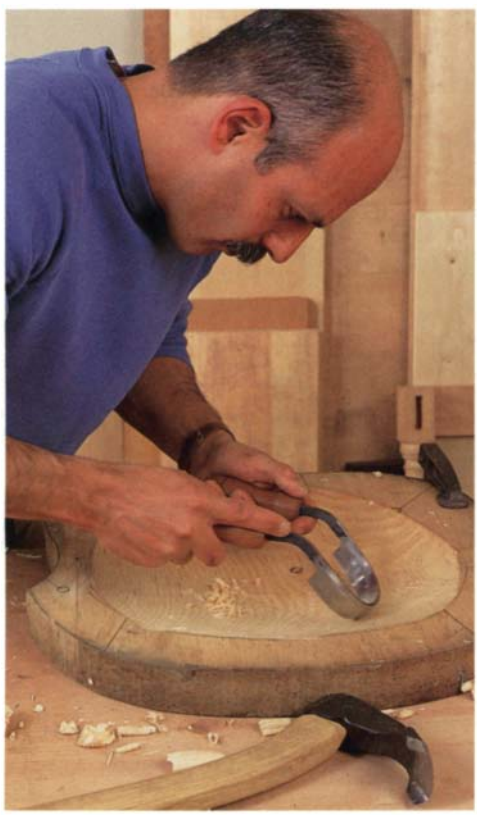
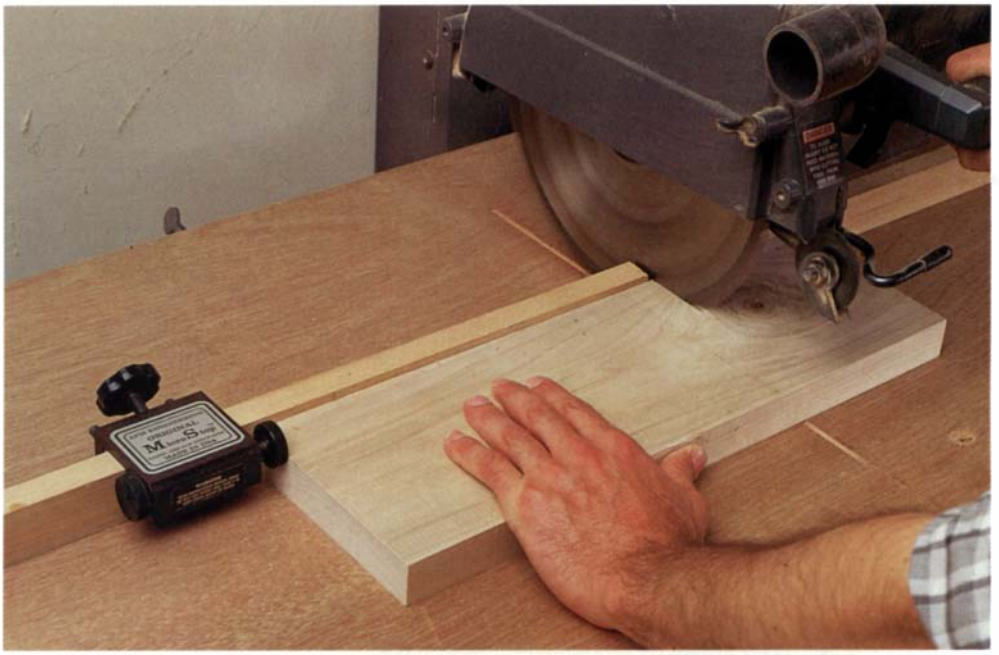
obtained a beautiful, shimmering surface, as though from a finely tuned handplane. When I tried the adze on an oak blank, however, the edge of the tool chipped and became a little ragged. I think the blade tip must have lost its temper when it was originally sharpened, so I resharpened it and made a second attempt on the oak blank. This time, I got results more like I'd obtained in the pine and with no damage to the blade. The adze sells for $150.

The inshave, made by Massachusetts toolmaker Ray Larsen, is lightweight and well-balanced. The handles are angled upward, so your hands don't get in the way of your work. With a cutting radius of about 2½ in., it's perfect for chair seats. It cuts effortlessly, removing large, chunky curls or fine, wispy shavings, leaving a silky surface. What's more, this tool really holds its edge: I carved the equivalent of four chair seats before the tool needed honing. The inshave sells for $85.

Some people might find the cost of these tools high. I'm willing to pay the price for a superior tool, though. I would rather buy once and buy right than be frustrated with an inferior tool and just end up spending more in the long run. If you are serious about hand tools, you'll like these. For more information, contact Drew Langsner at Country Workshops (90 Mill Creek Road, Marshall, N.C. 28753-9321; 704-656-2280). *–Mario Rodriguez*



***Good steel and handles that don't get in the way** are two reasons to like the handforged inshave (shown above) made by Massachusetts toolmaker Ray Larsen for Country Workshops.*



***AFM's MicroStop fits any ¾-in. fence,** and the stop, with its micro-adjusting plunge mechanism, makes it easy to cut any number of pieces to exactly the same length.*

MicroStop radial-arm saw stop

AFM Engineering's MicroStop fence stop is not a bad compromise between the expensive, commercial-fence and extension-wing systems and the jury-rigged stops woodworkers often throw together for their radial-arm saws or chopsaws (see the photo above). The body of the stop is a section of aluminum extrusion with a handled screw in the back. The screw exerts pressure on a plate inside the extrusion which bears on the saw fence, holding the stop in place.

The MicroStop's chief asset is its threaded plunge mechanism, which lets you adjust for as precise a measurement as you'll ever need as a woodworker. Moreover, once you've adjusted the plunge mechanism to the desired distance and turned the other wheel until it stops turning, the mechanism is secure—you will not bump it out of position.

The MicroStop sells for $29.95. While it's true that you could cobble up something similar to it for a couple of bucks in materials, the MicroStop works well and will save you from saying to yourself, "I've got to add one of those to my projects list...." The MicroStop is available from AFM Engineering (2535 S. Santa Anita Avenue, Arcadia, Calif. 91006). *–V. L.*

Where to find it

Wood Carvers Supply catalog
Whether you are an accomplished carver or you just use a skew chisel to trim your dovetails, there's a company you should know about. Wood Carvers Supply, Inc. specializes in carving tools and accessories and has been in business since 1955.

They are the oldest and largest distributor of Henry Taylor tools in this country, and they also sell their own brand of carving tool, called Lamp. Each and every Lamp tool is Rockwell tested, which is something no other manufacturer can say, according to Tim Effrem, Wood Carvers Supply's president. And the tools must check out within one degree of Rc 62 on the Rockwell hardness scale or be sent back to be retempered.

For a free catalog, call or write Wood Carvers Supply (P.O. Box 7500, Englewood, Fla. 34295-7500; 800-284-6229).

Rebuilt DeWalt radial-arm saws, parts for old machines
Tablesaws equipped with sliding tables or crosscut boxes, and miter, compound-miter and sliding compound-miter saws have moved in on the radial-arm saw's turf as a crosscut tool. However, many woodworkers, especially in professional shops, still look to the radial-arm saw as a dependable, heavy-duty crosscut tool that will stand up to some abuse. The industry standard was, and still is, a vintage DeWalt. And there's a company now rebuilding them and stocking parts for virtually every unit ever built.

Wolfe Machinery Co. (6107 Merle Hay Road, P.O. Box 497, Johnston, Ia. 50131; 800-345-6659) stocks old DeWalts, from the earliest days up through the 1980s. And

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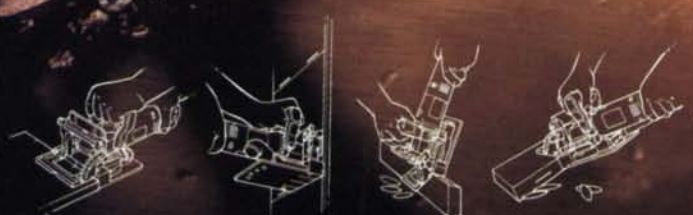

Fence is quickly and accurately set to proper height and tilted to 90°.

Fence is quickly flipped back to 0° for flush cuts.

Fence allows location on the outside face of a mitered joint.

Fence tilts from 0°-90° to locate on the inside face of a mitered joint.

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they carry home-shop units from 8-in. (blade size), ¾-hp on up to models with 20-in. blades, 30 in. of travel on a 52-in. arm and a 7.5 hp motor.

