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Fine WoodWorking
December 1989

A jointer can rabbet edges and do many other jobs besides squaring edges. Bernie Maas tells how on p. 62. Cover: Easy chairs highlight the living room set by Long Island, N.Y., cabinetmaker Ray McCarthy (see article on p. 74).

Fine Woodworking is a reader-written magazine. We welcome proposals, manuscripts, photographs and ideas from our readers, amateur or professional. We'll acknowledge all submissions and return those we can't publish. Send your contributions to *Fine Woodworking*, Box 355, Newtown, Conn. 06470.

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DEPARTMENTS

ARTICLES

Postmaster: Send address changes to The Taunton Press, Inc., PO Box 355, Newtown, CT 06470.

Narrow thinking and art disease—I think we should avoid the kind of narrowness concerning art and craft expressed in Woody Pistrich's letter (*FWW* #77). He sums up his position in the last line: "Instead of blurring distinctions, it is now time to establish some and put the proper forms back under their proper categories and contexts."

Unfortunately for Mr. Pistrich, times are not moving in his direction. The interrelationship between fine arts and the American craft movement is a fact of life. Without providing a history lesson in The Development of Crafts (and/or Art) in America, it may suffice to explain that as the "Fine Artists" in this country estranged themselves from much of the American public by dealing with more and more esoteric subjects and as they showed more and more esoteric work, they came to need interpreters or at least art historians to translate that work for public consumption.

Primarily for historical reasons, many people now relate well to "Craft" materials and craft techniques and have turned more and more to them, thus causing much of the resurgence we are now experiencing. Unfortunately for Mr. Pistrich, good technique, full understanding of materials and design are not enough for many Craft Artists. They have imaginations; they are innovative risk takers, they are more and more inclined to challenge the assumptions of history. They see in *new* ways.

When I lament the narrowness of craft (especially in wood) I'm seeking to remind us all that the field is broad enough to accommodate the full spectrum of work, from the most folksy traditional utilitarian to the most ethereal and expressive.

Art historians, art critics, academic institutions and various craft schools and craft organizations all find it convenient to "Put the proper forms back under their proper categories..." as Mr. Pistrich puts it. It's certainly much easier and in most ways clearer. However, this thinking has been a large impediment to the progress of new ideas. This progress need not be made at the expense of fine craftsmanship. We see, these days, the most exciting work coming from people who employ a solid understanding of materials, and the techniques that form these materials, to create extraordinarily thoughtful and intelligent work. Often that work contains more than craftsmanship and utility: it contains, or expresses, *ideas*.

Writers and woodworkers share the need to understand material if they are to use it to its best advantage. Having a repertoire of techniques in wood is what allows one to "say" what one wants, just as grammar, punctuation and spelling are necessary in writing. We can no longer get by on our exquisite grammar in either medium. Both in words and wood it's what we have to *say* that counts.

Tell us about your accidents:

The Taunton Press is gathering material toward a video workshop on safety and is looking for craftsmen with stories to tell. If you have had an accident and think others would benefit from your experience, write us with a short description of the accident and how you're working differently now. Send letters to Video Department, The Taunton Press, Box 355, Newtown, Conn. 06470.

We have a cute saying running through our school these days. "Hardening of the categories, leads to art disease."

—Verne Stanford, The Penland School of Crafts, Penland, N.C.

More on woodworking and art objects—The July/August issue (*FWW* #77) printed letters commenting on the relative merits of "practicality and aesthetics" and "art and craft." I know a number of avocational and a few professional woodworkers. We share the opinion that furniture is something to be used to sit on, sleep on and store things in and that good furniture should be both useful and pleasing to the eye. In addition to furniture, most of us will occasionally undertake to make a wooden "art object" which, like a painting or sculpture, is intended solely to please the eye and does not pretend to have any other useful function.

I enjoy reports on good furniture and good art, but not reports on "furniture that has been consciously designed to be either useless or near useless." Woodworkers have an amazingly broad spectrum of interests and *FWW* is doing well at the difficult task of having something for everyone. While "artiture" may be a valid pursuit, it is simply not woodworking. It should be reported in an appropriate journal, but not in *Fine Woodworking*.

—Eugene C. Hise, Oak Ridge, Tenn.

Allergies and woodworking—As an amateur woodworker, I have worked with various woods for more than 15 years with no ill effects, such as allergies, or health problems. Suddenly one weekend, without warning, after leaving my shop for the evening, I began coughing, experienced a shortness of breath and began to itch in several areas of my body. (I had been working with oak.)

The next day I visited a dermatologist who prescribed an ointment and some pills for the breathing problem. In a day or two I was fine again. He said that sometimes the body will suddenly reject or become allergic to substances (food, medicines, dust, etc.) that had never before been a problem. He said to stay away from oak and try some other wood.

I always wear a dust mask when working with woods, but I have a very small work area with no exhaust system. At any rate, I worked with some pine and maple a week later and the very same coughing and shortness of breath problems occurred, although this time there was no rash.

I am very concerned that I will have to give up my most cherished hobby due to allergic reactions. Perhaps other readers have had similar reactions to wood dust and could offer some advice on how they coped with the allergies and what they did to avoid suffering and keep on woodworking.

—Lane Jonap, Evanston, Ill.

Broader view of varnish needed—After reading Craig Deller's article, "Versatile Varnish" in *FWW* #77, I feel some comments are in order. The term "varnish" has been corrupted today to include a number of resin systems that can be quite different. These include alkyds, linseed/tung oil phenolics, oil-modified polyurethanes and vinyl toluene/styrene modified oils.

I felt Deller's article seemed slanted to alkyds only. Mr. Deller may not be aware of the fact that polyurethanes or

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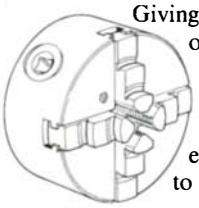

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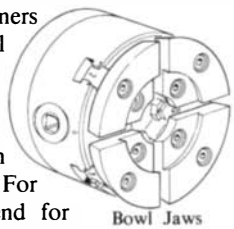

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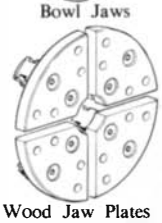

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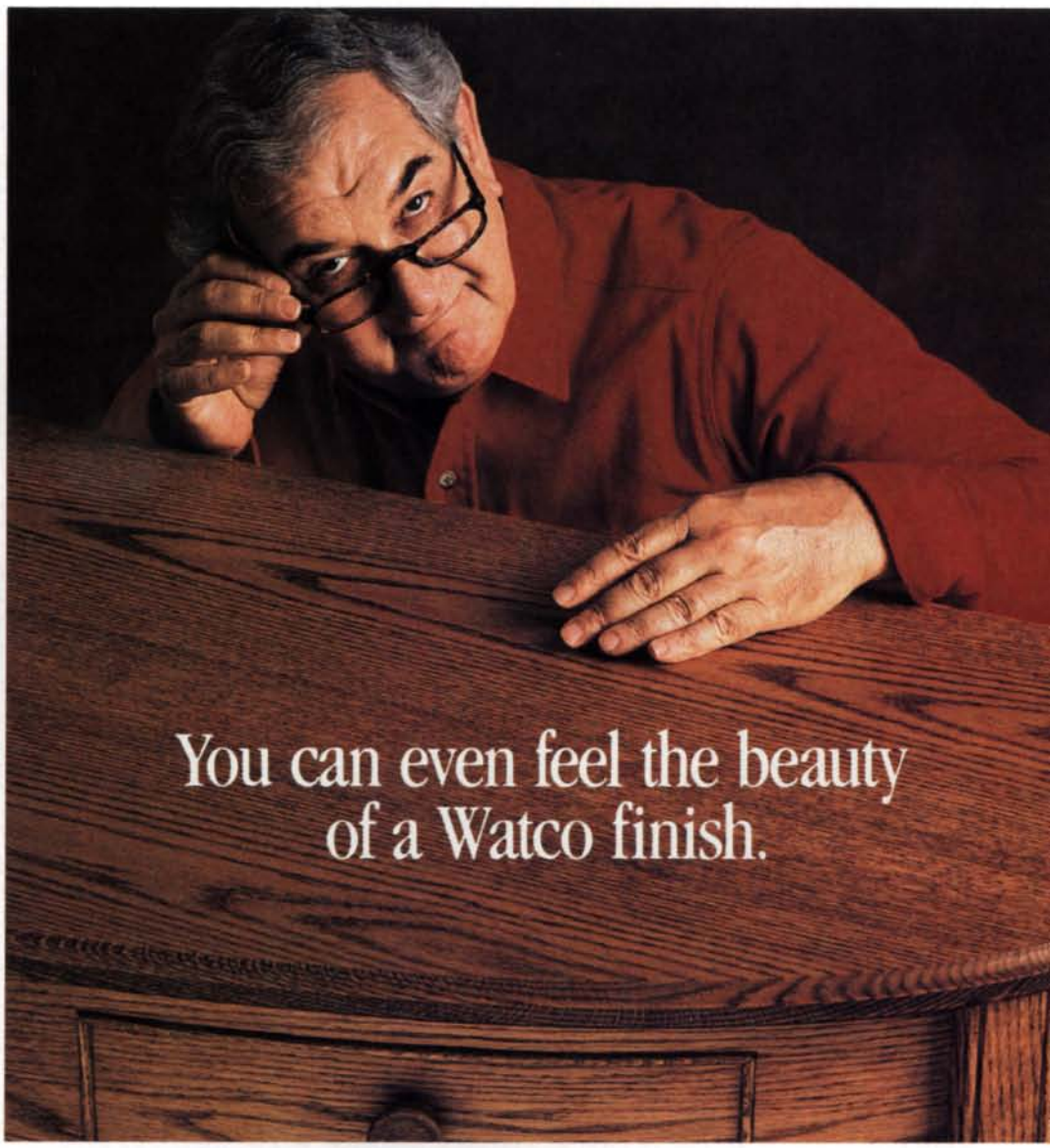

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phenolics are often blended with alkyds to improve properties such as hardness or drying time.

Varnishes are not divided into two groups, long oil and short oil. Rather, think of them as being on a continuum that runs from long to medium to short. Resin systems can be placed anywhere on the continuum depending on the characteristics required.

I also feel that "compatible oil-base stains" should not be used to color or tint varnish without prior testing. The liquids may be compatible, but their respective drier systems may not. You can severely retard, if not destroy, a product's ability to "cure" by upsetting a carefully balanced drier system.

The article also claims that "The best protection for any finish is a superior paste wax." I don't think paste wax provides durable protection. It is useful in eliminating the white haze that comes from rubbing a flatted finish, but you also lose control of the gloss. The wax has a tendency to raise the gloss of the finish, and a wax-treated surface will always need attention. On a floor, wax can be trapped between boards and cause problems when refinishing.

Lastly, eliminating a valuable tool such as polyurethanes from the finisher's arsenal, as Deller suggests, seems foolish. Finishes are truly specific. Polyurethanes impart hardness and durability that no alkyd can deliver. There are infinite possibilities in formulating them and their properties can vary greatly. Many polyurethanes on the market today may contain alkyd pre-polymer or can be blends of polyurethanes and alkyd resins.

In short, I think your readers deserve a more balanced view of "varnishes." *–Barry Oppenheim, Director of Research, The McCloskey Corp., Philadelphia, Pa.*

More on brush techniques for varnish–Some further points on Craig Deller's excellent article on varnish in *FWW* #77. If you are varnishing a violin, use a ¾-in. brush and dip it ⅛ in. into the varnish. If you are varnishing a dining room table, use a 2½-in. or 3-in. brush and dip it in about ¾ in. I think the comment about never shaking varnish is exaggerated. I have never had problems with bubbles, as brushing and surface tension pulls them out for me. Of course, it is not a good idea to repeatedly shake air into varnish for oxidation reasons. In addition, varnish should not be returned to the original container after use. I keep a slop varnish container for this material and use it on the back or insides of furniture. Varnish can be kept for years in plastic bottles if the air is squeezed out. This is not so handy for mixing, as required for those varnishes containing stearates, but it can be done.

Another suggestion: remember that sunshine seems to catalyze varnish polymerization and is a valid way to speed up drying. Varnish exerts a good deal of shrinking tension in drying, so you never need to worry about freshly varnished wood cracking in the sun. *–John W. Wood, Tyler, Tex.*

Preventing silicone contamination–I enjoyed Craig Deller's article on varnish (*FWW* #77). After using marine spar varnish in a boat yard environment for years, I have learned another method of preventing silicone contamination and fish-eyes. The extensive use of silicone waxes and power buffers on boat hulls in recent years has made thorough cleaning before varnishing an absolute necessity.

My solution is to use a silicone-removing cleaning solvent, sold in automotive supply stores for auto body painting. These silicone removers are used before refinishing to remove traces of silicones from automotive waxes. They are used to clean a surface, and are not added to finishes like fish-eye removers.

The cleaning solvent should be used liberally, and be applied

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following instructions. It is important to use an ample supply of clean paper towels or rags to avoid recontamination in the cleaning process. Although the solvents are volatile and smelly, I have never had any difficulty with dissolution of underlying coats of varnish, even when the last coat was applied only a day earlier in a cold boat barn. *—Chris Campbell, Lansing, Mich.*

Feedback on plate joiners—We at Kaiser are indebted to Allan Smith for his very objective review/comparison of all the plate joiners currently on the market (*FWW* #76).

There were, however, two minor points that we would like to clarify. First, in discussing our machine he mentioned "...This pivot system works well, but there is a small amount of play in the locking mechanism, and the small fence felt a bit delicate..." May we point out that we have now introduced our latest model, the "Vario 90," which takes care of these minor discrepancies. That is, we have made the pinion (which lowers the fence) from metal only (no plastic tip) and also replaced the round regulating rod with a flat one, which has additionally a scale for simple adjusting to the desired degrees (from 0 to 90), thereby ensuring solid fence stability.

Second, as to the comment about the "...Fine adjustment of the depth is extremely inconvenient, as it requires partial disassembly of the machine...", Mr. Smith was not aware that he had only to use the supplied Allen wrench in the rear of the bottom plate to make adjustments. Users don't normally have to do this because it is already adjusted at the factory, but if they desire, the Allen wrench is provided. *—Frank T. Trippi, Alexandria, Va.*

Ban ivory objects—It is remarkable to me how consistently you folks at *FWW* have made prominent display of objects using ivory in recent issues. At least in the July/August '89 issue, the back cover information points out that the material is 30-year-old "legal" ivory. (Your quotation marks, not mine.) Maybe that makes it alright; the old elephant might have thought otherwise. What I think is that your magazine, and especially its back cover, is a powerful vehicle for deciding what is good and successful in woodworking today. Being on your back cover *is* success. Your showing off any ivory, even "legal," fosters ivory lust. I call on your editors to establish a policy of rejecting any and all photos of ivory objects. *—George Oberst, Berea, Ky.*

Oak is a masterpiece—I have just finished a 24-in.-dia. carved tilt-top lamp table made of solid oak (not oak plywood). Liquid ammonia was used to darken some of the leaves.

After reading Peter Good's "No Ode to Oak" in *FWW* #77, describing all the bad things he associates with oak, I realize I must have created a real masterpiece.

One last comment: "Know your wood and work it accordingly"; don't condemn. Articles made of oak 300 years to 400 years ago are still good today. I am not an oak lover, but revere all woods. *—Ernest O. Nahapiet, San Jose, Cal.*

More praise for oak—Peter Good's article "No Ode To Oak," *FWW* #77, is no good, to put it mildly. Being from Oakland, he should know something about oaks, but alas, tell him to take his oak furniture out from under the woodshed and in out of the rain, and it will stop checking and warping.

I have some old, and I do mean old, oak antiques completely free of checking and warping. It appears his familiarity with oak is confined to left-outdoors furniture and possibly furniture trim at fast food restaurant franchises. I understand Barbra Streisand

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paid $93,000 for an oak settee antique, made by Stickley Brothers, at a recent auction. I have seen many pieces of Stickley oak antiques and believe me they are completely unchecked and unwarped. Many of them are highly sought after.

The many species of oaks are as varied as the many types of pines, and their grain and physical properties vary greatly. Hail to the oaks, symbols of strength and beauty.

–Walter Sheard, Horseheads, N.Y.

Keller comments on dovetail comparison–We appreciate the recent coverage of router dovetailing in the article by Alan Platt in *FWW* #78. However, there are several errors in data and descriptions regarding the Keller Dovetail System.

The Keller Model #1601 (or the prior #1600) will handle wood *16 in. or more wide*, not 6 in. wide as reported in the chart on p. 49. In addition, the Keller Dovetail System can be easily used for cutting not only through dovetail joints with traditional proportioned spacing, but also variably spaced dovetails, angled and compound angled dovetails, end-to-end dovetails and box joints. Instructions for the new models include directions for all these joints.

This corrects the data in the chart so that in the "Templates" column, Model #1601 (list price, $185) should read S–#4, #5, #6, #8, #9. Model #2401 (list price, $279) should read S–#4, #5, #9, #10. Model #3600 (list price, $375) should read S–#4, #5, #10. The same joint capabilities also apply to the now discontinued #1600 and #2400.

In addition, to correct Mr. Platt's description, the fit of the joint is affected *only* by adjusting the pin template location during the initial set-up time: the fit is not affected by either the router bit depth or the wood thickness. *–David Keller, Petaluma, Cal.*

Polishing finishes with ashes–In *FWW* #77, Michael Dresdner characterized polishing with cigar ashes to be one of those myths that everyone knows about, without, however, knowing anyone who's ever done it. Well, there is a germ of legitimacy to the use of tobacco ash as a polish, and I have so used the stuff; but not for wood finishes.

Before World War II, the angular gradations of Marine sextants were engraved on silver. Such sextants needed to be cleaned without damaging the accuracy or legibility of the instrument. Ordinary metal polishes, jewelers' rouge cloths and the like were all too harsh.

Life at sea being what it was then, the usual polishing materials, ammonia or sperm oil (applied with cotton), sometimes ran out, and one substitute was tobacco ash. I can't say how I learned of this method; probably from one of the old-timer Chief Quartermasters I was privileged to know. Tobacco ashes were thought to be *less* likely to scratch the silver, and also remove tarnish, than anything else aboard ship. All this explains why I'd agree with Mr. Dresdner: Tobacco ashes are probably too fine for polishing wood finishes.*–Henry Kramer, Somerville, N.J.*

Substitutes for bed bolts–I enjoyed Christian Becksvoort's article, "The Pencil-Post Bed" (*FWW* #76), but I do have one suggestion. Instead of using bed bolts, I use ordinary hex head bolts, with a flat washer at both ends of the bolts, and self-locking nuts. I have a couple of reasons for doing this. First, you don't need a special wrench to put the bed together (a wrench that also needs to be supplied to the customer because not too many people have a bed bolt wrench). All someone needs to put up or take down one of my beds is two small crescent wrenches. Availability is another point. Hex bolts are far easier to obtain in case one is lost in a

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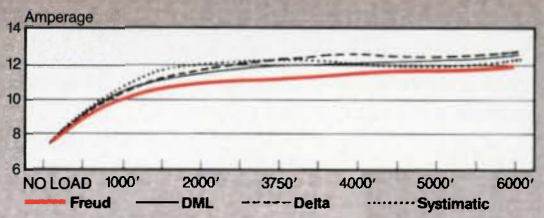
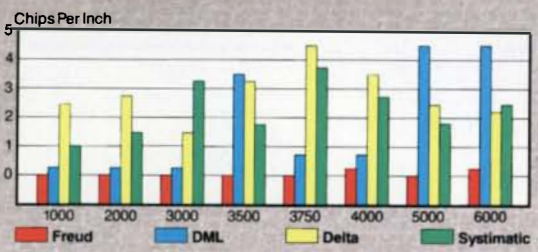
Freud provides the best performance among comparable carbide blades!!

A new mixture of carbide has been engineered at Freud that stays sharper longer and produces a cleaner finish on laminates, melamines, softwood, and hardwood.





Another finding showed sharper blades required less power (amperage) to make a cut. The Freud HOOK Carbide blade used less power and therefore out performed the competition by staying sharper longer.

Your local Freud distributor has a complete copy of the Pittsburg State University report and will be glad to show you their findings.

See for yourself how The NEW HOOK CARBIDE BLADE from Freud has been proven to be the best blade for your cutting needs!!

Call us today for the name of your local Freud distributor.

An independent test conducted by Pittsburg State University compared Freud's new HOOK Carbide blade with blades from Delta, DML (Dyanite), and Systimatic.

First, quality of cut was determined by the amount of chip out found on the finished edge of a double faced laminate board. The Freud HOOK Carbide blade significantly out performed the other blades by producing an almost chip free edge!!

Stock #	Dia.	Teeth	Bore
LU98M008	8″	64	5/8″
LU98M009	9″	72	5/8″
LU98M010	10″	80	5/8″
LU98M012	12″	96	1″
LU98M014	14″	108	1″

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move. For an inexpensive bolt cover just cut and flatten a piece of copper pipe. *–Tony Konovaloff, Tahoe Paradise, Cal.*

Woodworker's Waterloo–In Vernon Harper's article (*FWW* #76, p. 68), he asserts that the Duke of Wellington is known for accepting Napoleon's surrender at Waterloo. There are numerous valid claims to fame on behalf of Wellington, but this is not among them. In fact, Napoleon retreated from Waterloo following the defeat and did not surrender until nearly a month later and then to a Captain of the British Navy. *–Donn D. Lobdell, Englewood, Colo.*

Expanding world of woodworking–I have been subscribing to your magazine since its incipiency and consider it an excellent woodworking magazine in many ways. However, in respect to woodworking, it falls short because woodworking now (in the '80s) encompasses more than just "wood." There is also a variety of plastic laminates now available, through many different companies and in a zillion colors and textures, as well as veneers, plywood, cabinet-grade plywood veneers and some new man-made materials like Corian.

Basically, the only complaint that I have (being a part-time cabinetmaker) is to broaden the scope of your magazine. I can recall (after receiving the current issue) at least two other articles on router dovetail jigs and at least one other article on tuning up your tablesaw. Obviously there is still *plenty of room* for diverse and new articles in your horizon of forthcoming issues.

I would like to see articles dealing with cabinet-grade plywood, mica, Corian, veneers and plywood veneers in cutting and jointing designs, and the architecture, lay out and construction of various designs in kitchens, beds (preferably mica) and wall units using the materials that I mentioned above. *–Kerry J. Rubin, Baldwin, N.Y.*

Praise of large commissions–I want to compliment you, Douglas Schroeder and all who contributed to the article "Handling Large Commissions," *FWW* #78, pp. 74-79. The real-life experiences of Mr. Schroeder and his staff provided excellent reading, not only to those cabinetmakers building fine furniture of proven design and classical joinery, but also to retirees (like me) who have been there. This drive, ingenuity and ultimate success should be an inspiration to those currently "in the business."

I offer two comments, not meant to be derogatory. First, the article states that medium-density fiberboard (MDF) was chosen for the doors "because it is considerably more stable than plywood or hardwood." The veracity of this statement is subject to doubt for the environment of southwest Florida. (U.S.D.A. Forest Products Laboratory might not go along with this either.) And, Schroeder never states what adhesive was used on which bonding operations. Your readers would probably like to know for their applications.

–Thomas Sharp, Sanibel, Fla.

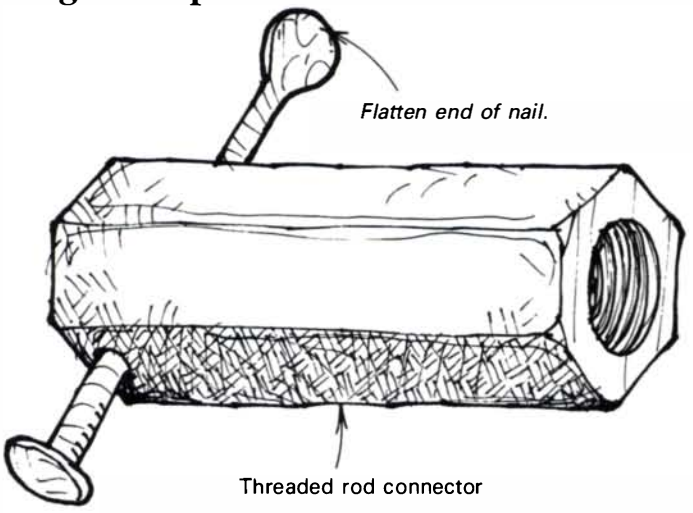
About your safety:

Working wood is inherently dangerous. Using hand or power tools improperly or neglecting standard safety practices can lead to permanent injury or death. So don't try to perform operations you learn about here (or elsewhere) *until you're certain that they are safe for you and your shop situation.* We want you to enjoy your craft and to find satisfaction in the doing, as well as in the finished work. So please keep safety foremost in your mind whenever you're in the shop.

–John Lively, publisher

edited and drawn by Jim Richey

Wing nut replacement



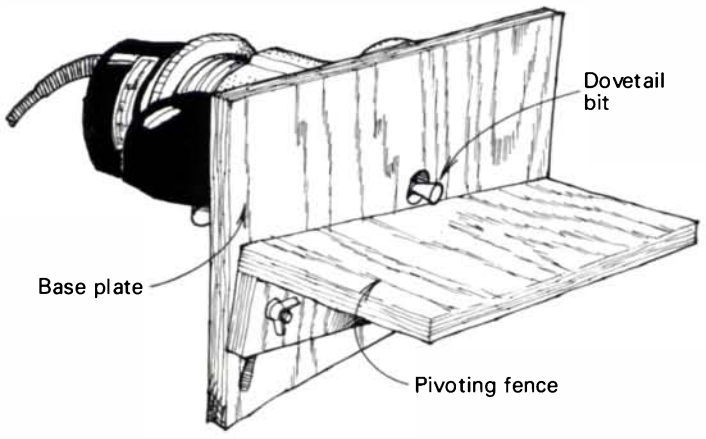
Since I'm not a super-macho type, I don't particularly welcome the pain in my thumb that comes from really torquing down a wing nut. So whenever possible, I replace them with the rod connector tighteners described below. In addition to relieving my thumb, the gadgets can be tightened with more force and go in smaller places than regular wing nuts.

To make the tightener, go to the local hardware store and buy a threaded-rod connector that's the same size as the wing nut you need. Drill a hole through one end of the connector and slip a nail through the hole. Flatten the pointed end on an anvil and grind the flattened end smooth. The device will make tightening and untightening a breeze.

—Gordon C. Su, Sandy, Utah

Quick tip: Carbon tracing paper leaves hard-to-remove blue lines, but dressmaker's tracing paper leaves lines that are easily removed with a damp cloth. The paper is available in many colors, including white and orange, allowing tracings to stand out on a variety of wood surfaces. It can be found in fabric and sewing shops. *—Stephen Finch, Little Grove, Australia*

Jig for routing sliding dovetails

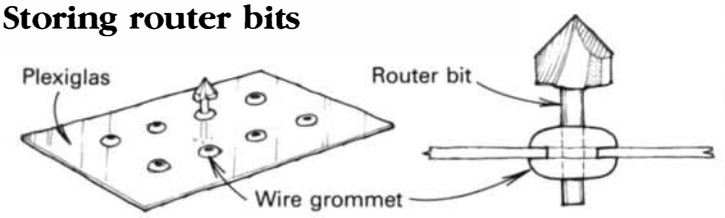


After reading Mac Campbell's article on sliding dovetails *(FWW* #62, p. 80), I was compelled to use the joint on a project. The jig for cutting the pin that Campbell describes is attached to the edge of an existing tabletop. I modified the jig so a wood baseplate mounted on the router replaces Campbell's stationary table. With the whole fixture attached to the router, I can move the bit across the wood rather than having to move the wood across the bit. With long pieces, this can be a big advantage in a small shop.

To cut the dovetail slot, I remove the fence entirely and slide the baseplate against an auxiliary fence clamped to the workpiece. Then, I re-attach the fence and adjust it to cut the correct size dovetail to fit the slot. I mark where the fence is set so I can repeat the setting. *—Larry Naumann, St. Louis, Mo.*

Quick tip: Hand-held wire brushes will dull with use as the wire ends become rounded. Run the brush lightly back and forth across the face of a grinding wheel to get it working as good as new. *—Dean Feight, Altoona, Ia.*

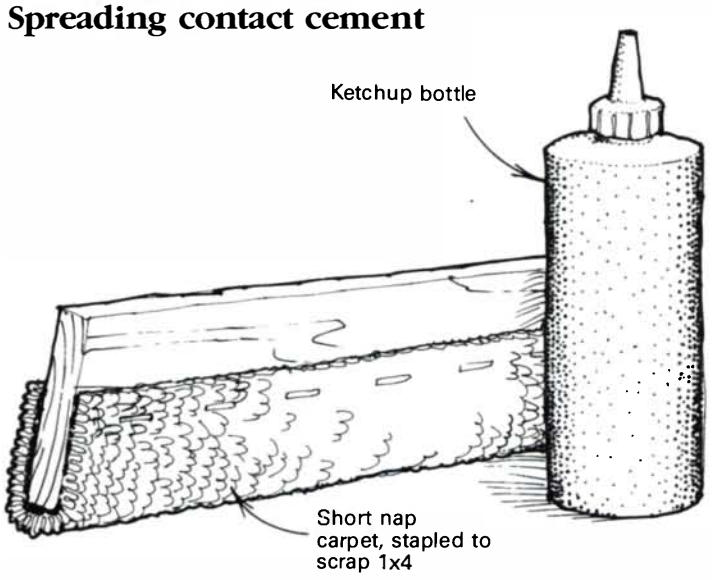
Storing router bits



This simple router bit storage rack will hold your bits securely and keep them from falling out or rattling against each other. The rack is made from a sheet of ⅛-in.-thick Plexiglas and wire grommets. Wire grommets are rubber, donut-like rings available at auto parts stores in a variety of sizes; take a router bit with you so you can buy the size that fits just right.

To make the rack, select a drill bit the same size as the core diameter of the grommet. Drill holes in the Plexiglas at 1-in. to 2-in. intervals and install a grommet in each hole. Installation will be easier if you lubricate the skirt of the grommet with a drop of oil. *—David McCampbell, Salmon, Ida.*

Spreading contact cement



As part of my general contracting business, we've built Formica-covered cabinets for years. But, applying the contact cement was an ongoing problem. We found that cleaning a spray gun took too much time and using rollers or paint brushes was just too messy. The simple, neat system we finally developed requires two items: a spreader made from carpet scraps and a plastic ketchup bottle to dispense the cement. Make the spreader by stapling a piece of short-nap carpeting to a 6-in.-long 1x4 scrap. Because the spreader takes only a minute to make and is free, we just throw it away when the job is done.

We purchase ketchup bottles by the dozens from a restaurant supply house. The big ones are about 8 in. tall and cost 20 cents a piece. A bottle may last several weeks before it begins to gum up, and once it does, we throw it away and start with a new one.

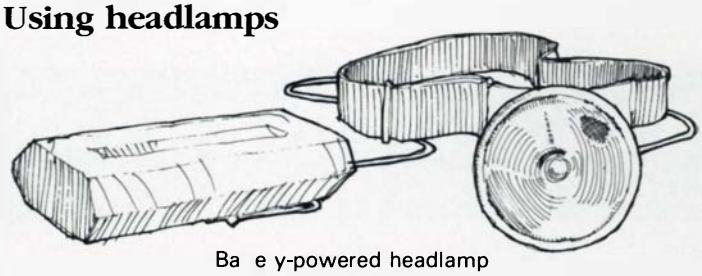
To apply the cement, squeeze out a zigzag bead of cement

onto the counter and the Formica. Then, spread the cement over both surfaces with the carpet-covered block. Right-handed people should hold the squeeze bottle in their left hand, the spreader in their right and work from right to left. With a little practice, you'll be able to keep the proper amount of cement in front of the spreader, which will make the operation quick and neat.

—Tim Hanson, Indianapolis, Ind.

Quick tip: Troubled by guilt from dumping used mineral spirits in a hole in my yard, I began pouring it into a clear plastic container. I noticed the sediment eventually settled out and the liquid on top was clear. I pour this off and reuse it, saving both money and guilt. *—Dr. Alan J. Pollack, Woodland Hills, Cal.*

Using headlamps



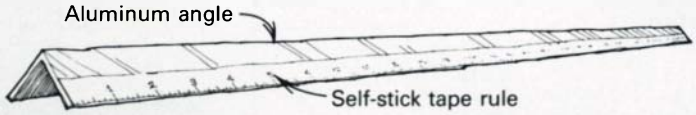
Ba e y-powered headlamp

We often don't realize how poor our shop lighting is because of our eyes' ability to make do. And even in a well-lit shop, when doing really close work, you'll find yourself working in your own shadow more often than not. The bright, focused light from a battery-powered headlamp is quite helpful in a variety of shop situations—taking measurements, sharpening blades and making adjustments inside a machine to name a few. A good source for headlamps is Recreational Equipment Inc., Box 88125, Seattle, Wash. 98188. *—Rick Kjarval, Chicago, Ill.*

Quick tip: To clean paintbrushes, cut a cross in a plastic coffee can lid, push the brush handle up through the cut and snap the brush/lid combination back onto the can. The lid will suspend the brush in the thinner while keeping the bristles away from the bottom of the can. And you can wiggle and slosh the brush without splashing paint thinner all over yourself.

—Larry A. Huff, Anamosa, Ia.

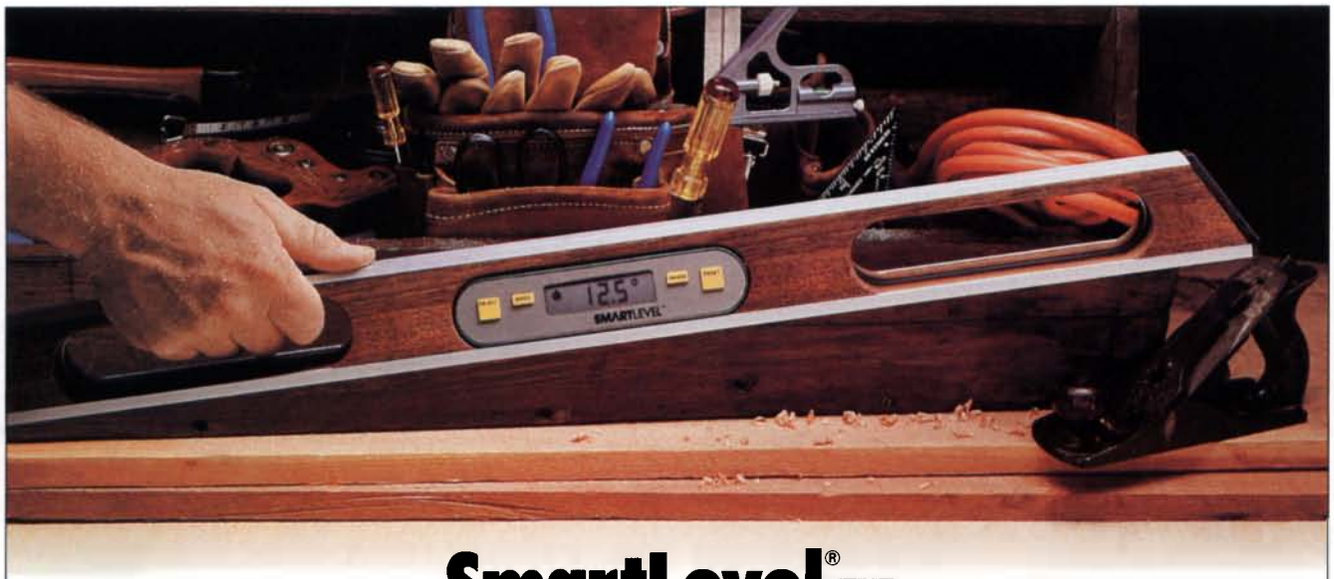
Marking ruler



For marking up long pieces of lumber or sheets of plywood, I use an 8-ft. length of ¾-in. by ¾-in. aluminum angle, which is available at most lumberyards. I attach self-stick tape rules (available from Woodcraft Supply, Box 4000, Woburn, Mass. 01888) on the two outer edges. The combination of the aluminum's thickness and the right-angle shape keep the rule straight and make it ideal for marking and layout. *—Bill Endress, Orlando, Fla.*

Weather strip for drawer rails

I've had to repair the drawer sides on several old chests due to wear between the side and the drawer rail. It's not a difficult job, but it's unpleasant nonetheless. Through my vocation, which is energy conservation, I've recently encountered a product that promises to eliminate drawer wear, and thus aid me in my avo-



SmartLevel®—

the new, electronic hand tool that accurately measures every angle, not just level and plumb

Your old bubble level is a thing of the past, because now you can own a SmartLevel.® More than just a level, SmartLevel is a digital inclinometer that electronically measures *every angle* easily, reliably and accurately—*every time!*

With the push of a button, SmartLevel measures and displays:

- Level or Plumb
- Rise Over Foot of Run (Pitch)
- Degree of Slope
- Percent of Slope

So you can quickly measure roof pitch; drainage, landscape or deck slopes; stairway rise; level and plumb. Plus, because SmartLevel displays *direct measurements,* you *don't have to do any other calculations* to figure pitch or slope.

SmartLevel helps reduce costly re-work

A SmartLevel helps you avoid re-work because—unlike a bubble level—you can always be sure your SmartLevel measures true. Just press the "Reset" button and your SmartLevel is easily recalibrated to reliable accuracy.

Just press the Mode button to directly measure rise over run (pitch) Δ, degree of slope °, percent of slope %, or level and plumb with, if you prefer, a simulated bubble (: |||). Arrow shows direction to true level/plumb.

Plus, SmartLevel provides an exact digital display of the measurements you make, so there's no guessing. The display

SmartLevel was designed by a team of engineers and experienced carpenters to make it easy to use and to last a long time.

can be read from as far away as 10 feet, overhead or below-shoulder level, in bright or dim light. The display even "flips over" so you can still *read it when it's upside-down.*

Made of sturdy, high-quality materials for durability

The heart and brains of SmartLevel is a rugged, solid-state sensor sealed inside a weather-resistant polycarbonate module. You can use it alone as a torpedo level or lock it quickly into the hand-holds in our 2-, 4-, or 6-foot rails.

The hand-crafted rails are made of strong, aircraft-grade aluminum, through-bolted to solid teak centers that absorb shock and resist warping. The triangular shape provides a low center of gravity to make SmartLevel more stable than I-beam levels.

100% guaranteed

The best way to see how good a SmartLevel is, is to get your hands on one. It's available exclusively from Wedge Innovations, its manufacturer. And you may return your SmartLevel within 30 days for a full refund if you're not 100% satisfied. But we're sure you'll want to keep it—and it's backed by a one-year warranty against defects in materials and workmanship.

So order yours today. Then you can stop second-guessing your old bubble level or replacing it year after year. Because you'll have a SmartLevel—the most accurate, versatile and durable "carpenter's level" you'll ever own.

Order by mail, or phone toll-free 1-800-SMARTLEVEL

1-800 762-7853
Please mention code K9FW
Mon.-Fri.: 7:30 AM-5 PM Pacific Time
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SmartLevel makes a perfect holiday gift.