More importantly for many home-shop woodworkers, Wolfe is also having over 130 replacement parts recast and machined to exacting specifications. If you own an old DeWalt radial-arm saw or if you come across a rusty old behemoth at an auction or in someone's backyard, chances are you'll be able to get the replacement parts to get it back into shape.

Call or write Wolfe Machinery directly for more information.

Ebon-X ebony substitute

Since we mentioned Ebon-X in the description of Silas Kopf's *Parabola* cabinet (back cover of *FWW* #101), a number of readers have called and written asking how they might find out more about the product. Ebon-X is manufactured by Supertech Woods, Inc. (P.O. Box 242, Schoolcraft, Mich. 49087; 616-323-3570) and is made from domestic walnut that has been chemically altered—not dyed. The black color goes all the way through the wood, and the wood can be machined, worked with hand tools, and sanded and finished just as though it were unaltered walnut.

Ebon-X is available as veneer ($3/sq. ft.) and as dimensional lumber from ⅛ in. thick through 1 in. thick in 1/16-in. increments (about $24/bd. ft. for clear, actual dimension, surfaced-two-sided lumber). Thicker stock is also available by special order, but is more expensive because it ties up the production equipment longer.

Besides the Jet Black product (Gabon ebony substitute), Supertech also manufactures an Ebon-X bronze and will be coming out with a new product soon, Ebon-X rose. The bronze is close to the color of the streaks in Macassar ebony, but it is that color throughout, not streaked like real Macassar ebony. The Ebon-X rose, due out by the time this is in print, is said to be brown with a pinkish tone, and it's streaked with jet black lines to simulate rosewood. Contact the manufacturer for further information, literature and/or a price sheet.

Bearings are us

Because all bearings eventually wear out, they should be inspected regularly and replaced when necessary. SKF Bearing Industries Inc. (1100 First Ave., King of Prussia, Pa. 19406-1352) offers a free booklet called *Bearing Installation and Maintenance Guide*. Write for the booklet, requesting publication #140-710.

Manufacturers can be helpful for information, but when it comes time to buy bearings, most manufacturers don't want to deal with the small quantities woodworkers need. Your best source is probably listed in your yellow pages under "power transmission." The shops listed will offer not only bearings but also a full line of pulleys, pillow blocks and V-belts.

Plastics, plastics, plastics

Where can you buy plastic to make your own router-table inserts, jigs, fixtures or guards? Well, you can either pay big bucks through a woodworking catalog for a few sheets of polycarbonate or acrylic, perhaps already drilled to accept your router. Or you can go straight to a commercial plastics supplier, save a small fortune and just have to drill a few holes. One plastics supplier that distributes nationally is AIN Plastics. AIN carries acrylic, polycarbonate, phenolic, polyethylene, nylon and Teflon, as well as many other plastics that are potentially useful in the workshop. The minimum order is $50. For a free catalog, call or write AIN directly (AIN Plastics, Inc., P.O. Box 151, 249 E. Sanford Blvd., Mount Vernon, N.Y. 10550; 800-431-2451).

Call for hardware sources

So often an otherwise exquisite piece of furniture suffers aesthetically because the hardware just isn't up to the standard of the woodworking. It is unfortunate, but it is tough finding nice hardware sometimes, especially if you're looking for something nonstandard.

I would like readers to send me names, addresses and telephone numbers for their sources of hardware so that we can compile a list for publication. I'm particularly interested in some of the smaller, specialty companies that I may not be familiar with. Thanks for your help.

—Vincent Laurence

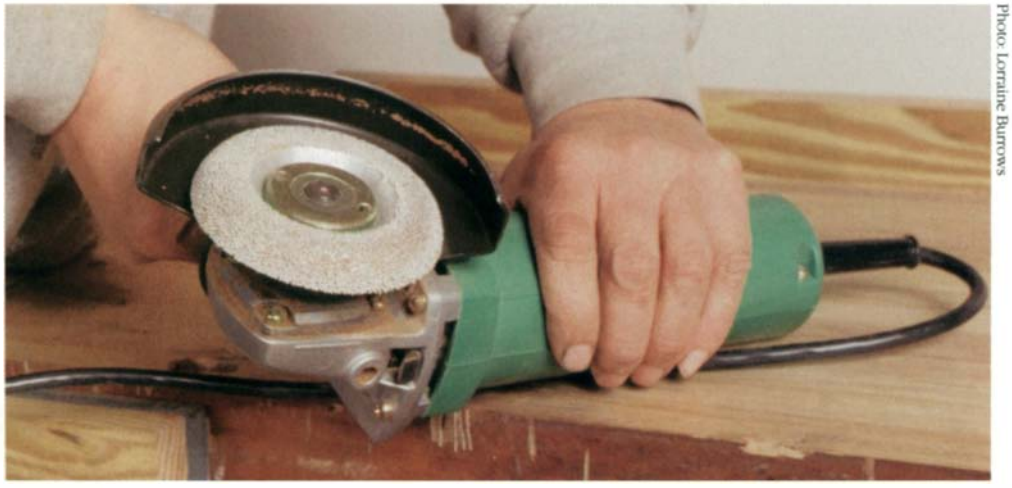


Photo: Lorraine Burrows

***Wood Carvers Supply's carbide grinder wheels** cut quickly but safely. The shape and density of the carbide barbs help to prevent the wheels from catching in the work.*

Carbide wood grinder wheels

I often rough out big dough bowls with a chainsaw or a mallet and large gouge. Until recently, I spent an inordinate amount of time sanding, but I've been able to cut my sanding time drastically because I began using these new carbide wheels in my angle grinder (see the photo above). In fact, the wheels, available from Wood Carvers Supply, Inc. (P.O. Box 7500, Englewood, Fla. 34295-7500; 800-284-6229), are aggressive enough that now I sometimes use them to do the roughing-out work. I've also found them useful for shaping many other concave and convex shapes.

These prickly 4-in.-dia. wheels excel at removing wood quickly and efficiently and leave a surprisingly smooth surface. The cutting action of the discs is caused by hundreds of cone-shaped carbide barbs welded to a metal disc and spaced tightly together. They cut well both with and across the grain and don't catch or clog easily. Any buildup can be removed with a file card or a stiff brush.

There are two shapes, a donut-like disc about ⅝ in. thick with a rounded-over edge and a tapered disc ½ in. thick at the center and ¼ in. at the edge. Both discs are available in two grits, medium and coarse. The donut-like disc sells for $44.90 and the tapered disc for $39.90. The mounting hole is a standard ⅝ in., but there's also a ½-in. adapter available for $4.95.

—Dick Burrows

Vincent Laurence is an associate editor of Fine Woodworking. *Mario Rodriguez is a contributing editor to* Fine Woodworking. *Dick Burrows is a writer and woodworker in Knoxville, Tenn.*

Fifty Years a Planemaker and User by Cecil E. Pierce. *Monmouth Press, Route 2, Box 7140, Monmouth, Maine 04259; 1992. $22.95, hardback; 80 pp. and* **Making and Modifying Woodworking Tools** by Jim Kingshott. *Guild of Master Craftsmen Publications, Ltd. Distributed by Sterling Publishing Co., Inc., 387 Park Ave. South, New York, N.Y. 10016-8810; 1992. $14.95, softback; 168 pp.*

The majority of U.S. woodworkers today are, to some extent, self-taught. This gives the woodworking scene a real vitality but brings along with it a level of frustration and a thirst for good information. I've recently come across two books on toolmaking that provide historical perspective on the craft while delivering lots of good information. And no wonder—the two authors have nearly a century of toolmaking experience between them.

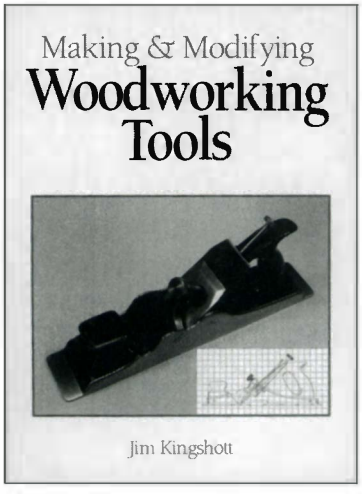
Cecil Pierce has spent five decades building boats, houses and furniture. He has also restored a railway car and developed a design for lobster traps. And along the way, he has managed to sandwich in planemaking as well. Reading his new book, *Fifty Years a Planemaker and User*, you feel that among his various devotions, planemaking has always been his real passion.

Pierce has a lively approach to his subject. He tells quite a few stories about the old days, and they give the book its flavor and its historical feel. Even some of his language seems from another time. This guy is the original crusty old-timer. But his anecdotes aren't just diversions—he does a fine job of weaving them into a solid "how-to" book.

The scope of *Fifty Years* is narrow. Pierce limited himself to explaining the construction of his unique bench planes. But what he covers he covers clearly and in enough detail that any careful reader should be able to make one of his planes. The book also has good information and sound opinions about related hand tools like scrapers and shooting (chute) boards that planemakers and woodworkers will find helpful.

Unfortunately, the photos are extremely poor and seriously detract from the book's quality. This deficiency is balanced, though, by the many beautiful line drawings by Sam Manning. They are rich in detail, yet clear and easy to read.

Despite it's few shortcomings, *Fifty Years a Planemaker and User* is a worthwhile and important book. It is an interesting blend of history and practical step-by-step instruction that injects life and personality into planemaking and collecting.



As a planemaker, I have experienced the thrill and deep satisfaction of making my own tools. The hardest part of the process was making the decision to try it and then taking the plunge. Jim Kingshott's book, *Making and Modifying Woodworking Tools*, will give aspiring but hesitant toolmakers an encouraging push.

Although the book deals mainly with making Norris-style metal-body planes, it does have a chapter on the construction of wood-body planes that is offered as a warm-up exercise in applying the principles of plane design. The book also includes a chapter on fitting and replacing wooden handles. This important subject is often ignored, and Kingshott covers it well. He points out that a comfortable handle looks good, feels better and often improves tool performance.

This book could also be described as metalworking for the woodworker. Kingshott covers the subject thoroughly, discussing a range of basic metalworking tools. There are chapters covering metallurgy, metal finishes and heat-treating. Kingshott explains things simply, in plain English and only gets as technical as is necessary. He doesn't go into much detail on the construction and fitting of the wood components, assuming that his reader is a competent woodworker already. I feel this is the book's greatest shortcoming.

Kingshott advises the reader, in the introduction, to read the entire book before making any of his planes. He correctly points out that the skills acquired and perfected on the simple planes early in the book will enable you to successfully build the more complex Norris-style panel planes he covers later on. *Making and Modifying Woodworking Tools* has over 150 photos, some in color, and 25 expertly drawn plans for planes. Kingshott's impressive breadth of experience and skill—over 45 years as a cabinetmaker and teacher—is evident in every chapter, and any reader will gain knowledge and confidence from his book.

—Mario Rodriguez

Painting Waterfowl with J.D. Sprankle by Curtis Badger and James D. Sprankle (1991, 238 pp.) and **Wildfowl Carving** by Roger Schroeder (1992, 312pp.). *Stackpole Books, P.O. Box 1831, Harrisburg, Pa. 17105; $49.95 ea., hardback*

Here are two fine books: one a reference work suited to the person new to painting waterfowl, the other appropriate for a wide range of wildfowl carvers.

Painting Waterfowl leads the carver through the process from color selection to the finishing steps, covering techniques such as color-to-water blending to achieve softness, painting vermiculation and feather flicking (the method Sprankle uses to define feather edges). The book is easy to read. It progresses through the painting process in an orderly manner, so the carver should not have to jump back and forth while painting. And the text is well supported with clear and informative photographs.

My recommendation for using this book is to read it through, and then review the second chapter, "The Sprankle Method." This will help the reader understand Sprankle's basic process and recognize that some methods, such as airbrushing, are alternatives, not necessities.

I should emphasize that all the techniques and color selections covered in the book are meant for acrylic paints; a carver who intends to paint with oil paints will be using different tube colors and different techniques.

In *Wildfowl Carving*, Roger Schroeder features the work of 12 accomplished wildfowl carvers and provides an interesting perspective on how these artists approach their art.

It is different from Schroeder's earlier books featuring wildfowl carvers, concentrating more on the way artists bring their personalities into their work rather than on the mechanics of carving. When carving techniques are covered, they are presented in isolation to explain the method an artist used to achieve a desired effect. This is not a "how to" book.

Wildfowl Carving provides the reader with vivid verbal snapshots of a variety of carvers. It provides an opportunity to see where their theories on carving are different and where they are similar. The writing is supported with high-quality photographs of completed carvings, and other photos that illustrate techniques used by the artists.

This book makes it plain that there is no single approach to successful wildfowl carving. Reading it should stimulate the carver to try to create a piece of artwork that expresses a feeling rather than just duplicating work.

—Jerry Meid

Woodworking on videotape

What holiday could woodworkers, of whatever faith, enjoy more than Christmas? Celebrants bedeck and enshrine a tree in

honor of a carpenter more famous than Art, Sam and Jim combined. And what gift would be appropriate to one of the world's oldest holidays? Perhaps one of the newest craft forms on earth: the woodworking video.

Here is a selection of the best videotapes I've found on woodworking. They all teach and entertain, demonstrating useful techniques and interesting projects, and they have good sound and lighting to boot. After watching a few, you'll see there's a lot to be said for armchair woodworking—it's inspiring and enjoyable, and the dust and noise are always at bearable levels.

In *Build a Shaker Table* (The Taunton Press, 63 S. Main St., Newtown, Conn. 06470; 800-888-8286. 1989, 60 minutes, $29.95), Kelly Mehler uses a particular project as a starting point to cover all manner of small-shop operations, always getting back to the theme of completing a beautiful piece of furniture. Speaking in a smooth and natural style, he discusses subtopics like shop organization, choosing wood, stock preparation and grain matching. Despite his youth, Mehler has techniques that will add to the bag of tricks of even long-time professionals.

For those who miss Bob Vila, *This Old House: Creating a New Kitchen II* (Pacific Arts Video Publishing, 11858 La Grange Ave., Los Angeles, Calif. 90025; 310-820-0991, #PBS105. 60 minutes $19.95) might be just the dose of useful nostalgia you need. Part I focused on the design, tearout and rough-in of an extensive kitchen remodel. The real woodworking starts in Part II, where Bob and his trusty sidekick, Norm Abram, show how to construct and install new cabinets—and flooring, tiles, appliances and countertops. The whooshing sound you hear is the vacuum being released on a group of related topics normally presented in too isolated a manner. Norm and Bob discuss integrating cabinets and all the other elements into the design and function of a modern kitchen. They make it logical, doable and fun.

Shop Planes with Roy Underhill (WTG Video, P.O. Box 1329, Mendocino, Calif. 95460; 707-937-0660. 1985, 60 minutes $29.95) takes us back 2,000 years or so to show how planes were invented. These two episodes of Underhill's show *The Woodwright's Shop* provide a comprehensive introduction to exotic as well as ordinary planes. Our host shows how to tune, sharpen, adjust and use these mainstays of the carpentorial arts. Underhill, the most vigorous man on television—sorry, Richard Simmons—doesn't just talk. He grunts and sweats as he demonstrates truing, thicknessing and squaring a board by hand with nary a video time-out. This tape makes top-quality video infotainment, especially for traditionalists.

In *Making, Using and Sharpening Wooden Planes and Cabinet Scrapers* (WTG Video, 1985, 90 minutes, $29.95), James Krenov, one of the Grand Old Men of American craft, introduces the tape with passionate arguments for hand woodworking. His acolytes in the woodworking program at College of the Redwoods proceed to take you through the steps involved in building a plane. In the middle of it, Ron Hock appears and informatively pitches the hefty blades that he makes and sells. Then back we go to the college where we sharpen, tune and employ our new tool. The stately pace won't thrill, but it won't chill either. Any viewer with mechanical talent and the requisite basic tools will be able to build a beautiful plane from the information and inspiration on this tape.

Newly minted woodworkers might check out Shopsmith's *Building Bookcases* (Shopsmith, Inc., 3931 Image Drive, Dayton, Ohio 45414; 800-543-7586, #ED0110. 1986, 40 minutes, $29.95), taught by Avian Rogers and Les Cizek, because it emphasizes basic technique and tooling with a whole addendum on shop safe-

ty. This is the third in a series of five good project-and-technique tapes. It's not a demo (or, worse, a sales tape) but a simple exposition on how to build and finish an oak plywood bookcase. It's of special interest to Shopsmith owners who aren't manual-minded, but it still works for folks who don't own the tool because it shows alternate methods of accomplishing most of the steps.

Turning Wood with Richard Raffan (The Taunton Press, 1985, 117 minutes $39.95) shows how well video can demonstrate techniques. The cameraman must have been wearing body armor—he seems to be closer to the wood than Raffan is. We can see every twist and turn of the tool. Raffan illustrates each of the various categories of basic turning with one or more projects, including kitchen tools, mallet, trivet, boxes, spindles and spheres. The guru of gouges even takes us through sanding and applying his trademark wax-over-wet-peanut-oil finish. He's as deft with an explanation as he is with a skew, leaving this viewer with the sense of things finally understood.