One sensor module will fit interchangeably into any of the 2-, 4-, & 6-ft. rails. The sensor module can also be used alone as a torpedo level.

SmartLevel Order Form

Mail to: Wedge Innovations, 532 Mercury Dr., Sunnyvale, CA 94086

Description	Item #	Qty.	Price	Total
Sensor Module (fits in any rail)	SM		$79.95	
2 ft. Rail (without module)	TR2		$25.00	
4 ft. Rail (without module)	TR4		$50.00	
6 ft. Rail (without module)	TR6		$75.00	

Sub total: _____

Calif. residents add local sales tax: _____

Shipping (add $6.50 for each rail ordered; Alaska & Hawaii $10 per rail): _____*

Total: _____

Payment method: ☐ Check ☐ VISA ☐ MasterCard

Card #: _____ Exp. Date: _____

Authorized card signature _____

Ship to: (No P.O. boxes please.)

Name _____

Address _____

City/State/Zip _____

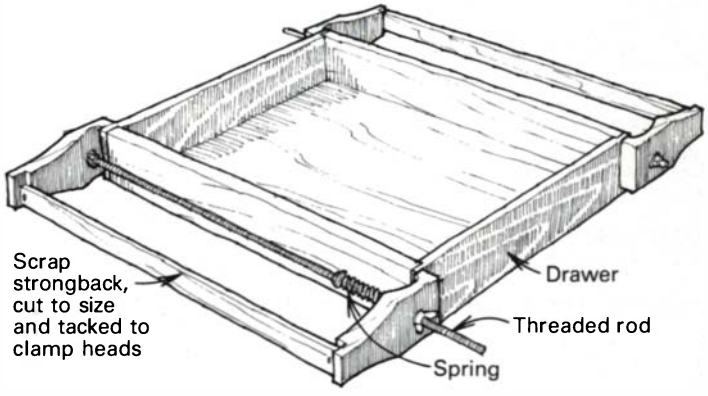
Daytime phone ( ) _____

*Mail orders, please allow 2 weeks for delivery. For faster service, credit card orders may be placed by phone. For overnight or second-day delivery service, call Wedge Innovations for delivery charge quote. Foreign orders please write, or FAX to 1-408-739-3353. K9FW

cation, which is woodworking.

The material generically called V-Seal is a very thin PVC plastic. It comes on 1-in.-wide rolls with an adhesive strip that is slippery and long wearing. It is folded and stuck on a door frame as a weather strip. In its woodworking application, I stick the material, left unfolded, to the top of the drawer rail. It reduces friction dramatically and will, I believe, eliminate further wear to the drawer. The material is available at a reasonable cost at most hardware stores. *–Edward Minch, Wilmington, Del.*

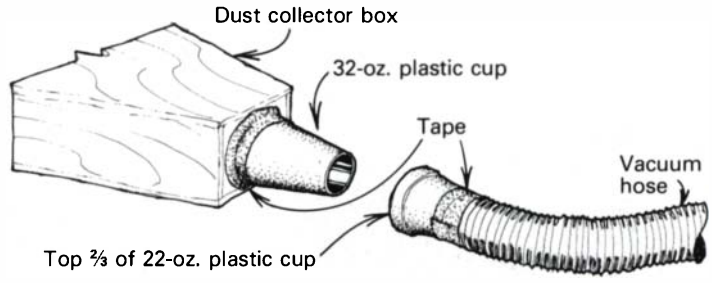
Shop-built drawer clamps



You can make up these drawer clamps quickly in any size needed. Just bandsaw the clamp heads from scraps of hardwood from around the shop and mount them on threaded rods. Cut a strongback to whatever length you need for a given job and tack it to the notch in the clamp heads. When clamping several of the same size drawers, a spring will help keep the clamp heads set at the right distance as the clamps are removed and replaced.

–Earl J. Beck, Oak View, Cal.

Vacuum hose connectors from plastic cups



I move my portable dust collector around the shop as needed. This system requires a quick way to connect the 3-in. hose to various tools. I discovered that refillable plastic soft drink cups, the kind sold at convenience stores, make an excellent connection system that's quick, tight, long lasting and very inexpensive.

First, I saw a 4-in.-dia. hole in the machine's collector box and, from the inside, I insert a 32-oz. cup, bottom first, all the way up to its reinforced lip. I tape around the cup on the outside of the collector box to hold it in place and then cut out the cup's bottom. I make the mating connector by cutting off the top two-thirds of a 22-oz. cup and taping it to the dust collector hose. Experiment with cup sizes to find a tight-fitting combination for your system.

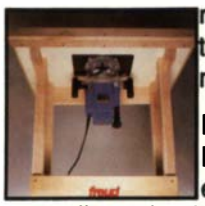
To fasten the hose to the machine, push the cups together—they will stay in place. To remove, just pull with a twist. If the connector should eventually crack, treat yourself to another

We'll Stand On Our Heads To Please Our Customers

Input	**15 Amps**	**120 Volts AC**
Horsepower		**3-1/4**
No Load RPM		**22,000**
Collet Capacity		**1/4",3/8", 1/2"**
Max. Plunge Depth		**2-3/4"**
Base Diameter		**6-5/8"**

Another Way to Look at Routers

The router has become a work horse in the wood working shop. When mounted under a



router table like the Freud FRT2000, the router can take the place of a more expensive spindle shaper.

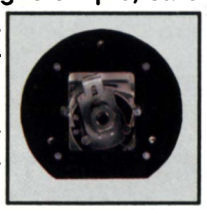
Freud's new FT2000, 3-1/4 HP Plunge Router with 1/2 inch collet has been engineered with your needs for a versatile and safe tool in mind. The mighty 3-1/4 HP motor is the most powerful you can buy!!

FOUR major features separate the FT2000 from other routers and make it a pleasure to use!

The **Long Collet**, 1-3/8 inch, has 6 constricting slots. This feature allows for a longer, more even grip of the bit shank. This decreases run out found on routers with shorter, single slotted collets and increases operating safety.

The **Micro-Adjustment Depth Control** makes accurate vertical settings quick and easy. No more twisting of the router body or "hit & miss" plunging with inaccurate measurements and difficult locking devices. An effortless turn of the knob does the trick! This makes table mounted adjustments a snap!

With the **Sliding Shaft Lock** found on the Freud FT2000, bit changing is simple, safe and easy. Only the one wrench provided is needed. No more busted or bruised nuckles and hands!! This is best appreciated when changing a bit with your router mounted under a table.



Safety was an important factor when the on-off switch and the plunge lock were designed! They would need to be released at the same time in the case of an emergency. Both are designed with a downward stroke to disengage each feature.

The *on-off switch* is located on the side of the router. A simple flick of the left thumb while holding the handle turns the machine on-off. The *plunge lock* is located by the right handle. It can be conveniently operated by the fingers of the right hand.

A 1/4 inch collet reducer and collet wrench are standard with this powerful machine. Optional accessories include micro-adjustment parallel fence and a set of template guides. The FT2000--3-1/4 HP Plunge Router List: $299.90 Call today for the name of your local Freud distributor!

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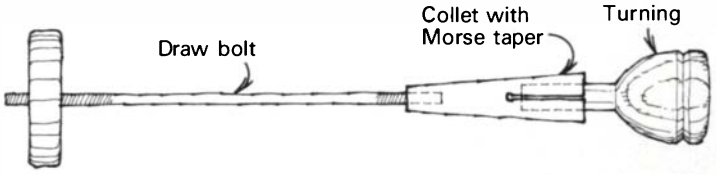
soft drink. It'll take longer to finish the drink than it will to replace the fitting. *–Ronald E. Miller, Macksville, Kan.*

Quick tip: Slipping a pair of discarded panty hose over the paper filter element on your shop vacuum will keep the filter from clogging without reducing the air flow. Because sawdust just shakes off the nylon, cleaning the filter isn't so messy.
–Roger Irwin, Palm Bay, Fla.

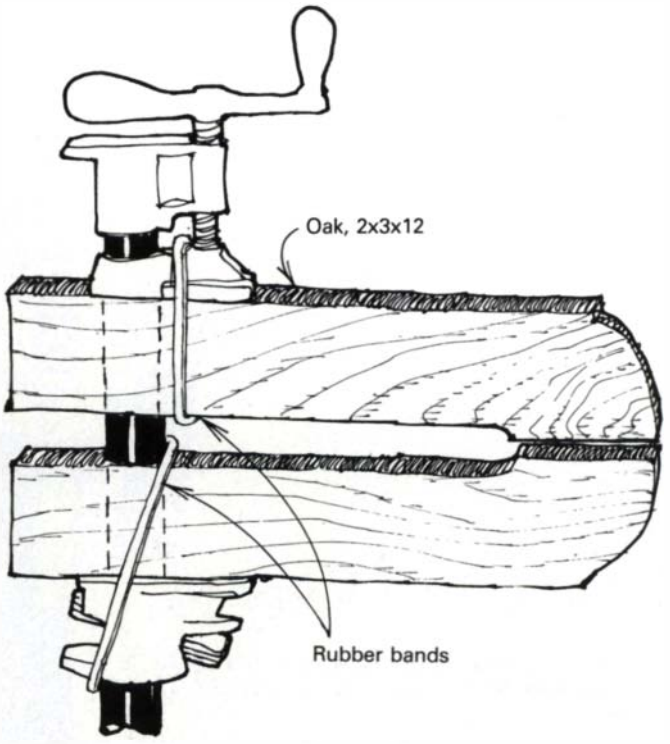
Collet and draw bolt lathe chuck



A simple Morse taper ½-in. collet chuck used with a draw bolt is an effective alternative to a heavy, expensive 3-jaw Jacobs chuck for turning small pieces. When the draw bolt is tightened, the collet's jaws securely grip the work. Morse taper collets are available from machine tool suppliers or Manhatten Supply Co., 151 Sunnyside Blvd., Plainview, N.Y. 11803.
–Eric Schramm, Los Gatos, Cal.

Quick tip: I always had trouble with the small squares of plywood I used as clamp pads falling off before I could tighten the clamps. I solved this problem by sticking a small piece of pressure-sensitive magnetic tape to one side of the plywood. Rolls of the magnetic tape are available from Brookstone Co., 127 Vose Farm Rd., Peterborough, N.H. 03458. *–Ralph W. Brome, Annapolis, Md.*

Quick long-reach clamp



Here's a long-reach clamp that can be made in minutes from an ordinary pipe clamp and scrapwood. The jaws are bandsawn

Buy 1 tool and get our 212 page tool free.

Just a few of the unique woodworking tools of the 3,500 others available from our most versatile tool, the 1990 Garrett Wade Catalog.
The 212 page Catalog, regularly $4.00, is Free with any order from this ad. Or if you would just like the Catalog, send us $4.00 with your name and address. It's the one woodworking source book you shouldn't be without.

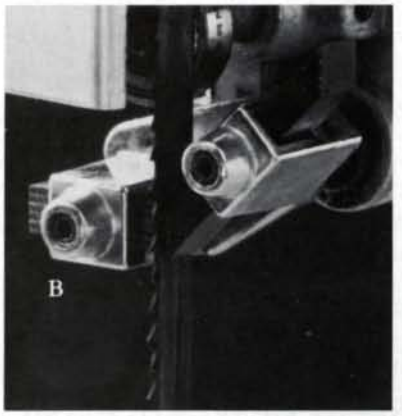
A / Our 202GF Gap Filling Glue Has Remarkable Properties
It has a very high solids content so that small gaps in our joinery are actually filled – with strength. And the "squeeze-out" beads right up and chips off when dry. No soaking in to ruin finishes. Dries to a light tan. Water clean-up.

62J01.01	1 pt. 202GF	$ 6.50
62J01.03	1 qt. 202GF	$11.50

B / Special Bandsaw "Cool Blocks" Prolong Blade Life And Increase Accuracy
Made of a special Graphite impregnated Phenolic Laminate, this set of 4 replaces your upper and lower side blade guides.

They run cooler than conventional steel guides and are more "slippery". You can set them actually touching the blade, consequently giving more control and accuracy over the cut. They are sure to improve the performance of whatever bandsaw you use. 8 sizes are available to fit most bandsaws.

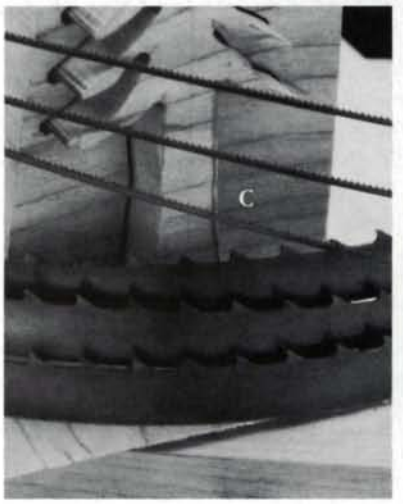
Model		
33K09.01	"A" Delta 14"	$11.95
33K09.02	"B" Sears 12"	$11.95
33K09.03	"C" Inca 10½"	$11.95
33K09.04	"D" Shopsmith	$11.95
33K09.05	"E" Old Sears (¼" Rd.)	$11.95
33K09.06	"F" Jet 14" (fits most Delta-type copies)	$11.95
33K09.07	"G" Gilliom (5/16" Rd.)	$11.95
33K09.08	"H" Delta 16"	$11.95



C / Garrett Wade Has Discovered Some Very Interesting Bandsaw Blades.

1/16" "Super Narrow" Blades
You may have never seen a blade like this 24 tpi, in a raker style, these give smooth cuts while making incredibly tight turns. We strongly recommend our "Cool Blocks" for these delicate blades, because they can be set closer to the blade without danger of overheating or destroying the teeth as normal metal guides can.

Cabinetmaker's Special Bandsaw Blades
A Garrett Wade exclusive. In appearance, they look like "skip tooth" blades. But each tooth is actually formed as a hook, with every 5th tooth an un-set raker. The result is a very smooth cutting blade that feeds very easily. Use the ¼" (4 tpi) blade for general work, and the ½" size (3 tpi) for resawing and heavy straight sawing.



93½" Blades (Delta 14" and copies)		
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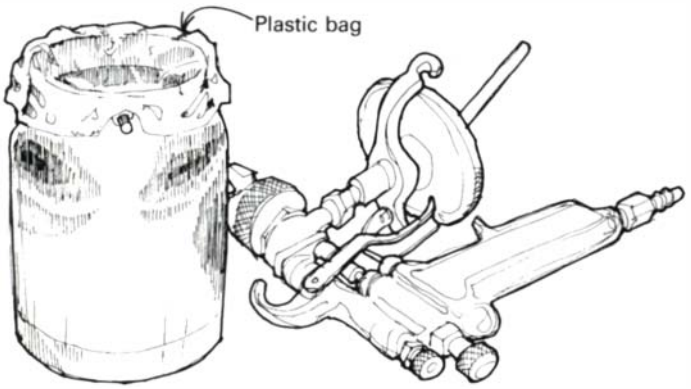
from two oak 2x3s that are about 12 in. long. Drill a hole the same diameter as the pipe, through one end of each jaw, and then slip the jaws onto the pipe between the regular clamp heads. Finally, install rubber bands, as shown in the drawing on the previous page, to keep the jaws in place.

–Dwight Christiansen, Newell, Ia.

Quick tip: When painting or varnishing all sides of a box or other small project, you can use three or four thumbtacks, with the points up, to elevate it above the table, thus preventing it from sticking. *–Dustin Davis, Frostburg, Md.*

Plastic bag paint pot liners



I keep a supply of plain one-gallon plastic food storage bags (without a zipper-like closure) to line the quart pot of my spray gun. This trick only works in pots with lever releases, not those that screw to the gun. I generally use two bags at a time, in case one should leak. The bags simplify waste disposal and minimize the amount of expensive solvent needed to clean the pot. I've never had any problem with solvents dissolving the bags.

If you're going to be spraying the leftover material soon, it may be sealed right in the bag with twist ties and stored in an empty quart paint can. However, if you leave paint sealed inside the bag for long, the material that dries on the inside of the bag may cause problems when spraying.

–Bruce De Benedictis, El Cerrito, Cal.

Quick tip: To avoid chipping the veneer when sawing cross-grain dadoes in plywood, make two passes. Cut through only the face veneer on the first cut, and then make a second pass to full depth. *–John Kriegshauser, Kansas City, Mo.*

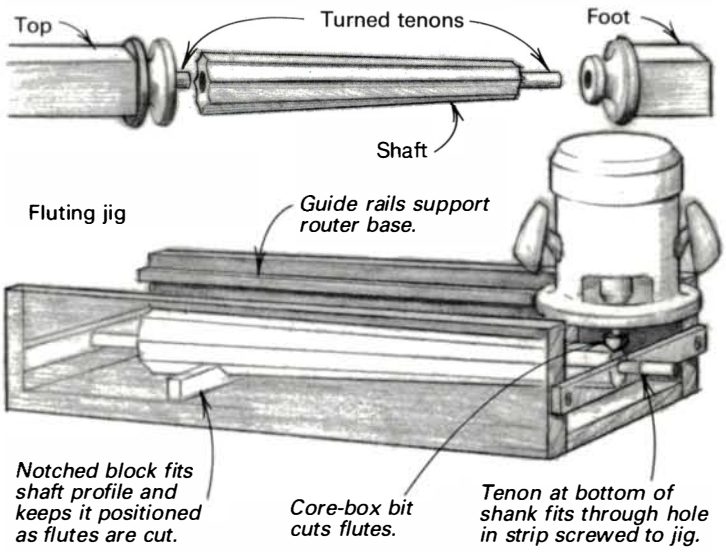
Matching a box to its lid

When I build small boxes, I construct the box body and the lid together as a solid unit and slice the top away from the box later. This ensures that the lid matches the size and grain of the body perfectly. One word of caution–it's risky to saw the lid right off the box. Instead, set your tablesaw blade's height at 1/32 in. less than the thickness of the side of the box before sawing all four sides. This approach will leave the lid attached with a thin web of wood, which can be cut with a razor knife before pieces are sanded and finished. *–Curtis W. Mead, Troy, N.H.*

Methods of Work buys readers' tips, jigs and tricks. Send details, sketches (we'll redraw them) and photos to Methods, Fine Woodworking, *Box 355, Newtown, Conn. 06470. We'll return only those contributions that include an SASE.*

Turning fluted piano stool legs

I'm making a piano stool and I want the legs to match the spindles that support the keyboard of an upright piano. Turning the spindles is easy; the hard part is turning the lower half of the leg into a tapered, eight-sided cone with concave sides. How should I proceed? —Alan Faulkner, Newfoundland, Canada



David Ray Pine replies: If I were going to make these legs, I would do them in three segments: a turned top, a taper-sawn and fluted shaft and a turned foot (see the drawing above). The final results will look best if you use a single stick of lumber for each leg and match the grain when joining the three pieces together. Starting with a square blank several inches longer than the final leg (for tenons), crosscut the blank into three sections. Bandsaw the square portions to size on the top piece and at the bottom of the foot. Now, turn the profiles on the tops of the legs and the feet, and bore a hole in one end of the foot, using the imprint left by the lathe's drive center to locate the hole. At this stage, you can turn a short tenon on the lower end of the top section, or you can center-bore each blank first, and then turn using a dowel plug in the hole for mounting it on the lathe, as described in "Making Period Bedposts" *FWW* #53, pp. 28-33.

Instead of turning the tapered shafts for the stool legs, bandsaw the taper using a jig like the one illustrated in the article cited above. Alternately, you could make the taper on the tablesaw or the jointer. Next, plane the corners until the shaft becomes octagonal. Turn a short tenon on the bottom end of the shaft to fit the hole bored in the foot, and bore a hole in the other end to accept the tenon or dowel on the top. You may hand-carve the flutes on the tapered shaft, but it's a tedious job; most likely the legs weren't hand-carved originally, but mass produced by machine. The speedier alternative is to cut the flutes with a core-box bit in the router, using the shopmade plywood positioning jig, shown in the drawing, to hold the shaft. A strip with a hole in it screws to one end of the jig and holds the tenoned end of the shaft. A strip on the other end also has a hole that accepts a dowel that fits into the hole in the other end of the shaft. Position the strips on the jig to hold the tapered shaft so the router bit will cut a flute as wide as the octagonal face at the top end and gradually taper off toward the bottom. A notched block, screwed to the bottom of the jig, is used to secure and index the position of the octagonal shaft during routing. The shaft is rotated for each flute, until all the flutes are done.

Making the legs from a solid piece of stock would be stronger, but you'll have to turn the tapered section along with the rest of the leg, and then cut the eight flutes using an indexing jig similar to the one just described. After shaping, the flutes need to be finished by hand-carving up to the projecting ring at each end. I've seen similar turned spindles that have coves cut directly above and below the flutes, allowing the cutter to run out to the end of the octagonal section.

[David Ray Pine makes period reproductions in Mt. Crawford, Va.]

Searching for standard bed sizes

I recently built a queen-size bed on commission, and I took the precaution of going to a furniture store and measuring a queen-size mattress before building the frame. Unfortunately, the customer's mattress turned out to be 3 in. narrower than the frame I built. Are there standard measurements for the different-size beds? —David L. Stewart, Gillett, Pa.

Christian Becksvoort replies: I'm not aware of any industry-wide standards for mattress and box spring dimensions. Evidently, the bedding industry can't even decide on the names of the sizes, let alone the dimensions. Approximate sizes, in width by length, are as follows: twin or single, 39 in. by 75 in.; full or double, 54 in. by 75 in.; queen, 60 in. by 80 in.; king, 76 in. by 80 in. There is also a "California king" which is about 80 in. by 80 in. As your experience indicates, these sizes are not followed by all manufacturers, and can vary from 1 in. (common) to 3 in. (rare). To further confuse matters, there are cot, tall persons, futon, custom-made, European (metric) and water bed sizes, all with different dimensions. Just thank your lucky stars that you don't sell fitted sheets for a living.

To avoid the grief you experienced, I insist that my customers buy their box spring and mattress before I commence building the bed frame. I measure the box spring at the bottom of its frame and allow another ½ in. to ¾ in. in the inside length and width of the bed frame. This allows easier insertion and removal of the mattress and box spring, and also makes it easier to change the sheets.

[Christian Becksvoort, a professional furnituremaker in New Gloucester, Maine, is a Contributing Editor to *FWW*.]

Preventing rust on cast iron

I have eight stationary machines with cast-iron tables in my shop. Presently they're all in excellent condition and I want to keep them that way. What's the best way to maintain cast iron and keep it from rusting? —Michael F. Strizak, Neffs, Ohio

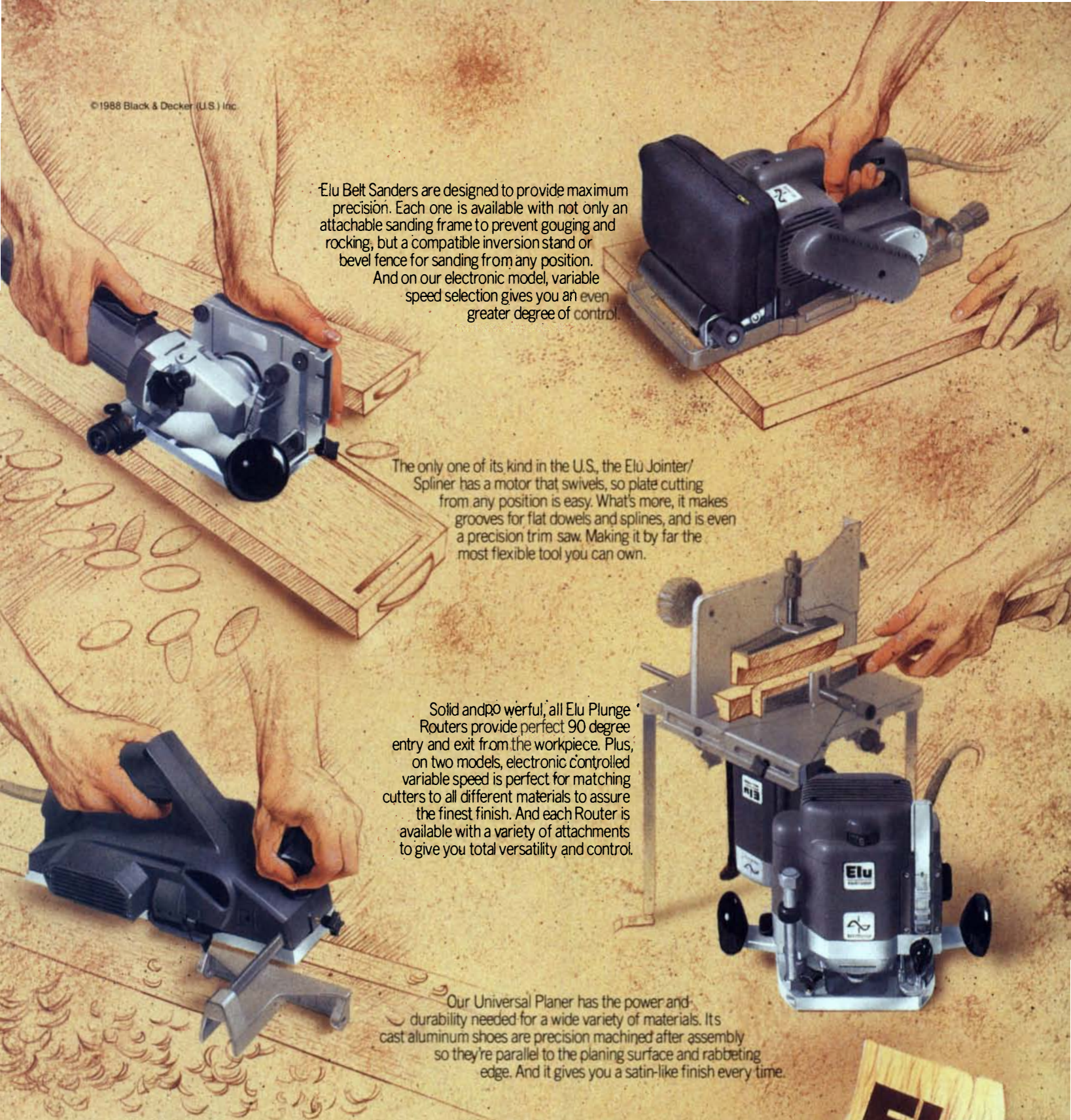
Rich Preiss replies: To maintain the cast-iron surfaces in my shop, I follow this simple regimen: I regularly buff the surfaces with 000 steel wool, to remove any light oxidation (rust), apply a coat of carnauba wax and buff it to a high polish. This treatment will not only protect the cast iron from further oxidation, but will also make your work glide over the metal tables much more smoothly. I perform this ritual at least once a week, and will do it more frequently on machines that are subjected to heavy use. I do not know of any polishes that will protect working surfaces better that wax, or extend the time between applications. It is my belief that the best way to retard the oxidation of cast-iron surfaces is to use the machinery regularly and to stay on top of each tool's maintenance schedule.

[Rich Preiss is head of the woodworking program at the University of North Carolina at Charlotte and a Consulting Editor to *FWW*.]

Fixing bandsaw vibration

Last year I purchased a Taiwanese bandsaw, and at the price I paid I didn't expect the best. But even after numerous adjustments, I still have trouble with vibration. What can I do to get the saw running smoothly? —Carl Mullin, Virginia Beach, Va.

Mark Duginske replies: Bandsaws have a tendency to vibrate more than other woodworking machines because of their many moving parts. Your vibration problem may be due to a number of different things: a bad motor or motor mount, an out-of-true pulley, a frayed drive belt, a bent shaft, an eccentric wheel (one that is not round and creates vibration when it spins), bad tires or even just a bad blade. It's also



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possible that several of these elements are working together to create vibration. The problem is frustrating, because undue vibration affects the quality of the cut and makes it difficult to perform good work on the machine.

It's best to isolate the vibration problem systematically, checking just one element at a time. Start with the motor and drive system: Take the blade off the saw and the belt off the motor. Run the motor to see if it vibrates. If it does, take the pulley off and run the motor without the pulley. If vibration occurs without the pulley, you'll need to see if there's a problem with the motor mount or saw stand. To do this, unbolt the motor from the saw and run it while it's clamped to the workbench. If the motor doesn't vibrate, your saw stand may need some work. You may consider building a new wooden stand or you could reinforce your metal stand with plywood. If the motor still vibrates on the workbench, start looking for a new motor. If, after alterations, you still experience slight vibration, try putting some dense foam padding or a rubber mat under the motor or the saw.

The next step in testing for vibration is to remount the motor, hook up the drive belt and try the saw without the blade. This will give you feedback on the saw pulley, the belt, the bottom wheel and the wheel's shaft. If there is vibration, it may be hard to detect the cause. You should start by replacing the drive belt, because it's inexpensive and may solve the problem. Most imported bandsaws come with cheap cast-alloy pulleys that should be replaced with new, machined steel pulleys that can be expensive, but run true and are long lasting. Also, check the alignment of the wheel and motor pulleys by holding a straightedge or a straight board against them and sighting any gaps along the rims. If the pulleys are misaligned, shift the position of the motor or mount as necessary.

Check the bottom bandsaw wheel shaft next. The best way to determine if there's eccentricity is to take the lower wheel off and check the shaft with a dial indicator for runout. If you don't have a dial indicator, run the saw momentarily, turn it off and watch the shaft as it slows down to see if it moves in an eccentric fashion. If the shaft appears bent, you may need to get a new one from the saw manufacturer.

After reinstalling the bottom wheel, the next step is to check the bandsaw wheels themselves for eccentricity or balance problems. An untrue wheel may be due to two factors: the wheel itself may not be round or it may be that the tire, which acts as a cushion for the blade, is worn or not of uniform thickness. Both the tire and the wheel have to work together if the saw is to run smoothly. Lack of trueness in a new wheel may be due to the manufacturer's poor quality control. Problems in an older saw may be due to the blade being left under full tension all the time. This can cause the wheel castings to warp and/or compress the tire. Both conditions result in an untrue wheel and vibration problems.

You can get a rough estimate of the trueness of your bandsaw wheels by switching on the saw (again, with the blade off) and watching the bottom wheel spin. If the bottom wheel appears to shudder as the saw slows down, it's likely to be eccentric or out of balance. You can test the roundness of the wheel with a dial indicator if you have one. The last check is to run the saw with the blade installed. If you have vibration, it's most likely that your wheels are untrue. Also, try running a couple of different blades, just in case a bad weld on one of the blades is the problem.

Unfortunately, there usually is no simple solution to wheel balance problems. If you suspect that the tire is the problem, replace it or turn the existing tire true by clamping a piece of wood to the saw frame, to serve as a tool rest, and use a very

sharp ⅛-in. gouge. To rotate the wheel for truing, use a 1-in. or 1½-in. sanding drum chucked in a portable electric drill as a friction drive. This is a potentially dangerous operation, so be careful. Also, you don't want to remove any more material than you need to, so cover the whole tire with chalk, and when the chalk is gone, stop truing.

After the tires have been replaced or turned round, it's time to balance the wheels. With the blade off, spin each wheel and let it come to a stop on its own. Mark the position of the wheel at the bottom, as the heaviest part will settle there. Recheck the position by spinning the wheel several times. If it usually stops in the same place, the wheel is definitely out of balance. To restore balance, remove a bit of metal from the heavy side by drilling small holes on the edge of the rim. Continue checking by alternately spinning and removing metal until the wheel no longer stops consistently in the same position.

[Mark Duginske is a woodworker, teacher and author who lives in Wausau, Wis.]

Repairing an antique chest

A friend brought me a leg from an antique chest and asked me to repair it. In moving the piece, he split a section from one of the feet, and then tried to repair the damage by gluing the pieces together with hot-melt glue. The holt-melt glue left gaps in the seam, which he filled with spackle. The break doesn't weaken the leg, but I need a way to soften the hot-melt glue so I can take the splintered section apart and glue it properly. —Ron Honthaner, Studio City, Cal.

Bob Flexner replies: You may be able to pry open the two parts with a screwdriver, since the thick hot-melt glue will probably be somewhat rubbery. If this doesn't work, carefully scrape the spackle from the edges of the break and remove the glue, using lacquer thinner as a solvent. Squirt the thinner into the gap with a syringe or eye dropper and keep the glue wet with the thinner until it softens and you can separate the parts. Take care to wear eye protection, lest the thinner squirts out unexpectedly; also, keep the solvent off your skin and work in a ventilated area. Once the parts are separated, rub the glue with a cloth soaked with the solvent and/or scrape until all the glue is removed and the wood feels raw. Avoid getting lacquer thinner on the finish, as this solvent will dissolve or lift most finishes.

Once the solvent has evaporated and the wood is dry, you can reglue the leg, using whatever glue was used to put the chest together in the first place (probably hide glue). Since the break in the leg is not structural, you should be able to get a good, sound bond, even if there are a few small gaps between the parts where the pieces had been scraped or splinters had broken off.

[Bob Flexner professionally finishes and restores furniture in Norman, Okla.]

Mysterious oily film

Some time ago, I built a pine hutch, and finished it, inside and out, with Watco stain and oil finish. Unfortunately, glassware that's stored in the hutch for even a short time becomes coated with an oily film. I sealed the interior of the hutch with shellac, and that reduced the problem, but didn't eliminate it. Do you have any suggestions? —Jonathan Wagman, Ulster Park, N.Y.

Michael Dresdner replies: Your problem reminds me of the story about the man who visited his doctor complaining of hip pain. When a battery of tests revealed no abnormalities, the doctor was stumped until he noticed the bulging wallet in the patient's hip pocket. He advised the patient to remove the wallet

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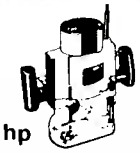

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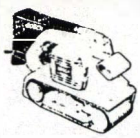

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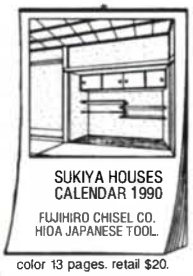

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before sitting down, and, of course, the pain ceased. As a further gesture of concern, the doctor presented his bill, which helped to trim the size of the offending wallet considerably.

Like the doctor, you should look for an alternative source for your oily film, as the dried Watco finish is more than likely not the culprit. I've noticed that the glassware in my kitchen cabinets also acquires an oily film during storage, and my cupboards are made of lacquered plywood. Therefore, I'm fairly certain that the problem is the fine mist of oil that becomes airborne while cooking.

However likely my guess is, there is a remote possibility that the mineral spirits in the Watco are reacting with the pitch in the pine, if the wood was not dried properly. Such a reaction could cause the filming you describe, but this is an extremely rare and unlikely situation. However, if this is occurring, the Watco oil can still come through a sealer coat of shellac. Topcoating the Watco with a reactive finish, like a curing urethane varnish, is a much better idea.
[Michael Dresdner is a Contributing Editor for *FWW* and a finishing consultant in Zionhill, Pa.]

Finishing the insides of canisters

I once made a set of maple kitchen canisters and a cherry cigar humidor and finished them inside and out with clear lacquer. However, the containers have been unusable for years because the lacquer smells so bad, even with the lids off. How do I keep that smell from penetrating anything stored inside?
–Michael Harvey, Sherwood Park, Alta., Canada

Kip Christensen replies: I can relate to your dilemma. In my first woodworking class, I made a bread box. The project came out fine, except that I finished the piece inside and out with Watco Oil. My family used the bread box for a time, but before long, no one would eat the bread because it had acquired a synthetic taste from the finish.

I am not an expert on chemicals and finishes, but I know that the odors you're concerned about are not a result of the lacquer solids (which, independent of the solvents, are basically inert), but rather of the solvents in the lacquer mixture. These solvents should have evaporated completely, but if the canisters were sealed before the finish was completely dry, the smell might have also been sealed in and the odor would likely have penetrated the wood.

To eliminate the odor, I'd start by removing the canister lids to let any solvent residue dissipate. To speed up the process, you could try repeatedly heating the insides of the open canisters with a hair drier until they are warm to the touch. Filling the canisters with baking soda could also help because it absorbs the solvent just as it does odors in your refrigerator. Of course, one solution is to make a new set of canisters and either finish the insides with odorless, light mineral oil or just leave the wood bare.
[Kip Christensen is a woodturner and Assistant Professor of industrial education at Brigham Young University in Provo, Utah.]

Problems with an inlaid tabletop

I have a 40-year-old tabletop inlaid with small pieces of oak, Douglas fir, white pine, Philippine mahogany, black walnut and red cedar. The inlays are 1/8 in. thick and are glued to a substrate of 1/4-in. fir plywood with LePage's liquid hide glue. The top has a polyurethane finish, but the glue keeps creeping out between the joints. How can I prevent the glue from rising and spoiling the finish? –Elmer Cooper, McDonald, Kan.