Chip Carving (The Taunton Press, 1987, 60 minutes $29.95) stars Wayne Barton teaching his Alpine art in a low-key but very engaging way. He shows how to create a pattern and then use just three simple knives to cut out a crisp design. Barton has an assuring manner that makes you think "Hey, I could do that." A lot of us would like to talk friends or relatives into taking up some form of woodworking, and this tape provides a good point of entry. It shows that woodworking can be easy, economical, portable and fun.

Beginners or early intermediate woodworkers should not watch Jim Cummins' excellent tape, *Small Shop Tips and Techniques* (The Taunton Press, 1989, 60 minutes $29.95)—that is, not until they have a good grip on some solid safety habits. Like the old pro he is, Cummins takes us on a guards-off roller coaster ride past some of the niftiest solutions to a wide variety of small-shop problems. I especially enjoyed his methods for making drill bits smaller, but still concentric, and drilling holes at compound angles. One of the most pleasant of presenters, he gives clear explanations of every step. The many creative solutions will tickle your technological soul.

Then there's the redoubtable Norm Abram of *The New Yankee Workshop*. Over the seasons, the Russ Morash/WGBH team has built a long list of titles (The New Yankee Workshop, P.O. Box 9345, South Burlington, Vt. 05407; 800-892-0110. $24.95 per episode, including measured drawings). In episodes focused on constructing a specific piece of furniture, Norm typically uses every tool available in retail stores. Consistent quality means you can pick a tape based on the project you'd like to see ensconced in your living room—I'm partial to the drop-leaf table. The lean Colonial or Shaker styling of most pieces he builds fits most decors, and the tapes are suitable for all skill levels. (And if you don't engage in face-nailing, just use clamps.)

As with any movie, it's hard to make a video that lives up to the book it's drawn from. But Michael Dresdner has managed to turn his *The Woodfinishing Book* (The Taunton Press, 1992) into a video that waxes the competition. *The Woodfinishing Video* (The Taunton Press, 1992, 40 minutes, $34.95) takes us into the shops of three of Dresdner's pals where they solve problems before our eyes. The interaction keeps things different and interesting. And any time you can solve three finishing problems in an hour, you're beating the rest of us. —*Sven Hanson*

Mario Rodriguez is a contributing editor to FWW. *Jerry Meid is a carver and judge of decorative bird carving in DeForest, Wis. Sven Hanson is a woodworker in Albuquerque, N.M.*

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.

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. San Francisco. For more information and schedule, contact Debey Zito (415) 648-6861.
Workshops-Various workshops including Japanese woodworking, joinery and sharpening. Contact: Hida Tool Co., 1333 San Pablo, Berkeley, 94702. (415) 524-3700.
Show-Contemporary Crafts Market, Nov. 5-7, the Santa Monica Civic Auditorium. For info, call (213) 937-4021.
Call for entries-Sleeping Beauties: The Fowler Museum, UCLA, 405 Hilgard Ave., Los Angeles, 90024-1549 Deadline: Dec. 4. For more info, call The Fowler Museum of Cultural History, Public Affairs Department, (310) 825-4288.
Show-The 1993 Celebration of Craftswomen, Dec. 4-5 and Dec. 11-12. Fort Mason Center, Herbst Pavilion, San Francisco. For more information, call (415)361-0700.
Shows-The North California Woodworking Show, Nov. 5-7, San Mateo Expo Center-Fiesta Hall, 2495 S. Delaware St., San Mateo; The South California Woodworking Show, Dec. 3-5. Los Angeles County Fairplex, Building 6, White & McKinley Ave., Pomona. For more information, call The Woodworking Shows (800) 826-8257 or (310) 477-8521.
Show-Color: Bright, thru Dec. 31. Show includes woodwork by Kim Kelzer. The Banaker Gallery, 251 Post St., #310, San Francisco, 94108. (415)397-1397.

COLORADO: **Classes**-Woodworking and related classes, year-round. Red Rocks Community College, 13300 W. 6th Ave., Lakewood, 80401. (303) 988-6160.
Seminars-Woodworking seminars, Sept. thru April. For more information, contact Schlosser Tool and Manufacturing Co., 301 Bryant St., Denver, 80219. (303) 922-8244.
Workshop-Tablesaw Techniques, Router Techniques HandPlanes and Scrapers, Veneering, Scrollsaws, Nov. thru Dec. The Woodworkers Store, 1550 South Colorado Blvd., Denver. (303)782-0588.

CONNECTICUT: **Juried Exhibition**-Holiday Festival of Crafts, Nov. 6-Dec. 24. Guilford Handcrafts, Inc., P.O. Box 589, Guilford. For information, call (203) 453-5947.
Exhibition-The Wesleyan Potters Annual Exhibit and Sale, Nov. 27 thru Dec. 12. For more information, contact Wesleyan Potters Craft Center, 350 South Main Street, Middletown, 06457. (203) 347-5925.
Exhibition-Celebration of American Crafts, Nov. 13 thru Dec. 24. Creative Arts Workshop, 80 Audubon St., New Haven. For more information, call (203) 562-4927.
Exhibition-25th annual Celebration of American Crafts, Nov. 15-Dec. 24. Creative Arts Work Shop, 80 Audubon St., New Haven. For more information, call (203) 562-4927.
Exhibition-15th annual holiday craft exhibition and sale, Nov. 20th-Dec. 24. For further information, contact the Brookfield Craft Center, P.O. Box 122, Brookfield, 06804. (203) 775-4526.

DELAWARE: **Show**-Art From the Lathe, thru Nov. 30 at Hagley Museum, Rt. 141, Wilmington. (302) 658-2400.

DISTRICT OF COLUMBIA: **Show**-Washington Crafts Expo, Nov. 19-21, Sheraton Washington Hotel, 2660 Woodley Road. Connecticut Ave., N.W. For further information, call (410) 280-9055.
Exhibition-The Arts and Crafts Movement in California, thru Jan. 9. Renwick Gallery, National Museum of American Art, Smithsonian Institution. For further information, call (202) 357-2247.
Show-Marketplace for 19th-century crafts, Nov. 5-7, Decatur House, 748 Jackson Place, N.W. For more info, contact Sarah Saville Shaffer (202)-842-0915.

FLORIDA: **Meetings**-Central Florida Woodworkers Guild, second Thursday of each month, Winter Park. (407) 862-3338.
Competition-31st annual Coconut Grove Arts Festival, Feb. 19-21. Coconut Grove Arts Festival, P.O. Box 330757, Coconut Grove, 33233-0757. (305) 447-0401.
Exhibition-Not for the holidays, Nov. 12-Dec. 24. Florida Craftsmen, Inc. 237 Second Ave. South, St. Petersburg. For more information, call (813) 821-7391.
Show-Coral Gables international festival of craft arts, Nov. 13-14, downtown Coral Gables. For more information, call (305) 445-9973.
Show-Florida woodworking and furniture supply show, Nov. 16-17, Orlando. For information, call (704) 459-9894.
Meetings-South Florida Woodworking Guild meets every second Monday of each month, 7 p.m. Constantines, 1040 East Oakland Park Boulevard, Ft. Lauderdale. For further information, contact Woody McLane at (305) 565-2729.
Exhibition-41st Florida Craftsmen Traveling Exhibition, Nov. 5 thru Jan. 9, Florida Gulf Coast Art Center, Belleair. For more information, contact Michele Tuegel, executive director, (813) 821-7391.

GEORGIA: **Workshops**-Japanese woodworking by Toshihiro Sahara. One Saturday each month. Sahara Japanese Architectural Woodworks. (404) 355-1976.
Classes-Woodworkers Guild of Georgia, PO Box 8006, Atlanta. For info, contact John Gorrell (404) 460-1224.

HAWAII: **Symposium**-Third annual forestry symposium, Nov. 9-11. Haniloa Hotel, Hilo. For further information, contact Mike Robinson, Hawaii Forest Industry Association, (808) 935-8291.

ILLINOIS: **Workshop**--Woodcarving arts & crafts festival workshops. Nature and the River, Nov. 9-11, Dec. 7-9. Green Tree Inn Bed and Breakfast, Elsah. For further information, contact Bon Rasmussen, 8828 Pendleton, St. Louis, MO 63144. (314) 962-1842.
Show-The Belleville Wood Carvers Club's 23rd annual midwestern wood carvers' show, Nov. 6-7. Belle-Clair Exposition Hall, 200 South Belt East, Belleville. For further information concerning the show and the availability of space, contact Don Lougeay, 1830 East "D" Street, Belleville, 62221. (618) 233-5970.
Workshop-Introduction to routers, Nov. 7; tablesaw jigs, Nov. 6; advanced tablesaw techniques Nov. 13; cabinetmaking I,II and III, Nov. 14 and Nov. 20-21. The Wood-Woodworkers Store, 286 W. Rand Road, Arlington Heights. (708) 253-8875.

INDIANA: **Classes**-Various woodworking classes and workshops. Woodworking Unlimited, 6038 E. 82nd St., Indianapolis, 46250. (317) 849-0193.
Show-10th annual winter art & craft fair, Nov. 26-27. Seasons Lodge Conference Center, State Road #46, Nashville. For more information, contact the Brown County Craft Guild, P.O. Box 179, Nashville, 47448, or call Kathleen Sullivan at (812) 988-2596.

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. For further information, contact David Wright (606) 986-7962.

MAINE: **Show**-Portland craft show, Nov. 19-21. For further information, contact the Portland Craft Show, Maine Crafts Association, PO Box 228, Deer Isle, 04627.
Workshops-Two-week furnituremaking course taught by Peter Korn. Basic woodworking, Nov. 1-12. For more information, contact the Center for Furniture Craftsmanship, 125 W. Meadow Road, Rockland, 04841. (207) 594-5611.

MARYLAND: **Call for entries**-The Crafts Collection 1994. Deadline: Feb. 25. For more information, contact Ruth Gowell at the Creative Crafts Council (703) 532-8645.
Exhibitions-Art Furniture with Eck Follen and Charles Swanson, Nov. 4-27; new work by Rosemary Siciliano, Dec. 2-22. For more info, contact the Meredith Gallery, 805 N. Charles St., Baltimore, 21201. (410)837-3575.

MASSACHUSETTS: **Instruction**-Full-time program in fine furniture construction. Complete facilities. For further information, contact Wm. B. Sayre, Inc., One Cottage St., Easthampton, 01027. (413) 527-0202.
Competition-Limited production furniture, thru Nov. 14. Danco Design Center, 10 West St., W. Hatfield. For further information, call (413) 247-5681.
Exhibition-The Domestic Object, thru Jan. 9. Fuller Museum of Art, 455 Oak Street, Brockton. (508) 588-600.
Call for entries-Danforth Craft Festival, Danforth Museum of Art, Framingham. Deadline: Nov. 10. For more information, call (508) 620-0050.
Show-Restoration '93, Dec. 6-8. Hynes Convention Center, Boston. For more information, call (617) 933-9699.
Classes-Woodworking classes, throughout most of the year. For information, contact Boston Center for Adult Education, 5 Commonwealth Ave., Boston, 02116. (617) 267-4430.
Workshop-Installing and selecting hardware, Nov. 6. The Woodworkers Store, 2154 Massachusetts Ave., Cambridge, 02140. (617) 497-1136.

MICHIGAN: **Workshop**-Build a Sack Back Windsor chair with Michael Dunbar, Nov. 6-10. For more information, contact Woodcraft Supply Corporation, 14695 Telegraph Road, Redford, 48239. (313) 537-9377.
Show-Fruitbelt Woodcarver's Show, Nov. 6-7. Cook Energy Information Center, Bridgman. For more information, contact Dolly Krieger, Cook Energy Information Center, (800)-548-2555.

MINNESOTA: **Classes**-Woodcarving classes year-round. For information, contact the Wood Carving School, 3056 Excelsior Blvd., Minneapolis, 55416. (612) 927-7491.

MISSISSIPPI: **Classes**-Various classes. Allison Wells School of Arts & Crafts, Inc. Canton. (800) 489-2787.

NEW HAMPSHIRE: **Classes**-Fine arts and studio arts. Manchester Institute of Arts and Sciences, 114 Concord St., Manchester, 03104.
Classes-Various woodworking classes. For information, contact The Hand & I, PO Box 264, Route 25, Moultonboro, 03254. (603) 476-5121.
Auctions-Antique and craftsman's tool auctions, year-round. For further information, contact: Richard A. Crane, Your Country Auctioneer, 63 Poor Farm Road, Hillsboro, 03244. (603) 478-5723.
Workshops-Week-long Shaker-style furniture and chairmaking workshops, year-round. For more info, contact Mary Sweet, Dana Robes, Wood Craftsmen, Lower Shaker Village, Enfield, 03748. (603) 632-5385.

NEW JERSEY: **Show**-South Jersey Wood Carvers 8th annual fall woodcarving show, Nov. 20-21. New Jersey National Guard Armory, Mt. Holly, Route #38, east of McDonalds. For more information, call (609) 589-6636.

NEW MEXICO: **Classes**-Woodworking classes. For information, contact North New Mexico Community College, El Rito, 87520. (505) 581-4501.
Classes-Fine woodworking classes, Santa Fe Community College, Santa Fe 87502. (505) 438-1361.
Juried festival-21st annual Southwest Arts and Crafts festival, Nov. 11-14. For further information, contact Southwest Arts and Crafts Festival, 525 San Pedro, N.E., Suite 107, Albuquerque, 87108.

NEW YORK: **Classes**-Various beginning and advanced woodworking classes. Constantine's, 2050 Eastchester Road, Bronx, 10461. (718) 792-1600.
Exhibition-The Ideal Home: 1900-1920, thru Feb. 27. For info, contact American Craft Museum, 40 West 53rd St., New York City. (212) 956-3535.
Classes-Traditional 18th-century woodworking techniques with Mario Rodriguez. Warwick Country Workshops, P.O. Box 665, Warwick, 10990. (914)-986-6636.
Meetings and classes-New York Woodturners Association meets bi-monthly. YWCA, 610 Lexington Ave. (53rd. St.) New York City. For more information, contact Howard Alalouf (914) 337-0226.
Exhibition-Art furniture by Edward Zucca, thru Nov. 24. The Reggiani Light Gallery, 800A Fifth Avenue, New York, 1002, (212)421-0400.
Exhibition-International Art & Craft competition—winners exhibition. Dec. 8-26. Art 54 Gallery, Soho. For more information, call (203)359-4422.
Show-The Show, Nov. 5-7. New York State Fairgrounds, Syracuse; Yonkers Raceway, Yonkers, Nov. 12-14. For more information, contact The Show, 24 East Ave., #173, New Canaan, CT, 06840. (800) 287-7891.
Juried fair-22nd annual WBAI Holiday Crafts Fair, Dec. 3-5, Dec. 10-12, Dec. 17-19. Columbia University, Ferris Booth Hall. For info, contact WBAI Holiday Crafts Fair, P.O. Box 889, Times Square Station, New York, 10108. (212) 695-4465.
Juried fair-13th annual Millbrook crafts fair, Nov. 26-27. For more information, contact Artisans Group, PO Box 468, Pine Plains, 12567. (914) 985-7409.
Show-19th annual Harvest Crafts Festival, Nov. 19-21, Nassau Coliseum, Long Island. For information, call (516) 288-2004.
Classes-Various golding classes for fine furniture, antiques, frames, carvings, restoration. Center for the Gilding Arts, 381 Park Ave. South, New York, 10016. For more information call (212) 683-4822.

NORTH CAROLINA: **Meetings**-North Carolina Woodturners, second Saturday of each month. Contact: P.O. Box 2968, Hickory, 28603. (704) 324-5960.
Classes-John C. Campbell Folk School, thru Nov. Brasstown. Contact: Dana Hatheway (800) FOLK-SCH.
Show-Showcase of woodcarvings—pre-Civil War America Feb. 26-27. The Charlotte Woodcarving Club. Grady Cole Center, 310 North Kings Drive, Charlotte. For more information or entry forms, contact Bonita Heffner, event coordinator, (704) 336-2584.
Show-The Show, Nov. 19-20. Charlotte Convention Center, Charlotte. For more information, contact The Show, 24 East Ave., #173, New Canaan, CT 06840. (800) 287-7891.
Show-High Country Christmas Art & Craft show, Nov. 26-28. Asheville Civic Center. For more information, contact Gail Gomez, High Country Crafters, 46 Haywood St., Asheville, 28801. (704) 254-7547.