Bob Flexner replies: It's not likely that your problem is caused by the glue creeping out between the pieces of inlay. First of all, hide glue does not creep like white and yellow glue, and secondly, the glue is 40 years old—not even white or yellow

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#222		1/4" Fingernail	1/4" Dia. of Circle		1/2"	1/4"	$12.50
#223		3/8" Fingernail	3/8" Dia. of Circle		5/8"	1/4"	$13.00
#224		1/2" Fingernail	1/2" Dia. of Circle		3/4"	1/4"	$13.50
#225		5/8" Fingernail	5/8" Dia. of Circle		7/8"	1/4"	$14.50
#506		1/2" Pattern	Flush Trim	1/2"	1"	1/4"	$15.00
#507		5/8" Pattern	Flush Trim	5/8"	1"	1/4"	$16.00
#508		3/4" Pattern	Flush Trim	3/4"	1"	1/4"	$17.00
#340		1/8" Cove	1/8" R	5/8"	1/2"	1/4"	$12.00
#341		1/4" Cove	1/4" R	1"	1/2"	1/4"	$13.00
#342		3/8" Cove	3/8" R	1 1/4"	9/16"	1/4"	$14.00
#343		1/2" Cove	1/2" R	1 1/2"	5/8"	1/4"	$15.00
#644		3/4" Cove	3/4" R	1 7/8"	3/4"	1/2"	$28.00
#350		1/8" Round Over	1/8" R	3/4"	1/2"	1/4"	$11.00
#351		3/16" Round Over	3/16" R	7/8"	1/2"	1/4"	$11.00
#230		1/4" Round Over	1/4" R	1"	1/2"	1/4"	$12.00
#354		3/8" Round Over	3/8" R	1 1/4"	5/8"	1/4"	$15.50
#355		1/2" Round Over	1/2" R	1 1/2"	3/4"	1/4"	$17.00
#656		3/4" Round Over	3/4" R	2"	7/8"	1/2"	$21.00
#657		1" Round Over	1" R	2 1/2"	1"	1/2"	$33.00
#199		Multiform Moulding	Unlimited Patterns	2 1/4"	2"	1/2"	$40.00
#601		1/8" Spiral Cutter		1/8"	1/2"	1/4" *	$ 9.00
#602		3/16" Spiral Cutter		3/16"	5/8"	1/4" *	$12.00
#603		1/4" Spiral Cutter		1/4"	3/4"	1/4"	$12.00
#903	Solid Carbide	1/4" Spiral Cutter		1/4"	3/4"	1/2" *	$12.00
#904		3/8" Spiral Cutter		3/8"	1"	1/2" *	$24.00
#905		1/2" Spiral Cutter	*Proper Adaptor Will Be Supplied	1/2"	1 1/2"	1/2"	$29.00
#402		3/8" Dovetail	8 degree For	3/8"	1/2"	1/4"	$12.00
#404		1/2" Dovetail	8 degree Leigh	1/2"	13/16"	1/4"	$12.00
#708		1 1/16" Dovetail	8 degree Jigs	1 1/16"	1"	1/2"	$17.50

ITEM NO.	BEST CUT BEST PRICE	DESCRIPTION	ANGLE/DEPTH/RADIUS CIRCLE DIAMETER	LARGE DIA.	CUTTING LENGTH	SHANK SIZE	PRICE
#415		1/4" Core Box	round nose	1/4"	1/4"	1/4"	$10.00
#416		3/8" Core Box	round nose	3/8"	3/8"	1/4"	$11.00
#417		1/2" Core Box	round nose	1/2"	11/32"	1/4"	$14.00
#418		3/4" Core Box	round nose	3/4"	5/8"	1/4"	$15.00
#719		1" Core Box	round nose	1"	3/4"	1/2"	$18.00
#470		1/4" Straight	plunge cutting	1/4"	3/4"	1/4"	$ 7.00
#471		5/16" Straight	plunge cutting	5/16"	1"	1/4"	$ 7.00
#472		3/8" Straight	plunge cutting	3/8"	1"	1/4"	$ 7.00
#473		7/16" Straight	plunge cutting	7/16"	1"	1/4"	$ 7.00
#474		1/2" Straight	plunge cutting	1/2"	1"	1/4"	$ 7.00
#775		1/2" Straight	plunge cutting	1/2"	2"	1/2"	$14.00
#476		9/16" Straight	plunge cutting	9/16"	1"	1/4"	$ 7.00
#478		5/8" Straight	plunge cutting	5/8"	1"	1/4"	$ 8.00
#479		3/4" Straight	plunge cutting	3/4"	1"	1/4"	$10.00
#500		3/8" Flush	Trimming	3/8"	1/2"	1/4"	$ 7.00
#502		1/2" Flush	Trimming	1/2"	1/2"	1/4"	$ 7.50
#503		1/2" Flush	Trimming	1/2"	1"	1/4"	$ 8.50
#804		1/2" Flush	Trimming	1/2"	1 3/16"	1/2"	$ 9.00
#545		Tongue & Groove	Straight	1 5/8"	1"	1/4"	$30.00
#845		Tongue & Groove	Straight	1 5/8"	1"	1/2"	$30.00
#546		Tongue & Groove	Wedge	1 3/16"	1"	1/4"	$30.00
#846		Tongue & Groove	Wedge	1 5/8"	1"	1/2"	$30.00
#450		1/8" Beading	1/8" R	3/4"	1/2"	1/4"	$11.00
#451		3/16" Beading	3/16" R	7/8"	1/2"	1/4"	$11.00
#233		1/4" Beading	1/4" R	1"	1/2"	1/4"	$13.00
#453		5/16" Beading	5/16" R	1 1/8"	1/2"	1/4"	$14.00
#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
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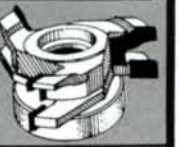

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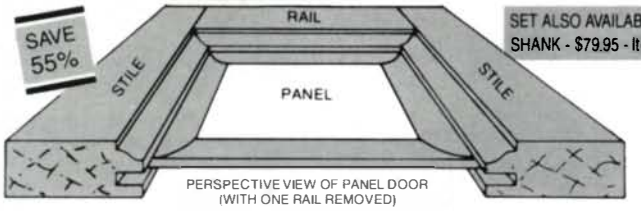

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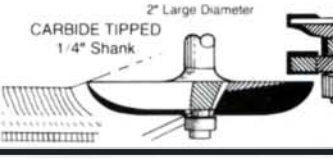

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READER SERVICE NO. 63

glue will creep when it becomes that old and brittle. Your problem is probably due to the edges of the inlay lifting up from the plywood as the top side of the veneer shrinks more than the bottom side. This is a natural occurrence in old furniture decorated with marquetry, parquetry or crossbanding.

Refinishing the top won't solve the problem; no finish totally protects wood from air and moisture, which cause the shrinking. In fact, nothing will correct the problem short of removing all the pieces and regluing them to the plywood. Stripping and sanding will be only a temporary cure because the edges will probably still rise. Your best bet is to learn to appreciate the top's condition as a natural characteristic of age in a piece of inlaid furniture.

[Bob Flexner's videos, *Repairing Furniture* and *Refinishing Furniture*, are available from The Taunton Press, Box 355, Newtown, Conn. 06470.]

Streaks in walnut

After planing some roughsawn walnut, I noticed that its figure contained light grayish-brown streaks, shown above. The streaks are about 1/4 in. wide and run the length of a 10-ft. board. What caused these streaks and what can I do about them? —*Sam Elsey, Camden, Tenn.*

Jon Arno replies: Judging from the sample, the light streaks appear to be decayed areas. These areas are lighter in color than the normal wood, but they appear softer and they also contain occasional worm holes. I suspect the walnut tree was invaded by beetle larvae and their tunneling provided access to fungi that attacked the surrounding wood tissue.

This problem isn't very common with walnut. Borers will often infest sapwood, but walnut heartwood is normally very durable. As the growing tree converts sapwood to heartwood, it releases chemical substances that are transported toward the center of the trunk or branch, via the rays, and stored in dead interior cells. In walnut, these substances polymerize to produce the wood's attractive dark color. However, their biological purpose is to protect the tree and they are quite toxic to decay-causing organisms.

The sad reality is that no wood is totally immune to decay when adequate moisture is present and fungi have an opportunity to develop in the wood. Unfortunately, there is no way to undo the damage once decay has occurred. Even if the wood is structurally sound, it will be difficult to hide the discoloration. Because the decay streaks are soft and porous, any attempt to touch them up with stain will probably darken them considerably, making them even more noticeable.

[Jon Arno is a woodworker and amateur wood technologist in Schaumburg, Ill.]

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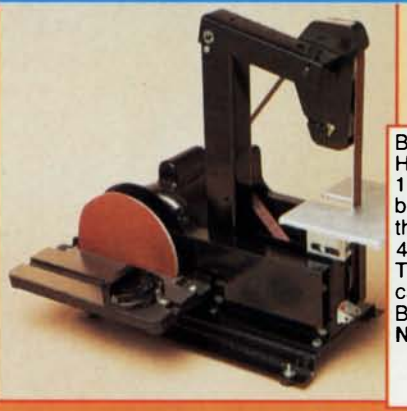

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READER SERVICE NO. 163

by Dick Burrows

Problems with tablesaws—We do our best to evaluate the power, adjustability, stability, accuracy and other features of various stationary power tools, but many readers have asked about durability, especially on shop workhorses such as the tablesaw. It's one thing to test a tool for a month or so, and another to use it heavily for years, for all sorts of jobs and materials. We think the best way to get this kind of information is to ask our readers.

What sort of problems have you encountered over the years with your tablesaw? Did it turn out to be underpowered? Was it difficult to maintain? Did you find yourself constantly having to realign it? Did the fence live up to the manufacturer's claims? How many hours per month do you run your saw? Has your saw maintained a high degree of accuracy during these periods? Are you sorry you didn't buy another model? We'd be interested in hearing about any of your experiences that you think might be valuable for other readers.

Please send your comments to Tablesaws, c/o Dick Burrows, Editor, *Fine Woodworking,* 63 S. Main St., Newtown, Conn. 06470.

Designing computer furniture—Computer desks, cabinets and other furniture for the electronic age are hot items, if the letters and calls we received after we discussed the subject in *FWW* #77 are any indication. Some of the letters dealt with the need to make computer furniture really adjustable, and some with possible safety concerns that we thought should be passed along.

Dr. Pendleton Tompkins, an obstetrician in San Mateo, Cal., pointed out that American medicine is becoming more aware of dangers associated with Video Display Terminals (VDTs). For pregnant women, these include risk of miscarriage, premature labor and fetal abnormalities. He said vision disturbances and, in at least two cases, cataracts have also been associated with VDTs.

Tompkins referred us to a book-length series of articles by Paul Brodeur in *The New Yorker* (June 12, 19 and 26, 1989). He said the articles indicated that VDTs can be dangerous in all directions and there is no way to screen out all the electromagnetic fields. "However, users are much safer if they sit 28 in. or more from the screen in front of them and 40 in. away from the back of the screen. These safe distances should be shown in your diagram in *FWW* #77, p. 32."

B.R. Wilkinson, an occupational ophthalmologist in Nanaimo, B.C., Canada, said he thought several of the pieces of furniture in the article looked as if they would be impractical for a person who wears bifocal glasses because there was no allowance made to bring the monitor down to bifocal area. "While young people who have no difficulty focusing often like to have the monitor almost level with their eyes, this is not practical for older people who will be much more comfortable with it considerably lower. It is even possible that they would prefer a recess in the table to get the screen as low as possible."

Dr. Wilkinson said the article prompted him to start drawing designs, and he offered a couple of other thoughts for those planning new furniture. First, he cited computer stands designed to make it easy to adjust the monitor position. A small stand, he said, can make it easy to tip and rotate the monitor to eliminate annoying light reflections on the screen. Anything that allows delicate and accurate adjustment of the workstation does wonders in reducing computer fatigue.

George McCue of Kirkwood, Mo., was also concerned about vision, saying he was puzzled that high-tech furniture such as computer workstations was so consistently designed, as shown in *FWW* #77, with a 60° angle between the top of the monitor (at the operator's eye level) and the keyboard.

"The reason may be that so many computer operators are still young. A surprise awaits them in their first confrontation of keyboard and monitor with bifocal glasses, for then instead of shifting their line of sight from one to the other with a flick of eye movement, the movement will involve the entire head in aligning the reading lens in the lower part of the glasses with whichever computer component they need to view." He points out that none of this head-bobbing occurred in the old days of the typewriter when paper and keyboard were only 10° or so apart.

To help cure the problem, he recommends a feature on his computer desk, which he calls "The Pit." His monitor rests on a part of the desk that is dropped 3 in. below the work surface. He says this arrangement brings the eye/keyboard relationship to about 30°, close to the old typewriter paper/keyboard relationship. Another possibility, he suggests, is to get a pair of full-lens reading glasses, designed for the eye-keyboard-monitor range you most often use.

As we indicated in the "Letters" column in *FWW* #78, several readers warned against using magnetic latches with computer workstations. Lennart Andre of Danielson, Conn., for example, called the magnetic latches "a design flaw which could cause grave results. *Never* use magnetic door catches near computer equipment. Magnets and computers do not mix. The possible erasure or curruption of data on diskette (or hard disc) is likely when magnets are in the computer vicinity." Andre recommended substituting mechanical catches for the magnetic catches as soon as possible.

In our article, we pointed out that designing computer furniture was a relatively new field, and we hoped readers would send us pictures of their designs. We have received several interesting ones, but we are still interested in seeing more. Please send them along.

Proper credit for turner—A group including some of the world's best woodturners recently made a special "Carousel of Canes" honoring Albert LeCoff, who has been very influential in promoting the resurgence of woodturning in recent years. We featured some pictures of the canes on the back cover of *FWW* #78, along with a brief article on LeCoff and the presentation of the canes. LeCoff was obviously pleased and honored by the whole thing, and in the excitement gave us some wrong information on the maker of one of the canes. An understandable mistake, and we would like to now give credit where it's due. The cane that has a handle that unscrews into a container was actually made by R.W. Bob Krauss of Crescent City, Cal.

More sources of supply—We try to list sources of supply for all of the unusual or difficult-to-find tools and materials that are mentioned in our articles. Most often we use the suppliers recommended by the authors of each article. And whenever possible, we try to list at least one mail order supplier or the phone number and address of the manufacturer, who in turn can advise you of your local supplier.

Often companies not mentioned in the articles will call to advise us that they offer the same products, and we'll pass that information along to you from time to time.

Ernie Conover, for example, of Conover Woodcraft Specialties, 48125 Madison Rd., Parkman, Ohio 44080; (216) 548-3481, called after reading the turning article "Backyard Timber, Tabletop Treasure" in *FWW* #78. He advises, "Our company supplies super glue as described in the article, as well as deep fluted bowl gouges in both ¼-in. and ½-in. sizes. Our bowl gouges are manufactured by us from pure M-2 high-speed steel."

If you are looking for hardware for some of the projects in *FWW*, you might check with Paxton Hardware, 7818 Bradshaw Rd., Upper Falls, Md. 21156; (301) 592-8505. Ledley Clarke Boyce, the president of the company, advises us that they also have the hardware for three of the projects listed in the May/June issue: the pencil-post bed, the campaign chest and the display cabinet. The company also offers an illustrated catalog. □

Dick Burrows is editor of Fine Woodworking.

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DA3000W	3/8" angle drill, 7.2 volt	238	130
4390DW	9.6 volt cdls recip saw kit	218	124
6010DL	3/8" drill w/flashlight, 7.2 volt	198	115
6092DW	V/spd drill, kit complete	237	120
6093DW	V/spd drill w/clutch—complete	248	125
6891DW	Drywall gun 0-1400, 9.6 volt	225	119
632007-4	9.6 volt battery	49	30
632002-4	7.2 volt battery	42	28
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3612BRG	3 H.P. router w/set of guides —holder, straight, & trimmer	422	234
3620	1 1/4 H.P. plunge router w/cse	182	105
3612B	3 HP plunge router sq/base	376	195
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9924DB	3"x24" belt sander w/bag	268	149
9045B	1/2 sheet finish sander	216	125
9207SPC	7" sander-polisher	262	149
804550	1/4 sheet pad sander w/bag	85	55
9900B	3"x21" belt sander w/bag	254	145
9035	1/3 sheet finish sander	100	65
9045N	1/2 sheet sander w/bag	219	125
804530	6" round sander	95	59
GV5000	Disc sander 5"	109	69
9401	4"x24" belt sander w/bag	302	165
	•••GRINDERS•••		
9501BZ	4" grinder, 3.5 amp	137	69
9503BH	4 1/2" sander-grinder	153	89
9609B	9" angle grinder, 15 amp	230	145
9505BHZ	5" disc grinder, 5.1 amp	163	99

Model		List	Sale
	•••SAWS•••		
5007NBA	7 1/4" circular saw w/elec. brake	228	124
5007N8K	5007NBA with case	265	150
4200N	4 3/8" circular saw 7.5 amp	213	119
4301BV	Orb. var/spd jig saw 3.5 amp	274	149
JR3000V	Var/spd recip saw w/case	224	124
9820-2	Blade sharpener	354	199
JV1600	Variable speed jig saw	220	129
JV2000	Variable speed orb. jig saw	242	135
5402A	16" circular saw - 12 amp	605	328
LS1440	14" Miter saw	624	425
2414	14" cut-off saw AC/DC	350	205
5008N8A	8 1/4" saw w/electric brake	276	155
5201NA	10 1/4" circular saw 12 amp	560	295
JR3000WL	2 speed recip saw w/cse	220	122
LS1020	New 10" miter saw	440	239
2708W	8 1/4" table saw w/carb. blade	474	255
2711	10" table saw w/brake	800	479
5005BA	5 1/2" circular saw	211	119
4302C	Var/spd orbital jig saw	287	155
5077B	7 1/4" Hypoid saw	248	138
5007NB	7 1/4" circular saw 13 amp	209	119
	•••PLANERS•••		
2012	12" portable planer, 12 amp	930	499
1900BW	3 1/4" planer w/case	198	114
2040	15 5/8" planer	2470	1525
1100	3 1/4" planer w/case	381	209
410	Dust collection unit	480	269
2030N	12" planer/jointer	2970	1825
1805B	6 1/8" planer kit w/case	646	359
	•••DRYWALL GUNS•••		
6800D8	2500 rpm 3.5 amp, drywall	140	89
6801DB	4000 rpm 3.5 amp, drywall	140	89
6800D8V	0-2500 rpm 3.5 amp, drywall	154	95
6801DBV	0-4000 rpm 3.5 amp, drywall	154	95
6805BV	0-2500 rpm, 4.8 amp	177	109
6820BV	0-4000 rpm, 5.2 amp	194	99
	•••DRILLS•••		
DA3000R	3/8" angle drill 0-1400 rpm	256	145
DP4700	1/2" v/spd w/rev. 4.8 amp	198	119
HP2010N	3/4" v/spd hammer drill w/cse	285	165
6404	3/8" drill 0-2100 rpm, 2 amp.	102	65
6510LVR	3/8" drill rev. 0-1050 rpm, 3.5 amp	137	79
6013BR	1/2" drill rev. 550 rpm, 6 amp	240	135

3612BR 3 H.P. Plunge Router With Round Base Sale 189

LS1020 10" Miter Saw w/Freud LU84M011 50 tooth carbide blade Sale 279

SKIL

2735-04 12V Var/spd Cordless Drill Kit Complete With Case & 2 Batteries Sale 135

77 The Famous Skil 7 1/4 Worm Drive Saw Sale 139

Model		List	Sale
	•••JIG SAWS•••		
4580	Vari - orbit jig saw w/cse.	144	105
4540	Var/spd adjustable straight line	107	75
4560-02	Var/spd adjustable auto-scroll w/case	118	79
	•••SANDERS•••		
7102	2 1/2"x16" belt sander	65	55
7212	3"x18" belt sander	89	65
7845	4"x21 3/4" belt sander	259	175
7313	3"x18" belt sander 4.5 amp	72	64
595	3"x21" sander w/bag 5.5 amp	197	125
7575	1/4 sheet palm sander	52	49
7582	1/3 sheet palm sander	101	75

Model		List	Sale
	•••SAWS•••		
5865	(825) 8 1/4" worm drive saw	2 50	164
5250	2 1/4 HP circular saw	68.99	64
5790	(810) 10 1/4" circ saw drop foot	400	269
5750	(807) 7 1/4" circ saw drop foot	198	142
5625	(552) 6 1/2" circular saw	175	124
3810	10" Miter saw	263	219
5825	(367) 6 1/2" worm drive saw	229	148
5350	2 1/3 HP circular saw	80.99	74
5656	(553) 7 1/4" circular saw	132	119
5765	(808) 8 1/4" circular drop foot	216	149
5665	(554) 8 1/4" circular saw	204	145
5510	(551) 5 1/2" circular saw	112	95
77-04	7 1/4 worm drive saw kit comp w/cse, 24 tooth carbide blade & adjustable rip fence	271	175

3810 10" Motorized Miter Saw 15 amp — Sale 219

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PORTER CABLE

9850 Cordless Drill Kit with Extra Battery—Sale 159

555 Plate Jointer with Assorted Biscuits—Sale 189

Model		List	Sale
	•••ROUTERS•••		
630	1 H.P. router 6.8 amp	175	110
690	1 1/2 H.P. router 8 amp	225	120
691	1 1/2 H.P. router D handle	245	135
536	1 1/2 H.P. speedmatic router	310	195
518	3 H.P. 5 speed router	560	335
520	3 H.P. 15 amp router	510	315
309	3.8 amp laminate trimmer	135	85
695	1 1/2 H.P. router/shaper	310	195
696	Heavy duty shaper table	170	119
100	7/8 H.P. router	165	99
537	1 1/2 H.P. D handle router	325	199
5060	"Stair Ease" stair templet	194	125
5061	"Stair Ease" hard wood	204	135
5008	Dovetail template kit	99.50	79
5009	Mortise & Tenon jig	54.95	49
43451	Carbide bit for 5009 jig	18.95	15
7308	laminate slitter	190	129
5116	omni-jig	395	269
	•••SANDERS•••		
351	3"x21" belt sander w/o bag	225	125
352	3"x21" belt sander w/bag	235	129
360	3"x24" belt sander w/bag	310	179
361	3"x24" belt sander w/o bag	290	169
362	4"x24" belt sander w/bag	325	185
363	4"x24" belt sander w/o bag	310	179
505	1/2 sheet pad sander	195	114
330	Speed block sander 1/4 sheet	97	58
303	Paint remover	235	149
304	7" disc sander 4000 rpm	200	125
305	7" disc polisher 2000 rpm	200	129
	•••SAWS•••		
315-1	7 1/4" top handle 13 amp circ saw	195	115
9315-1	315-1 comp. w/cse. & carb. blade	225	129
617	7 1/4" pushhandle saw 13 amp	195	115
9617	617 comp. w/cse. & carb blade	225	129
368-1	8 1/4" top handle saw 13 amp	205	135
314	4 1/2" trim saw 4.5 amp	215	125
345	6" saw boss 9 amp	170	99
9345	345 compl. w/cse. & carb. blade	200	129

Model		List	Sale
	•••DRILLS•••		
7556	1/2" right angle drill	295	175
7511	0-1000 rpm 3/8" v spd drill 5.0 amp	185	109
7514	0-750 rpm 1/2" v spd drill 5.0 amp	195	119
7545	0-2500 rpm drywall gun 5.2 amp	169	99
7540	0-4000 rpm drywall gun 5.2 amp	165	98
666	0-1200 rpm 3/8" H.D. v spd drill	185	122
621	0-1000 rpm 3/8" H.D. v spd drill	155	95
659	0-4000 rpm drywall gun 4 amp	130	79
9850	12 volt cordless drill w/cse	230	129
8500	Extra 12v battery	48	35
	•••JIG SAWS•••		
548	X HD bayonet saw	265	169
9548	X HD bayonet saw w/case	290	179
7548	Top handle jig saw 4.8 amp	230	125
7648	Barrel grip jig saw 4.8 amp	225	135
	•••RECIPRO SAWS•••		
9629	Recip saw var/spd. 8 amp	235	135
9627	Recip saw 2 var/spd 8 amp	225	125
9647	TIGER CUB recipro saw	195	119
	•••PLANERS•••		
320	Abrasive plane 3 amp	160	99
9118	Porta plane 7 amp kit	335	189
9652	Versa plane 10 amp kit	430	275
367	3 1/4" planer 6.5 amp	225	145
	•••NEW TOOLS BY PORTER CABLE•••		
7399	5.6 amp drywall cutout unit	120	79
43218	Drywall cut-out bit	9.50	5.50
7310	5.6 amp laminate trimmer	145	95
7312	5.6 amp offset base lam trimmer	209	125
7319	5.6 amp tilt base lam trimmer	165	105
97310	LAM TRIM KIT W/STD BASE, TILT BASE, OFFSET BASE, SLITTER BASE, GUIDE & CSE	330	189
7334	6000 rpm 3.7 amp 5" random orbit sander	205	125
693	1 1/2 H.P. plunge router	280	169
97750	1/2" var/spd hammer drill w/cse	260	169
6931	Plunge router base	120	79

Porter Cable 690 1 1/2 H.P. Router—Extra Special 120

BOSCH

1581 VS Top Handle Jig Saw with Case—Sale 155

1273 DVSK Var/Spd. 4x24 Belt Sander with Stand — Sale 205

Model		List	Sale
	•••ROUTERS•••		
1608	5.6 amp laminate trimmer	140	89
1608L	Same as above w/trimguide	145	92
1608T	5.6 amp tilt base trimmer	159	99
1609	5.6 amp offset base trimmer	205	122
1609K	Laminate installers kit w/1609 Offset base, trimmer tilt base, trimguide, 1/4" collet, collet nut, wrenches, hex keys and case	295	169
1601	1 H.P. Router 25,500 rpm	165	105
1602	1 1/2 H.P. Router 25,000 rpm	199	125
1603	1 1/2 H.P. D handle router	223	135
1604	1 3/4 H.P. 2 handle router	219	118
1604K	Same as above w/cse & access.	269	159
1606	1 3/4 H.P. D handle router	243	145
1611	3 H.P. plunge router	349	198
1611EVS	"NEW" 3 H.P. electric var/spd. plunge router	410	255
1611-220V	3 H.P. plunge router 220 volt	383	249
90300	3 1/4 H.P. router	500	339
	•••DRILLS•••		
11-212VSR	Bulldog 3/4" SDS rotary drill	339	189
1196VSRK	3/8" var/spd. hammer drill w/cse	215	110
1198VSR	1/2" var/spd. hammer drill	229	129
3050VSRK	"NEW" 9.6V var/spd. cdls. drill w/case & 2 batteries	235	159
91064	3/8" var/spd. mighty-midget drill	169	105
91066	1/2" var/spd. mighty-midget drill	179	115
1158VSR	Var/spd. 3/8" drill 2.8 amp	99	69

Model		List	Sale
	•••HEAT GUNS•••		
1942	Heat gun 650°-900°	99	69
3268	Heat gun 600° & 1000°	89	65
	•••SAWS•••		
1581VS	Top handle jig saw	239	129
1582VS	Barrell grip jig saw	225	123
8C	Bosch metal case for above jig saws		28
8BA	Bosch blade assortment for jig saws—30 of Bosch's best selling blades		23.99
1652	8 1/4" circular saw	189	119
1651	7 1/4 circ. saw drop foot	179	99
1654	7 1/4 circ. saw pivot base	179	99
1632VSRK	Recip saw 8.4 amp orb var/spd	225	135
	•••SANDERS•••		
1290	1/2 sheet finishing sander	199	129
1290D	1/2 sheet finishing sander w/bag	205	135
1272	3"x24" belt sander	279	165
1272D	3"x24" belt sander w/bag	299	175
1273	4"x24" belt sander	295	169
1273D	4"x24" belt sander w/bag	315	179
3270D	3"x21" belt sander w/bag 5 amp	225	135
1273DVS	Var/spd. 4x24 belt sander	339	189
	•••PLANER•••		
3258	3 1/4" planer w/blade guard	210	129
3258K	3258 planer w/cse	235	145
11304	"The Brute" Breaker Hammer	1950	1195

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DELTA BENCH TOP TOOLS

Model		List	Sale
23-700	Wet/dry grinder	201	159
23-680	6" bench grinder ¼ H.P.	81	66
23-880	8" bench grinder ½ H.P.	136	105
23-980	10" bench grinder 1 H.P.	246	235
11-950	8" drill press	164	135
14-040	14" drill press	313	309
40-150	15" hobby scroll saw	178	139
28-160	10" hobby band saw	189	144
31-050	1" belt sander 2.0 amp.	93	75
31-460	4" belt/6" disc sander	178	139
31-340	"NEW" 1" belt/8" disc sander	226	169

DELTA STATIONARY

		List	Sale
34-761	10" unisaw 1½ H.P.	1715	1339
34-740	Super 10" motorized table saw	690	439
34-429	10" tilting arbor bench saw 1½ H.P.	1479	1049
33-990	10" radial arm saw	727	565
11-072	32" radial drill press	487	399
37-280	6" motorized jointer	440	369
50-179	¾ H.P. 2 stage dust collector	435	339
50-180	1 H.P. dust collector	535	425
50-181	2 H.P. dust collector	760	619
37-154	Deluxe DJ-15 6" jointer w/¾ H.P. motor	1288	999
33-150	8¼" saw buck	770	499
34-670	10" motorized table saw	437	369
34-985	⅛ H.P. stock feeder	698	489
34-444	Table Saw Complete w/1½ H.P. motor & stand	845	619
34-445-34-444	Table Saw complete w/30" Unifence	1075	779
33-890	12" Radial Arm Saw 1½ H.P. complete w/legs	1710	1179
28-283F	14" Band Saw w/enclosed stand & ¾ H.P. motor	875	685
17-900	16½" Floor Drill Press	485	379
40-601	18" Scroll Saw w/stand & blds	995	689
34-080	10" Miter Box **Xtra Special**	289	209

NEW TOOLS BY DELTA

33-050	8¼" Sawbuck	742	559
34-330	8¼" Table Saw 13A	321	245
32-100	Stationary plate jointer	645	445
36-040	8¼ compound miter saw	216	169
70-200	20" Drill Press	905	719

MILWAUKEE TOOLS

		List	Sale
0395-1	9.6V cdlss. drill w/cse	264	159
0219-1	9.6V cdlss. drill w/cse	277	165
0385-1	7.2V cdlss. drill w/cse	174	115
0224-1	⅜" drill 4.5A magnum	189	112
0234-1	½" drill 4.5A mag 0-850 rpm	199	115
0244-1	½" drill 4.5A mag 0-600 rpm	199	115
0222-1	⅜" drill 3.5A 0-1000 rpm	174	105
0228-1	⅜" drill 3.5A 0-1000 rpm	164	98
0375-1	⅜" close quarter drill	208	129
0379-1	½" close quarter drill	243	145
6539-1	Cordless screwdriver 190 rpm	113	69
6540-1	Cdlss. screwdriver w/bits & cse	154	99
6546-1	Cdlss screwdriver 200 & 400 rpm	120	75
3102-1	Plmbrs rt angle drill kit	330	189
3002-1	Electricians rt angle drill	320	185
5399	½" D-hdle ham drill kit	304	185
1676-1	H.D. Hole Hawg w/cs	415	229
6511	2 sp SawZall w/cs	214	125
6405	8¼" circle saw	219	129
6750-1	Drywall gun 0-4000 4.5A	154	95
6507	TSC SawZall w/case	229	129
6170	14" chop saw	430	249
6012	Orbital sander 3⅝"x7⅜"	189	109
6014	Orbital sander 4½"x9¼"	199	115
6305	6¼" cordless circle saw	299	175
6753-1	Drywall gun 0-4000 3.5A	134	83
8977	Var. temp heat gun	114	75
5397-1	⅜" v. spd. hammer drill kit	232	145
5371-1	½" v. spd. hammer drill kit	318	179
3107-1	½" v. spd. rt angle drill kit	340	195
6754-1	Drywall gun 0-4000 4.5A	179	119
6747-1	Drywall driver-0-2500	154	95
0230-1	⅜" drill 0-1700 rpm	179	105
3300-1	½" v. spd. magnum rt angle kit	299	179
5660	Router 1½ H.P.—10 amp	299	189
5680	Router 2 H.P.—12 amp	350	225
5455	⅞" polisher 1750 rpm	209	125
6215	16" chain saw	280	179
8975	Heat gun	89	59
6365	7¼" circular saw	195	114
6366	7¼" circ saw w/fence & bld	204	119
6368	7¼" circ saw w/fence, bld & cse	233	135
0216-1	2 spd cordless drill Hi-torque	222	129
0235-1	½" drill keyless chuck mag	209	119
6016	¼ sheet pad sander	79	52
6145	4½" grinder 10,000 rpm	154	95
6142	6145 w/cse & access.	192	119
0239-1	½" drill keyless chuck	199	114
6749-1	Drywall gun 0-2500 4.5A	189	125
6377	7¼" worm drive saw	295	165

DAVID WHITE

		List	Sale
LP6-20	Level package including: level, tripod, rod & case	290	205
LT8300P	Level transit	739	525
LT6-900	Level transit	365	265
ALT6-900	Autolevel transit	549	395

ADJUSTABLE HANDSCREWS BY JORGENSEN

Item No.	Jaw Length	Open Cap	List	Sale	Box of 6
#5/0	4"	2"	12.88	7.75	43.00
#4/0	5"	2½"	13.83	7.95	45.30
#3/0	6"	3"	14.83	8.50	47.60
#2/0	7"	3½"	15.94	9.50	51.00
#0	8"	4½"	17.74	10.25	58.40
#1	10"	6"	20.29	12.39	68.10
#2	12"	8½"	23.29	14.25	78.00
#3	14"	10"	29.53	18.30	101.75
#4	16"	12"	38.38	23.75	139.95

STYLE 37 2½" Throat ¼"x¾" BY JORGENSEN

Item No.	Jaw Length	List	Sale	Box of 6
3706	6"	8.86	5.99	33.95
3712	12"	9.81	6.49	36.75
3718	18"	10.83	6.99	39.70
3724	24"	11.83	7.59	43.10
3730	30"	13.19	8.59	48.75
3736	36"	14.43	9.49	53.95

JORGENSEN STEEL I-BAR CLAMPS

Model	Size	List	Sale
7224	24"	25.82	16.50
7236	36"	27.71	17.50
7248	48"	30.44	18.50
7260	60"	33.90	21.99

PONY CLAMP FIXTURES

Model		List	Sale	Lots of 12
50	¾" black pipe clamps	12.48	7.50	80
52	½" black pipe clamps	10.41	6.00	65

STYLE J. ADJUSTABLE HANDSCREW KITS

Model	Length Jaws	List	Sale
J04	4	7.10	5.39
J06	6	8.13	5.89
J08	8	9.12	6.59
J10	10	10.66	7.29
J12	12	13.21	8.59

ADJUSTABLE CLAMP BENCH VISES

30404	4" swivel base bench vise	55.80	38.95
30505	5" swivel base bench vise	76.80	53.75
30606	6" swivel base bench vise	93.10	64.95

JORGENSEN RAPID ACTING VISES

40709	4"x7" Jaw with 9" opening	132.95	85.00
41012	4"x10" Jaw with 12" opening	156.75	98.00

SENCO AIR NAILERS

Model		List	Sale
SFN1	Finishing nailer 1" - 2"	377	268
SFN2	Finishing nailer 1½" - 2½"	571	398
SN2	General purpose 1⅞" - 3"	621	445
M2	General purpose 1⅜" - 2"	475	349
SN4	General purpose 2" - 3½"	685	475
LS2	Pinner ⅝" - 1"	351	255
SKS	Stapler ⅝" - 1½"	351	249
LS5	Pinner, 1" - 1½"	399	289
PW-RFR	Roofer, ½" - 1¼"	351	249
MW-DRFR	Roofer, ¾" - 1¾"	486	349

BOSTITCH AIR NAILERS

Model		List	Sale
N80C-1	Utility coil nailer	730	405
N80S-1	Stick nailer	760	409
T36-50	Sheathing & decking stapler	550	309
N12B-1	Coil roofing nailer	725	405
N60FN-2	Finishing nailer	595	355
T31	Brad nailer	245	149

RYOBI SPECIALS

		List	Sale
JP155	"NEW" portable 6" jointer/planer	545	329
R500	2¼ H.P. plunge router	326	159
TS25IU	10" miter saw	392	179
TS25IUS	10" miter w/acc. kit and B & D 73-770 carbide blade	435	225
AP10	10" surface planer 13 amp.	820	358
RA200	8¼" radial arm saw	515	245
RE600	3 H.P. plunge router	398	199
R150K	1 H.P. plunge router w/cse	206	99
BE321	3"x21" v/spd. belt sander	259	125
BD1020ARK	7.2v cdls. drill w/cse	193	79

HITACHI TOOLS

Model		List	Sale
TR6	Trimmer	177	95
TR8	Plunge router, 1½ H.P.	219	119
TR12	Plunge router, 3 H.P.	354	175
C10FA	10" dlxe. miter saw	490	269
C8FB	8½" slide compound saw	859	479
FREUD	LU91M008 - 8½" c/bld 48 tooth	58	45
C15FB	15" miter saw	745	399
FREUD	LU85M015 - 15" c/bld 108 tooth	181	115

LEIGH DOVETAIL JIGS

D1258-12—List 314.00—Sale 265.00
D1258-24—List 375.00—Sale 305.00
LEIGH INSTRUCTIONAL VIDEO—SALE 29.00!!