OHIO: **Workshops**-Earl Richards and the Park District of Dayton and Montgomery County. Hand tools, Nov. 13; traditional joinery, Dec. 4; stationary shop tools, jigs and fixtures, Jan. 8; traditional finishing techniques, Feb. 12. For more information, call (513) 836-4976.
Exhibition-Contemporary Crafts and the Saxe Collection, thru Nov. 14. Toledo Museum of Art, Box 1013, Toledo, 43697. For more information, call (419) 255-8000.
Workshops-Woodturning, tablesaw fundamentals, cane weaving techniques, finishing, thru Nov. The Woodworkers Store, 2500 East Main St., Columbus, 43209. (614) 231-0061.
Show-The Show, Jan. 14-16. Veterans Memorial Hall, Columbus. For more information, contact The Show, 24 East Ave., #173, New Canaan, CT 06840. (800) 287-7891.
Workshops-Hand-tool joinery and bandsaw and tablesaw techniques, March 7-11. Conover Workshops, 18125 Madison Road, PO Box 679, Parkman, 44080. (216) 548-3491.

OREGON: **Meetings**-Guild of Oregon Woodworkers meets the third Friday of every month. For info, contact the

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Guild at PO Box 1866, Portland, 97207. (503) 293-5711.
Meetings-Cascade Woodturner's Association, third Thursday of each month. For information, contact Cascade Woodturners, PO Box 91486, Portland 97291.
Classes-Oregon School of Arts and Crafts, 8245 S.W. Barnes Road, Portland, 97225. (503) 297-5544.
Show-The Oregon Woodworking Show, Nov. 19-21. Portland Expo Center, Exhibit Hall C, 2060 N. Marine Drive, Portland, 97217. For more information, call The Woodworking Shows (800) 826-8257.

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.
Classes-Build a Chippendale mirror, Nov. 6-7; traditional Shaker oval boxes, Nov. 12-13; color theory and antiques do's and don'ts, Dec. 4-5; Bob Flexner on understanding wood finishing, Dec. 11-12. Old Mill Cabinet Shoppe, 1660 Camp Betty Washington Road, York, 17402. (717) 755-8884.
Show-The Philadelphia Craft Show, Nov. 4-7. Philadelphia Civic Center, 34th South and Civic Center Blvd. For information, call the Philadelphia Museum of Art (215) 763-8100.
Show-Furniture of Tommy Simpson, thru Nov. 7. The Society for Contemporary Crafts, 2100 Smallman St., Pittsburgh, 15222. (412)261-7003.
Exhibition-Antique Tool Discovery Day, Nov. 13. The Mercer Museum, 84 South Pine St., Doylestown, 18901. For more information, contact the Curatorial Dept. at (215) 345-0210.
Juried exhibition-Artworks craft market, Nov. 5-7. Artworks Expo Center, 100 N. State Street, Ephrata, Lancaster County. For info, contact Terri Lipman (717) 244-8438.
Call for entries-Holiday ornament juried sale and exhibition. Palmer Museum of Art. Deadline: Nov. 15. For an entry form, send SASE to Catherine H. Zangrilli, Friends of the Palmer Museum of Art, Pennsylvania State University, University Park, 16802-2507. (814) 865-7672.
Classes-Woodturning with David Ellsworth. Three-day weekend workshops in private studio. Nov. 12-14, and Nov. 19-21, Dec. 3-5 and Dec. 10-12. For more information, contact David Ellsworth, Fox Creek, 1378 Cobbler Road, Quakertown, 18951. (215) 536-5298.

RHODE ISLAND: **Exhibition**-Conservation by Design, thru Jan. 16. The Museum of Art, Rhode Island School of Design, Two College St., Providence. (401)454-6348.

TENNESSEE: **Workshops**-Handmade for the holidays (woodturning), Nov. 13. For more information, contact the Craft Center, Appalachian Center for Crafts, PO Box 430, Route 3, Smithville, 37166. (615) 597-6801.

TEXAS: **Meetings**-North Texas Woodworker's Association meets the third Tuesday of each month. For more information, contact Bruce May. NTWA, PO Box 831567, Richardson, 75083. (214) 271-0125.
Show-Wood Sculpture by Robert Longhurst, Dec. 4-Jan. 10. Judy Youens Gallery, 3115 D'Amico, Houston. For further information, call (713) 527-0303.

VERMONT: **Courses**-Yestermorrow Design and Building School, Route 1 Box 97-5, Warren 05674. (802) 496-5545.
Workshops-The direct approach to craftsmanship, design and shopmath, machine setup and use, Japanese hand tools, sharpening. Jan. 8-9 and Feb. 5-6. For information, Trillium School of Woodworking, Route #2, Box 4015, Middlebury, 05753. (802) 545-2266

VIRGINIA: **Exhibition**-Richmond craft and design show, Nov. 19-21. Richmond's Centre for Conventions and Exhibitions; holiday invitational exhibition, Nov. thru Dec. For more information, contact Hand Workshop, 1812 West Main St., Richmond, 23220. (804) 353-0094.
Exhibition-Tools exhibition, Jan. 14 thru June. Colonial Williamsburg, PO Box 1776, Williamsburg, 23187-1776. For more information call, 1-800-HISTORY.

WASHINGTON: **Show**-Jill Henrietta Davis, glass artist and furnituremaker, thru Nov. 7. Peterson Art Furniture, 122 Central Way, Kirkland. (206) 827-8053.
Show-The Northwest Carvers Association 13th annual woodcarving show, Nov. 13-14. Western Washington Fairgrounds Expo Hall, 9th and Meridian, Puyallup. For more information, contact the Northwest Carvers Association, PO Box 6092, Federal Way, 98063-6092, or call Bill Orvis (206) 927-5232.
Show-Western Washington woodworking show, Nov. 12-14. Seattle Center-Exhibition Hall, Mercer St. at 3rd Ave. North, Seattle, 98109. For more information, call The Woodworking Shows, (800) 826-8257.
Workshops-Antique restoration. Caning, Nov. 11; planemaking, Nov. 1-15; wood joints, Nov. 22-29. For further information, contact The Woodworkers' Store, 3823 Stone Way North, Seattle. (206) 634-3222.

WISCONSIN: **Show**-The Northeastern Wisconsin Woodworkers' Guild 11th annual spring show, Feb. 19-20, Port Plaza Mall, Green Bay. For info, send a SASE to Curt Andersen, 2942 Jack Pine Lane, Green Bay, 54313. (414) 434-1288.
Juried Show-22nd annual festival of the arts, April 174. Application deadline: Jan. 7. For further information, contact Festival of the Arts, PO Box 872, Stevens Point, 54481.
Workshops-Advanced marquetry, Nov. 6; building wooden toys, Nov. 13; a day in the shop, Dec. 4. For further information, contact The Woodworkers' Store, 845 Mayfair Road, Wauwatosa. (414) 774-1882.

CANADA: **Classes**-Fall woodworking courses on carving, finishing, furnituremaking, router and toymaking, more. Also lathe turning with Michael Hosaluk, Nov. 25-27. For more information contact Tools 'n' Space Woodworking, 338 Catherine St., Victoria, B.C, V9A 3S8. (604) 383-9600.
Juried exhibition-Explorations in Wood, December. For more information, contact Ken Guenter, P.O. Box 6584, Postal Station C, Victoria, B.C., V8P 5N7.
Show and Competition–The Brantford Wood Show and wildfowl and carving competition, Nov. 12-14. Brantford and District Civic Centre, Market St. South, Brantford, ON N3T 5R7. For information, contact Paul Fulcher, (519) 449-2444.
Meetings-West Island Woodturners Club (Montreal, Que.) meet every Tuesday, September thru May. For more information, contact Dennis Brown, 8817 Cure Legault, Lasalle, Que. H8R 2V9. (514) 366-6071.
Workshops-Five days of intensive hands-on Ultra-Lite-Sawmilling, in a rainforest on a small N.W. Pacific Island with Will Malloff. The North Island College, Box 320 Sointula, B.C. V0N 3E0. (604) 974-5429.
Juried exhibition-Explorations in Wood, Dec. 15-24 and Jan. 4-12. Presented by the Vancouver Island Woodworkers Guild at the Maltwood Gallery, University of Victoria, Victoria, B.C. For more information, contact Vancouver Island Woodworkers Guild, PO Box 6584, Postal Station C, Victoria, B.C. V8P 5N7.
Exposition-The Calgary Woodworking Expo, January 14-16. Roundup Centre, Calgary. Free tool draws. Free seminars. Everything for the serious woodworker. Admission $6.50. For more information, contact DJC Enterprises (403) 236-5834.

ENGLAND: **Workshops**-Sharpening and using edge tools for paper conservators, Nov. 15-19. For information, contact Bruce Luckhurst, Little Surrenden Workshops, Bethersden, Kent TN26 3BG. Telephone: Bethersden, (0233) 820 589.
Workshops-Traditional hand finishing for cabinetmakers. Finishing new surfaces, Jan. 30-Feb. 4. West Dean College, Chichester. For more information, contact Alexi Stuart, West Dean College, West Dean, Nr. Chichester, West Sussex, PO19 0QZ. 024-363-301.

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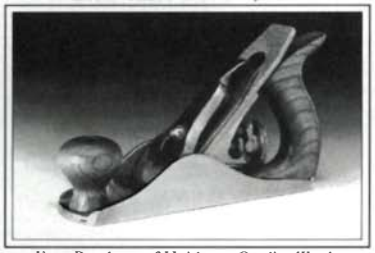

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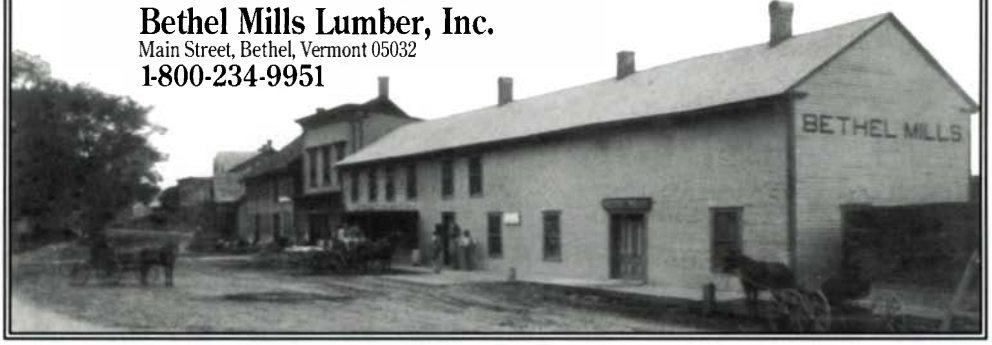

READER SERVICE NO. 111

***Furnishing touches**—For his newborn's bedroom, Indiana woodworker Mark Adams made Disney-inspired furniture (above) with colorful home-dyed marquetry.*

***Crisp colors and subtle shading** give Adams' marquetry (left) its punch. He colors his veneers with salt-based fabric dye and adjusts the tone with salt and bleach.*

Home-dyed veneer adds cartoon colors to marquetry

The imminent arrival of a child seems to inspire some of our most ambitious projects—and least accurate time and cost estimates. How many times have you visited a couple who was expecting a baby and found a house half ripped apart, a pregnant woman swinging a hammer and a father-to-be lathered with glue as he made his first attempt at hanging wallpaper? In the case of Mark Adams, Franklin, Ind., who made all the furniture in the photos on this page, the scope of prenatal (and, inevitably, neonatal) work was staggering. On the crib alone, which he finished just in time for his firstborn's arrival, he spent eight months—200 hours just on the marquetry. Next came the toychest, which consumed over 1,000 hours of labor. And this while running a woodworking shop with 25 employees.

For Adams, the crib project not only prepared a special place for his first child to sleep but also prepared him for the sleep deprivation a newborn imposes on its parents. Before his daughter arrived, he was getting up regularly during the night. That's because he wasn't content to use pre-dyed veneers in the elaborate, Disney-inspired marquetry he planned. The dying process involved as much as 48 hours of boiling and required that he stir the mixture every hour or two straight through the night.

He obtained remarkable results with fabric dye and a roasting pan. Here follows Adams' recipe for home-dyed veneer.

Adams starts the dyeing process by selecting pieces of cloud-white maple veneer, which won't skew the dyed hue. (Some of the veneers he uses are natural, the black is Gabon ebony, for instance, but most of them are dyed.)

With his maple veneers ready, Adams fills a 3½-gal. roasting pan with water and mixes in a 1⅛-oz. packet of dye powder, stirring for several minutes. Adams settled on RIT fabric dye, a sodium chloride-based dye that produces excellent colors and resists fading from ultraviolet rays. The powder should be completely dissolved before

Photos this page: Jonathan Binzen

the veneer goes into the pot or some of the veneers may take on color unevenly.

He cuts veneers down to fit into the pan and loads them in 10 or 20 at a time. Cutting sheets oversized or putting too many in the pan will restrict water circulation, causing the dye to penetrate unevenly.

Then he covers the roasting pan, puts it on his Coleman camp stove and starts boiling. He checks the brew every hour or so, being careful to avoid the burst of steam when he knocks the lid off. He pulls the pieces and flips them, stirs things up and adds water if needed.

The pieces take on color quickly, but he keeps boiling them until the color has penetrated the veneer completely. Adams generally boils veneers for 16 to 24 hours, but sometimes it takes 48 hours for the dye to penetrate completely.

As a rule, the veneers appear a shade or two darker when wet. He always includes some test pieces of veneer in the pan. Then he can remove one after several hours and dry it in a microwave oven (two minutes and 35 seconds at high setting is his formula) to assess the color and penetration. If the color is too light, he strengthens the dye by adding table salt to the water. He doesn't add more dye; once the veneers have taken on color, additional dye makes the color muddy.

To make a lighter color, he removes the finished veneers from the pot and stirs ¼ cup or so of bleach into the brew. Then he returns a few sheets for another 20 minutes of boiling. Once out of the pot, the dyed veneers can go in the microwave. When the timer rings, they're ready to use.

—Jonathan Binzen, assistant editor

Rules of thumb

A rule of thumb, according to the *Morris Dictionary of Word and Phrase Origins* by William and Mary Morris (1988, Harper & Row, Publishers, Inc., 10 East 53rd St., New York, N.Y.), is a rough guess "based more on experience than on precise measurement." These rules are usually some observation that's been generalized to help guide behavior in similar situations. For example, "Measure twice, cut once."

But why are they called "rules of thumb"? The Morrises presented two possible origins for this expression. The first, and most logical, is the frequent use of the first segment of the thumb, which is about an inch in the average adult male, as a crude measuring device. The second, and perhaps more interesting source, comes from the vats of the old brewmasters. The Morrises noted, "In the days when beer was truly beer, not the pasteurized soft drink that passes for beer today, the chief brewer sometimes tested the temperature of a batch of brew by dipping in his thumb."

The following woodworkers' rules of thumb were sent in response to our request in *Fine Woodworking* #99. They will give you some idea of the kinds of problems our readers have been brewing up in their shops.

If you don't have time to sand it before you paint it, you'll have to make the time afterward.

You can never find a warped board when you're building a curved structure.

Old tools never die, they accumulate.

Building furniture from blueprints is only for sissies, perfectionists and those who do it for a living.

—George Rome, Louisville, Ky.

Anything cut to length is too short.

—Larry Schiffler, Hopewell Jct., N.Y.

If a married couple is spending in excess of $5,000 on a construction or renovation project, recommend a marriage counselor.

—R.D. Adkins, East Fairfield, Vt.

The distance between hindsight and perfection is measured in firewood, sawdust and frustration.

—Bill Schmidt, Oakdale, Calif.

There are two times when a woodworker hurries—just before he makes a mistake and just after. *—Lon Schleining and Jeff Snith, Long Beach, Calif.*

To avoid hitting your thumb while nailing, be sure to hold the hammer with both hands.

The piece that you have just put glue on will always fall glue side down into the sawdust when you drop it.

—David Heckel, Charleston, Ill.

The shortest pencil is worth more than the longest memory.

—Greg Gibson, Albany, Ga.

Many thanks to those who took the time to send in these homilies. They were great fun to read, and remember, no matter where you go, there you are.

—Robert Vaughan, contributing editor, Roanoke, Va.

***Craftsmen in action** complemented the displays of finished work at the Design in Wood show in San Diego in June. Here Chris Case, a woodcarver and show volunteer, carves a carousel horse (a finished example is on the left).*

Design in Wood

They say it never rains in Southern California. "Not so," says Pat Edwards, the organizer and superintendent of the 1993 Design in Wood show put on by the San Diego Fine Woodworkers Association (SDFWA). "It actually poured June 5th, the day all the entries arrived at the Del Mar fairground," said Edwards.

Rain wasn't the only thing that poured. The exhibition hall, located under the fair's grandstand, was overflowing with more than 200 exhibits, which is quite a difference from the first show 12 years ago. That show drew only 45 entries.