• •HOLIDAY SPECIALS• •

SAW KITS

		List	Sale
1581VSK	Bosch top hdle jig saw with case & 30 Bosch blades	300	179
1582VSK	Bosch barrell grip jig saw with case & 30 Bosch blades	280	172
C8FBK	Hitachi 8½" slide compound saw with Freud LU91M008 carbide, 48 tooth	917	509
C15FBK	Hitachi 15" miter saw with Freud LU85M015 carbide, 108 tooth	926	499
6507K	Milwaukee var/spd reciprocating saw w/cse with Milwaukee 18 blade assortment	253	149
JR3000VK	Makita var/spd reciprocating saw w/cse with Milwaukee 18 blade assortment	262	148

SANDER KITS

		List	Sale
330K	Porter Cable ¼ sheet sander w/1 roll of 80X & 120X paper & dispensor	135	89
505K	Porter Cable ½ sheet sander w/1 roll of 80X & 120X paper & dispensor	232	145
7334K	"NEW" Porter Cable random orbit sander with/1 roll of 80X & 120X discs	255	155
8E321K	Ryobi 3x21 v/spd belt sander w/Ryobi sanding frame	299	159
1273DVSK	Bosch 4x24 v/spd belt sander w/Bosch stand	448	205

CORDLESS DRILL KITS

		List	Sale
6012HDWK	Makita 2 spd. drill kit w/clutch. Inclds: extra battery & holster	284	149
6092DWK	Makita var/spd drill kit w/brake. Inclds: extra battery & holster	297	155
6093DWK	Makita var/spd drill kit w/clutch & brake. Inclds: extra battery & holster	308	159
9850K	Porter Cable var/spd drill kit w/clutch. Inclds: extra Porter Cable battery	258	159

PLATE JOINTER KITS

		List	Sale
555	Porter Cable plate biscuit jointer w/cse & 1000 assorted biscuits	302	185
JS100	Freud plate biscuit jointer w/cse & 1000 assorted biscuits	318	175

JET TOOLS

Model	Description	List	Sale
JBS-14MW	14" band saw, 1 H.P.	482	375
JTS-10	10" table saw w/stand, 1½ H.P.	554	435
JTS-12	12" table saw w/stand, 1½ H.P.	630	495
JWS-18	½"spindle shaper w/stand. 1 H.P.	479	365
JJ-4	4" jointer, ½ H.P.	310	269
JJ-6	6" jointer, ¾ H.P.	465	369
JWP12	12½" bench planer, 2 H.P.	569	385
JSG-6	6" x 48" belt & 12" disc sander, 1½ H.P.	634	485
OR1012	10" bench drill press, ⅓ H.P.	179	175
OR1458	14" bench drill press, ½ H.P.	279	259
OR1758	17" bench drill press, ½ H.P.	319	289
OR1458F	14" floor drill press, ¾ H.P.	369	339
OR1758F	17" floor drill press, ¾ H.P.	395	349
OR2501F	20½" floor drill press, 1 H.P.	655	529

HOLIDAY HELPERS

		List	Sale
RP	Radi plane edge rounder & extra blds	20.95	16.95
SS	Zircon stud sensor	19.95	16.50
PL-425	Stanley 25' powerlock return rule	18.35	8.95
PL-425L	Stanley rule lot of 4	73.40	34.95
IJ32	Incra Jig universal positioning jig	39.95	31.95
Incra Gauge	Universal precision measuring gauge	15.99	12.75
ELECTRA/LEVEL	Zircon remote water leveling device	29.95	22.95
MINI-LIGND	Moisture meter range 6-20%	110	88
MINI-LIGNO "E"	Moisture meter range 6-36%	120	96
MINI-LIGNO "S"	Moisture meter range 6-20%	120	96

SWANSON SPEED SQUARES

		List	Sale
#101	Swanson speed square	8.50	6.30
#114	Swanson magnetic square	14.50	10.75
#107	Swanson "Big 12" square	20.50	14.25

AEG POWER TOOLS

		List	Sale
H8SE75S	3X21 var/spd belt sander	249	169
EZ505	7.2v 2 spd cdlss drill w/batt & chg	189	79
EZ506	7.2v var/spd cdlss drill w/clutch	214	139
S82E20RL	V/spd ½" hammer drill	268	179
SSPE800	V/spd 8 amp recipro saw	220	135

ARROW STAPLERS

		List	Sale
T-50	Heavy duty staple gun	22.75	15.95
ET-50	Electric staple gun	32.50	22.75
ETN-50	Flush front electro-matic staple gun	35.60	24.95
HT-50A	Heavy duty hammer tacker	36.40	25.50
T25	Wire tacker (up to ¼")	35.60	24.95

FREUD SAW BLADES

⅝" Bore—Industrial Grade
CARBIDE TIPPED SAW BLADES

Item No.	Description	Diam.	Teeth	List	Sale
LU72M010	Gen. Purp. A.T.B.	10"	40	58	39
LU81M010	Gen. Purp. Tr.Ch.	10"	40	65	43
LU82M010	Cut-off	10"	60	77	48
LU84M011	Combination	10"	50	65	42
LU85M010	Super Cut-off	10"	80	96	57
LM72M010	Ripping	10"	24	57	38
LU73M010	Cut off	10"	60	70	44
LU87M010	Thin kerf	10"	24	60	42
LU88M010	Thin kerf	10"	60	74	49
LU98M010	Ultimate	10"	80	107	79
LU89M010	Non-ferrous metal	10"	72	87	65
PS203	Gen'l Purp.	7¼"	24	25	19
PS303	Plywood	7¼"	40	36	25
DS306	6" Dado - Carbide			184	109
DS308	8" Dado - Carbide			196	119
F0	1¾"x⅝" Biscuits 1000-Qty			32	27
F10	2⅛"x¾" Biscuits 1000-Qty			32	27
F20	2⅜"x1" Biscuits 1000-Qty.			34	29
FA	Assorts Biscuits 1000-Qty			34	29
WC104	4 pce. chisel set w/cse ¼"-1"			54	44
WC106	6 pce. chisel set w/cse ¼"-1"			73	56
WC110	10 pce. chisel set w/cse ¼"-1½"			119	85
F8100	16 pce forstner bit set ¼"-2⅛"			284	159
94-100	5 pce router bit door system			288	159
JS100	Biscuit Jointer w/case			300	159
FT2000	3¼ H.P. plunge router 5 amp			299	185
CE82	Planer w/cse. carb. blds. & guide			218	129

BLACK & DECKER

Model	Description	List	Sale
1166	⅜" drill 0-2500 rpm 4 amp	96	55
2600	⅜" drill 0-1200 rpm 4.5 amp	125	85
1575	⅜" scru drill 0-1200 rpm 5.0 amp	228	135
1180	⅜" drill rev. 0-1200 rpm 5.0amp	176	115
3030	7¼" circular saw 13 amp	195	98
3370-10	3¼" planer 5.2 amp	230	114
3027-09	7¼" circular saw 10 amp	145	69
7980	8" Light duty drill bit sharpner	63	40
1349-09	½" Timberwolf drill 2 spd.	466	298
2038	Drywall gun 0-2500 5.0 amp	160	95
2037	Drywall gun 0-4000 5.0 amp	160	95
2660	Drywall gun 0-4000 4.5 amp	138	87
2054	Tek gun 0-2500 5.0 amp	239	145
2050	Tek gun 0-900 5.0 amp	249	155
2661K	"NEW" 13.2 volt cdls drill w/cse	385	255
2687	⅜" var/spd 9.6 volt drill 0-800	238	145
4015	½ sheet sander 3.0 amp	190	125
1707	8½" crosscut miter saw	813	469
1703	10" miter saw w/73-770 blade	313	179
3157	Orbital var/spd jig saw	203	125
3153	Variable speed jig saw	195	120
3047-09	7¼" super saw cat w/brake	282	168
3048-09	8¼ "super saw cat w/brake	297	179
79-032	Workmate 200, 23#	103	75
79-033	Workmate 300, 28#	117	79
79-034	Workmate 400, 35#	152	99

1166 ⅜" Drill 0-2500 Sale 55

Carbide Tooth Saw Blade

Model#	Diameter	#Teeth	List	Sale
73-707	7-1/4	35	16.95	13.40
73-718	8	22	12.50	8.95
73-716	6-1/2	18	13.10	7.10
73-756	6-1/2	36	28.96	16.30
73-717	7-1/4	18	13.14	7.10
73-737	7-1/4	24	16.36	9.00
73-757	7-1/4	40	29.72	16.35
73-758	8	40	42.04	24.15
73-759	8-1/4	40	42.86	24.60
73-719	8-1/4	22	18.96	10.60
73-739	9	30	31.48	16.25
73-769	9	60	66.58	35.90
73-715	5-1/2	16	13.00	7.30
73-704	7-1/4	18	19.50	12.49
73-740	10	32	33.20	15.95
73-770	10	60	61.46	29.95
73-711	10	50	65.08	29.95

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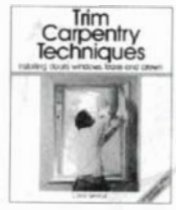

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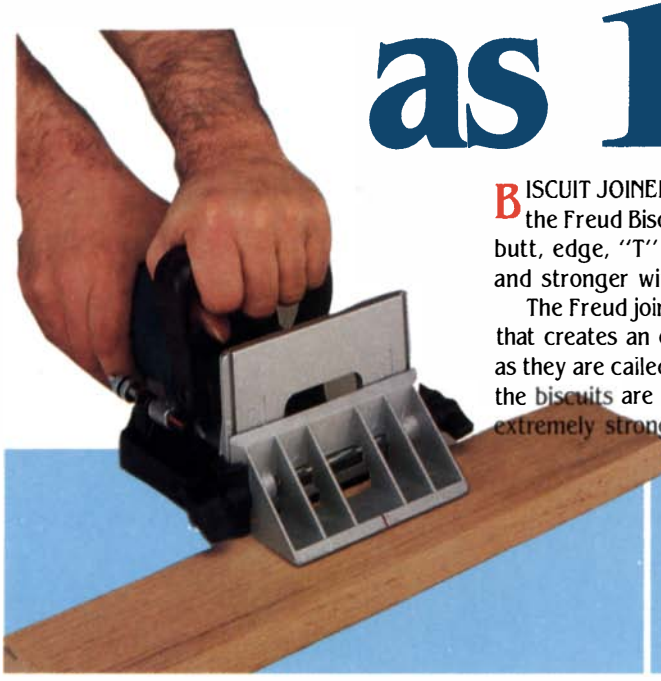
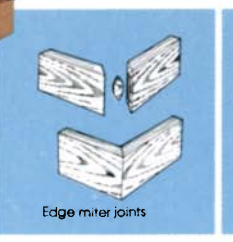
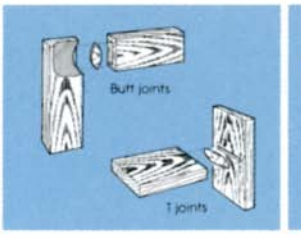
FREUD'S BISCUIT JOINER:
It Works as Easy as 1·2·3

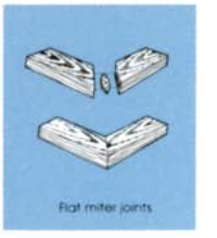


BISCUIT JOINERY is now easy and economical with the Freud Biscuit Joiner machine. Joints, such as butt, edge, "T" and others, can be made quicker and stronger with the use of the Freud joiner.

The Freud joinery machine is a plunge cutting tool. It has a rotating carbide cutter that creates an elliptical slot in the surfaces to be joined. The splines, or "biscuits" as they are called, are inserted into the slot along with any water based glue. Because the biscuits are made of wood, the water makes them swell in the joint making an extremely strong and firm bond.

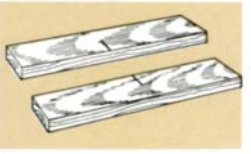






1 Lay Out

The boards that are to be joined should be placed together and the location of each joint marked on both pieces. The vertical fence is adjusted to the depth desired for the slots. Turning the wing nuts on the side of the fence allows it to move easily in the tracks. The fence is accurately calibrated to allow you to easily move it to center of the joint *(See Figure 1)*.



At this point, you have determined the horizontal location of the joint by marking the wood and vertical location of the joint by setting the fence.

2 Cut

You are now ready to make the slots for your biscuit joint.

There is a red indicator line on the front of the fence and a corresponding red mark on the base plate *(See Figure 1)*. You can use either of these marks for alignment with the lines drawn on the mating pieces of wood.

With the wood securely held in place, align the red mark with the line on the board. With one hand you can grasp the body of the machine. The other hand is placed on the handle. Turn the machine on and, with a steady forward motion, push the joiner body forward to make the biscuit slot. Repeat the process for each marked area on all of the wood pieces.

Simple and Easy!!! The wood particles are automatically ejected through the machine's exhaust port.

3 Assemble

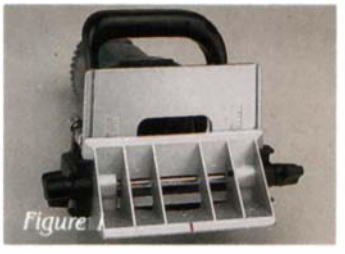
Apply a water based glue to the slots and surfaces being joined. Insert the biscuits in the slots and push the boards together. For best results you will need to clamp the joint together for the glue manufacturer's recommended drying time.

There you have it, 1-2-3!! An extremely strong joint produced quickly and easily by you and the Freud Joiner Machine.

You will find a complete instruction "How to" book with each machine. Illustrated with photographs and drawings, it is designed for those woodworkers not familiar with biscuit joinery. The Freud biscuit joiner will prove to be a highly valued tool for your woodworking projects.

MITER JOINTS? NO PROBLEM!

By reversing the fence, you can join mitered pieces (See Figure 2). The steps are the same.



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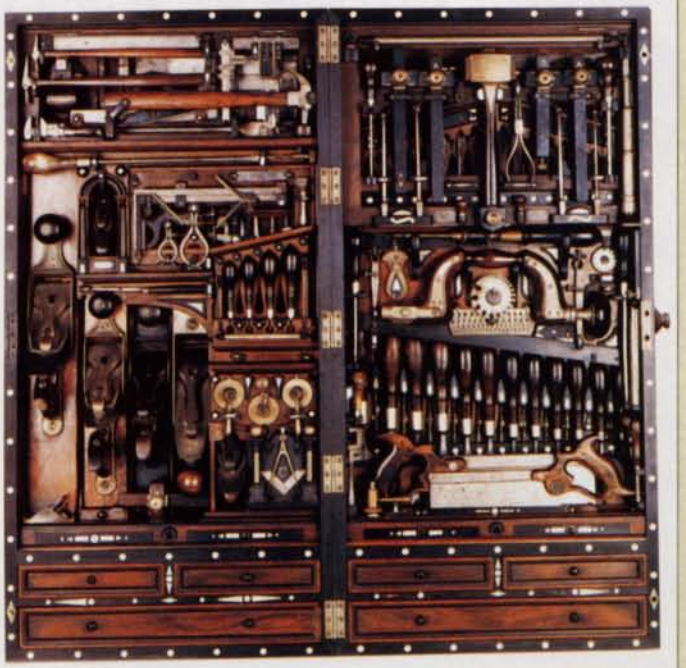

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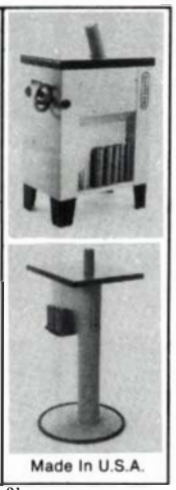

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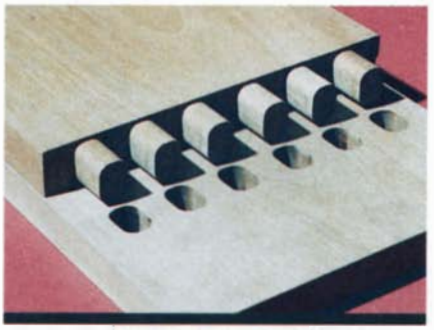

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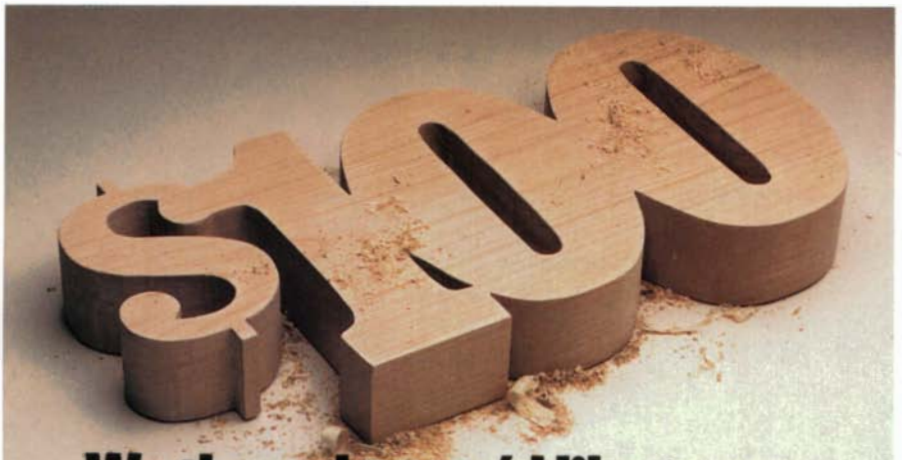

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Building a Roll-Top Desk

Interlocking slats form an all-wood tambour

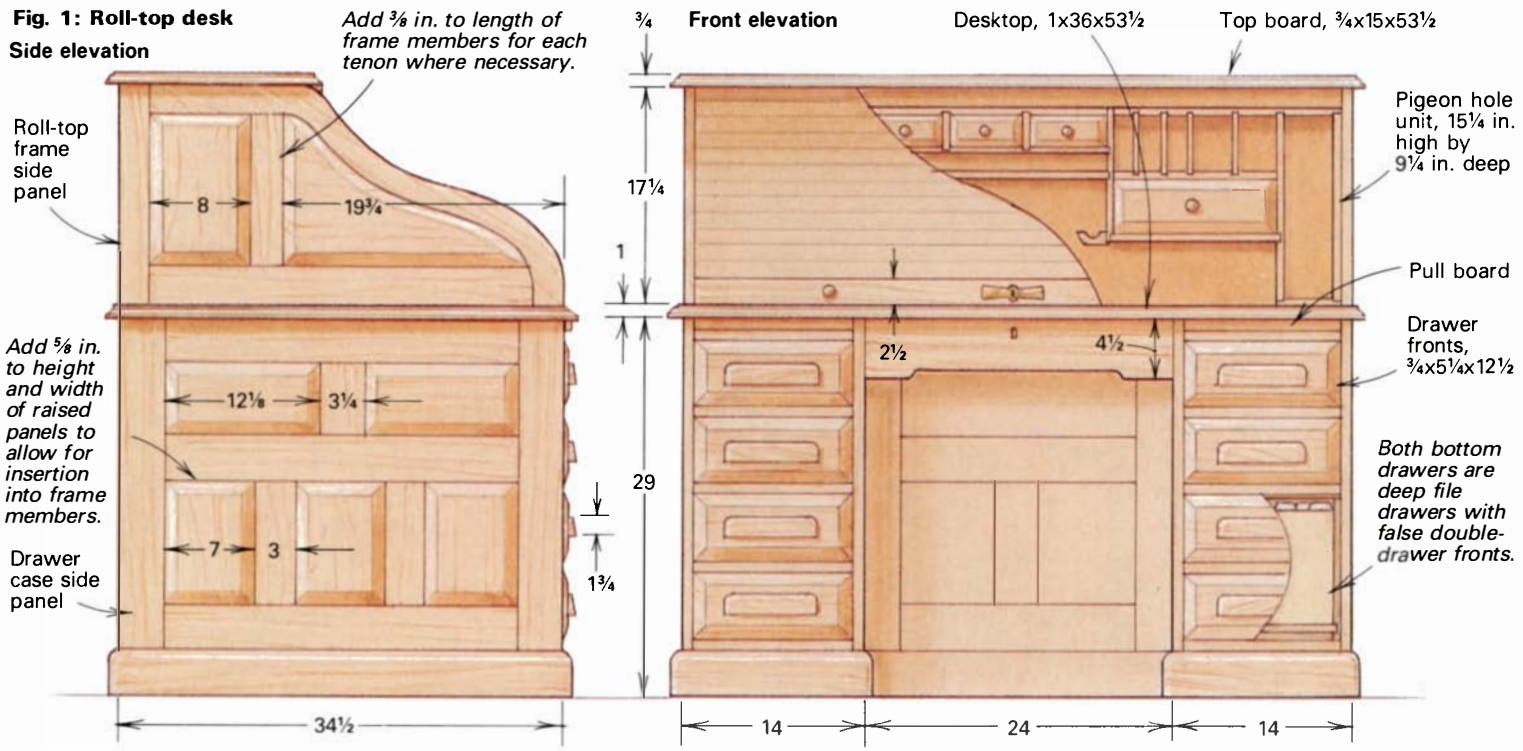
by Kenneth Baumert

I can recall my first encounter with a roll-top desk. My parents and I were visiting my uncle's home and were impressed with all the compartments and little drawers in his desk. Many years have passed since that visit, and I now realize that the greatest asset of a roll-top desk is not all the storage areas provided by the drawers and pigeon holes, but the tambour curtain that can be drawn over the working area to transform a cluttered utility desk into an elegant piece of furniture.

Before building my roll-top desk, I did a little research to determine what would be a typical design. The roots of the roll-top stretch back more than two centuries to the "bureau à cylindre" or cylinder desk, which was built in France in the 1700s. The curved solid cover, called a cylinder fall, "disappeared" as it was rotated into a large housing chamber within the desk. Another French cousin of the roll-top was the "secrétaire à abattant," which had a hinged, solid wood cover. This desk contained the small drawers and pigeon holes now found in the roll-top. Finally, a third relative of the roll-top, the tambour desk, came into prominence in England and America during the Hepplewhite and Sheraton periods of the late 1700s. It featured horizontal tambour doors that generally did not cover the writing surface. It wasn't until 1850 that Abner Cutler, owner of the Cutler Desk Co. in Buffalo, N.Y., combined elements from these desks and patented a desk with all the features we associate with roll-tops today: A curving tambour curtain that pulls down from above to completely enclose the pigeon holes and writing surface.

Although there have been many variations on the basic roll-top desk through the years, the most common method for constructing the tambour has always been to glue the slats to a canvas backing. This somewhat awkward process requires a special clamping board large enough to hold all the slats tightly together while the cloth backing is glued onto them. I used this method on my first roll-top, simply butting the slats together edge to edge. This may work on smaller tambours, but on my 4-ft.-wide roll-top, the slats at the convex part of the S-curve gradually separated from each other. Even though I could solve this problem by alternately rab-

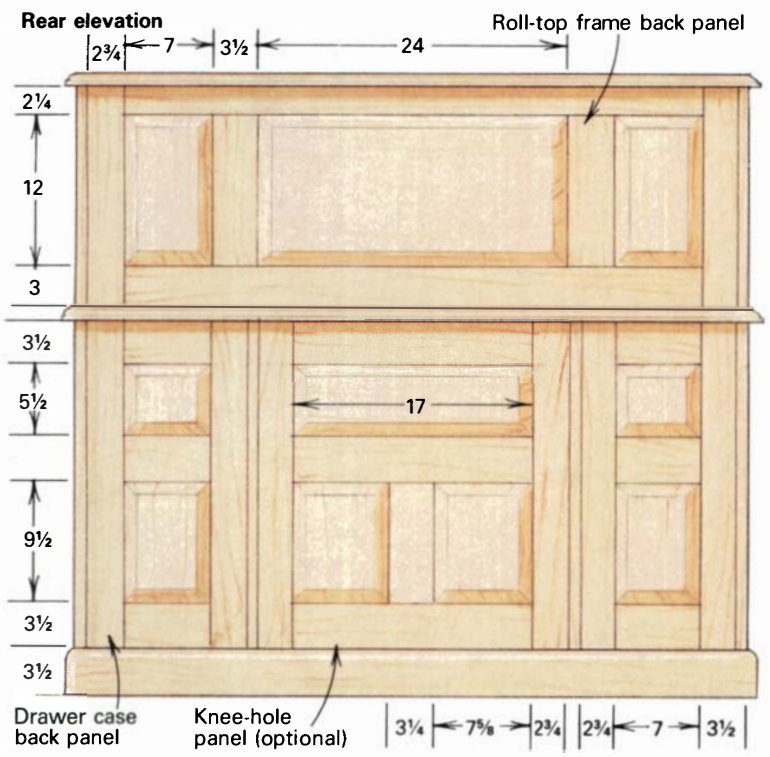
Fig. 1: Roll-top desk



beting the edges of the slats like shiplap boards, so they would overlap and strengthen the cloth-back curtain, I wanted to eliminate the cloth backing completely. So, I sat down at the drawing board and designed an interlocking joint for the edges of the slats—kind of an elongated ball-and-socket joint—that holds the slats together without any backing at all. The mating parts of this joint are cut with a dado blade and standard router and shaper cutters. The interlocking tambour design, along with a mechanism for locking the six lower-case drawers by closing the tambour, help make this roll-top both a challenging project and a unique piece of furniture worthy of its long heritage.

Understanding the basic construction—The desktop in the photo at right is 36 in. deep and 53½ in. wide. The desk requires approximately 170 bd. ft. of hardwood lumber and about 25 bd. ft. of a secondary wood, such as poplar or pine, for drawer sides and slides. Drawer bottoms require two sheets of ¼-in. plywood or the equivalent amount of solid wood. I use ⅝ stock for the writing surface so I can end up with a 1-in.-thick top after straightening and planing it. All the other parts are milled to their appropriate thickness from ¾ stock. The top board, drawer fronts, tambour stock and frame members of the frames and panels all are ¾ in. thick after milling. The raised panels and drawer sides are ½ in. thick and the pigeon holes are made from both ½-in.- and ¼-in.-thick stock.

One of the challenges presented by a complex piece of furniture like this is that it must be designed to be easily disassembled into its component parts for transport. Figure 2 on the following page shows how the parts go together. The two identical frame-and-panel drawer cases are glued up as individual units and form the foundation of the desk. Next, I attach the roll-top frame to the desktop with screws running from the underside of the top through elongated holes to allow the wide, solid top to expand or contract. Then, I attach the desktop and roll-top assembly to the drawer cases with figure 8-shape desktop fasteners, available from The Woodworkers' Store, 21801 Industrial Blvd., Rogers, Minn. 55374-9514, and various other mail-order companies. The circular shape of the figure 8s lets them rotate slightly to allow expansion and contraction, making them ideal for attaching solid tops. Four



Drawings: Kathleen Rushton

Photo: Jeff Gnuver

A roll-top desk combines the best features of a utilitarian workspace with the elegance of a piece of fine furniture. The tambour on the author's oak desk, above, is made with interlocking slats, instead of being the more common cloth-back tambour.

figure 8s are screwed to the top edge of each case, as shown in figure 2. The desktop is then placed on top of the cases and the locations of the figure 8s are marked on it. Then, the top is removed and shallow mortises are drilled with a brad-point bit at the marks on its underside. The figure 8s fit into the mortises so the top will pull down tight to the frames when the screws are driven home. Be sure to angle the screws that go through the figure 8s and into the top so you can drive them in without hitting your knuckles on the side of the drawer case. To complete the base assembly, the center drawer is slid into place on guides screwed to the sides of the drawer cases.

The interlocking slats of the tambour are now fed into the access grooves at the top of each of the curved side panels. The top board is attached with figure 8s screwed to the roll-top frame in the same way the desktop is fixed to the drawer cases. Finally, with the tambour open, the pigeon hole unit is slid into place. It's made to just fit between the side panels and below the fully opened curtain. Felt glued to its bottom lets it slide easily without marring the surface of the desk. A narrow strip tacked along the back of the desktop acts as a stop to make sure the pigeon holes aren't slid so far back that they interfere with the opening of the curtain.

An optional knee-hole panel can be installed with knock-down hardware between the drawer cases. I prefer the heavy, solid look that this knee-hole panel gives the desk, especially when the desk is used in the center of a room instead of up against a wall. I originally used four regular 90° metal angle brackets to join the knee-hole panel to the drawer cases, but I've since found a somewhat more elegant solution, identified simply as "joining devices" in The Woodworkers' Store catalog. These three-part knock-down brackets, shown in the detail of figure 2 on the next page, provide a tight connection and disassemble and reassemble without having to remove and replace screws. The two brown plastic mating portions of the device screw to the parts to be joined and a metal joining plate slides over them to make the connection.

Making the frames and panels—As you can see in figure 1 at left, the basic building blocks of the desk are all frame-and-panel assemblies, except for the desktop and top board, which can be glued up and cut to size at this time. You'll need a left, right and back panel

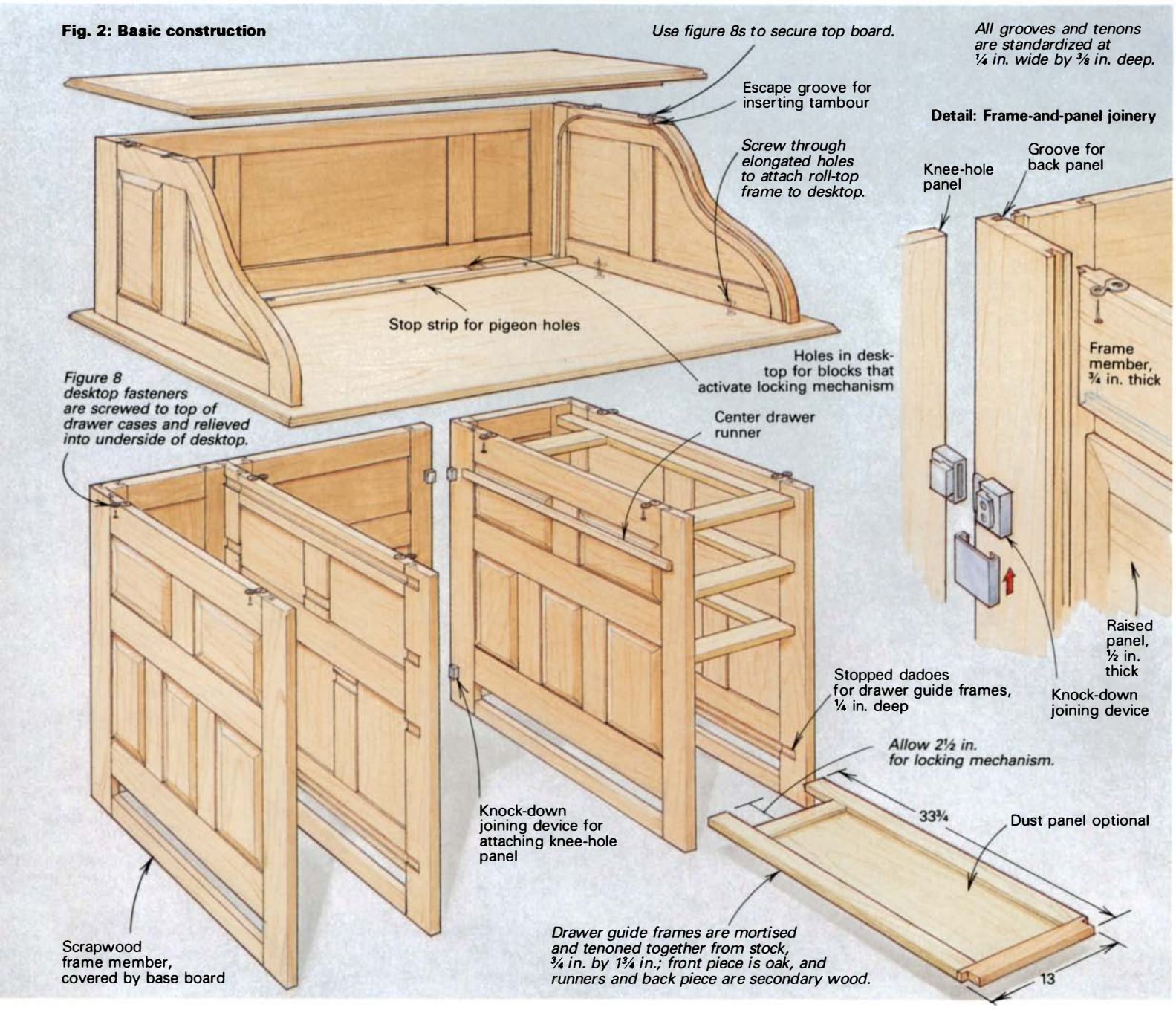
assembly for each of the drawer cases and, if you choose, a knee-hole panel assembly to go between them. The roll-top frame requires a back panel assembly and the two curved side panel assemblies. To begin, determine the overall dimensions of the desk you're building based on the size of the desktop, and prepare a parts list. Then, cut out, groove, tenon and bevel all the frame-and-panel parts for the base of the desk and the roll-top frame at one time.

I cut the grooves in the frame members with a dado blade on the tablesaw. These grooves accept the tenons from adjoining frame members and also provide the space to house the floating, raised panels. To simplify machining I've standardized the groove for all the pieces at ¼ in. wide by ⅜ in. deep. Where the back panels of the drawer cases and the roll-top frame join their respective side panels, a ¼-in. by ⅜-in. tongue, machined the full length of the frame member, is glued into a groove in the inside surface of the vertical frame members of the appropriate side panels. While you're cutting grooves and tenons, don't forget the parts for the drawer guide frames (see figure 2 below), as they also use the same size groove and tenon.

I originally cut the rectangular raised panels with a dado head on the tablesaw, but this was very time-consuming because of all the sanding needed to clean up the bevels. When I tried to make the cut in one pass with a panel-raising cutter on the shaper, I had to reject a significant number of panels because of chipping. Even when I made multiple passes, there was some chipping across the grain. To eliminate this chip out, I switched to a two-tool operation on the tablesaw and shaper. First, I make a 1/64-in.-deep scoring cut on the tablesaw at the inner edge of the bevel. Next, with the sawblade set to the same angle as the shaper's panel cutter, I saw off most of the waste. Finally, the shaper is set up to make the finish cut.

By slightly changing the settings on the tablesaw and shaper, you can bevel the ¾-in.-thick drawer fronts right after the panels are made. Experience has taught me to belt sand the outer surfaces of the drawer fronts and panels before cutting the bevels to avoid rounding the crisp edges of the raised panels. To sand the cross-grain bevels, I clamp the panels to the workbench and begin sanding with 80-grit paper on an electric block sander. Oak panels usually don't need to be sanded finer than 120-grit;

Fig. 2: Basic construction



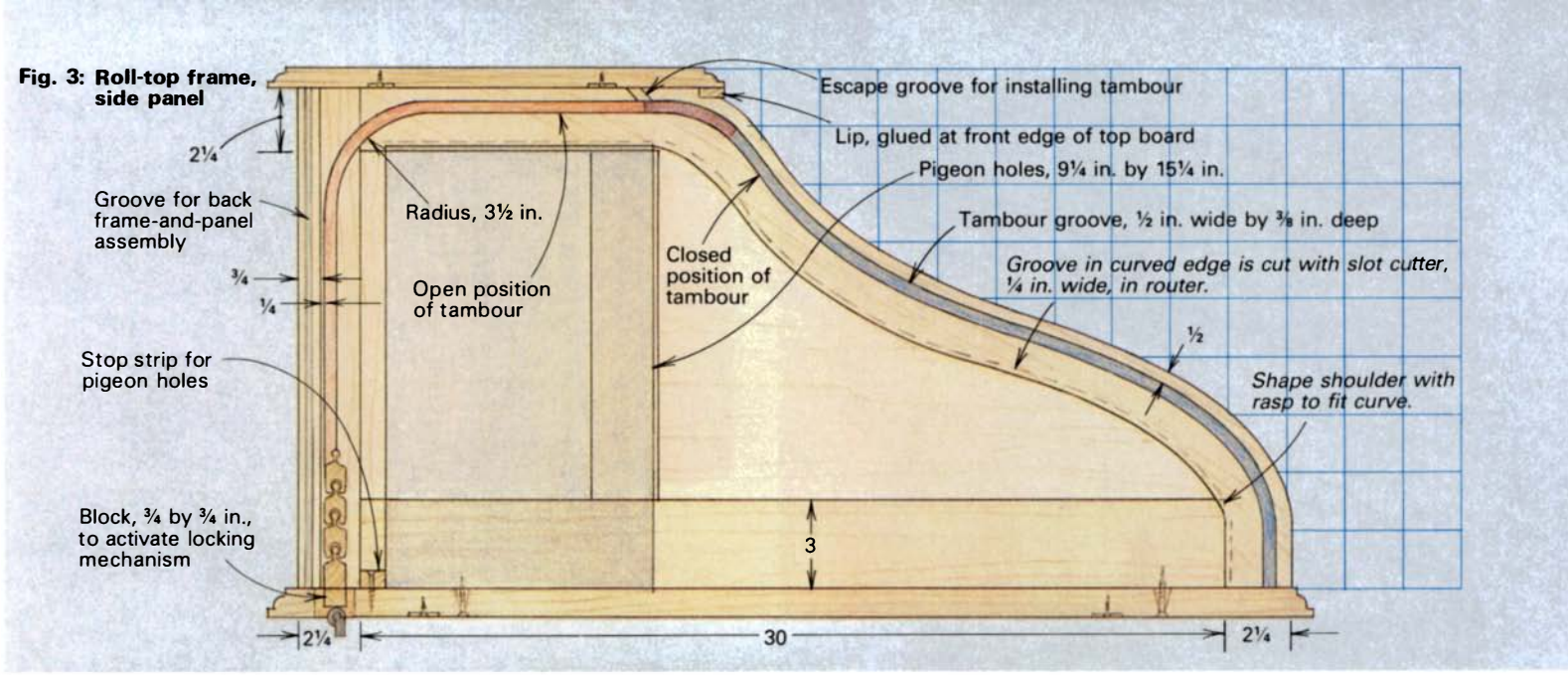


Fig. 3: Roll-top frame, side panel

walnut and birch are usually sanded to 220-grit.

Work out the design for the curved frame-and-panel sides for the roll-top frame full scale on paper. When the tambour is open, only the handle slats should show and when the tambour is closed, there should be only one or two slats hidden behind the lip on the front edge of the top board (see figure 3 above). To test this relationship, lay a string along the path of the tambour groove on your drawing, and mark the length of the string when it's lying in the closed tambour position. Now, move the string to the open tambour position and compare the distances. Because the depth of the desktop is already established, you must vary the height of the side panel assembly and the slope of the curve until the two distances are equal.

Once you've established the profile of the roll-top frame, you can bandsaw the curved frame members and sand them smooth with a drum sander chucked in the drill press. Then, rout the groove in the inside edge with a bearing-guided ¼-in.-wide slotting bit. With rasps and files, I fit the shoulders of the tenons to the curve where the bottom frame piece of the side panels join the curved frame. After the frame pieces are complete, use them to lay out a pattern for the curved panels. Bandsaw the panels to shape and bevel them with a horizontal panel-raising shaper cutter in conjunction with a guide bearing. If you don't have one, you can use a bearing-guided router bit with a profile that will remove most of the waste, and then finish up with chisels and sandpaper to match the bevel on the other panels.

After all the frame-and-panel parts are grooved and tenoned, assemble them into the modules that will make up the desk. Take care when gluing the joints to avoid locking the panels to the frames; the panels must float freely so they can expand or contract with changes in humidity. In addition, be sure you have a flat area to lay out your clamps or you might end up with twisted case sides. After the cases are glued up, I run a baseboard around them, mitering it at the corners and screwing it to the case from inside the bottom rail. Since the first 3½ in. of the bottom rail gets covered by the baseboard, I save oak by leaving a gap and using scrapwood or secondary wood at the very bottom (see figure 2 on the facing page).

After removing the clamps from the frame-and-panel assemblies, sand the frame pieces with a small electric pad sander to about 100-grit. Keep the sander on the frame members and be careful not to round over the crisp corners of the raised panels. I go over the cases again with 100-grit after they are glued up and then usually finish-sand them to 120-grit.

Before gluing up the drawer cases, you need to lay out and cut the dadoes on the inside of the case sides to receive the drawer guide frames. I cut these stopped dadoes on the tablesaw, and then use a router to clean them out to within about 1 in. of the front, and right up to the groove for the back panel assembly at the rear of the case sides. Then, notch the front corners of the guide frames to fit the stopped dadoes (see figure 2). I use the tablesaw to ensure square and accurate notches. When the guide frames are all notched to fit, glue up the drawer cases. Make sure the cases go together square or you'll spend hours fitting the drawers to out-of-square openings.

With the base of the desk in clamps, you can turn your attention to the roll-top frame. Before gluing the curved side panels to the upper back panel, you'll need to rout the tambour groove, as shown in figure 3 above. The easiest way to do this is with a ½-in.-dia. pattern cutting bit and a Masonite template. Pattern cutting bits come with interchangeable bearings that fit on the ¼-in. shaft *above* the cutting portion of the bit, and they are available from Trendlines, 375 Beacham St., Chelsea, Mass. 02150. The top bearing makes it possible to use a Masonite template bandsawn to fit right up to the inside edge of the desired groove. Clamp the template and side panel to the top of your bench and rout the ⅜-in.-deep groove. The next step is to mark the location of the escape grooves for inserting the tambour slats and rout them freehand. Now you can glue the side panels to the upper back panel and attach the roll-top frame to the desktop. The top board can't be screwed in place until the tambour is installed, but this is a good time to mount the figure 8s to the side panels and mark and drill to recess them in the underside of the top. As shown in the photo on p. 49, a thin strip is glued below the front edge of the top. The purpose of this small lip is to fill the gap created by the curve of the tambour as it goes under the top. However, this piece should be made and glued in place only after the tambour is installed to be sure it doesn't interfere with the tambour's motion.

Drawers and locks—Each of the drawer cases that comprise the base of the desk contain three drawers and a pull board, as shown in figure 1 on p. 48. Both bottom drawers are deep file cases that can hold either manila folders or Pendaflex hanging files. The fronts of the file drawers incorporate a visual ploy common to this style of roll-top: a false double-drawer front. The narrow, center drawer runs on wooden guides screwed to the side cases (see figure 2 on the facing page). Additional drawers, as many or few as you prefer, can be made to fit the pigeon holes.