Most of the exhibits were from the SDFWA's 1,000-plus members, but many pieces were from makers in the northern part of the state, too (entries are limited to California residents). And besides the large number of pieces being displayed, the event was about to be deluged with visitors. The fair itself drew an estimated

Photo this page: Alec Waters

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crowd of more than a million.

In addition to regular exhibits, the 1993 show sported demonstration booths for woodturning and carving, as shown in the photo on p. 140. Another area, set up like a 19th-century workshop, featured SDFWA members hand-crafting 50 child-sized chairs to be donated to local charities and to the needy.

This year, there were 16 categories of woodworking to be judged: contemporary and traditional furniture, art furniture, items made for children, scale-model building, unscaled models, clocks, musical instruments, segmented turning, solid face-plate turning, solid spindle turning, contemporary and traditional accessories, and beginner, intermediate and advanced woodcarving. A small sampling is shown in the photo at right.

Judges select award winners based on utility and workmanship, appearance and originality, and neatness. Awards for the 1993 show totaled $6,000 in cash, and there were three SDFWA awards, a sponsors' trophy worth $250 in merchandise and a $200 superintendent's choice award.

For more information about the show, write to SDFWA, P.O. Box 99656, San Diego, Calif. 92109, or call the Del Mar Fair entry office at (619) 792-4207.

–Alec Waters, assistant editor

Photo: Alec Waters

***Graceful wooden forms**—Kerin Lifland's table with its rosewood legs and circular top was a third-place art furniture winner. Here the table supports Oliver Jones' carved elk flute (third prize in musical instruments) and Brenda Behrens' myrtle wood bowl, which received honorable mention in the face-plate turning class.*

Tool collectors celebrate Stanley's 150th anniversary

Almost 500 people from as far away as England converged on the Stanley Tool Collectors' Convention in Hartford, Conn., June 17-19. Timed to coincide with the Stanley Works' 150th anniversary, the event was organized and hosted by John Walter, tool dealer, author of *Antique & Collectible Stanley Tools Guide to Identity and Value* and publisher of the *Stanley Tool Collector News.*

There were more than 90 exhibits of both educational displays and sale tables. Lectures and demonstrations were given by experts such as Roger Smith, author of two books on American planes, Phil Stanley, author of a book on Stanley rules and levels, and Bob Kaune, an expert on Stanley's Bedrock planes. Stanley corporate officials gave a tour of the firm's headquarters and its New Britain, Conn., hand-tools plant.

The convention was so successful, said Walter, that he will be organizing another to be held in 1995. For information on either convention or on old Stanley tools, call John Walter at (614) 373-9973.

–Vincent Laurence, associate editor

Photo: Louis J. Lauler

***Magnum opus in teeny tools**—From the sliding bevel on the right to the shoulder vise on the left, all the tools in this photo are functional as well as fractional. About one-quarter scale, most are made of ebony and boxwood. The Norris plane infill is rosewood and is a working model; the shavings shown in the photo were actually made with it. The plane was made from a set of engineering drawings from a replica kit produced by R.H. Wood.*

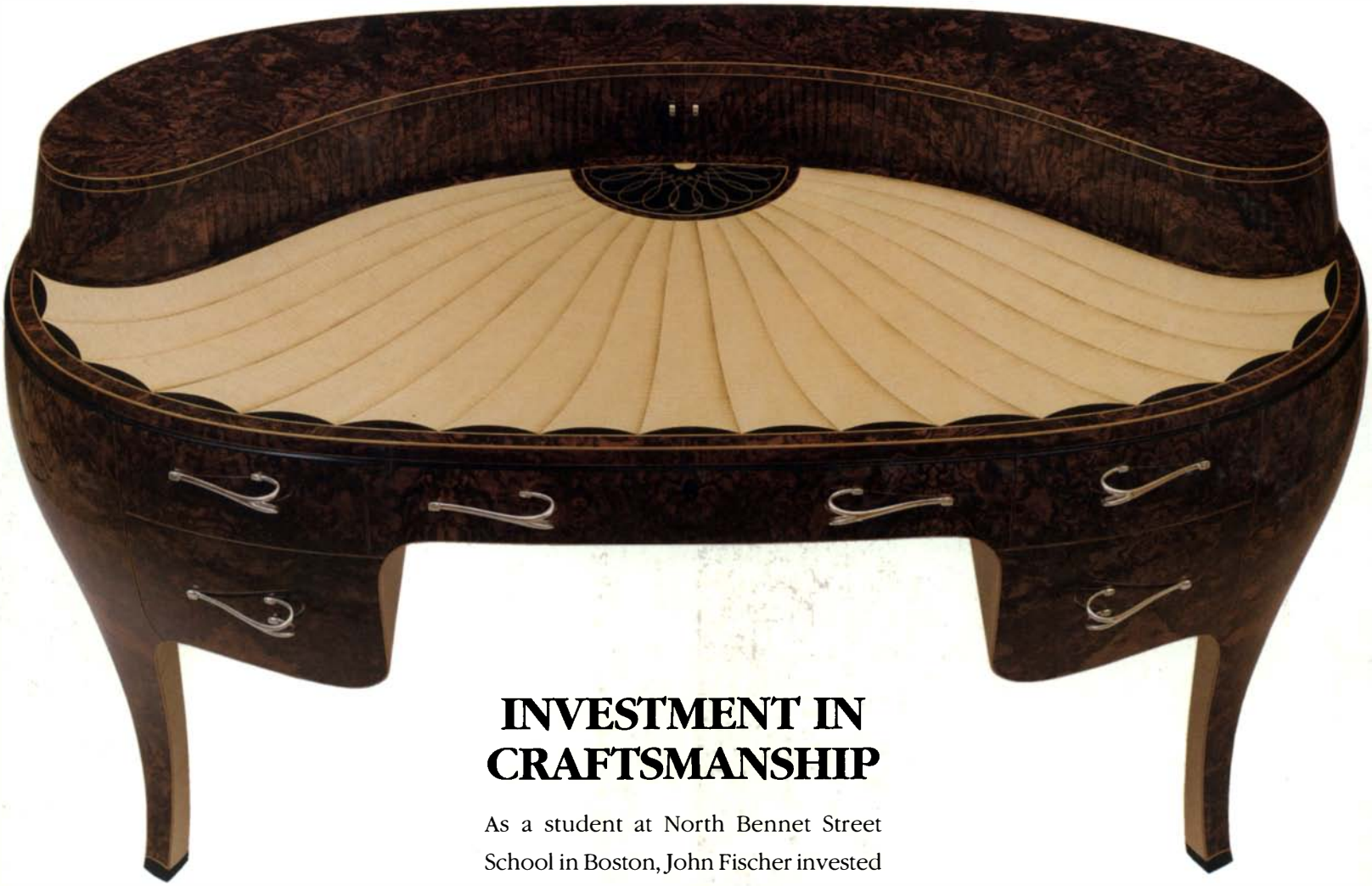
Small craft advisory

We've all heard stories, or told our own, about making do with a shop in cramped quarters. But when Louis J. Lauler says he can set up his bench in a shoe box, he's perfectly serious. Lauler made the bench and tools shown in the photo at left. For a sense of the scale he works on, have a look at the item he's got clamped in his shoulder vise.

Lauler, an American who lives in England, does have full-sized tools and makes full-sized furniture. But several years ago, he visited the Toy and Miniature Museum in Kansas City, Mo., and has since developed a weakness for the diminutive. He plans eventually to make a full complement of joiner's tools fit for Stuart Little and a pint-sized tool chest to hold them. *–J.B.*

Notes and Comment

Got an idea you'd like to get off your chest? Know about any woodworking shows, events or craftsmen of note? Just finished a great project? If so, we would like to hear about them. How about writing to us? And, if possible, send photos or transparencies to Notes and Comment, Fine Woodworking, *PO Box 5506, Newtown, Conn. 06470-5506.*



INVESTMENT IN CRAFTSMANSHIP

As a student at North Bennet Street School in Boston, John Fischer invested more than 10 months of work into this desk. When he was finished, he used the piece to help pay back someone else's investment in him.

"I gave the piece to my wife, Angel, in gratitude for the two years of sacrifice she made along with me as I began my education in woodworking," Fischer said.

The rich appointments of the desk include walnut burl on the hammer-veneered sides, curly English sycamore, ebony, cherry and mahogany for the structure. The looping pattern at the center of the desk in front of the tambour doors is cherry inlaid into ebony. Fischer also designed the sterling silver hardware and carved the wax forms that were used for casting it.

Fischer currently operates his own furnituremaking shop in Brooklyn, N.Y.

Photos: Lance Patterson