My desk drawers have dovetails on all four corners and are flush

Fig. 4: Locking mechanism

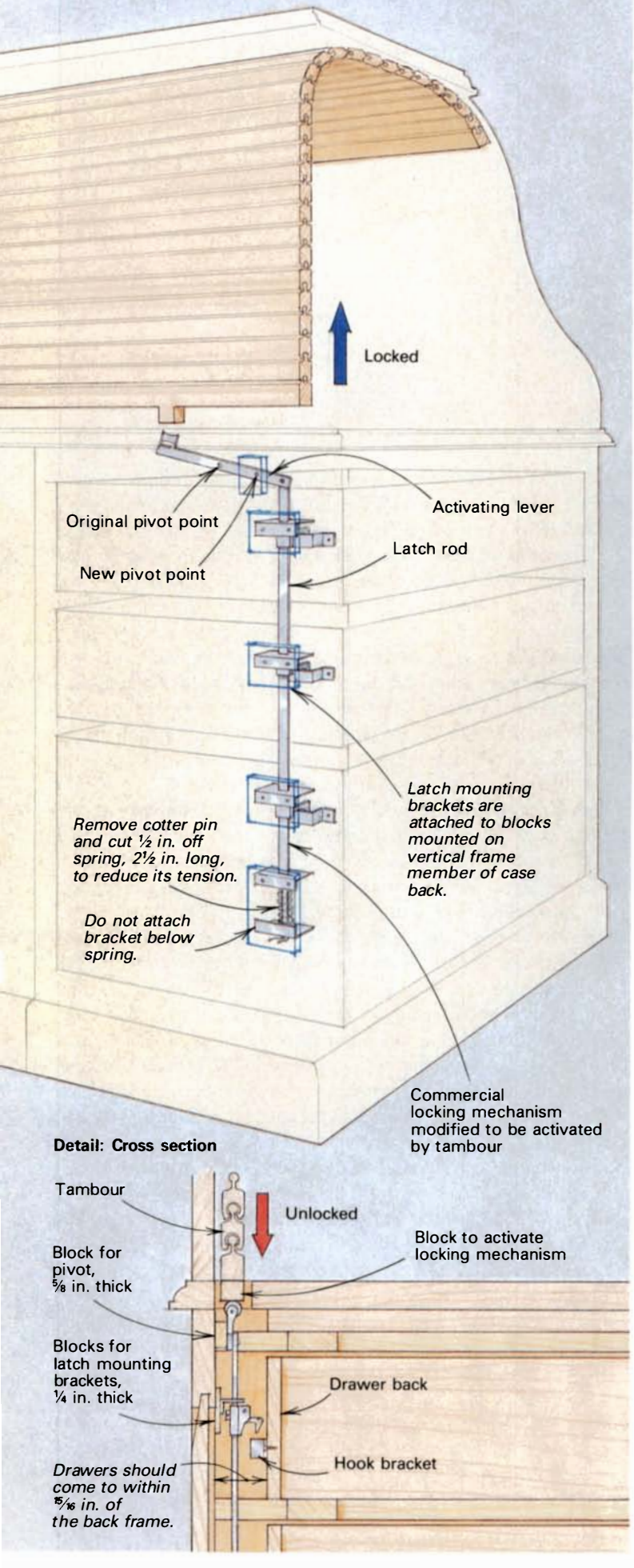
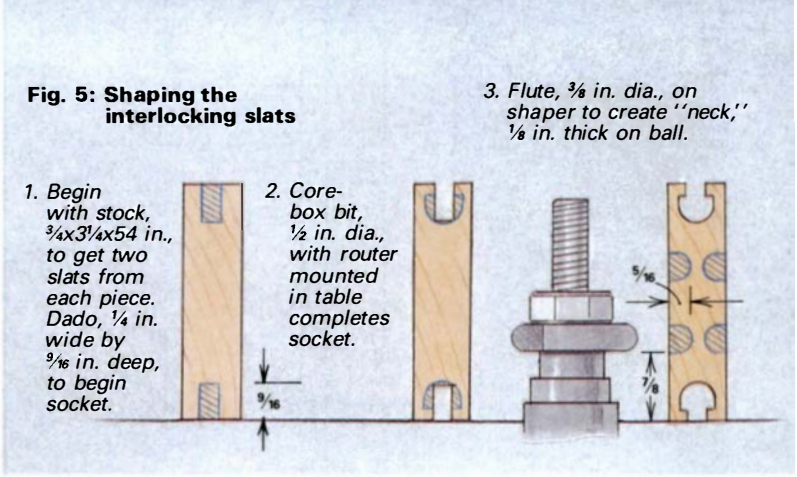


Fig. 5: Shaping the interlocking slats

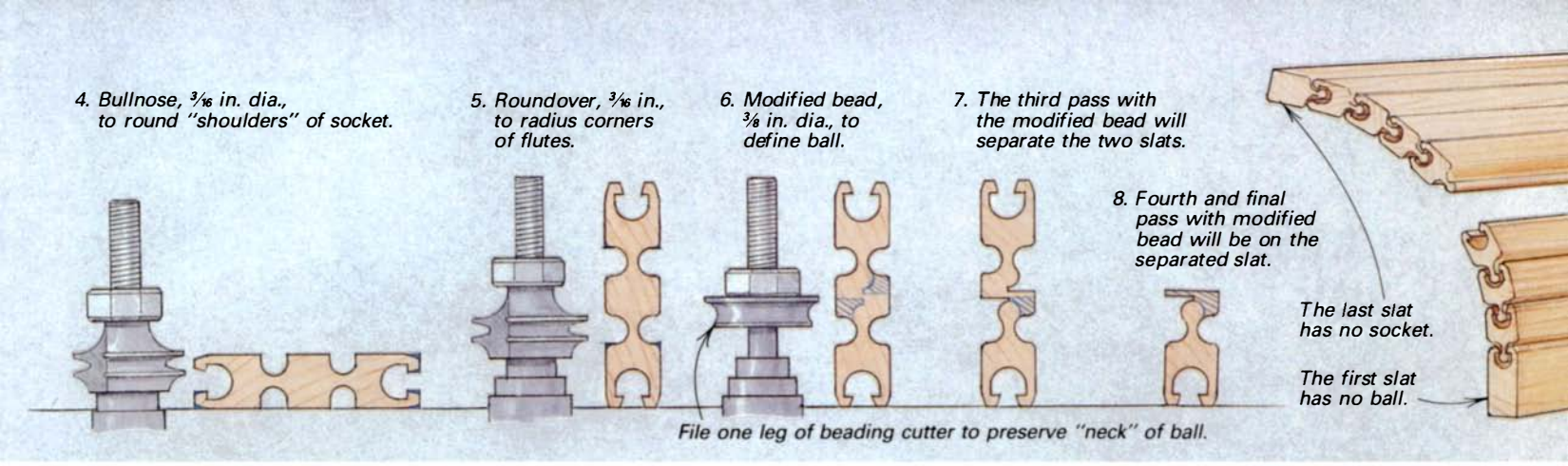


mounted, meaning they fit within the case frame so their front edges are flush with the case. Flush drawers make it imperative that both the cases and the drawers be built perfectly square; the fit around the drawer front is right there for all to see. The wooden drawer pulls are easily made if you begin with a long piece of stock. Clamp this long board in a vise and lay out for several pulls, marking both the length of the pull and the location of the finger notch for each. Then, with the long piece still in the vise, rout all the notches with either a 45° bevel or a core-box bit. Bevel the front face of the pull stock on the tablesaw, and sand this beveled face. Now, crosscut each handle from the long stock and round the corners.

There are only two key holes on the desk, as shown in the photo on p. 49: one on the bottom slat of the tambour to secure it to the desktop and one for locking the center drawer. The side drawers lock automatically and simultaneously when the curtain is closed, and conversely unlock when the curtain is open.

I couldn't find a locking system designed to be activated by the tambour of a roll-top desk. But Selby Furniture Hardware Co. (321 Rider Ave., Bronx, N.Y. 10451) has a mechanism (part #L-7CTRDSK U) that locks all the side drawers when the center drawer is closed. With a few modifications, I made the mechanism work off the weight of the tambour. Metal rods with spring-loaded latches are screwed to the inside back of each of the drawer cases, and activating levers are connected to the top of each of these latch rods. To work off the center drawer, as the mechanism is designed to function, the latch rods are placed so the activating levers extend over to each side of the center drawer. Each lever is screwed to the back frame of the drawer cases so it will pivot when its free end is forced up by triangular metal brackets screwed at the back of each side of the center drawer. So, when the center drawer is closed, the brackets push up on the lever and the lever's pivoting action forces the latch rod down, engaging the latches with hook brackets on the back of each drawer and locking all the side drawers simultaneously. When the center drawer is open, a spring at the base of each latch rod pushes the rod back up, disengaging the latches and unlocking the drawers. However, this system is cumbersome because the center drawer has to be left partially open for the side drawers to be unlocked. By modifying the mechanism, as shown in figure 4 at left, I made it work off the weight of the tambour.

I reversed the position of the activating levers so that instead of the brackets on the center drawer pushing up on the levers to lock the drawers, the tambour will be pushing down on them. This means that the springs at the bottom of the latch rods, instead of pushing down on the bottom mounting bracket, will be pushing up against the first mounting bracket from the bottom. Since the bottom mounting bracket moves with the latch rod, it must not be screwed to the frame of the desk. Although the springs were easily squeezed by the force of the brackets on the center drawer, the



weight of the tambour was not sufficient to compress them. To remedy this I cut ½ in. off the 2½-in.-long springs and moved the fulcrum point of the activating levers closer to the lifting point to increase the levers' mechanical advantage.

Now that I've installed a few of these mechanisms, I find it's easier to mount the lock on the desk back before gluing the drawer case together. The lock is mounted with the curtain contact point 1 in. above the drawer case. A 1½-in. square is cut in the desktop and blocks glued to the last slat of the tambour activate the lock through these openings. The final step is to mount the hook brackets on the back of each drawer for the spring-loaded hooks to grab.

Shaping the tambour slats—One of the keys to shaping the interlocking joint on the edges of the slats is beginning with 3¼-in.-wide boards. This width allows you to get two slats out of each piece, which speeds up the process, and gives you a substantial piece of wood to work with, which keeps your hands away from the cutter. The 3¼-in.-wide boards should be milled ¾ in. thick and crosscut a little longer than the finished length of the slats. I prefer to sand the surfaces of the stock before machining the slats so the only clean up I have later is on the rounded-over corners.

Figure 5 above shows the progression of cuts I use to make the joint. The socket for the elongated ball-and-socket joint is begun with a ¼-in.-wide dado cut on the tablesaw and completed on the router table using a ½-in.-dia. core-box bit. You need to set the router table fence so the core-box bit will center on the dado groove to begin cutting. Once you're in the groove, the ¼-in.-dia. shaft of the core-box bit will guide itself along the dado.

The ball portion of the joint is formed on the shaper. First, I make four cuts with a ⅜-in. flute cutter to define the ⅛-in.-thick "neck" of the ball. Then, I change to a multiple profile cutter, as shown in step #4 of figure 5 above, which has the next two shapes I need: a 3/16-in. bullnose to contour the "shoulders" of the socket and a 3/16-in. roundover for what will be the outer edges of the slats (step #5 of figure 5). The bullnose cut is made with the stock flat on the table; all the other passes are made by running the stock on edge. I readjust the fence and the height of the cutter in between the bullnose and roundover operations. The final ball shape is formed with a ⅜-in. beading cutter that I modified by grinding back one of the protruding cutting wings so it would leave the neck of the ball. To avoid weakening the piece prematurely, make the first two cuts on opposite sides from opposite edges. The third pass will separate the two slats (see step #7 of figure 5) and the fourth and final cut will be done on an individual slat.

The whole operation results in a significant amount of chips and sawdust because the process removes approximately 40% of the blank. It may be desirable to hog out as much of the waste as possible with a dado head on the tablesaw; some woods are less forgiving than others and won't tolerate heavy shaper cuts without splintering. Depending upon the quality of the wood, you should machine 5 or 10 extra slats to ensure that you end up with the 25 to 30 good slats needed for a desk. Don't forget to make a wide slat with only a socket for the handle slat, and make another with only a ball for the last slat. Also, the small blocks that fit through the holes in the desktop and disengage the locking mechanism when the tambour is open are glued to the last slat.

I don't crosscut the slats to final length until after I've screwed the roll-top frame to the desktop so I'm sure to get an accurate measurement. The slats should be about ⅛ in. shorter than the distance between the curtain grooves. Then, I cut a rabbet on the back side of both ends of each slat to leave a 7/16-in.-thick tenon. Calculate the length of the tenon to leave the back of the slats 1/16 in. shorter than the distance between the roll-top side panels. The tenons for the handle slat have to be somewhat thinner and rounded so this wider piece will negotiate the curves.

Building the pigeon holes—I build the pigeon hole unit after the rest of the desk is complete so it can be dimensioned to fit between the side panels with very little to spare. When laying out the pigeon holes, consider how the desk will be used and design the compartments to suit that particular purpose.

All pigeon hole pieces are cut to size and sanded. Make the top and end pieces a little wider than the shelves and dividers so they can be rabbeted for a back piece. The grooves for joining the parts are all dadoed on the tablesaw. To ensure that the compartments all come out square, it's important to lay out and cut all the grooves from the same end of the horizontal shelves. This can be tricky, so take your time and check your spacing before you glue up the unit. Don't be surprised if you have to trim some of the pieces to length to account for the depths of the dadoes. Gluing up the pigeon holes is a delicate process because some grooves are only ¼ in. wide by ⅛ in. deep.

After all the component parts have been built and fitted together, the desk should be disassembled and the parts finished separately. I apply up to seven coats of polyurethane to the writing surface to completely close the pores. The other portions of the desk get three or four coats of polyurethane, and I sand between coats. The tambour slats are finished individually with a liberal amount brushed into the interlocking sockets. Once the finish is completely set, all wearing surfaces, such as the tambour's ball joints and the tambour grooves in the curved panels, as well as the drawer guides, are coated with a hard carnauba wax to ensure free and easy movement. □

Kenneth Baumert is a mechanical engineer and woodworker in Emmaus, Pa.

A sliding dovetail is very useful for joining boards cross-grain, and it can be cut entirely with hand tools. Above, Thomas notches the front edge of a shelf so the joint will be invisible when the two components slide together.

Cutting Sliding Dovetails

Guide blocks aid hand tool precision

by William Thomas

The housed dovetail or tapered sliding dovetail is one of the most underused joints in the cabinetmaker's repertoire. Typically it is dismissed as being too time-consuming and difficult to make. It is, however, the best way to join the end of one board cross-grain into the middle of another board without nails, screws or dowels.

The natural structure of wood causes problems with any cross-grain joint. In a typical dado joint between a shelf and a vertical case side, for example, the mating side-grain to end-grain surfaces make poor glue joints. Adding rabbets, or even tenons, does not change this basic relationship, unless you also add screws or nails. Dowels come loose as wood expands and contracts during the year. The sliding dovetail avoids these problems because it is an interlocking mechanical connection that doesn't require adhesives, so wood can move naturally without breaking the joint. And, all you need to cut the joint is a careful layout, a beveled guide block, a sharp chisel and a plane.

Joint Anatomy—Sliding dovetails are made in a variety of forms, but the most common one has the top surface of the joint dadoed straight in and the tapered dovetail cut into the bottom surface. The joint is typically stopped in the front and a shoulder is set back ¼ in. to ½ in. The most important feature of a true sliding dovetail is its taper, which is thinner at the front than at the back. This taper allows the joint to be assembled loosely for trial fitting, only becoming tight when driven home. It's always a surprise when the hand-tight trial fit needs to be driven apart with a mallet.

Tools for dovetailing—Cutting a sliding dovetail involves basic hand tools plus a couple of special items: a chisel guide block and a dovetail plane. The important feature of both of these tools is an angled edge. The chisel guide block is simply a board somewhat longer than the width of the stock to be joined; one long edge is square and the other long edge is beveled about 80°, or at about a 1:6 taper. The dovetail plane looks like a rabbet plane, but it has a sole

with the same bevel as the guide block and a skewed iron. Dovetail planes are commercially available, but can easily be made by modifying an old skew rabbet plane, as explained in the sidebar below.

Laying out the joint--To avoid confusion, the joint should be carefully laid out in a systematic manner. Unlike dovetails commonly used for drawer or case work, one half of the joint cannot be scribed from the other, and the accuracy of the fit is entirely dependent on cutting the lines correctly. Start by locating the top line of the dado and scribing this line across the face of the socket board and down across the back edge.

Next, determine how deep the recess will be. A marking gauge should be set to this measurement and the bottom line scribed on the back edge of the board parallel to the face. Along this line (not along the face), measure out the thickness of the pin board and mark the other bottom corner. Then, with a T-bevel set to the sole angle of the dovetail plane, scribe a line from this bottom corner up to the face. This establishes the shape of the joint at the back edge. Before going any further with the socket board, take the marking gauge and scribe a line across the bottom face of the end of the pin board and carry this line across the front edge.

To establish the front end of the socket, mark the shoulder setback line on the face. I have never heard of a rule for how wide the front end should be, so I finally made up my own rule as follows: The narrowest width (the root or front inside corner) of the dovetail should be equal to half the thickness of the pin board.

Building a dovetail plane

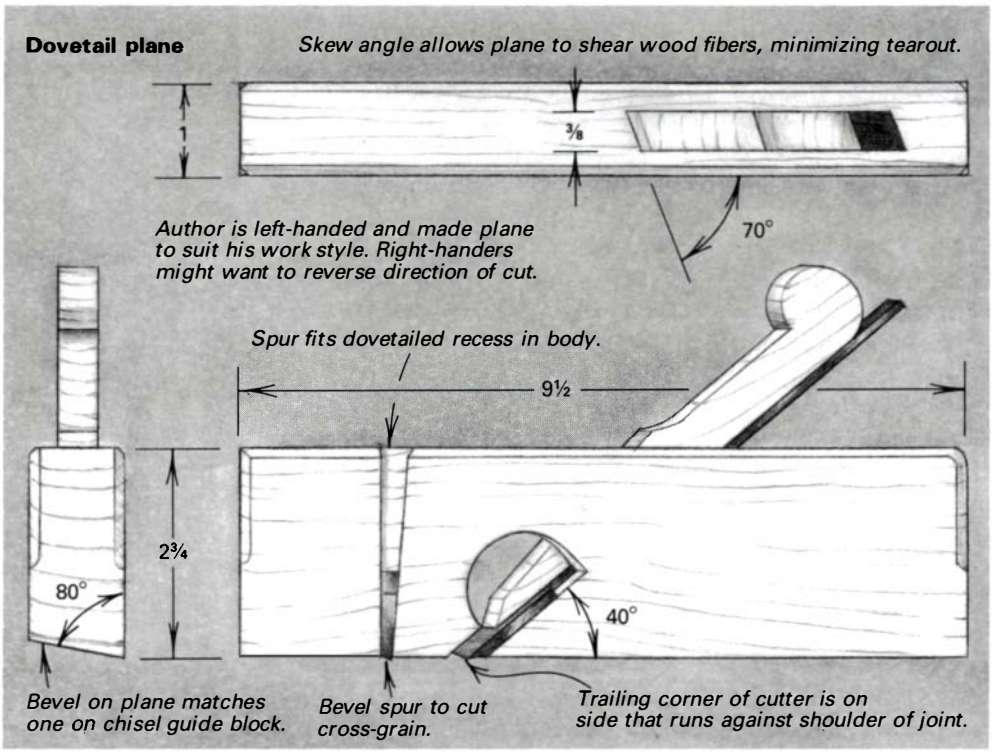
Dovetail planes can be made from old wooden skewed rabbet planes, which are commonly available at antique-tool shops, flea markets and yard sales. There are plenty of them around, so find one that is free of warp, checking and dry rot. Avoid rusty irons and irons that have been sharpened so much that they will have to be reground at a different angle. If you are especially lucky, you might find a plane with a spur for scoring cross-grain. You could also construct a dovetail plane entirely from scratch or buy one from Woodcraft Supply, 41 Atlantic Ave., Box 4000, Woburn, Mass. 01888.

When making a dovetail plane, I've found that the most important technical point is that the corner of the skewed iron that cuts the deepest must be the trailing corner. In other words, when you look down at the plane as it cuts, the leading corner of the iron will overhang the end of the board and the trailing corner will be against the shoulder. This orientation is critical because it allows the iron to shear the wood with the grain. If the inner corner is leading, the iron will tear out the wood.

To ensure this orientation, remove the iron and wedge and make sure the side that will ride against the shoulder of the joint is perfectly flat. Set a T-bevel to 80° and scribe the iron on the front and back ends, so that its trailing edge will be located as described. Then, set the plane in a vise, with the sole facing up, and carefully joint the surface down to the bevel lines.

Since the iron is already tempered, it must be shaped with a high-speed grinder. Polish the face of the iron, paint it with layout dye and wedge it back in the plane with the excess sticking out. Then, lay a scriber flat on the plane sole and score a line parallel to the bottom of the plane on the iron. Grind to the line, with the tool rest set at 90° to the face of the iron. Be sure to grind square when removing this much stock because the thickness of the steel will absorb the heat. Once parallel to the line, reset the tool rest to grind in the bevel. Work slowly and have a cup of water close by to quench the metal frequently, so you don't ruin the temper. When the bevel is parallel and straight to the sole, hone it in the normal way. Since old plane irons are often laminated with hard steel, I suggest using waterstones for this operation. Set the iron in the plane and drive the wedge home. With the iron retracted enough to not take a cut and with the plane in one hand, strike the front of the plane with a mallet. Then, try a cut. If the shavings are too heavy, strike the back end with a mallet to retract the cutter slightly. Rub the sole with paraffin wax and you're all set.

Finally, add a spur cutter to your plane to score the wood fibers ahead of the main iron. Acquire a small piece of ⅛-in. untempered tool steel, which can be shaped with a file. Next, lay out and cut a sliding dovetail recess with both edges beveled on the side of the wood body, starting at the top of the inside face of the plane and tapering down toward the sole. Now you can shape your piece of steel so it can be wedged tightly in this recess with about 1/16 in. extending below the sole. A skewed bevel should be filed in the protruding end, as shown in the drawing below. Next, file a notch in the outside face of the spur to facilitate its removal. After tempering the spur, hone the bevel and wedge the spur in place. (For more on tempering, see *FWW* #50, pp. 73-76.) —W.T.



Drawing: Kathleen Rushton

Thomas uses a guide block with an 80° bevel as accurate reference surface for paring the angled wall of the dovetail socket. Note how the socket tapers from the back of the joint to the front.

To prevent tearout when working with a plane that does not have a spur for cross-grain scoring, the author cuts a line with a chisel guided by the 90° side of the guide block.

The 80° bevel on the dovetail plane automatically cuts the proper bevel on the pin. The taper shown is created by planing more off the front of the pin than the back.

This means that the taper varies with the thickness of the stock, but it isn't necessary to know the actual amount of taper. This rule simply ensures that the joint will be as strong as possible given a particular board thickness. One of the most confusing relationships in this joint is that the root thickness lies along the inside shoulder of the male board, and therefore lies on the surface of the socket board. Starting at the top line, measure this root distance along the front shoulder line and mark the front corner. Then, using a straightedge and knife, connect the front and back corners on the face to establish the taper.

Cutting the socket—Traditionally, the socket would be sawn with a dovetail or other stiff-blade backsaw and then chiseled out. I'm not stuck on drudgery, so I rout the dado with a straight bit that is the same width or narrower than the root. This ensures the socket will have a clean bottom and a square top shoulder. After squaring the front shoulder with a chisel, I stand the board up vertically in a vise and clamp the chisel guide block on the taper line, as shown in the top photo at left, so a chisel can be run down the beveled edge to cut the angled wall of the socket. Pare the shoulder in several passes using a 1-in.- to 1¼-in.-wide chisel. All surfaces must be flat and clean. Once everything is perfect, cut the pin board to match.

The pin board—The shoulder lines have already been scribed on the end of the pin board, so the first thing to do is notch the front corner to the setback line, as shown in the photo on p. 54. This is a necessary first step because the narrowest part of the root width must be marked on the shoulder. This root-width mark and the shoulder scribe line are the only layout marks necessary on the pin board. The dovetail plane will automatically establish the correct bevel angle.

Clamp the pin board down flat with the end overhanging the edge of the bench, and then clamp the square edge of the guide block along the shoulder line. Hanging the end off the bench allows the socket board to be slipped on for trial fitting without unclamping the pin board. If your plane has a spur to score a crisp line across the grain, you can start planing; otherwise, you must score the shoulder first by laying a chisel against the face of the guide block and dragging a corner along the line, as shown in the center photo at left.

Fitting the joint with a dovetail plane is mostly a matter of knowing when to stop, and you have two guideposts to help you gauge this. The first is the thickest corner (back, outside) of the dovetail. Remember, this corner is the same thickness as the board, so your aim is to just reach that point with the plane. The other guidepost is the diagonally opposite corner of the dovetail's cheek: The front inner corner marked on the front shoulder. Since the plane automatically establishes the correct bevel angle, all you need is to establish the taper and then remove stock until these two guideposts are reached. Start with short passes near the front edge until the plane appears to be parallel to the taper, and then take long passes until you're close to the marks, as shown in the bottom photo at left. Concentrate on keeping the correct taper and planing a flat surface. If your plane doesn't have a spur, stop every few passes and score the shoulder with a chisel. The correctness of the taper can be judged by sliding the joint together partway with the dovetail sides touching and observing whether the top face of the male board is parallel to the shoulder of the dado. When you reach the guideposts you previously laid out, the dovetail should fit perfectly.

Offhand, I can't think of many uses for one sliding dovetail. They are usually made in sets; for example, on each end of a shelf. This means that one is right-handed and one is left-handed. Both are made the same, using the same tools, and the only difference is that one male end is planed going up the taper and the other end going down the taper. Otherwise, they should be mirror images and must fit the same. It is wise to make the pin board extra wide at the back. This way if the joint is loose, you can cut the shoulder back slightly to allow the pin board to slide forward for a tighter fit. Then, the front edge of the board can be planed down flush afterward.

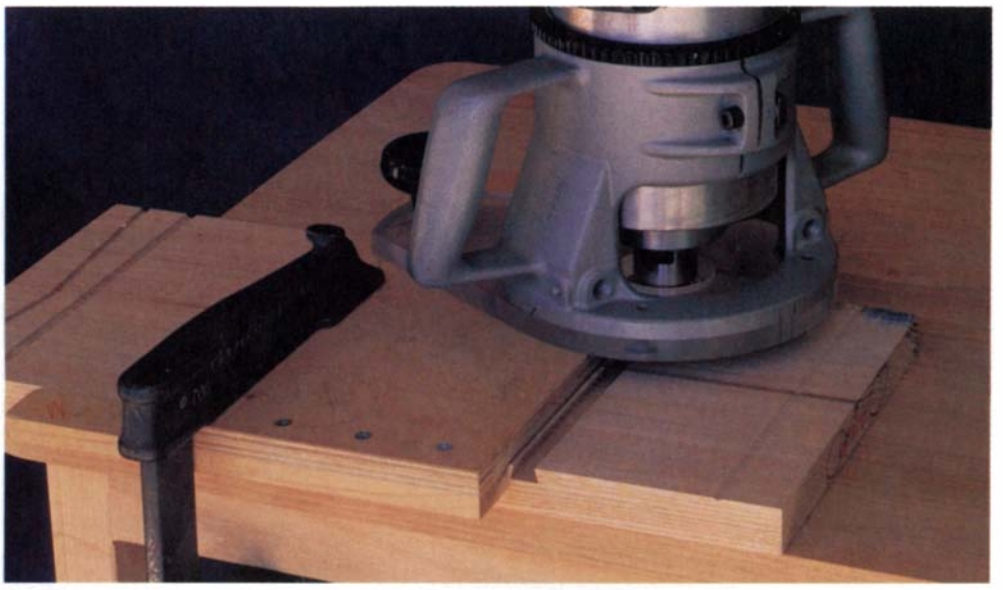
With practice, the sliding dovetail can be cut quickly and neatly. I know that many cabinetmakers use a router and jig for the whole job, but the beauty of doing it by hand is versatility. Routing dovetails involves constructing jigs that can handle each variation of stock width or thickness, and this jigging up pushes the mind to work further along toward repetition, uniformity and mass production. By acquiring two simple tools, the guide block and the dovetail plane, you can hand-cut joints of any size or taper. All it takes is some careful thought and work. Handwork exercises the mind as well as the muscles. □

William Thomas is a cabinetmaker in Hillsboro, N.H.

Routing sliding dovetails

by Pat Warner

Machine-cut sliding dovetails are easy to make; the setup is quick and the jigs are fairly simple. The dovetail pins are cut on a router table equipped with a sliding fence. The socket is more safely cut when the work is secured and the router is guided by a template.



Routing dovetailed sockets with a template and guide collar is more accurate than with an edge-guided router. The offset knob on the modified router base also makes controlling the router easier.

Routing the socket: I rout the socket with a single pass of a dovetail bit of the desired width. You could cut the socket on the router table, but because the bit is trapped and the wide stock is difficult to handle, this may be inviting accidents and inaccuracies. I prefer to guide the hand-held router with a template, rather than a board clamped to the work, because all too often the router base is not concentric to the cutter. Also, the router is raised above the crosscut tearout, which is produced when cutting or routing across the grain and which can prevent the router from sliding across the board. Finally, the work site is more visible, indexing is simplified and clamping down the template closer to the cut helps flatten any twist or cup in the workpiece.

The templates for routing the dovetail ways are simply modified bench hooks made of ½-in. birch plywood, 7 in. or more wide and at least as long as the slot. The long hook on the template makes the index secure, and only one clamp is needed to hold it fast, as shown in the photo above, so there is nothing to get in the way of the router as it makes the cut. Only one edge of the template is used as a guide, so you will need both a left and a right template; both guide edges must be perpendicular. One problem with template routing is that only half of the router base rides on the template. To compensate for this relatively unstable arrangement, I have developed a modified router base with an offset-grip knob, as shown in the photo above, that increases stability and facilitates safe and predictable handling. This one tactic has done more to upgrade my hand routing than any other routing accessory.

The template guide collar attached to the router base must be larger in diameter than the dovetail bit. The centerline of the socket can be located directly off the working edge of the template by adding one-half the collar diameter to the required distance from the end of the stock. The socket can be cut from either the front or back of the panel by pulling the collar against the template with the grip knob. If you want a stopped socket, rout it from the back. For an easier job, I preplow the socket with a straight bit. Using the same collar for both the dovetail and straight bits will ensure both cuts are on the same centerline.

Routing the tenons: Clamping the workpiece to a modified, bridled sliding carriage fitted to the router table fence, as shown in the photo below, allows for extremely accurate adjustments when routing the pins. However, if the workpiece is not clamped to a sliding guide, dovetailing its end can be dangerous because of the force generated by the design of the dovetail bit. Although this downward shear force is minimal, the workpiece can be difficult to handle. Installing a tight-fitting table insert around the bit can help.

Photos: Curtis B. Wilson

A sliding fence attachment holds the work while routing the pins. Adjust the fence so the workpiece is not trapped between it and the router bit.

Before routing, set the depth of cut to 0.005 in. less than the depth of the socket. A feeler gauge is handy for this type of measurement. Lay out the pin using either a sliding bevel gauge or the dovetailed socket itself as a guide. Now, set the fence on the router table to take slightly less than the scribed shoulder width per pass. The fence should be adjusted so the cutter is partly recessed into the fence; do not trap the workpiece between the fence and the cutter. Next, clamp the part to be cut to the sliding fence attachment, make the pass, and then rotate the piece before you make a second pass and rout the other shoulder. Check the fit, adjust the fence and make additional passes on each face until the pin fits the socket. Be sure to make all cuts in a single pass from right to left. If the tenon is to fit a blind socket, I turn the piece 90°, clamp it to the sliding fence attachment, and then rout a third shoulder with either a dovetail or straight bit. □

Patrick Warner sells routing equipment and teaches classes in router techniques and in making jigs and fixtures in Escondido, Cal. For more information, contact the author at 1427 Kenora St., Escondido, Cal. 92027.

Building an Ahrens-Fox Fire Engine

A colorful classic in 1/16 in. scale

by Doug Kenney

The 1928 Ahrens-Fox fire engine, distinguished by its silver pressure dome on top of the piston pump, is one of the most elegant fire engines ever built. The author's 16-in.-long model, above, is built from natural-color woods, including bloodwood, mahogany, maple and walnut.

Of the dozens of scale model vehicles I've built, few compare in class and elegance with the 1928 Ahrens-Fox fire engine. The front-mounted piston pump crowned by the shiny chrome pressure dome distinguishes it from all other fire engines. I built the Ahrens-Fox, shown in the photo above, from a full-scale engineer's drawing, mixing straight reproduction and artistic interpretation. Instead of assembling the fire engine piece by piece, I employed an assembly-line method: I constructed subassemblies, and then combined these to complete the model. The fire engine involves six units: the piston pump, the engine and cockpit, the rear bed, the chassis, the base and hose housings, the spoked wheels and final details.

Despite its complex appearance, the Ahrens-Fox isn't hard to build; the only special tools you'll need are a pin vise for working with tiny drill bits, several hole saws and a set of numbered drills. All the parts are either pinned in place or held with yellow glue, and I use different-color woods to enhance the beauty of the model. Many hardwood parts, such as the headlights and axle pins, are available from Toys and Joys, 407 Woodcreek Dr., Lynden, Wash. 98264; brass stock is available from your local hobby store.

Assembling the piston pump—The body of the pump is a block of ¾-in.-thick bloodwood or satiné, a bright red Brazillian hardwood, cut into an octagon and capped with a ⅛-in.-thick satiné cross. The other components are shown in figure 1 on pp. 60-61. The first step is to cut and fit the four pistons and mounting jacks, as shown in the drawing. The pressure dome is a 1¼-in.-dia. hardwood ball wrapped with a strip of tape to simulate a metal seam. The dome is painted with Testor's chrome enamel before being doweled to the pump.

The Y-inlet at the front of the pump is made from two lengths of ⅜-in. dowel, drilled down the center with a #30 drill. Cut a 60° angle on one end of each, glue the angles to each other and sand the end of the Y-inlet flat so it can be glued to the two discs on the front of the pump, as shown in the drawing. Then, round over the end of a 7/16-in. dowel and pin it atop the Y-inlet.

Gluing up the engine housing and cockpit—To save on expensive wood, I made the engine housing from a 1¾x2x3 pine block sheathed with ⅛-in.-thick satiné. Glue a thin strip of cherry to the ridge of the housing. The fire wall is a thin cherry panel, with quarter-round notches sawn out of the corners. Drill two 5/64-in. holes in each notch. I hand-drill small holes like this with a bit in a pin vise. Then, bend the small grab bars from 5/64-in. brass rod and press them in place before gluing the fire wall to the engine housing.

The radiator is ¼-in.-thick mahogany. Start with a 2-in. by 6-in. strip and plow 10 lengthwise kerfs, 3/32 in. wide, 1/16 in. deep and 1/16 in. apart, with a thin-rim blade on a tablesaw. Crosscut the section to length, add the maple trim and complete the radiator, as shown. The four strips applied to the sides of the engine housing simulate vents. They are grooved using the above method, except the 13 kerfs are 3/32 in. deep, crosscut with the saw's miter gauge set square and the blade tilted at a 45° angle. Before gluing the strips, put a radius on each by rocking it back and forth on a belt sander and clean up the kerfs with an emery board.

To complete the engine housing, drill a hole in the fire wall for the steering column. Start by drilling a pilot hole at 60° and reaming the hole with a #20 (0.161 in. dia.) drill. I make the steering wheel from three pieces: a rim, a spoke center and a 5/32-in. brass rod column. The rim is a ⅛-in.-thick maple disc cut with a ⅛-in. hole saw. Mount the disc temporarily on a spindle. Then, round the disc's edges by spinning it as you rock it back and forth against a belt sander. Next, spot-glue the disc to a scrap of veneer to support it while drilling out the center with a ¾-in. brad-point bit.

Photo above: Brad Stanton

Finally, pry off the veneer with a knife or by sanding. The spoke center disc is sliced off the end of a ¾-in. walnut dowel. To form the four quadrants shown in the drawing, press the disc against a ½-in.-dia. drum sander, but be careful to avoid sanding your fingers. Glue the spoke disc to the inside of the rim. Then, bore a center hole and slip the finished wheel on the column, leaving ⅛ in. of the brass rod protruding for the horn.

For the floor board, cut a ¼-in.-thick piece of satiné and rip the footrest strip at 45° on the tablesaw. Four pieces of 3/16-in.-thick rosewood make the seat, with the sides shaped as shown. Glue the seat together first, and then glue it to a mahogany block. Drill holes for the grab bars and fit them to the sides as shown. Apply the "Ahrens-Fox" name to the floor board assembly with ⅛-in.-high white rub-on letter decals, available from an art supply store.

Making the rear bed—The sides of the rear bed are two 5/16-in.-thick pieces of satiné glued to a mahogany end piece. The top edges of each bed side are bored with a #9 bit, located as shown, for dowel stanchions that support the brass rail. A 3/32-in. hole is bored through each stanchion 13/16 in. up from the bottom to house the brass rails and ladder hooks. Assemble the bed and stanchions with the rails in place, and mount the hose hooks in each bed side. I used yellow satinwood for the chemical tank, which mounts behind the seat. Before shaping the edges, either with a router or by sanding, bore a ⅜-in.-dia. hole in the top for the walnut fill cap. A 1/16-in. hole through the cap holds its brass rod handle. Drill the holes for the front ladder hooks, slip them in place and glue on the tank.

Boring axle holes—The chassis of the fire engine is a single maple board with a notch cut out in front for the hose box assembly. Bore four 7/32-in. axle holes ½ in. deep, centered on the stock. The fenders are rings I drilled with two large hole saws: a 3⅝-in. saw for the outside diameter and a 3-in. saw for the inside. One ring makes the two forward fenders and one ring is needed for each rear fender. With the larger hole saw chucked up, set your drill press for 500 RPM and drill three holes 1/32 in. shy of drilling through (see the above, left photo). The remaining wood anchors the fender blank while you drill out each fender with the smaller hole saw. Remove the fenders by sanding away the bottom using a 50-grit belt on a stationary belt sander. Slice the rings as shown and round the front fenders on the belt sander.

The running boards are 5/16-in.-thick mahogany strips, fit and glued between the fenders. Make the sloped step from a 9/16-in. by 9/16-in. satiné strip ripped in half at a 45° angle. Now, glue the fenders to the chassis, keeping the grain vertical to minimize cracking. The tail platform is three pieces of 5/16-in.-thick mahogany lined up with the running boards and glued to the lower edges of the rear fenders. For detail, I glue a rosewood battery box and two tool/parts boxes to the running boards.

Mounting the base and hose housings—The base is a 3¼-in.-wide by ½-in.-thick mahogany board that fits on top of the chassis. Like the chassis, the front end has a notch for the hose box, with the top edges of the prongs rounded on the belt sander. Drill four holes for mounting the piston pump, which is attached later.

The booster hose reel is made from a square mahogany block with a 1-in. hole bored through its length and one corner cut away. Glued to the ends of the reel are two 1¼-in.-dia. discs cut with a 1⅜-in. hole saw, each with a counterbored hole in the center for the axle pegs, which secure the spindle at the ends. Round the outside of the housing, except for the corner to be glued to the underside of the base, on the belt sander until it matches the discs. Cut a window in the reel to make threading the hose easier. The bed, engine, cockpit and pump can now be glued to the base, and the base can be glued to the chassis. Then, the booster hose reel and front hose box with bumpers can be attached to the chassis.

Left: With a large hole saw chucked in the drill press, the author makes two concentric cuts to create rings from which he'll fashion the fire engine's fenders. The same method is used for making rims and tires for the spoked wheels. Right: To keep the holes for the spoked wheels aligned in the center hub and outer rim, a home-made alignment jig is used with the drill press. Eight brass tubes pressed into the walnut outer ring act as bushings to guide the drill bit, while a round maple spacer keeps the hub centered in the rim.

Cutting out spoked wheels—The wheels have a separate rim, hub, tire and eight spokes. Tires and rims are fabricated with hole saws following the same process used for the fenders. The tire requires a 2¾-in. saw for outside cuts and a 1⅝-in. saw for inside cuts. Use 1¾-in. and 1¼-in. hole saws for the rims. I used Milwaukee brand hole saws; other brands may have a different wall thickness, so check their inside cutting diameters. The hubs are slices of 9/16-in. dowel bored to accept ⅛-in.-dia. spokes.

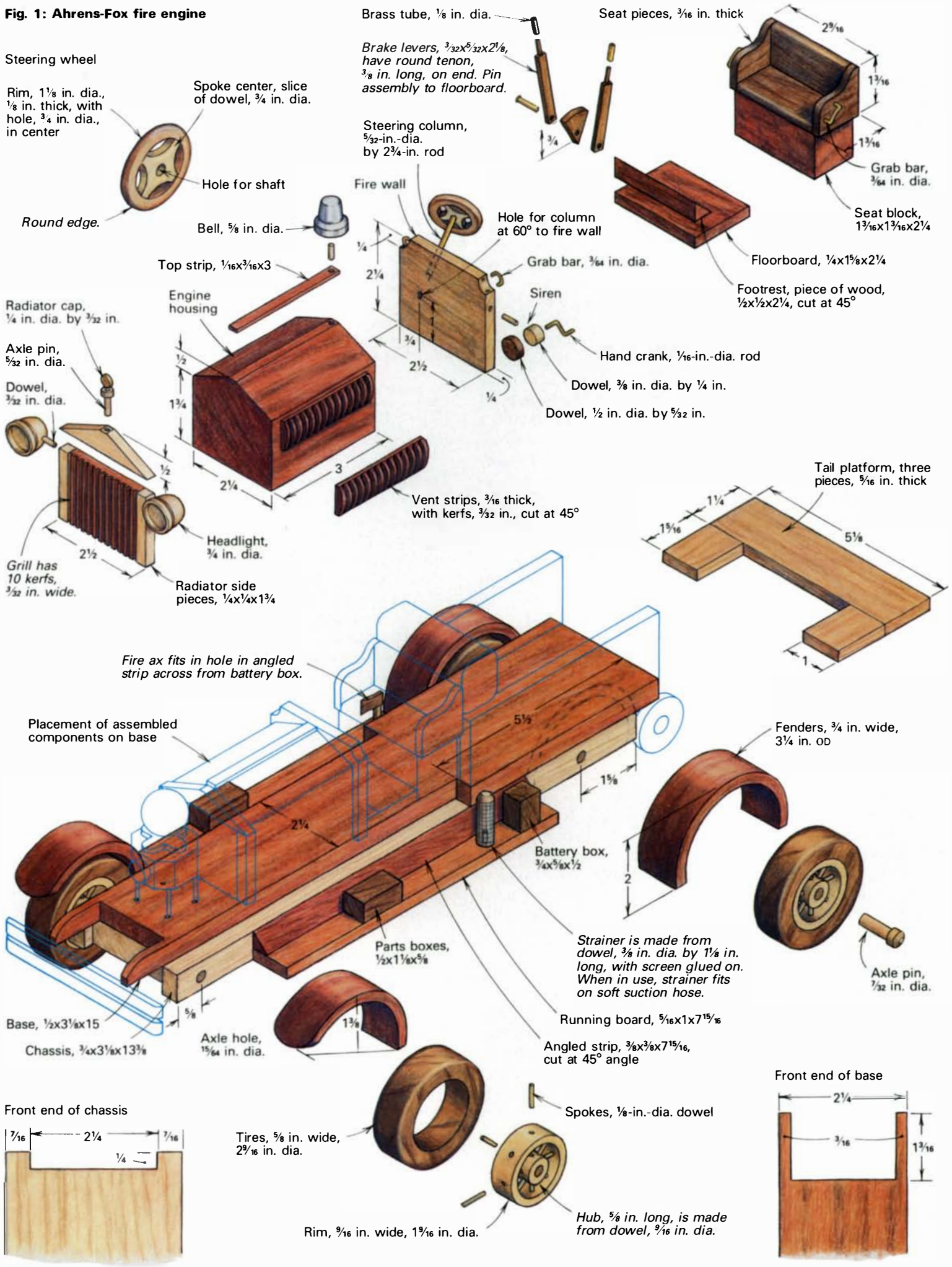
I devised the jig, shown in the above, right photo, for boring the spoke holes through the rim and hub simultaneously on the drill press. The outer ring of the 4-in.-dia. jig has eight 5/32-in. brass tubes that act as drill guide bushings. The inner jig has a spacer ring that centers the hub while the spoke holes are bored. Insert ⅛-in. brass rods in the holes to keep the parts from shifting. Number and mark the orientation on each pair of rims and hubs as you work.

To assemble the rim/hub, slip two opposing spokes at one time through the rim into the hub and seat them with a large pair of pliers—there's no need for glue. Then, sand any protruding spokes flush with the rim. To assemble the wheel, bead glue on the inside of the tire and when it turns tacky, slip the rim in. Apply a heavy coat of polyurethane to keep everything in place. When the wheels are dry, bore the hub for the axle, round the edges of the tire, just as with the steering wheel earlier, and attach the finished wheels.

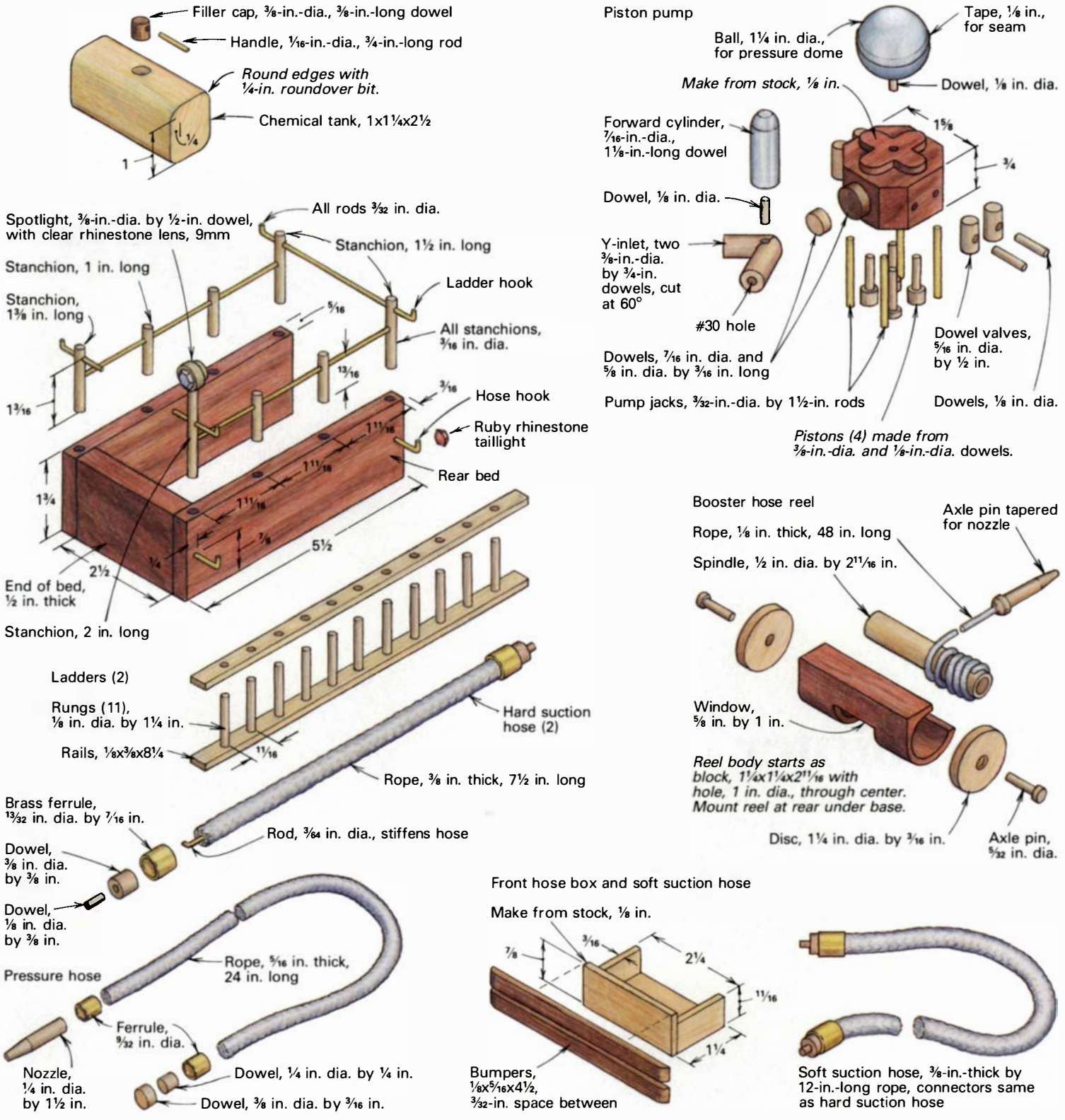
Finishing touches—Hoses, ladders and lights add nice detail to the fire engine. For the hoses, I use three sizes of braided polyester rope, cut with a hot knife to avoid fraying. Each rope receives a ferrule or two, made from brass tubing, and couplers made from short lengths of dowel, as shown at the bottom of figure 1. The nozzle on the booster hose is an axle peg tapered to a blunt point in a pencil sharpener. Use 2 ft. of 5/16-in. rope for the pressure hose stored in the rear bed. Three lengths of ⅜-in. rope make the suction hoses: a 12-in.-long "soft" suction hose, stored in the front hose box, and two 7½-in.-long "hard" suction hoses that mount on hooks aside the bed. Each hard hose is stiffened with a 3/64-in. brass rod threaded through the center. The strainer for the soft suction hose is a ⅜-in. dowel, rounded on one end and wrapped with fiberglass window screening.

Each ladder is made by fitting 11, ⅛-in. dowels into two cherry rails. The headlights are pegged to the corners of the radiator. To

Fig. 1: Ahrens-Fox fire engine



Drawing: Lee Hov



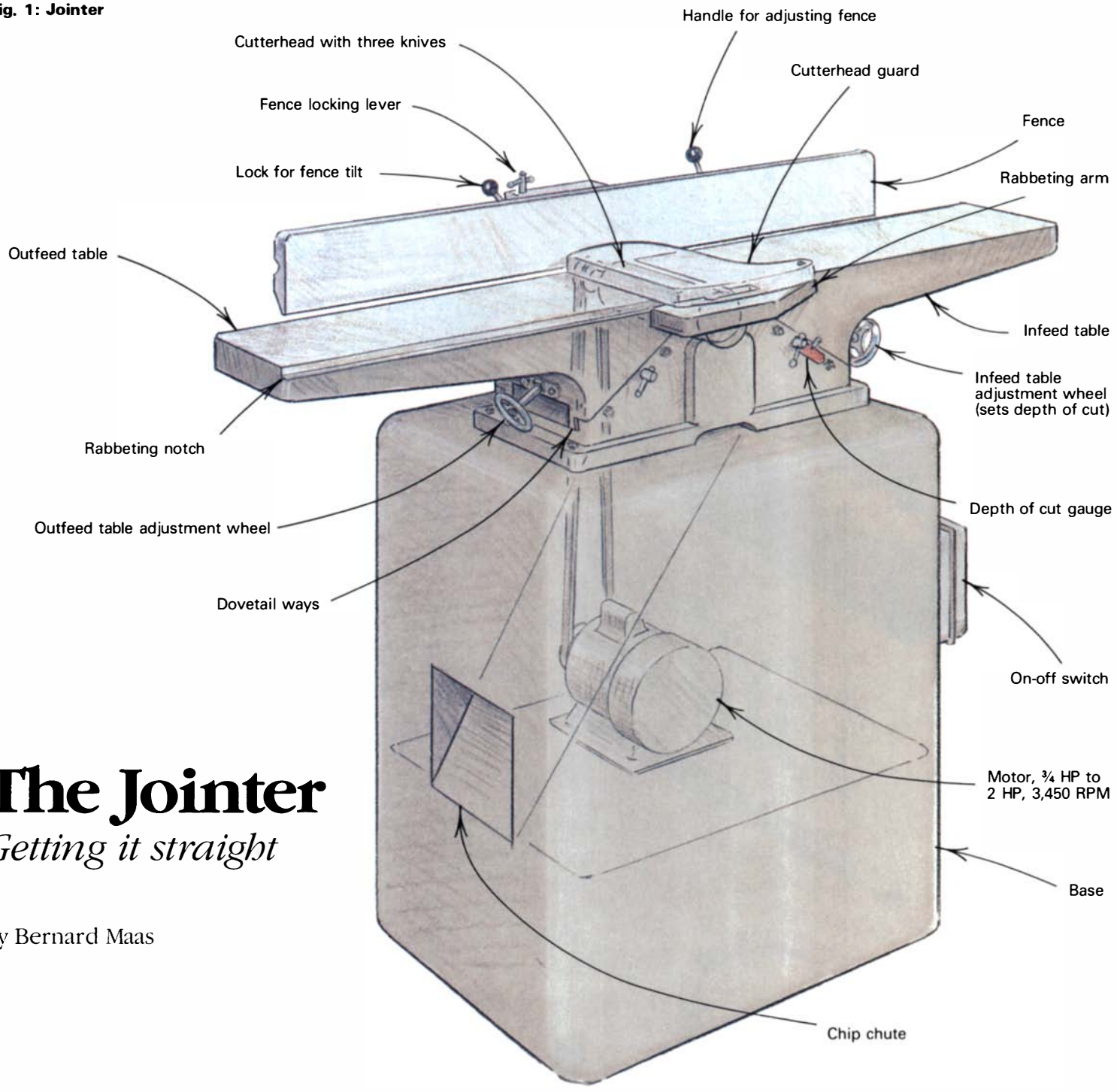
make the spotlight, bore a concentric hole with a ⅜-in. brad-point bit into a ½-in.-dia. mahogany dowel. Slice ⅜ in. off the bored end, slip a 4-in. length of ⅜-in.-dia. dowel into the hole, for a handle, and round the back side of the disc. Glue a 9mm rhinestone (available at a hobby shop) in the hole and pin the spotlight atop the bed stanchion with a 3/64-in. brass rod. Glue two 8mm ruby-color rhinestones to the rear edge of the bed for taillights.

The radiator cap is a 5/32-in. axle peg and a slice of ¼-in. brass rod. Shorten the peg by ¼ in., and then sand the head to 3/32 in. high. Slice a 3/32-in. disc from the brass rod, glue it to the peg and fit it atop the radiator. A small silver bell, about ⅝ in. in diameter (available from a craft supply store) is pinned or glued atop the fire wall.

To make the brake/shift lever assembly, whittle a 5/64-in.-dia. round tenon on two walnut sticks and slip on a brass tube handle. The lever base is a triangular piece of ⅛-in. maple with a radius cut on the shortest side. Secure the lever assembly to the floor board with a brass pin. The siren is two pieces of dowel glued together with a 1/16 in. brass rod hand crank and pegged to the fire wall. A miniature ax (item #756) on the right running board is available from Sir Thomas Thumb, 914 Landis Ave., Lancaster, Pa. 17603. To complete the fire engine, brush a satin finish on the wood and apply clear nail polish on the brass parts to prevent tarnishing. □

Doug Kenney builds wooden model vehicles in South Dennis, Mass.

Fig. 1: Jointer



The Jointer

Getting it straight

by Bernard Maas

A properly tuned up jointer is essential for precision woodworking. Without the jointer to machine a straight, true and square edge or flatten a rough, irregular surface, the other tools in the shop can't fulfill their potential for precision work. If you want to pull straight, flat boards out of the planer, you must start with a jointer-trued surface facedown on the planer table. If the stock is bowed or twisted going into a planer, the feed rolls will clamp it flat during the cut, but the wood will pop back to its old shape on the outfeed. A tablesaw is even more dependent on a jointer; without a straight edge to run against its fence, a tablesaw cannot be safely used. And, of course, when edge gluing boards, that last pass on the jointer guarantees a perfect joint. Even after the panels are glued up, the jointer can be of service, cutting rabbets for joinery and chamfering edges for a finishing touch.

A jointer is a simple machine. It consists of a two-, three- or four-blade cylindrical cutterhead, infeed and outfeed tables and a fence, as shown in figure 1 above. However, this simplicity belies the machine's complex geometry. The infeed and outfeed tables must be perfectly flat and parallel with each other and, across their width, parallel with the axis of the cutterhead, as shown in figure 3 on the facing page. The knives must be installed in the cutterhead so that they all protrude the same distance and the highest point of their arc is tangent to the plane of the outfeed table. If the various components are not properly aligned, the jointer cannot machine a straight and true surface and it therefore becomes practically useless. So, before I get into the specifics of its operation, I'll discuss the jointer itself—its parts, maintenance and adjustment.

Jointer anatomy—Jointers range in size from 4-in.-wide hobbiest models up to 24-in.-wide cast-iron monsters used in mills. The size

Drawings: Roland Wolf

Fig. 2: Gib/dovetail assembly

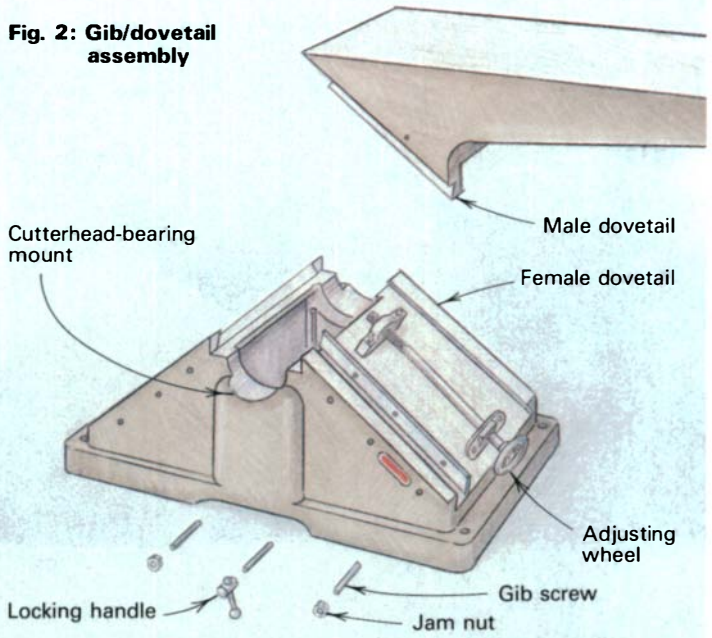
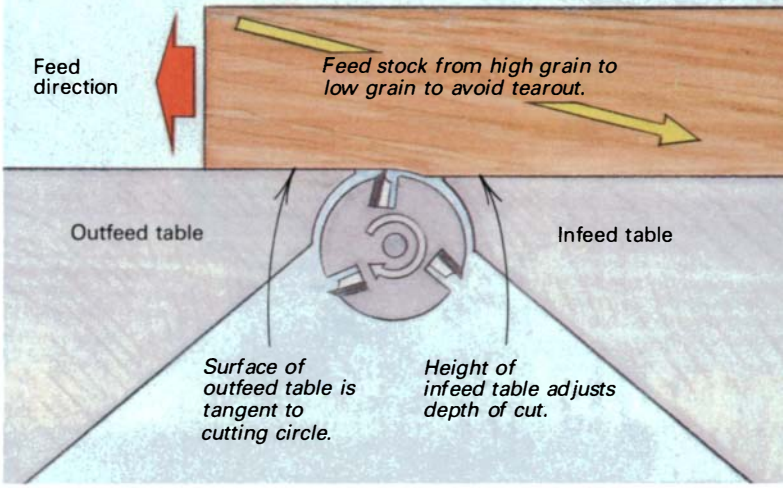


Fig. 3: Table alignment and direction of feed

Infeed and outfeed tables must be parallel with each other and with the cutterhead across their width.

Downward pressure is transferred from infeed table to outfeed table as stock passes over cutterhead.



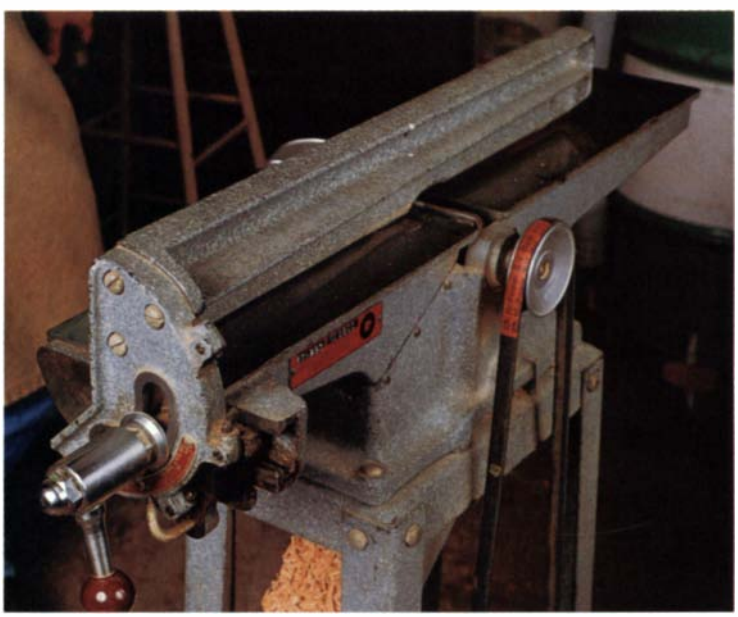
designates the maximum width of the cut the machine can make, based on the length of the knives and the cutterhead cylinder, which in turn dictates the width of the tables. If you walked into a small- to medium-size cabinet shop, you'd most likely find a 6-in.- or 8-in.-wide jointer with a total table length of 4 ft. to 6 ft. Narrower models aren't wide enough to be much good for flattening surfaces of boards and their correspondingly shorter tables don't provide enough support for accurately edge jointing long pieces. The 6-in.- and 8-in.-wide machines strike a balance between performance and cost; their tables are long enough for accurately edge jointing long boards, wide enough to allow some surfacing of boards, and they range in price from $400 to $1,200. As the table width increases, so does the size of the motor and the weight and price of the tool. Most 12-in. jointers qualify in all respects as heavy-duty industrial machinery.

Mid-size jointers generally have a ¾-HP to 2-HP, 3,450-RPM motor that drives the cutterhead between 4,000 RPM and 5,000 RPM with pulleys and a V-belt. To keep your jointer running smoothly, you should periodically check the cutterhead for bearing wear, the V-belt for wear and the pulleys for alignment. The cutterhead bearings should have a solid feel and turn silently. Wobbles, vibrations and grating noises are obvious signals that the bearings should be replaced. As with an automobile fan belt, it's important that the jointer belt is not frayed or nicked. Check the pulley alignment by placing a straight edge flat against the outer rim of one of the pulleys. If they're in line, the straight edge will just contact the rim of the other pulley. Adjust, if necessary, as indicated in your owner's manual. Out-of-line pulleys will not only lead to premature belt failure, but the continuous uneven pressure could eventually erode the arbor hole in the pulley until it won't stay on its shaft.

Depth of cut is regulated with either a lever or handwheel that raises or lowers the infeed table. The distance between the top of the infeed table and the highest point of the cutting arc determines the depth of cut. On some jointers the outfeed table adjusts up and down like the infeed table, which can be handy when replacing knives and aligning the tables.

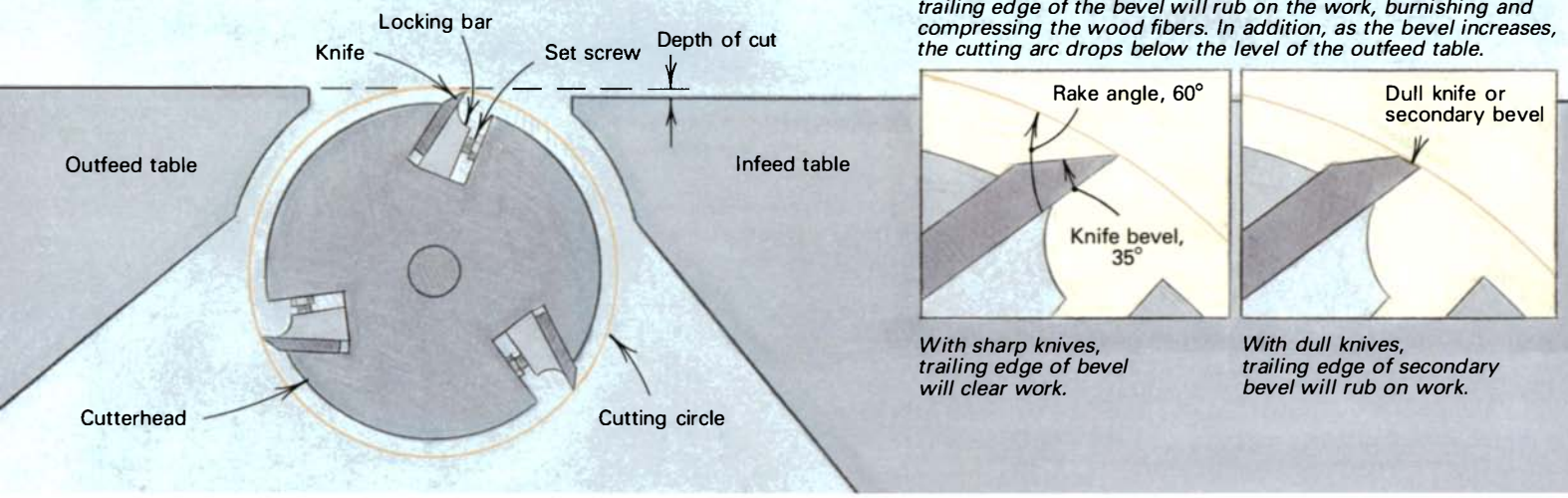
For edge jointing, the fence is usually set 90° to the table. This ensures that the edge being machined will be square with the surface that's run against the fence. The top photo at right shows the type of fence most commonly found on high-quality jointers. This

The Rockwell fence, above, is typical of the center-mount fences found on most 6-in. and larger jointers. The fence is attached to a casting that covers the cutterhead pulley and the exposed knives behind the fence. The lever on the casting unlocks the fence's movement across the tables and the smaller lever unlocks the fence to set its tilt. A plunge pin is a positive stop for 90° and 45°. The knob attached to the fence itself is a handhold for adjusting the fence.



Another common type of fence slides in a channel in the front end of the infeed table. The knob operates a socket wrench that can be slipped over one nut to adjust the tilting mechanism or over another nut to control the side-to-side movement of the fence.

Fig. 4: Cutterhead geometry and the effects of dull knives



When knives are dull or secondary bevel is too great, the trailing edge of the bevel will rub on the work, burnishing and compressing the wood fibers. In addition, as the bevel increases, the cutting arc drops below the level of the outfeed table.

With sharp knives, trailing edge of bevel will clear work.

With dull knives, trailing edge of secondary bevel will rub on work.

If adjusting the gibs fails to correct a table sag or tilt, brass or paper shims can be inserted as shown to lift the table.

fence usually has a positive stop for both 90° and 45°, and the casting supporting the fence doubles as a guard to cover the cutterhead behind the fence. The most common fence on smaller and/or less expensive jointers slides along a bar or track at the front of the infeed table (see the bottom photo on the previous page). Before buying a jointer with this fence, make sure the tilting lock and the side-to-side lock are separate from one another or you will have to reset the fence to 90° each time you move it. It's a good idea to move the fence from time to time to ensure even wear along the entire width of the knives. I like to save 1 in. or 2 in. at the rear of the knives so I have a pristine edge for those final clean-up cuts.

The blade guard is a cast-metal fixture that rotates on a spring-loaded pivot in the infeed table and covers the exposed portion of the cutterhead. Make sure the tension on the spring is great enough to swing the guard up against the fence after the trailing end of the work passes over the cutterhead. Woodworkers can argue all day about the pros and cons of tablesaw guards, but there's no good reason not to use a jointer guard. It's simple and it works.

Aligning the tables—New jointers should come from the factory with their tables parallel to each other and the cutterhead. However, because this alignment is so crucial to a jointer's performance, it's prudent to recheck it anytime the tool is moved or knives are replaced. In the university shop where I teach, I occasionally catch a student using the outfeed table as a seat. After my blood pressure has gone back down, I check the table for sagging (drooping front to rear) and tilting (angling side to side).

To check table alignment, raise the infeed table to the same height as the outfeed table and hold a reliable straightedge, at least 3 ft. long, near one side of the infeed table. If all is well, the straightedge will contact both tables along its full length and no light will show beneath it. Repeat this on the forward side of the tables. If light shows on one side and not the other, there's tilt. If light shows at the rear of the outfeed table and not at the front, it indicates sag. A gap of even a few thousandths of an inch is a problem.

If adjustments are needed, check your owner's manual for the recommended procedure. Don't panic if that doesn't work. The instructions for the 8-in. Rockwell in our shop call for a detailed readjustment of the gibs, which are the keys that fit in the dovetail ways that the table moves along (see figure 2 on the previous page). This has never worked for me. What does work is loosening the gibs, lifting the end of the table and inserting a few shims until everything is back where it should be, as shown in the photo at left. Brass shim stock is ideal, but matchbook covers and index cards are okay and they'll last for years.

Changing the knives—Because of the precision required, some woodworkers dread their first knife change so much that they put it off indefinitely. The knives continue to cut, but they develop a secondary bevel as they dull, as shown in figure 4 above. When this secondary bevel gets to be larger than about 1/64 in., it no longer provides adequate clearance and begins to rub against the wood fibers behind the cut, burnishing and compressing them so they will not glue or finish reliably. You can avoid this by changing the knives when you see a heel forming behind the cutting edge. By the way, honing dull knives with a sharpening stone while the knives are still in the machine will only enlarge the secondary bevel and increase the burnishing problem; it is not a substitute for changing knives. Some books and instruction manuals recommend honing a minute secondary bevel, *as the last step when installing sharp knives*, in order to extend cutting edge life. However, it should be noted that if the honed bevel is too large, you will have the same burnishing problem as with dull knives (see figure 4).

Unless you're experienced at precision-grinding, send your knives out to be professionally sharpened, and keep a spare set of sharp knives on hand to avoid downtime. The knives should come back to you ground with a single bevel of about 35°. Repeated sharpening will reduce the height of the knives. Be careful: Eventually the lock bar may not be able to grip the knife solidly. To avoid a dangerous situation, check your manual or contact the manufacturer for minimum knife height. One more thing to be aware of: Most manufacturers warn that removing all the knives at once and then replacing them one at a time can dangerously stress

the cutterhead. Instead, remove a single knife, replace it with a freshly sharpened one and tighten it down completely before removing the next knife.

The basic strategy of installing knives is simple. The knife is inserted into the cutterhead slot and held firmly, but not too tightly in place, with two or three set screws. At this time, the knife should be parallel with and slightly higher than the outfeed table when the cutterhead is rotated so the cutting edge is at top-dead center. Then, with the cutterhead set at top-dead center, push the knife down until it just brushes a straightedge extending off the outfeed table, as shown in the photo below. When the knife is in line with the outfeed table along its entire length, secure it by tightening down all the set screws.

Simple enough, right? Well, yes, except for the tendency of the knife to devilishly squirm a hair's breadth out of alignment as the set screws are tightened. This tendency can be reduced by tightening the middle set screw first and then alternately tightening the other screws as you work out to the ends. One improvement on the basic system for aligning the knives is to use a piece of ¼-in. or thicker Plexiglas, which spans the width of the cutterhead, instead of a straightedge. This lets you set the height of the knife all along its length in one step. Somewhat more effective is the "Magna-Set," available from Uniquest Corp., 585 W. 3900 South, Suite 6, Murray, Utah 84123; (800) 331-1748. This device has magnets that grip the knife and hold it in alignment while the set screws are tightened. I've found this to be the best solution so far, but even it can be humbled by the proclivity of the knife to squirm as the lock bar is tightened.

Using the jointer—A jointer demands respect! Read your instruction manual and heed its safety warnings. Never run anything shorter than 10 in. through a jointer. Short pieces can tip into the jointer's throat and be kicked back by the cutterhead, potentially exposing hands to serious injury. Likewise, be wary of face jointing thin stock. It chatters, is difficult to feed and may creep uncontrollably under the guard and fence. When edge jointing narrow stock, anything that doesn't stand as tall as the fence, take special care to keep your fingers clear of the cutterhead; nipped fingertips from inadvertently dragging them over the cutterhead are one of the most common injuries in the woodshop. Use push sticks whenever possible, and maintain your balance when feeding stock. You should never be pushing so hard or leaning on the work so much that your hands would be in danger should the piece kick back. Even standing idle, a jointer cutterhead, with its razor-sharp knives, smacks of potential danger, so keep the guard in place.

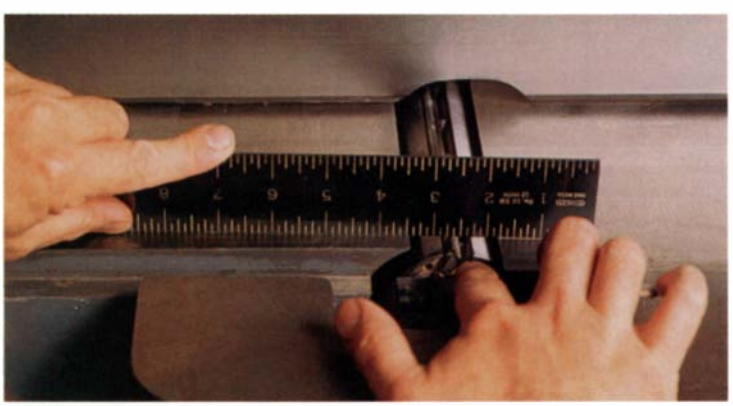
Work is always fed from the right at a moderate rate. Rate of feed is important: If it's too fast, scallops appear; too slow and burn spots show. Feed pressure is in three directions: sideways against the fence to ensure a square cut, downward to eliminate vibration and chatter and forward to advance the lumber. At the outset, both hands bear against the work on the infeed table. As the work passes over the cutterhead, you must transfer your downward pressure to the outfeed table with your left hand and continue the pressure on the outfeed table as you finish the cut to ensure that the flat plane being created on the underside of the work is parallel with the plane of the outfeed table. As you transfer the pressure, you should maintain a constant feed rate because abrupt slowdowns or complete stops will show on the finished surface.

Whenever possible, feed the lumber into the jointer so the cutterhead will be cutting with the grain, as shown in figure 3 on p. 63. Of course, this is the ideal grain picture. Quite often, the grain direction will reverse somewhere along the board. If so, take your best guess and run the piece slowly at a moderate depth of cut. If there's too much grain tearout, reverse the board and make another pass to see if there's any improvement. Tearout can be minimized, and often eliminated, by reducing the depth of cut and drastically slowing the feed rate to a creep over the problem area.

Finally, keep in mind that jointing opposite faces or edges doesn't ensure that they are parallel. For parallelism, true up one face with the jointer, and then run the board through a thickness planer with the flattened face on the table. The same principle holds true for edges. Straighten one edge on the jointer and run this edge against the tablesaw fence as you rip the board to width. If you rip the board 1/32 in. to 1/16 in. wide, you can clean off the saw marks with a single pass on the jointer.

Surfacing—To true up a face, line up the fence with the far end of the knives to allow maximum width of cut. This means full knife exposure because a wide workpiece forces the guard completely aside; so before you begin, see that the blade guard functions properly and you have a solid, reliable hold-down. Figure 5 below shows a hold-down I designed for this purpose. I keep several sizes for different lengths of stock in the university's shop and they've given reliable and safe service for more than 10 years.

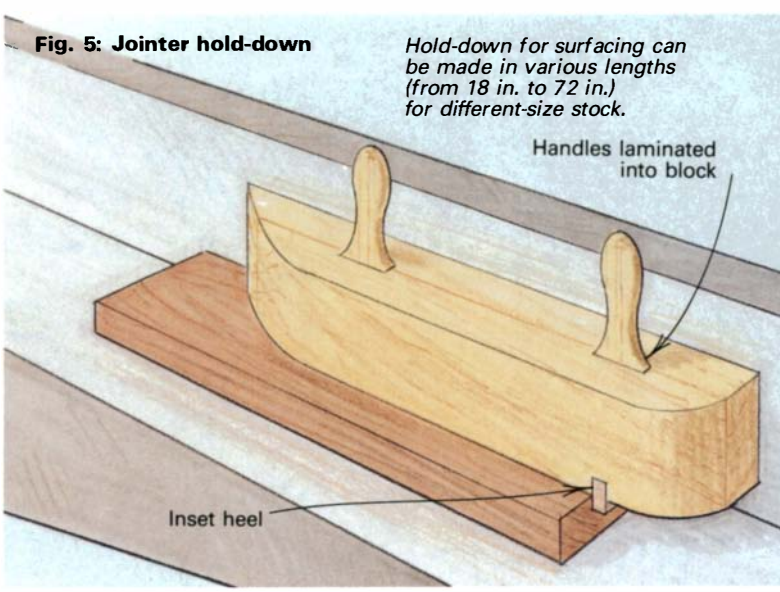
If the board is bowed or cupped, it's best to flatten the concave



To set the knife height, hold a straightedge on the outfeed table and rotate the cutterhead back and forth. Adjust the knife height until it just brushes the straightedge. Set the height at both ends of the cutterhead and then tighten the set screws, beginning with the center one and moving out to both ends. This reduces the chance of the knife squirming out of alignment as the set screws are tightened.

Fig. 5: Jointer hold-down

Hold-down for surfacing can be made in various lengths (from 18 in. to 72 in.) for different-size stock.



side, which allows the workpiece to rest on its "ears" or corners. If you must joint the convex side, flatten the center or high point first. Don't rock the piece over the cutterhead or you'll end up either tapering the work or planing the curve.

Set the infeed table for a cut of 1/32 in. to 1/16 in. and no more! You'll be cutting maximum width and you don't want to lug down the motor. In addition, if you have to use excessive feed force, you increase your chances of slipping. With the heel of the hold-down firmly against the butt end of the stock and with a firm grip on the handles, feed the lumber at a slow to moderate rate over the knives. If the board is twisted, tip it so you're planing down the high corner. Don't let the work tip or rock, but keep it steady and on line. As a flat area is created, press it snug to the outfeed table. Check the surface after each cut to make sure you're removing the high spots. The planed area should increase with successive passes. With bowed boards be careful not to force the bow down as the board passes over the cutterhead or you'll be planing the curve instead of eliminating the high spots.

Experienced woodworkers sometimes surface boards that are wider than the jointer knives by working alternately from both edges of the boards. It's kind of a hit-and-miss process, but with a little practice you can flatten a board up to twice the width of the jointer. Don't worry about perfectly matching the opposing cuts; as long as the board will lie flat, the planer will clean up the job.

Edge jointing—When your properly flattened boards emerge from the thickness planer, they'll have straight, parallel faces. Next, you'll want to establish an edge that is square with the freshly planed faces and straight along the length of the board. For most edge jointing, set the fence exactly 90° to the tables with a square. The exceptions to this would be intentionally beveling an entire edge to a specific angle or chamfering an edge (planing a small bevel along the edge). In these cases, set the angle of the fence with an adjustable bevel square that's been set with a protractor.

If the edges of the boards are nowhere near straight, work the concave edge whenever possible, just as when surfacing. If the convex edge must be worked, go after the high point of the curve first. On extremely arched edges, it might save time to snap a chalkline lengthwise on the face of the board so you can bandsaw it as close to straight as possible before jointing.

The most common error when edge jointing is not holding the trued face tightly against the fence all the way through the cut. Attention to this is even more critical when making beveled or chamfered cuts because the face has a tendency to slide off the angled fence. If your fence tilts in both directions, you can reduce the sliding by tilting the fence so that it creates an acute angle with the table instead of an obtuse angle.

There is one other exception to the rule of setting the fence to 90° for edge jointing. In production shops, it's fairly common to set the fence a couple of degrees out of square when jointing boards to be glued up for doors and panels. As the boards are glued up, the face that was run against the fence is alternated from the front to the back of the panel on each adjacent board. This method results in a flat panel because combining the two angles will always add up to 180°. This technique works fine in a production situation in which panels are glued up from 2-in.- to 3-in.-wide boards without concern for grain match. In this instance, the panels all tend to match because they're all random. However, if grain match is important, jointing from alternating faces might force you to joint an edge against the grain, which could result in tearout. That's why most specialty and one-of-a-kind shops set the fence at precisely 90°; the boards can then be arranged for the optimum grain match and their edges jointed from whichever face will allow the least chance of tearout. □

Bernard Maas is a woodworking teacher at Edinboro University in Edinboro, Pa.

Sources of supply

The following companies manufacture mid-size jointers.

Busy Bee Machine Tools Ltd., 475 N. Rivermede Rd., Concord, Ont., Canada L4K 3R2
Delta International, 246 Alpha Dr., Pittsburgh, PA 15238
Farris Machinery, 2315 Keystone Dr., Blue Springs, MO 64015
Grizzly Imports Inc., Box 2069, Bellingham, WA 98227
Hitachi Power Tools, 4478-E Park Dr., Norcross, GA 30093
Jet Equipment and Tools, Box 1477, Tacoma, WA 98401
Lobo Power Tools, 9034 Bermudez St., Pico Rivera, CA 90660
Makita USA, 14930 Northam St., La Mirada, CA 90638-5753
Mini Max, 5933-A Peachtree Industrial Blvd., Norcross, GA 30092
Powermatic, Morrison Road., McMinnville, TN 37110
Ryobi America Corp., 1433 Hamilton Parkway, Itasca, IL 60143
Sears Power Tools, Sears Tower, Chicago, IL 60684
Shopsmith Inc., 3931 Image Dr., Dayton, OH 45414
Sunhill-Nic Inc., 1000 Andover Park E., Seattle, WA 98188
TCM Industries Inc., 322 Paseo Sonrisa, Walnut, CA 91789
Wilke Machinery Co., 120 Derry Court, York, PA 17402

Jointing beyond the basics

Rabbeting: There are a number of tools to cut a rabbet, including handplanes, routers, dado sets on the tablesaw and high-speed shapers, but when the rabbet runs with the grain, my choice of tools is the jointer. It's easy to set up and it gives crisp and clean results.

Sadly, not all jointers are equipped for rabbeting. In order for a jointer to have this capability, an arm is either bolted to or cast as part of the infeed table to support the work as it's passed over the near end of the knives. A notch (or rabbet) milled into the outfeed table allows the unrabbeted portion of the work to clear the outfeed table, as shown in the photo on the facing page. In addition, the knives should be installed so their ends all extend the same distance beyond the end of the cutterhead.

To set the width of the rabbet, measure from the near end of the knives to the fence. Set the infeed table for a 1/16-in.-deep cut and feed the workpiece into the knives. For each succeeding pass, increase the depth of cut by 1/16 in. or less until you reach the desired depth. The rabbet's maximum depth is limited by the notch in the outfeed table; its maximum width is limited only by the length of the knives. Because the guard must be removed for rabbeting, extra care should be taken with this operation. To ensure adequate hand clearance, the stock should be at least 6 in. wide. If the rabbeted piece must be narrower than 6 in., rabbet a wider piece and then rip it to the narrower width.

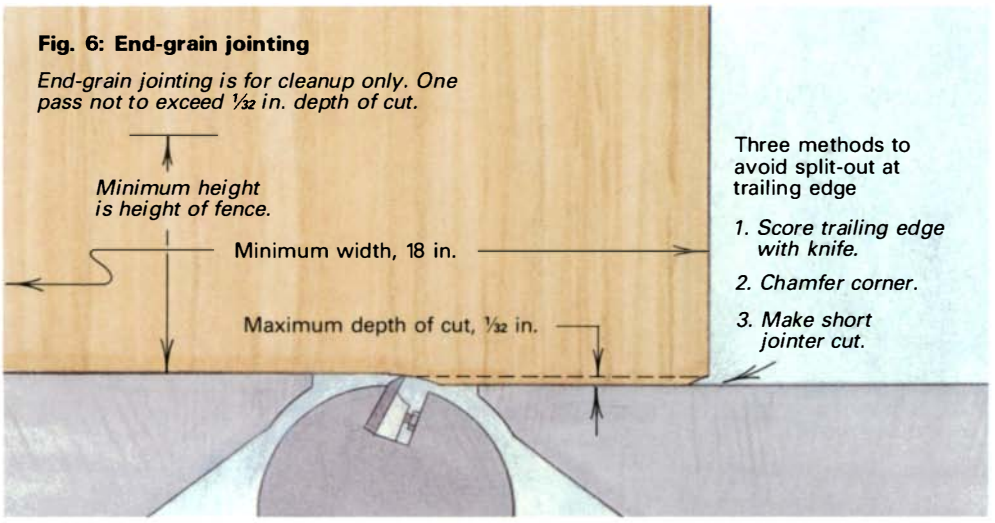
End-grain jointing: Many experts advise against jointing endgrain because the hardness of endgrain dulls knives and also increases the danger of the piece tipping into the jointer's throat and being kicked back by the cutterhead. While there's no doubt that endgrain is harder on knives than side grain, a tight knot is also rough on knives. The likelihood of kickback is not really due to grain orientation; the chances of kickback would increase if the end-grain section wasn't long enough so the panel could be held tightly to the infeed table to prevent the leading edge from tipping into the throat.

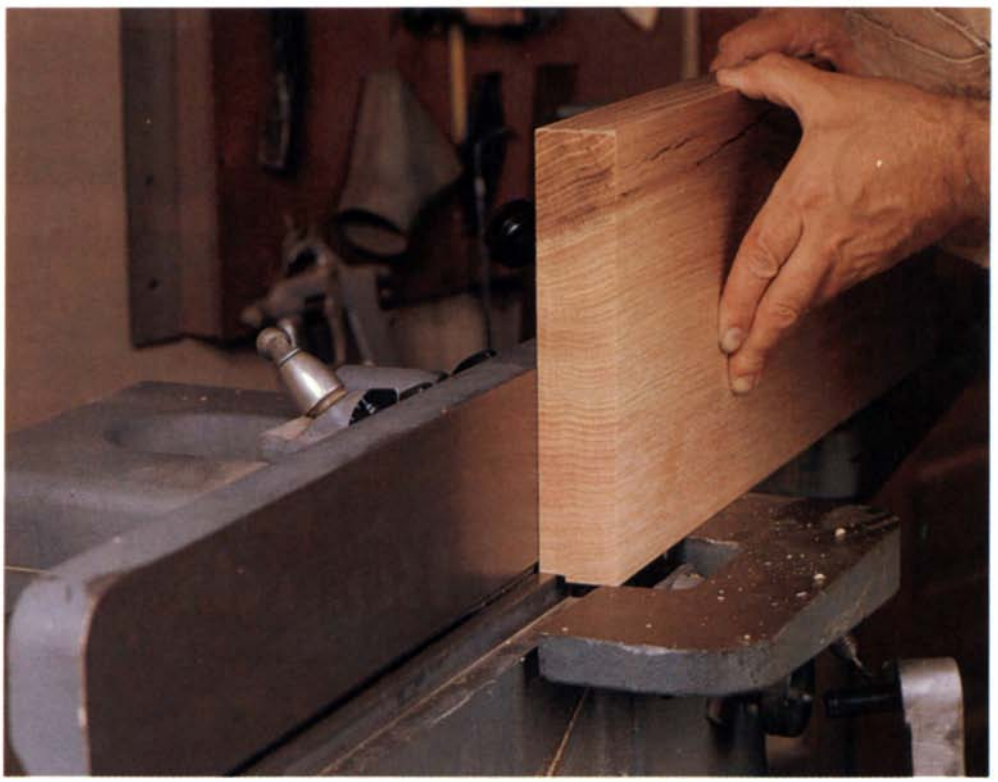
I believe that end-grain jointing can be a reasonably safe alternative to the hours of tedious sanding required to remove every last burn and saw mark from the stubborn endgrain on wide, glued up panels. But end-grain jointing is only safe if the following criteria are met: the panels are at least 18 in. wide across the grain and tall enough to generously clear the height of the fence; very light cuts are taken (1/32 in. or less); and the endgrain of the panel is held firmly to the infeed table until the leading edge has passed over the cutterhead and is supported by the outfeed table.

If these precautions are taken, the endgrain will come through the jointer clean and crisp. However, when the trailing edge hits the knives, the unsupported grain at the back side of the panel will split out. Figure 6 above shows three methods to avoid this. Keep in mind that end-grain cuts are only for cleanup. If you take more than one or two passes, you risk trimming the end out of square with the edges.

Fig. 6: End-grain jointing

End-grain jointing is for cleanup only. One pass not to exceed 1/32 in. depth of cut.





The rabbeting arm supports the board, and the notch in the outfeed table lets the unrabbeted portion of the board go by. Here the author is on his third pass; when rabbeting, the infeed table is lowered an additional 1/16 in. for each successive pass.

Cheap tricks: Following are some quick fixes that add a touch of detailing to a job and give it that million-dollar look of meticulous hand-crafting. For instance, if you're putting up a set of shelves, a simple 1/8-in. chamfer on the edges turns square-nose carpentry into cabinetry. Set the jointer fence to 45° and run both edges through—total time is 45 seconds! Use the same approach to create quickie moldings, cabinet door stops and so on. It's an easy way of softening a corner and the effect is both visual and tactile.

Drawer problems? Perhaps you built them last winter when household moisture was low. When summer brought heat and humidity, your once carefully fit drawers wouldn't budge. The jointer can remedy this in a few minutes.

If the width of your jointer matches or exceeds the height of your too-tight drawers, the fix is easy. Treat the side of the drawer as though you are surfacing lumber. Protect your corner joints by following the rules for preventing split-out when end-grain jointing. Set the jointer for an absolute minimal cut and pass the drawer through. Let the rear of the drawer be the trailing edge, just to be on the safe side. Check for fit and repeat the process if needed.

Are the drawers too high? Use the rabbet setup procedure. Slide your fence forward until the distance between it and the near end of the knives is equal to the thickness of the drawer sides. In turn, pass all four edges (tops or bottoms) of the drawer sides through the jointer. Feather away any cross-grain ragging with sandpaper.

If you're building a cabinet with a door, rabbet the forward faces of the top and bottom boards with the jointer before you assemble the carcase. A 1/4-in.-deep rabbet slightly wider than the thickness of the door should do. The upper and lower rabbets will not only serve as door stops, but also prevent dust intrusion.

While you're working on that cabinet, consider using a continuous piano hinge to hang the door. You can't beat it for strength or the jewel-like detailing of the long, polished barrel. The problem with a piano hinge is mounting it perfectly straight, but if you've got a jointer that can cut rabbets, you've got the solution. Before the carcase is assembled, rabbet both the hinged side of the cabinet and the door edge to just fit the hinge leaf. Be sure to let the entire barrel protrude beyond the door and frame. Now, here's the trick: When you're locating the screw holes with the awl, punch them off center, toward the rear of the rabbet. Then, as the hinge is screwed down, it will be drawn tightly to the wall of the rabbet and be dead on line. —*B.M.*

Glued-up panels are essential for many woodworking jobs. The process seems straightforward, but care must be taken to ensure that the panel has an attractive grain pattern, is flat and free of excess glue. Above, the author removes glue squeeze-out with one of the small plastic tabs used to seal plastic bags in grocery stores. The narrow strips along the edges of the assembly are scraps that prevent the clamps from damaging the panel. Clamps are mounted both above and below the panel to keep it flat.

Edge Gluing Boards

Making flat panels with nearly invisible joints

by Christian Becksvoort

Many woodworking projects involve gluing together several narrow boards to make a large panel for a tabletop, carcase side or other large surface. The process seems fairly straightforward, but there are many factors to consider. Selecting the stock, matching and orienting the grain, jointing the edges, gluing and clamping all affect the outcome of the finished panel.

The process begins with proper stock selection. It is highly unlikely that you can get a finished ¾-in.-thick panel out of ¾-in. stock. Even if the glue-up was perfect and the surfaces were planed to perfection, some scraping, sanding or planing would be necessary. Rough ¼ lumber is a full inch, which gives ample thickness for machining out a ¾-in.-thick panel. Unfortunately, the surface of rough-sawn lumber is so uneven that it is difficult to match grain and color or detect minor imperfections, such as surface checks. Thus, when I purchase ¼ stock, I have it milled on two sides to ⅞ in., hit or miss. This means that most of the faces will be planed (hit), although there will be an occasional patch missed by the planer. To me that's a good compromise; about 95% to 98% of the surface is visible, yet there is still ⅛ in. of stock for sanding or planing after the panel is glued. The result is a clean panel that is a full ¾ in. thick.

In general, avoid cupped or twisted stock. Bows and crooks are salvageable. The more careful you are in selecting stock, the easier the glue-up and the flatter the panel. When possible, cut all the pieces out of a single board to ensure similar grain and color throughout. Remember, it is virtually impossible to get three 4-ft. pieces out of a 12-ft. board. Most boards must be trimmed from 1 in.


In gluing up narrow boards, the goal is to produce a panel of uniform color, with a fairly continuous grain pattern across its width, as shown in the photo above, left. A poorly matched panel, shown in the photo above, right, looks more like an assemblage of separate boards.

to 6 in. on each end to remove checked sections. Individual panel pieces should be 1 in. to 2 in. longer than the finished panel to allow for gluing, clamp "sliding" and final trimming. Also, allow ample width for jointing, especially if the pieces are crooked or have rough edges.

Matching grain and color—When all the panel pieces are cut, match the grain and color. The goal is to produce a panel that looks as if it has continuous grain across its width, as opposed to separate boards glued together. Parallel grain along the edges of boards is fairly easy to match to parallel grain of the next board. Wide-face grain is a bit more difficult, while grain that runs out at an acute angle is extremely difficult to match up. The photos above show good and poor matching in a panel. With a little time, effort and practice, matching grain becomes almost second nature. The result of a well-matched panel is quite subtle. On the other hand, a mismatch is glaringly obvious. Experiment with different patterns: Remember that even with only two boards there are 16 different combinations of matching them!

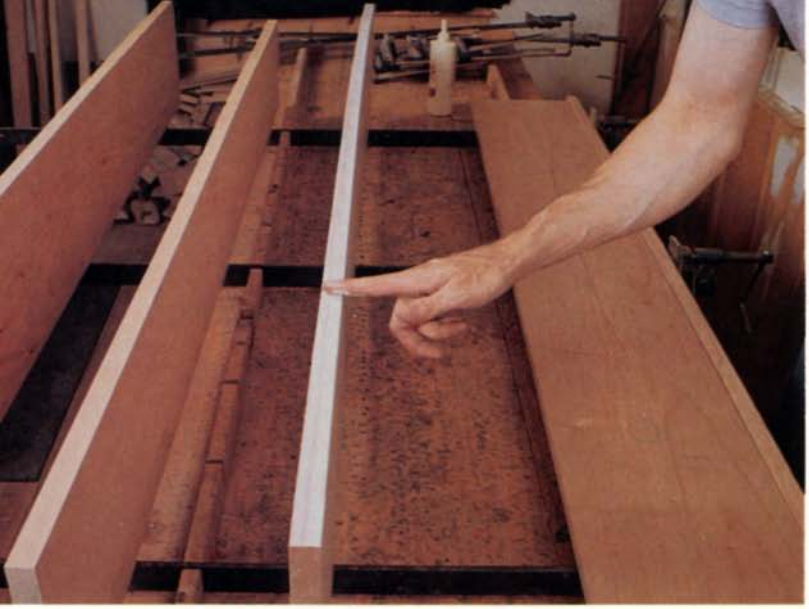
Another aspect of matching is growth ring orientation. Here there are two schools of thought. The first holds that every other board in a panel should have its growth rings reversed. Thus, as each board cups, a slightly wavy panel results. The other theory is to have all the growth rings face the same direction. Then, if the boards should warp, they form one large curve. Generally, I hold with the second theory; I use cherry almost exclusively and it is a relatively stable wood. But I would follow the first method if I was working with wood that was prone to cupping or to excessive movement throughout the year (such as oaks or hickory). A second factor would be the amount of bracing or support attached to the panel. A tabletop with little overhang and rails under its full width will usually stay flat. So will a chest side that has locked corners and divider supports. On the other hand, large free-floating or unsupported panels, such as pedestal tabletops or slab doors, should have their growth rings reversed.

Finally, don't let rules stand in the way of common sense. If you have only three boards, and each has one good face and a minor defect (knot, worm hole, sap or chipped grain) on the other face, then obviously the defects all go on the underside. Nobody wants them on a tabletop or the outside of a cabinet, no matter what the rules say. Once the boards are selected and their positions in the panel are determined, I mark the panel with a triangle, like the one shown in the above, left photo. The triangle makes it easy to instantly reconstruct all the careful matching you've just completed.

Next, true up the edges with a jointer or a long handplane. Either way, the edges of all boards must be absolutely perpendicular to the faces, otherwise the panel will be cupped. Some older texts recommend leaving a 1/64-in. gap in the center of each joint. This works only if the wood has recently come out of the kiln and has picked up some moisture at the ends. The theory is that eventually the rest of the board will pick up moisture, thereby relieving the stress caused by the gap. When I join boards, I aim for a tight joint along the full length. Undoubtedly there will be slight gaps now and then. If hand pressure can close the gap, I don't worry about it. However, if full clamping pressure is required to close the joint, there will be too much stress on the panel and the pieces must be rejointed. I always dry-fit my panels before gluing, so I can check if all the joints are tight, and identify potential problems, such as misalignment. For instance, two adjacent bowed boards may align properly, but result in a bowed panel. In this case, it's necessary to flip one board over so the bows counteract each other. Even though this makes aligning the joint more difficult, it results in a straighter panel.

There are several ways to make aligning boards easier. In furniture factories, a "glue joint" is used. This is usually a modified tongue-and-groove joint along the edges. I should stress that this joint is merely for alignment, not for extra strength. A fresh, well-fitting butt joint with good glue is more than adequate. Old timers used dowels on their glue joints, but I don't care for them. In fact, if they are too long, they can actually work to weaken the joint, since the grain of the dowels runs across the grain of the boards. I find these devices unnecessary. If an unexpected misalignment occurs during glue-up, lay a piece of scrapwood on the high area and persuade it down with a mallet before the clamps are fully tightened.

Glues are a matter of preference. There are specific glues for special circumstances: resorcinol and epoxy for exterior use, plastic resin for water resistance and hide glue for possible future disassembly. I use an aliphatic resin glue, Titebond, almost exclusively. It is relatively inexpensive, has a reasonable assembly time, requires no premixing, possesses a long shelf life, sets fast, has very little creep and makes an exceptionally strong joint. It's ideal



Fingers make fine glue applicators. Here the author runs a bead of glue along the length of the joint and spreads it over the entire edge. A brush or narrow paint roller could also be used.

Rather than rely on dowels or other devices to align boards during glue-up, Beckvoort simply uses a mallet and a piece of scrap to hammer on the joint until the boards lie flat.

for panel work. Clamp time is 20 minutes under ideal conditions (over 75 degrees F, low humidity) to two hours if the panel will be subjected to stress (planing or sanding).

Clamps are another item to take into account. Bar clamps come in standard lengths, from 1 ft. to 10 ft., while pipe clamps can be made from any length pipe. Although pipe clamps are cheaper, they bend easier. The steel I-clamps or flat bar clamps last several lifetimes. My favorites are Hartford clamps, no. 5, available from the Hartford Clamp Co., Box 8131, E. Hartford, Conn. 06108; (203) 528-1708. These have a ¼-in. by 1½-in. steel bar, and a sliding L-vise handle, which is a joy to use in close quarters.

If you glue panels on a regular basis, a glue table or rack is indispensable. Pipe clamps have "feet" or flat bases that allow them to be set directly on the floor or workbench. Bar clamps are more likely to tip over, so they should be supported by a rack or glue table. The table consists of a sturdy base, a top at a convenient height and two ¾-in. by 2-in. rails about 24 in. apart to accept clamps. After you clamp the rails together, cut slots about 6 in. apart with a dado blade. The size and shape of the slots depend on the style of clamps you have. Then, attach the rails opposite each other. When setting up the table, place clamps in the end slots and sight along the length of the table to be sure the clamps are parallel, that is, in the same flat plane. The table may need to be shimmed, otherwise you might introduce twist into the panels being glued. A glue rack is a little simpler—merely two rails on a frame or, better yet, on a braced plywood sheet to catch glue drops. The rack can be put on sawhorses and stored upright if space is at a premium, but it will have to be leveled each time you use it.

Tightening clamps—On most panels, I space the clamps about 2 ft. apart on the glue rack. As the glue-up proceeds, other clamps will be put on the top of the panel between the bottom clamps to equalize the pressure and keep the panel flat. Spacer sticks inserted on each edge keep the clamp heads from compressing the grain. Now it's time for a dry run. Does everything line up? Are there any major gaps? Can you align the joints? If all checks out, it's glue time.

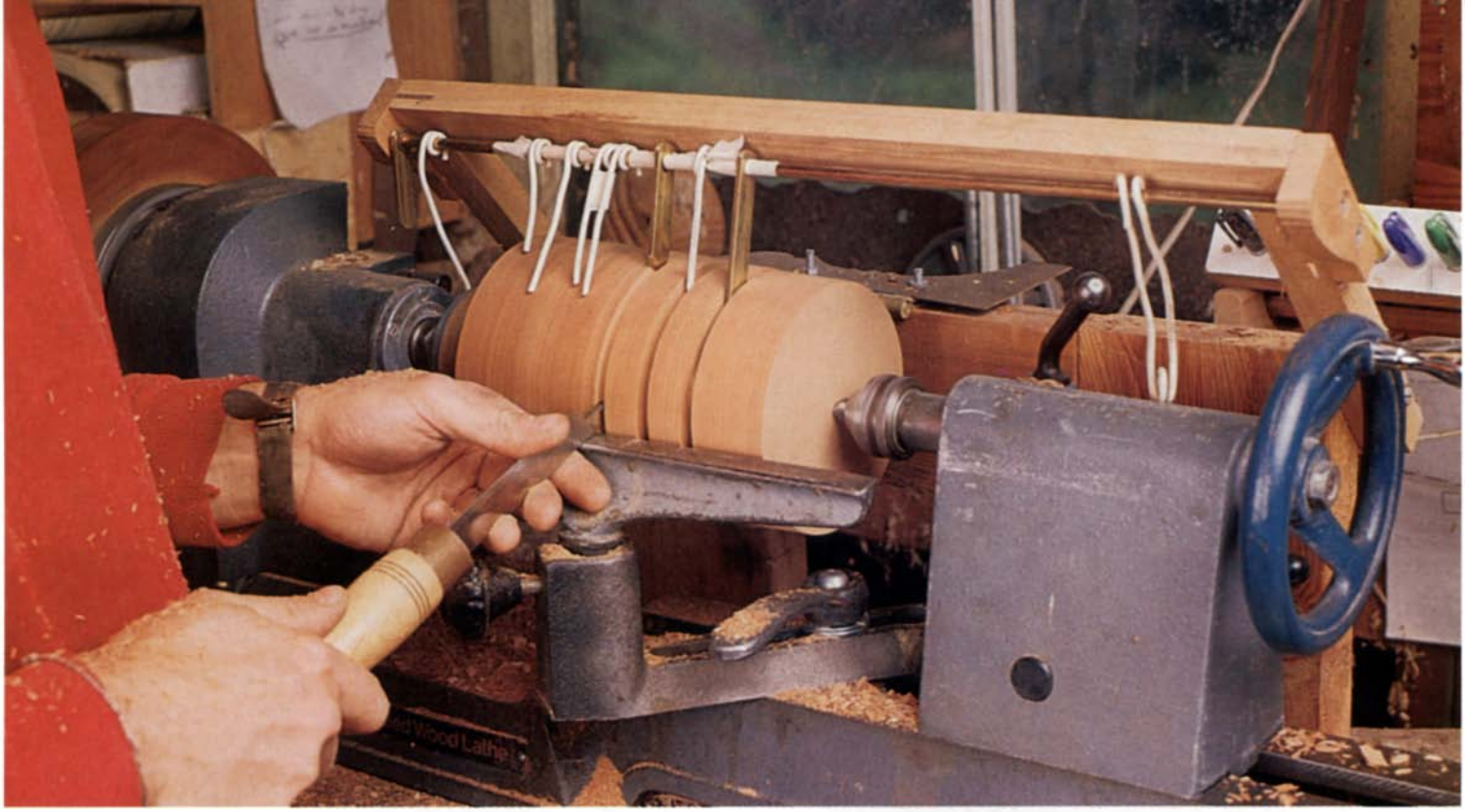
I prefer a thin glue film on each surface of the joint, but one thick film per joint works too. Run a bead of glue the length of the joint and spread it over the entire surface of the edge. Fingers work fine as applicators, as shown in the above, left photo. Then, lay the boards back down in order and proceed clamping. I usually start at the area of worst alignment and force the boards up or down as needed by pushing, prying ends up or down or persuading high spots with scrapwood and a mallet, as shown in the above, right photo. After the first bottom clamp is tight, set a clamp on top, midway between the bottom clamps. Never tighten all the bottom clamps first, as this causes the panel to buckle and explode. Finally, go back and tighten up the clamps as much as possible. If necessary, clamp the ends, as shown in the photo on p. 68. Having "glue-starved joints" is nothing but an excuse for dirty (oily), ill-fitting joints or inappropriate glue. The clamp pressures recommended by glue manufacturers for automatic clamp presses far exceed any pressure you can apply by hand. The key is to keep the pressure even on the top and bottom so the joints are tight and the panel flat. A certain percentage of glue is forced into the grain; only the excess squeezes out. Have you ever noticed that when using very thin glue films there is little, if any squeeze-out? Even so, the joint holds.

Excess glue should be removed since it introduces moisture into the panel, causes swelling and slows drying. It also clogs sandpaper and gums and dulls planer knives when dry. A cloth or scraper will do, although recently I've started using the little flat plastic tabs used to seal plastic bags in grocery stores. They do an excellent job and can be reused by flexing them and popping off the dried glue. Be sure to remove glue from both sides of the panel. When doing a run of several panels, scribble the time on the panel so you'll know when you can free up the clamps for the next round.

Cleaning up squeeze-out—As a general rule of thumb, I never glue up wide panels in one piece, but in two halves. A 48-in.-wide tabletop made up of many narrow boards can provide a real wrestling match. Four or five boards is all I usually do at a time, unless they are very well behaved.

When the panels are dry, the clamps can be removed. Again, alternate between the top and bottom clamps so that the pressure can be released evenly. Planing or sanding is the next step, which you can do in your shop if you have a wide planer or belt sander. I find it is more cost-effective to take several panels to a large cabinet or mill shop and use the wide belt machine. Five or six panels can be sanded, all the same thickness, flat and smooth to 120-, 150- or even 180-grit, in about one-half hour at a cost of $20 to $30. These machines can handle 24-in.-, 36-in.-, 48-in.- or 56-in.-wide panels. Look in the yellow pages and call for an appointment. □

Christian H. Beckvoort builds custom furniture in New Gloucester, Maine, and is a Contributing Editor to Fine Woodworking.



For fast and consistent multiples, the author uses a special jig, consisting of a series of dangling brass and wire fingers supported by a hinged frame. Fingers of varying lengths are set to ride on specific places on the turning. When a finger falls through a groove that's been cut with a parting tool, Gellman knows he has reached the desired depth.

Efficient Spindle Turning

Tricks for speed and consistency

by Steve Gellman

I began woodturning nine years ago on a light-duty Walker Turner lathe set up in the mudroom of our home. I turned firewood into mallets, rolling pins and spindles, although my tool techniques were unsophisticated and I used more sandpaper than I care to remember. As I progressed, I kept coming up against the difficulty of making identical copies of objects. With no formal training in woodturning, I had to rely on a laborious mishmash of techniques to get the job done. It was only after hundreds of hours working at the lathe that a process, an efficiency, began to emerge from it all.

Nowadays, I do a lot of architectural work, and specialize in building stairways for which I make all the parts, including balusters, finials and newel posts. I also manufacture several turned items, including wooden tops, turned boxes and a line of falconry accessories. All these products require good production spindle-turning skills. In this article, I'd like to share some of the tricks I've discovered during my trial-and-error learning process. Whichever ones you adopt, I think you'll find that they'll not only speed up your turning, but make it more consistent and enjoyable as well.

Improving your lathe—Whatever turning you do, it's important to work on a well-tuned lathe. Even if you have an inexpensive lathe, you can make several easy modifications to improve its performance. The simplest is to add weight to the lathe stand, which increases the tool's ability to absorb vibration and prevents the lathe from waltzing around the room when you turn a heavy, out-of-round blank. To increase the weight of my lathe, I built a ¾-in. plywood box to straddle the legs and filled the box with 750 lbs. of sand.

A couple of little lathe annoyances that can slow down production are also easy to fix. One is a nicked and dented tool rest, which can lead to a bumpy surface on the workpiece because it prevents you from making a sweeping cut with a smooth, continuous motion. First, you can avoid denting your rest by grinding off the sharp corners of your lathe tools. To clean up dents and nicks, I either file the surface of the rest smooth or epoxy an old hacksaw blade (with the teeth filed off) to the top of the rest. The blade provides a new rest surface, and the hard steel of the blade is very difficult to dent. Another annoyance I lived with for years was the lightweight little plastic handwheel on the tailstock. I finally bought a new 6-in. cast-iron wheel and handle (available from

A shopmade lathe clutch, shown here fitted to Gellman's Rockwell lathe, can speed up many spindle-turning jobs because it makes it possible to disengage the motor without switching it off. The clutch also allows turning speed to be decreased during a cut.

The author's shopmade steady rest consists of two wedge-shape pieces fit between the ways, one with a notch that bears against the spindle, preventing it from whipping. As the spindle diameter decreases, Gellman taps the rear wedge to advance the friction steady rest, which is made from naturally oily teak.

MSC, 151 Sunnyside Blvd., Plainview, N.Y. 11803; 800-645-7270, in N.Y. 516-349-7100) and had it machined to fit my tailstock. The heavier wheel tightens or loosens with a flip of the wrist, and makes mounting or unmounting a workpiece lightning fast.

Another time-saving accessory is a foot-operated clutch, shown in the top photo, above. I learned about this device from Del Stubbs, a California turner and teacher who uses the clutch both to save time and to make turning safer for beginning students. The clutch works like this: The lathe's motor is mounted on a hinged plywood plate that allows up-and-down movement. A cable tied to the motor plate goes up to a small pulley underneath the lathe ways and then down to a hinged foot plate near the floor. The operator disengages the clutch by stepping on the foot plate, hence pulling up on the motor plate and releasing the tension on the drive belt. The clutch makes it unnecessary to shut off the motor to install or remove a turning blank, check the progress of the turning or change the position of the tool rest. The clutch also allows you to start the workpiece spinning slowly. Work carefully if you build a clutch for your lathe. Install lock washers on all the screws and bolts and use a braided steel cable; if the motor plate was to suddenly release, the lathe would unexpectedly and instantly begin spinning, possibly causing serious injury.

Making steady rests—Long, thin spindles tend to whip during turning unless stabilized by a steady rest, a friction device that supports the rotating spindle. In my shop, I often use my fingers to support the spindle during turning because I can feel what's happening between tool and wood. If a piece gets too hot, I use a rub block, a small piece of green wood with a V-notch cut in it.

There are dozens of steady rest designs, and many of those are described in *The Practical Woodturner*, by F. Pian, 1979, part of the Home Craftsman series published by Sterling Publishing Co. Inc., 2 Park Ave., New York, N.Y. 10016. I use three basic types. One commercially available rest has a rigid rim with three adjustable friction contacts. I prefer it for large architectural turnings because it surrounds the workpiece and locks it on the lathe, even if the piece should come loose during turning. The second type, which I made in my shop, has two ball bearings mounted on a post that fits into the tool-rest base. The bearings roll against and support the spindle—it's unbelievably loud, but effective. The third type of rest, and the one I use most often for production turning, is shopmade from two wedge-shape pieces of teak slipped in between the ways of the lathe bed. One wedge has a V-notch cut out that contacts the spindle (see the bottom photo at left). Although the oily teak prevents burning, I usually rub candle wax into the notch. Unlike a fixed rest that has to be moved and reset as the spindle gets thinner, my homemade rest can be quickly tapped down to maintain constant support of the spindle.

Holding the work—Chucking is the process of holding and driving turning blanks; employing an efficient chuck system is the key to profitably turning a large run of spindles. While there are lots of commercially available chucks, don't limit yourself to what's offered in catalogs. A woodturning lathe allows lots of room for creative implementation of homemade chucks and holding devices. Often in production, the workpiece will go through a number of processes and I often turn a special fitting for a specific job; for instance, if the spindle ends are round, I'll make a concave-shape tip. The only real requirement for homemade fixtures is that the headstock drive chuck must center the work and provide enough friction to spin the piece; the tailstock must grip the work so it runs true and provide enough pressure to keep the piece snug against the drive center. Most high-quality lathes have a Morse-taper hole in the headstock to accept the drive center and a similar hole in the tailstock for a live center. By turning a matching Morse taper on one end of a short blank and a cup, cone, sphere or square on the other end, you can customize a chuck to fit the particular spindle you're turning. Further, a custom center allows a turning that's already been cut from the lathe to be remounted for finish-turning or sanding.

Finding spindle centers—Finding the center of a blank quickly and precisely is important, especially when you have a dozen or more spindles to turn. For smaller spindles, I use the centering jig mounted under my lathe, shown in the photo on the facing page. It's comprised of four small square frames with a screw point protruding in the center of each one. To use it, you simply push the end of the blank into the frame that's just larger than the blank, rotate the blank until all four edges touch the frame and push in—it's much faster than marking diagonal lines.

Often, a spindle is temporarily removed from the lathe during

turning; for instance, to drive a ferrule on a turned handle. To recenter properly, the spindle must go back on the drive center in the same position that it came off. Therefore, I notch one prong of my spur-style drive center with a small grinding bit in a Dremmel tool. After I chuck the spindles once, they bear an impression of the spur so I can easily refit them on the drive center.

Choosing lathe tools—Selecting the right tool is as important in turning as it is in any other woodworking task. This is especially important if you're turning multiples because the right tool will do the job faster and leave a better surface on the turning. Although I own many turning tools, I use just a few of them for most of my production work: a ½-in. deep-fluted gouge ground to a lady-finger profile, a 1-in. straight skew, a 2-in. rounded skew, a 1½-in. "peeler bar" (a square-nose scraper-like tool), ¾-in. and 2-in. gouges and an assortment of parting tools. For spindle work, I prefer tools with steep, slightly hollow-ground bevels that are angled between 30° and 32°. In contrast, most bowl gouges come ground to a shallow angle, sometimes only a few degrees. I also like grinding down the shoulders on all my gouges, producing a lady-finger profile, which looks like the blade of a spade shovel. Even though it means more sharpening, the gouge's steep beveled edge and the rounded shoulders allow me to get into tight places on a turning, like narrow coves or between beads, without the corners of the edge catching.

I've grown accustomed to using a ½-in. "long and strong" deep-fluted gouge for turning most of my beads and coves. A 2-in. gouge is a beginner's delight and a workhorse of a tool. This tool can level, hog out or take very fine shavings. The gouge's 1-in.-deep edge has corners high enough above where most cutting takes place that it has very little tendency to catch the spinning work. With the gouge's edge skewed to the work, I get a cut that's a cross between the cut produced by a regular skew and peeler bar.

I have a couple of different-size skews for different jobs. I use a ¾-in. or 1-in. skew for turning pummels, and for most ordinary operations, such as leveling, my 2-in.-wide carbon-steel rounded skew can't be beat. It's just like a regular straight skew, except I grind the diagonal cutting edge to a shallow convex curve with the edge bevel hollow ground and finely honed. The tool produces a very clean cut because the thin, sharp edge slices the wood fibers instead of scrapes them. I use the rounded skew like a regular straight skew for rough leveling, but the rounded blade gives me more edge to work with and is less likely to catch. Also, since the curved blade has less contact with a flat surface, there's less pressure on the workpiece and less likelihood of breaking a thin spindle.

One of my favorite lathe tools is the peeler bar because its wide edge allows full contact with the workpiece, so I can remove a lot of wood, fast. The tool is like a square-nose scraper, but is beefier and has a steeper bevel. I made my peeler bar from an old planer blade that's 1½ in. wide and ⅜ in. thick. Viewed from above, the profile of the cutting end is square, except for the left corner that's rounded to about a ½-in. radius. The entire cutting edge is ground to a 45° bevel. The rounded left shoulder of the tool allows long, fast pulling cuts from right to left without the edge digging in. To use the peeler bar for say, rounding a square blank, set the tool rest the thickness of the blade below center and position the tool at the middle of the blank. Now, drop one hand so the heel of the bevel contacts the spinning blank on center, angle the tool 15° to the axis of the blank and take a sweeping cut from the center outward (to avoid splitting). I often use my peeler bar to take long leveling cuts on straight or barrel-bellied spindles.

With any of these tools, the most important point to remember is that unless they're 100% sharp, you'll have to force them through the wood, and this is where most problems with tool digging or grain tearing occur. My sharpening method involves grinding the bevel on a 100-grit aluminum oxide grinding wheel, turning at a slow 150 RPM to prevent heat from ruining the tempered edge, and then honing the edge on a fine India stone, using soap and water as a lubricant. My sharpening setup is directly behind where I stand at the lathe so I can quickly turn around to touch up an edge and get right back to work.

Gellman uses his shopmade center-finding jig, mounted conveniently under his lathe, to quickly mark the center on a spindle. After selecting the correct-size frame, he rotates the turning blank in the frame, automatically centering it, and then he pushes the blank against the screw in the center to mark it.

Jigs for turning multiples—Repetition and consistency are the keys to good production turning. Short of using a duplication lathe, the trick to efficiently turning identical spindles, like all the balusters for a staircase, depends on quickly establishing the location and depth of elements, such as pummels, coves and beads. There are many ways to do this, but the most common is to use a pattern or marking stick to locate the transitions and calipers to check the diameter of the spindle at various points. First, mark the end pummels and cut these shoulders with a skew or gouge. Then, rough-turn the length round and mark the transitional elements from the pattern or marking stick. Next, a parting tool is plunged in at each mark to reduce that detail to the proper diameter, which is checked with calipers; most production turners have enough calipers to set one to each diameter needed. On a long spindle, you'll need to set a steady rest and you might not want to cut the thinnest portions until the rest of the spindle is turned to avoid whipping problems. Now you can turn the areas between the transitional elements to shape. Some turners like to keep a pattern behind the lathe so they can cut the shape mostly by eye. It's amazing how accurate you can be this way.

In lieu of calipers and a pattern, there's a simple shopmade device that can aid the production of identical spindles. The jig, shown in the photo on p. 71, consists of a wood frame that's hinged off the back of the lathe and designed to swing over the bed. The top of the frame holds a rod from which a number of short lengths of wire and/or brass bar hang. These "fingers" are arranged, according to length, directly over the transition areas to act as both markers and depth indicators. Masking tape is used to keep the fingers in their proper locations on the rod. After the blank is turned into a rough cylinder, the fingers ride on the turning while a parting tool is used to cut the grooves. Each finger shows when the tool has cut deep enough by flipping through the groove to the back side of the turning. These fingers can be repositioned as needed and can be tailored to suit any production turning job. □

Steve Gellman is an architectural woodturner and stair builder in Arcata, Cal.

The author made four of the easy chairs described in this article and 14 additional pieces in a limited production run of contemporary furniture that required developing jigs for accurately and consistently making more than 375 mortise-and-tenon joints.

Making Easy Chairs

Tenoning square rails to round legs

by Ray McCarthy

Over the years, I have developed a pretty efficient system for building traditional-style furniture and contemporary cabinets. But when architect Al DeVido approached me with his design ideas for a whole house full of contemporary furniture, I had to rethink my entire operation. He wanted me to make 14 chairs of various styles, one sofa and three tables that involved 72 legs and more than 375 mortise-and-tenon joints, a mass of millwork and joinery greater than anything I had confronted before. And although DeVido designed the furniture, I was still responsible for its structural quality. In gearing up my shop and methods for this production run, I had to avoid getting hung up on the idea that the standard way is the only way. For example, traditional wisdom calls for cutting joints while pieces are square and then shaping them. But the jig system I developed made it easier to shape the stock and then chop the mortises.

In this article, I will describe the basic design and techniques I used to build an easy chair. You also can scale up the chair dimensions to build the sofa or apply the system to a table. It's a good first project for a chairmaker because you can use a single easy chair, whereas dining chairs generally require building a set. Each of the four easy chairs has four corner posts joined to side panels, a back panel and a front rail with mortise-and-tenon joints. Flats routed on the legs using a simple jig setup give these joints the appearance of being coped. A plywood seat base, fastened to cleats, slants gently from the front rail to the back of the chair and a slatted backrest supports overstuffed cushions. The panels for the sides and backs are overlapping decorative layers of veneered plywood. Different shapes and colors were used for each panel, as can be seen in the photo above. The side and back panels are assembled before joining them to the posts.

Stock preparation—I used white ash because the design called for a light-color wood, and I wanted a more prominent grain pattern than either birch or maple. I selected 12/4 stock for the legs and 5/4 stock for the other parts and looked for pieces with consistent color and straight grain. The 5/4 stock was already surfaced on two sides, and when the lumberyard offered to surface the 12/4 stock free of charge, I jumped at the chance; however, I supervised the operation to ensure the wood was fed in the proper direction through the planer to avoid excessive tearout.

Because 3-in.-thick ash is especially prone to warping, I cut it 1-in. oversize and let it stabilize for a few days before working on

the legs. The extra width was just enough to allow me to remove the bow that developed after ripping. Straightening the badly warped wood on a jointer would have taken a lot of time, so I reripped the pieces on the tablesaw with a straightening jig—a piece of ½x8x96 plywood with a strip of hardwood along the bottom that fits in the miter-gauge slot in the tablesaw. The stock butts against a fence at the back of the jig, and strips of sandpaper glued across the jig at 12-in. intervals keep the stock from sliding. The only problem was that the thickness of the jig brought the 3-in. ash above the maximum height of the sawblade. I cut the stock as high as I could, snapped off the waste and then removed the lip remaining on the top corner with a hand-held power planer. Then, I ran the straight edge against the fence to rip the stock to a rough dimension just over 2¾ in.

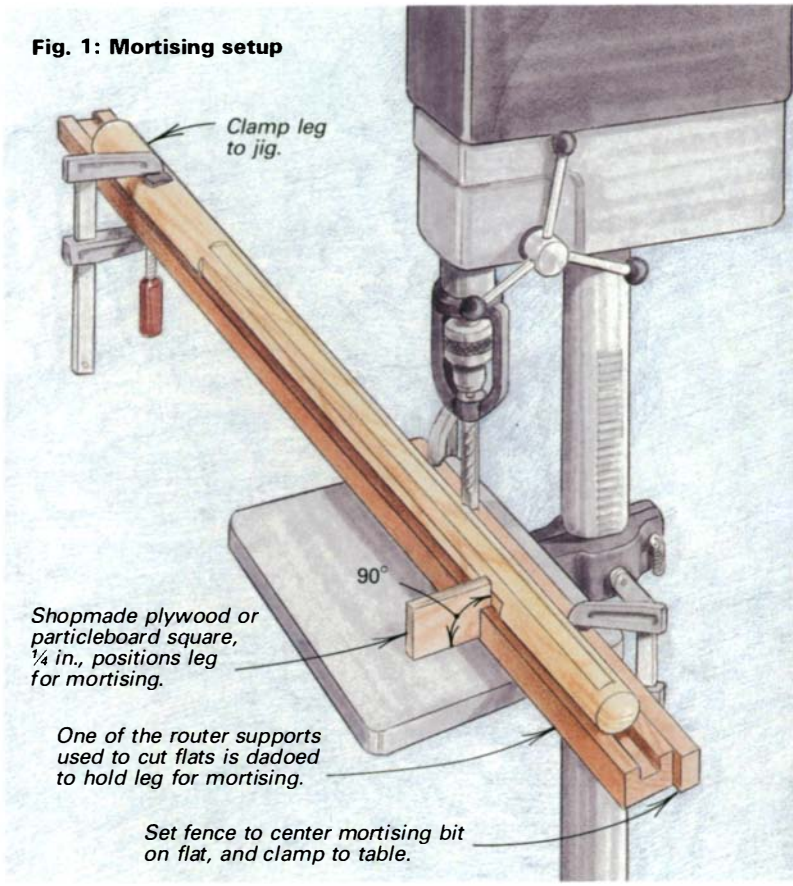
At first, I considered turning the legs, but then I decided a shaper would be the best way to produce the uniformly round posts required for accurate joints. I ordered three sizes of custom-made carbide quarter-round cutters for the job: one size for the sofa and easy chairs, one for the dining table and one for the dining chairs, side chairs and side tables. To end up with round legs, the thickness of the stock must be equal to the diameter of the cut, so I thickness-planed the leg stock to 2¾-in. squares. Also, I carefully adjusted the shaper to avoid undercutting or leaving any excess material. Pushing 72 pieces of heavy ash through the shaper four times each while maintaining a uniform feed rate and holding the stock tight to the table and fence was technically simple, though a bit strenuous. Next, I cut the legs to length on my radial-arm saw with a stop block and sanded them to remove cutter marks and ridges. An alternative technique would be to cut the mortises in the legs while the stock is square and then turn the legs round. However, it will take a skilled hand to get the uniformly round and straight legs possible with the shaper. And this technique will require coping the entire length of the frame sides to meet the legs.

Even though I wanted the assembled frames to appear as if they had been coped to the legs, I didn't want to go to all the trouble of cutting them to match the profile of the legs. To achieve this effect, I used a router and the jig setup shown in the photo above to cut flats on the legs to the required dimensions. Since these flats correspond in length and width to the frames to be joined to the posts, as shown in figure 3 on p. 77, the joints fit together so snugly they appear coped. The jig consists of two 1¼x2^{13}⁄$_{16}$x40 hardwood router supports that must be true and square, two small filler strips of ½x¾x2½ hardwood, two wedges and three ¼-in. plywood stop block templates: one for the back panel, one for the side panels and one for the front rails. To cut the flats, sandwich the leg between the router supports and put a wedge under each end of the leg. Wedge up the leg at both ends until it is flush with the top of the jig, and then clamp the leg securely between the supports. Now, clamp a plywood template on top of the leg/jig sandwich to control the length of the flat to be routed and to secure the assembly to the bench. With a ¾-in. straight bit in the router, adjust the depth of cut to set the width of the flat. Make this adjustment using a scrap piece of leg stock. Begin at a shallow depth and keep increasing the depth until the flat is 1⁄16 in. wider than the finished thickness of the assembled frames. A flat that is slightly narrower than the rails will leave an apparent gap between the leg and rail.

After routing a flat on one side of the leg, you must make another flat at exactly 90° to the first one to ensure the chair will be square. The jig will automatically position the leg by referencing off the just-routed flat. To do this, simply rotate the leg 90° so the just-milled flat faces the inside surface of one of the side jig pieces. Place one of the small filler strips of hardwood at each end of the

The side pieces of this jig hold the leg and provide a work surface to rout the flats that give the joints between the legs and panels a coped appearance. The flats also provide a reference surface for mortising the round legs.

Fig. 1: Mortising setup



milled flat, between the leg and the jig piece. Adjust the leg flush with the top of the jig using the wedges and clamp the leg tight between the jig pieces. The router will cut the second flat precisely perpendicular to the first, provided the jig pieces are square.

Machining the mortises—I cut the mortises with a ⅜-in. mortising-chisel bit in the drill press, but you could rout them or cut them by hand. Because a mortising bit has tapered sides, it is difficult to square the bit to the work. I first square the table to a piece of drill rod chucked in the drill press. Then, to keep the round legs from rolling during mortising, I make a cradle from one of the router supports used to cut the flats by dadoing a 1-in.-wide by ¾-in.-deep groove down the center of the piece, as shown in figure 1 above. Because the router supports have already been trued and squared, they will hold the leg square to the mortising bit. Although a V-groove can be used, I think the square corners hold better with less clamping pressure. Cutting the dado is easier too. Position the leg in the cradle for mortising by referencing from the squared-up drill-press table with the ¼-in. plywood or particleboard shopmade square, shown in figure 1. After clamping the leg to the cradle, clamp a fence to the drill-press table, centering the

Drawings: Bob La Pointe

mortising bit on the flat of the leg, and set the depth stop for 1⅛ in. Lay out the mortises as shown in figure 3 on the facing page and start drilling.

Three thousand strokes later I was done mortising the legs, but the bit left the bottoms of the mortises very rough. I cleaned these up with a chisel before thoroughly sanding the legs, starting with 120-grit paper and working up to 220-grit in an orbital sander.

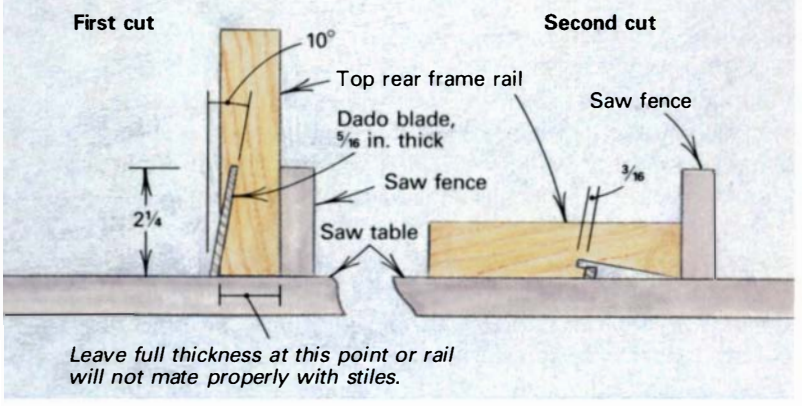
With the legs finally out of the way, I began work on the rails and stiles that would make up the back and side frames of the easy chair. After jointing and planing the ¾ ash until it was 1⅛ in. thick, I ripped the rails and stiles to the dimensions shown in figure 3. When cutting the rails to length, allow an extra 1⅛ in. at each end for the tenons. I cut the tenon cheeks on my tablesaw using a stock Delta tenoning jig, which securely holds the work even when cutting longer pieces. I then crosscut the shoulders using a stock miter gauge with a wooden fence attached. Check the tenons to be sure they don't bottom out in the mortises and allow at least 1/16-in. clearance on the top and bottom so you'll have a little flexibility when positioning the frames on the legs. The frames' positions are determined by the ends of the flats, not by the tenons.

To determine the length of the stiles, fit the frame rails in place on the leg, tight against the top and bottom of the flat, and then measure the length of stile and add ½ in. on each end for stub tenons. I cut the stub tenons on the tablesaw with the tenoning jig and rout the corresponding mortises in the rails with a ⅜-in. straight bit guided by a stock router-mounted fence and stop blocks.

The great strength of this chair evolves not only from the glue joints, but also from the massive rails, which are more than 5 in. wide, and the precision-mating of the mortise-and-tenon joints. It's important when dealing with these great widths, however, to observe seasonal, across-the-grain movement of the wood. I offset 3½-in.-wide mortise-and-tenon joints to connect the legs to the frames. Gluing only the mortise-and-tenon portion of the joints allows for slight expansion and contraction of the rails each year without wreaking havoc in the joints. When assembling the side frames and the back frame, be sure the shoulders of the rails are flush with the edge of the stiles, as this edge must butt evenly to the flat routed on the legs.

The rear frame requires cutting a large, angled groove into the front, bottom of the top rail to support the backrest slats before assembly. With a 5/16-in. dado blade set at 10° and raised 2¼ in., position the rip fence to leave the full thickness of the rail at the bottom when the rail is run between the fence and the dado blade, as shown in figure 2 below. If you don't do this, the rail will be thinner than the stiles at the joints. You'll probably have to make your own saw-table insert because the stock inserts don't usually allow the dado blade to be raised this high. A dado blade raised this high can be dangerous, so use a featherboard to hold the stock to the rip fence. With the rail lying face down and leaving at least a 3/16-in.-deep groove for the backrest slats, trim the waste with a standard blade set at the same angle as the dado blade.

Fig. 2: Grooving the top rail



The veneered panels—The side and back frames have Carpathian elm burl, Honduras mahogany and white ash veneered panels that contribute to the easy chair's contemporary accent. The mahogany and ash are preveneered plywood, but I veneered the elm to ¼-in. lauan (Philippine mahogany) plywood. I bought all the plywood and veneering supplies from my local lumberyard, but veneer supplies are also available through Constantine, 2050 Eastchester Rd., Bronx, N.Y. 10461; (212) 792-1600.

I bandsawed the plywood to the various shapes, and then I belt- and disc-sanded them to nice, fair curves. The shapes do not require exacting accuracy but should have smooth, flowing lines. Using the plywood pieces as templates, cut the veneers, where needed, slightly oversized. Also cut thin strips for veneering the raw plywood edges. Although contact cement has traditionally been considered too weak and flexible for veneer work, I used it because these are purely decorative, non-wearing surfaces and I don't have the presses necessary for traditional veneer work.

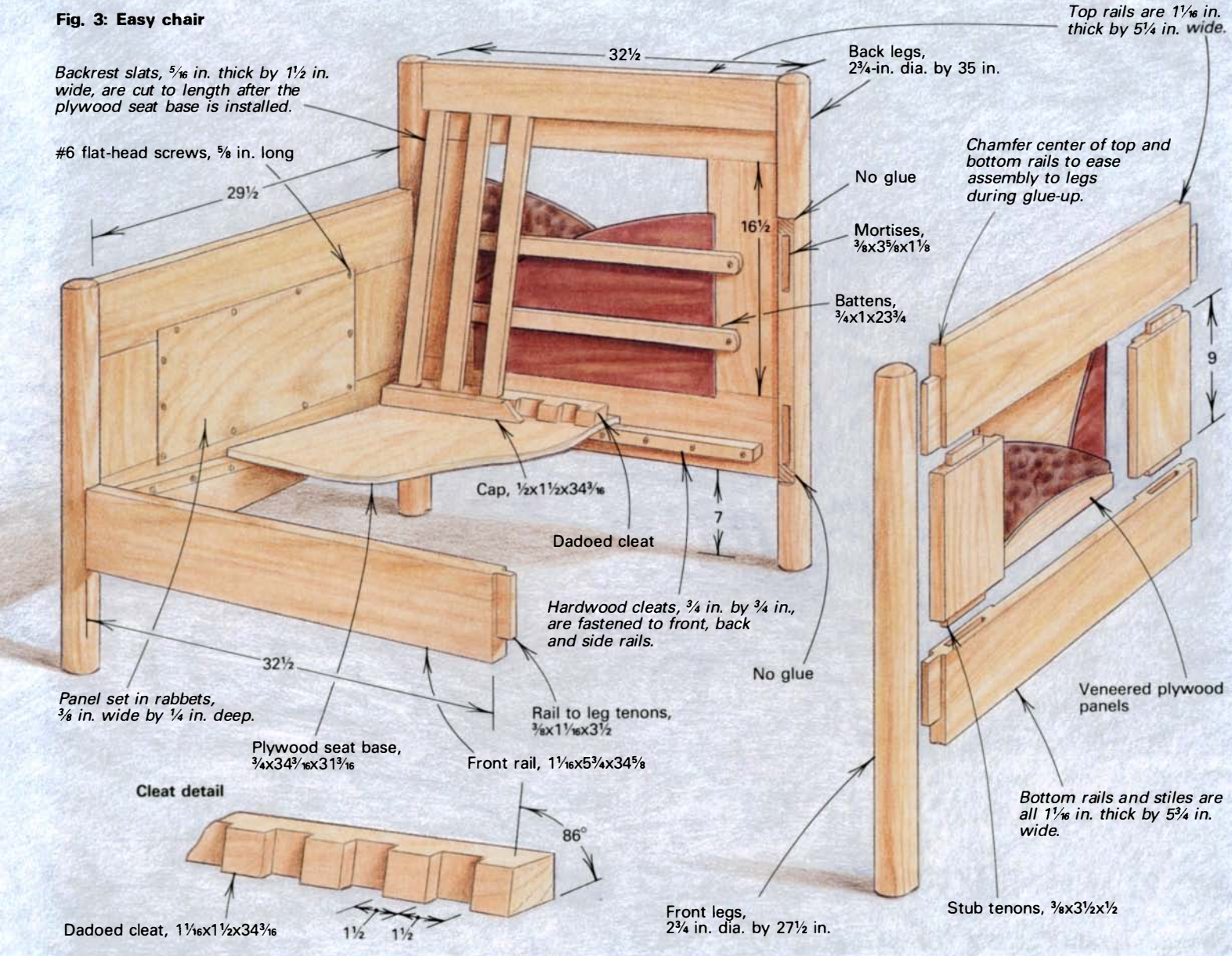
I applied veneer strips to the exposed plywood edges and trimmed them with a laminate trimmer before cementing the face veneers. Next, I filed and sanded the edges of the face veneers after rough trimming them with the laminate trimmer. Before installation, I finished the veneered panels with urethane, buffed them with steel wool and waxed them. This finish provides a higher luster than the rest of the chair, which is finished with tung oil.

The side frames have two curved panels overlapped on one full-frame backup panel. I routed the inside of the side frames with a ⅜-in. ball-bearing-guided rabbeting bit set ¼ in. deep and then squared out the corners with a chisel. The full-size ash-veneered plywood background panel is screwed into the rabbet with ⅝-in. #6 flat-head screws. The two overlapping curved plywood panels are then simply contact-cemented to the front of this panel.

The rear frame uses three overlapping, curved panels with an open space at the top through which the backrest slats can be seen from the rear, as shown in the photo on p. 74. Rabbeting the rear frame was somewhat more complicated because the three panels do not close in the entire space and two layers of the plywood panels need to be rabbeted into the frame. I placed the actual panels on the frame and marked the rabbets, which are routed with a ⅜-in. ball-bearing-guided rabbeting bit. Rout the ½-in.-deep rabbet for the middle panel along the bottom rail and up the side rails to the marks. After marking for the background panel, I reset the depth of cut on the router to ¼ in. and routed the required rabbet. These panels are held in place by two battens screwed into the rear frame stiles, as shown in figure 3 on the facing page. The foreground panel is contact-cemented to the middle rabbeted panel.

Assembling the chair—After you cut the front rail and tenon each end, as shown in figure 3, glue and clamp the two front legs to the rail. Before I glued the frames to the legs, I filed slight chamfers on the corners of each frame (see figure 3) to make it easier to clamp the frames to the legs. Chamfer only the center of the rails or the chamfer will show after assembly. Now, glue and clamp the two back legs to the rear frame. When the glue dries on these units, glue the two side frames to the back unit and then glue the front unit to the sides. With everything glued and clamped,

Fig. 3: Easy chair



measure the diagonals to check for squareness and make adjustments, if necessary, by clamping diagonally on the long measure to pull the chair square.

The seat platform is ¾-in. plywood attached to ¾-in. by ¾-in. hardwood cleats that have been screwed to the bottom rails on all four sides. I fastened the front cleat so the top of the plywood is flush with the top of the rail; the back cleat is 2 in. lower. Cut the plywood to size, rounding out the corners to clear the legs. Now, temporarily place the plywood seat on the cleats and draw lines under it on the side frames to locate the side cleats. Screw the side cleats in place and then screw the plywood seat to them.

Eleven slats, spaced 1½ in. apart, form a backrest support for the overstuffed cushion. The length of the backrest slats is determined by cutting one slightly long and trimming it until it just slips under the lip of the 5/16-in. groove in the top rail of the rear frame. Then, with the slat pressed firmly against the angled cut of the groove, mark the position of the cleat that holds the bottom of the slat and determine the angle for the face of the cleat, as shown in the cleat detail in figure 3. On my chairs, this angle is about 86°, but it varied slightly from chair to chair, so be sure to measure the angle before cutting. With my radial-arm saw, I dadoed the angled face of the cleat to accept the backrest slats. Then, I glued and screwed the cleat to the plywood seat from beneath. The backrest slats are glued into the grooved top rail with marine-grade epoxy, but float freely in the dadoes of the bottom cleat to compensate for any movement of the plywood seat. Screw a hardwood cap over the front of the dadoed cleat to hold the backrest slats in position.

I belt-sanded the slight crown on the top of the legs, first with 60-grit paper and 120-grit, and then finish-sanded with an orbital sander progressing from 120-grit through 220-grit paper. As an alternative, you might want to round over the tops of the legs with a ¼-in. or ⅜-in. quarter-round bit in the router, but this must be done before the chair is assembled.

Because the success of any finish starts with the preparation of the piece, I sanded all the furniture with 120-grit through 220-grit paper before applying two coats of pure tung oil thinned to about one-half its consistency with mineral spirits. Pure tung oil is available from many marine supply stores and numerous mail-order companies, such as Garrett Wade Co. Inc., 161 Ave. of the Americas, New York, N.Y. 10013; (212) 807-1757. The overstuffed cushions were made by a local upholsterer and are not attached to the chair. □

Ray McCarthy is a professional woodworker and builds custom furniture and cabinets in Sag Harbor, N.Y.

The author grips the muslin with the palm of his hand, instead of his fingers, to stretch it smoothly and evenly over the seat. Then, he rolls the horse hair under at the edges, so that no hair hangs over the edge roll, and tacks the muslin in place.

Upholstering a Slip Seat

A traditional approach with horse-hair padding

by Don Taylor

Most experienced woodworkers consistently produce refined furniture that draws praise from friends and family. But give those same craftsmen a piece of material and they turn to all thumbs. With a little knowledge and practice, however, most woodworkers can produce a slip seat that will do justice to the finest furniture. In this article, I will describe the traditional technique of upholstering a slip seat for a chair, such as the Chippendale described by Eugene Landon in *FWW* #73, pp. 84-87.

Recessing the slip-seat frame into the chair rails minimizes the upholstered appearance, while horse-hair padding, suspended by webbing and burlap over an open wooden frame and covered with upholstery material, provides comfortable cushioning. Horse hair was traditionally the preferred padding because it retained its loft and stayed in place better than Spanish moss, grass or other alternatives. Although horse hair is used for restoration work, it is expensive and often difficult to work; therefore, I'll also discuss the more common method of gluing high-density foam, which is easier to work, very durable and more comfortable, to a plywood platform in the sidebar on p. 80.

The first step in upholstering any chair is to build the wooden frame to fit the chair and serve as the foundation for the seat. Interwoven jute webbing, stretched across and tacked to the top of the frame, provides the seat's main support and is the base for the padding and covering materials. Tacking burlap over the webbing prevents the horse-hair padding, which is laid on top of the burlap, from filtering through and being damaged by the webbing.

Cotton muslin, stretched and smoothed over the horse hair, is wrapped over the edge of the frame and tacked to the bottom. This is perhaps the most critical step of the operation because it determines the seat's final shape and form. Finally, cotton batting is loosely laid over the muslin to add extra softness and prevent the horse hair from uncomfortably poking through the upholstery material, which is stretched over the cotton batting, wrapped over the edge of the frame and tacked to the bottom of the seat frame.

Tools and materials—Only a few specialized tools, which are shown in the top photo at right, are needed for upholstering. A basic tool kit includes a tack hammer, upholstery shears, a webbing stretcher and a tack lifter, all of which are available from Constantine (2050 Eastchester Rd., Bronx, N.Y. 10461; 212-792-1600) for under $50. You'll also need a utility knife, a tape measure and a straightedge, such as a 54-in. upholsterer's metal straightedge, carpenter's square or T-square. A sewing machine is helpful, but not absolutely necessary.

For a traditional seat, you'll also need about 8 ft. of 3½-in.-wide red-stripe jute webbing, several pounds of curled horse hair, about 6 ft. of 5/32-in. welt cord, about 4 sq. ft. each of 10-oz. burlap, cotton muslin, cotton or polyester batting, and a piece of upholstery fabric, some white chalk and some no. 2, no. 3 and no. 8 upholstery tacks or webbing nails.

Constructing the seat frame—The open seat frame is constructed from a medium-density hardwood such as soft maple or white elm. Cut the ⅞-in.-thick by 2¼-in.-wide strips to fit your chair. Mortise-and-tenon joints were traditionally used, but I believe that dowel or bisquit joints work just as well. Whatever joint you use, allow a full 1/16-in. clearance on all sides between the seat frame and the chair rails for the upholstery fabric. Because some fabrics are thicker than others, I recommend buying the fabric before constructing the seat frame so you can make sure you leave enough space.

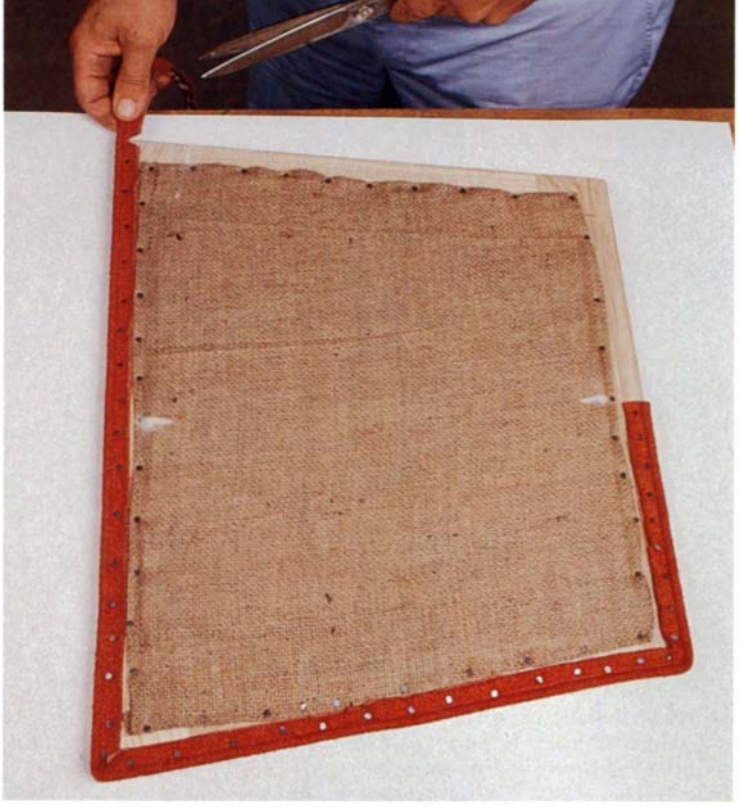
I make full-size poster board or cardboard templates for laying out the stock and determining the angles of the frame pieces. If you use mortises and tenons, allow extra length on the side rails for the tenons. For dowel or bisquit joints, cut the stock for a butt fit. Next, the frame is glued and clamped together. When the glue has dried, handplane or belt-sand the joints flush before you rip an 8° bevel around the top outside edge. The bevel starts on the side of the seat frame at a point even with the top of the chair rail when the frame is placed in the chair. This bevel softens the transition from upholstered seat to chair frame, and it also reduces wear on the upholstery. Sand or plane away all sharp edges and corners so they won't cut through the fabric, and then test-fit the seat frame to ensure there is enough clearance for the fabric. If the seat is tight, plane it to fit; if it's loose, tack cardboard along the edge of the seat frame to fill the gaps.

Installing webbing and padding—With either the front or back rail facing you, clamp the seat frame to your workbench. Do not cut the webbing to length until after it has been stretched and tacked in place. Center the first strip of webbing about 1 in. onto the rail that is facing away from you. Then, fold 1 in. of webbing either under or over itself to provide a strong double thickness for nailing. Next, I drive webbing nails or no. 8 upholstery tacks into the center and each outside corner of the webbing, and then drive two tacks in between, for a total of five tacks. The last two tacks are spaced farther away from the edge than the first three and are staggered to prevent splitting.

After the first end is secured, the webbing is stretched taut with the webbing stretcher, as shown in the bottom photo at right. The webbing stretcher is a block of wood with a row of protruding nails that grip the webbing and a handle that levers the block against the seat frame, thereby stretching the webbing. The webbing should not be stretched so tight that it distorts the frame; it should yield just slightly under pressure. Try to stretch each band to the same tension. Drive in five equally spaced no. 3 upholstery tacks about ¾ in. from the inside edge of the seat frame to temporarily hold the strip. Cut webbing about 1 in. beyond the row of upholstery tacks so you have enough material to fold the webbing over, and then retack it through a double thickness with five webbing nails as before. This process should be repeated when a strip of webbing is added to each side of the first band. Next, weave two bands of webbing at a right angle to the three bands of webbing

Basic upholstery tools for making a slip seat include from left to right: a tack lifter, shears, tack hammer and a webbing stretcher. You will also needed webbing nails, no. 8, no. 3 and no. 2 upholstery tacks, chalk, a dark marker and a measuring tape.

Stretch the webbing taut by levering the webbing stretcher against the wooden frame. Note the position of the webbing on the frame, the nailing pattern and the weave pattern of the webbing. The loose ends of webbing will be folded over and nailed with webbing nails in the same pattern as the other end.



After the burlap is tacked in place, install the edge roll and notch the corners to avoid build up of material. Allow the edge roll to overhang the seat frame about 1/16 in.

running front to back, alternating over, under and over, as shown in the bottom photo on the previous page.

The next step is to cut a burlap barrier 2 in. wider and deeper than the installed webbing. Whenever installing material in upholstering, you should always work from the center, to ensure adequate material on each side for pulling and stretching and to keep the material square to the frame. After centering the burlap on the seat frame, temporarily tack the middle on all four sides; it is much easier to remove these tacks with the tack lifter if they are not driven completely home. Now, remove the tack on the front rail and turn the burlap over or under so it extends about ¼ in. beyond the edge of the webbing. Drive a tack in the center of the rail, close to the edge of the burlap, and pull the burlap toward the front corners until it is taut. Then, tack about 1½ in. from each corner of the front rail, and complete the front of the frame by spacing tacks 1 in. apart between the tacks previously installed. When the front rail is finished, do the same to the back rail. Be sure to pull the burlap taut, but don't stretch it excessively. The burlap is tacked to the side rails in the same manner as the front and back rails.

Making the edge roll—An edge roll tacked around the top outside edge of the seat frame keeps the padding in place and softens the frame edges, increasing comfort and reducing wear on the fabric. I make the edge roll by wrapping 5/32-in. welt cord with cotton muslin, burlap or even upholstery material, leaving a ½-in. flap of doubled material to one side of the roll, and machine-sewing as close as possible to the welt cord. A zipper-foot or welting-foot attachment on a sewing machine allows sewing close to the welt cord. You could also hand-sew the edge roll, or you could even apply the edge roll without sewing by driving no. 3 tacks through the flap as close to the cord as possible. Starting in the center of any side, allow the edge roll to overhang the seat frame by 1/16 in., and tack through the flap of material along the outside perimeter of the seat frame. After the first tack, pull the edge roll tight and tack about 1 in. from the corner. Fill in the space with no. 3 tacks about 1 in. apart. Cut a V-notch at the corner, bend the edge roll around it and tack close to the corner, as shown in the photo at left. Then, stretch the edge roll tight and tack about 1 in. from the next corner. Fill in the space with no. 3 tacks and repeat this procedure until you are back where you started.

The next task is to lay in the horse-hair padding. Curled hair is available in three different grades that are based on the amount of horse mane included in the mix. The cheapest is a mix of 15% horse mane and 85% hog hair, followed by a mix of 50% horse mane and 50% horse tail, while the top of the line is 100% horse mane. Retail prices range from $8 to $12 per lb., usually with a 50-lb. minimum. New England Upholstery Supply Co., 23 Sanrico Dr., Manchester, Conn. 06040; (203) 643-6773, sells horse hair at a 50-lb. minimum, as well as a full line of upholstery supplies. Your best solution might be to salvage horse hair from older furniture.

High-density foam: a convenient alternative

Upholstering with high-density polyurethane foam offers some real advantages over traditional horse hair. Foam is readily available at fabric or upholstery supply stores, reasonably priced and easier to use. In addition, cushions with foam maintain their loft and don't "sing" as horse-hair seats do when people sit on them.

Foam can be used with the open seat frame and jute webbing as before or with a solid seat platform, as shown in the photo at right. The open seat frame makes a slightly more comfortable seat, but a ½-in. or ⅝-in. plywood platform is much easier and quicker to make. In addition to the foam and platform, you will need cotton muslin, upholstery fabric, tacks and spray adhesive suitable for foam. Although cotton or polyester batting is optional with this procedure, either could be used to further shape the seat.

The extra cushioning provided by foam makes it practical and comfortable to build a slip-seat base by simply gluing high-density foam to a piece of ½-in. plywood, which is then upholstered the same way as the traditional horse-hair slip seat.

Upholstering with foam: I cut the foam to the full size of the seat and then bandsaw a 45° bevel around the top edge. The foam can also be cut with a utility knife and metal straightedge or an electric carving knife. Cement the foam to the seat platform by spraying a 3-in. band of adhesive around the perimeter of the foam and seat platform. I find it easier to place the plywood on the foam, as shown in the photo at left. Cover the foam, which has been glued in place, with polyester batting, layering it until you reach the desired fullness. Using the techniques described in the main article, finish up the seat by installing the muslin cover and upholstery fabric. —*D.T.*

Also, you can check with your local upholstery shops because many times some hair will be left from a piece that's been reupholstered. The quantity of hair needed depends on the size of the seat, but an average 14-in. by 16-in. seat takes 1 lb. to 2 lbs. of hair. If you use reclaimed curled hair, pull it apart to fluff it up and restore its loft. Before putting on any horse hair, mark the centers on the bottom of the front and back seat rails to establish reference points for later installing the cotton muslin. Now, lay the horse hair evenly on top of the burlap, building up about a 3-in. layer that's somewhat thicker in the middle to give the seat a crown. Pat the hair into position with your hands, feeling for voids and low spots as you go.

Installing the cotton muslin—Once the muslin is on, it is very difficult to correct mistakes, so I take extra time here to smooth the fabric and add hair to fill voids and to shape the cushion. Cut the cotton muslin, allowing at least 2 in. extra on all sides, and mark the center on the front and back edges with a pencil. Align the center marks on the muslin with the center marks previously made on the bottom of the frame. Using no. 2 upholstery tacks, temporarily tack the muslin at the center point of the front rail of the seat frame, pull the muslin tight and tack the center of the back rail. Repeating this procedure, temporarily tack the center of the sides. I then remove the tack on the front rail, smooth the muslin from the center of the seat to the front edge to remove any slack, and retack. I find it easiest to work with the seat on edge, smoothing with one hand, holding the material in place and then retacking with the other hand, as shown in the photo on p. 78. As you pull the muslin, curl the hair under on the edges to eliminate voids and give the seat a firm edge. Pull the muslin with the palm of your hand, not just your thumb, to get smoother results, and work the fabric back and forth so no hair hangs over the edge roll. Then, pull the muslin tight to one corner of the front rail and tack it. Repeat the process on the other corner of the front rail. Following this sequence, I tack the back rail and then the side rails in position. I don't fully set any of these tacks until I have worked my way around the seat frame and have completely smoothed the muslin.

Once the muslin fits tight, with no wrinkles or voids, I drive the tack in the center of the front rail home, and tack the material every ¾ in., working from the center to the corners and pulling and smoothing material as I go. The process is repeated first for the back rail and then the side rails. Finish installing the muslin by pulling the corners at a 45° angle to the frame and holding it with a no. 2 tack, as shown in the top photo at right. Cut the excess muslin along each side of the tack to the point of the corner, fold over the material on the sides and tack before cutting away the excess material, as shown in the center photo at right. I check the seat carefully for voids or low spots in the padding and redistribute the horse hair with a sharp ice pick. Poke the ice pick carefully through the muslin, and then use the point to move the horse hair from surrounding areas into the low spots.

To improve comfort and appearance, I put a layer of cotton or polyester batting, the material used for lining quilts, over the muslin cover. Cotton batting, the traditionally used material, should be separated so only half the thickness is used. Tear cotton batting with your fingers to fit the muslin cover; however, use the seat frame as a pattern and cut polyester batting to fit. I cut the upholstery fabric with 2 in. of extra material on each side and apply it the same way as the cotton muslin, but with no. 3 upholstery tacks. Again, work from the centers to the corners, pulling and smoothing as you go. The material should be stretched tight to eliminate wrinkles, but it doesn't need to be as tight as the muslin. Less pulling will be required because the shape of the seat has already been formed, but be sure to pull the fabric evenly so that patterns or lines will be square to the seat frame. When turning the corners, I fold the sides in first and then the front, as shown in the bottom photo above, so the fold is not seen from the front of the seat.

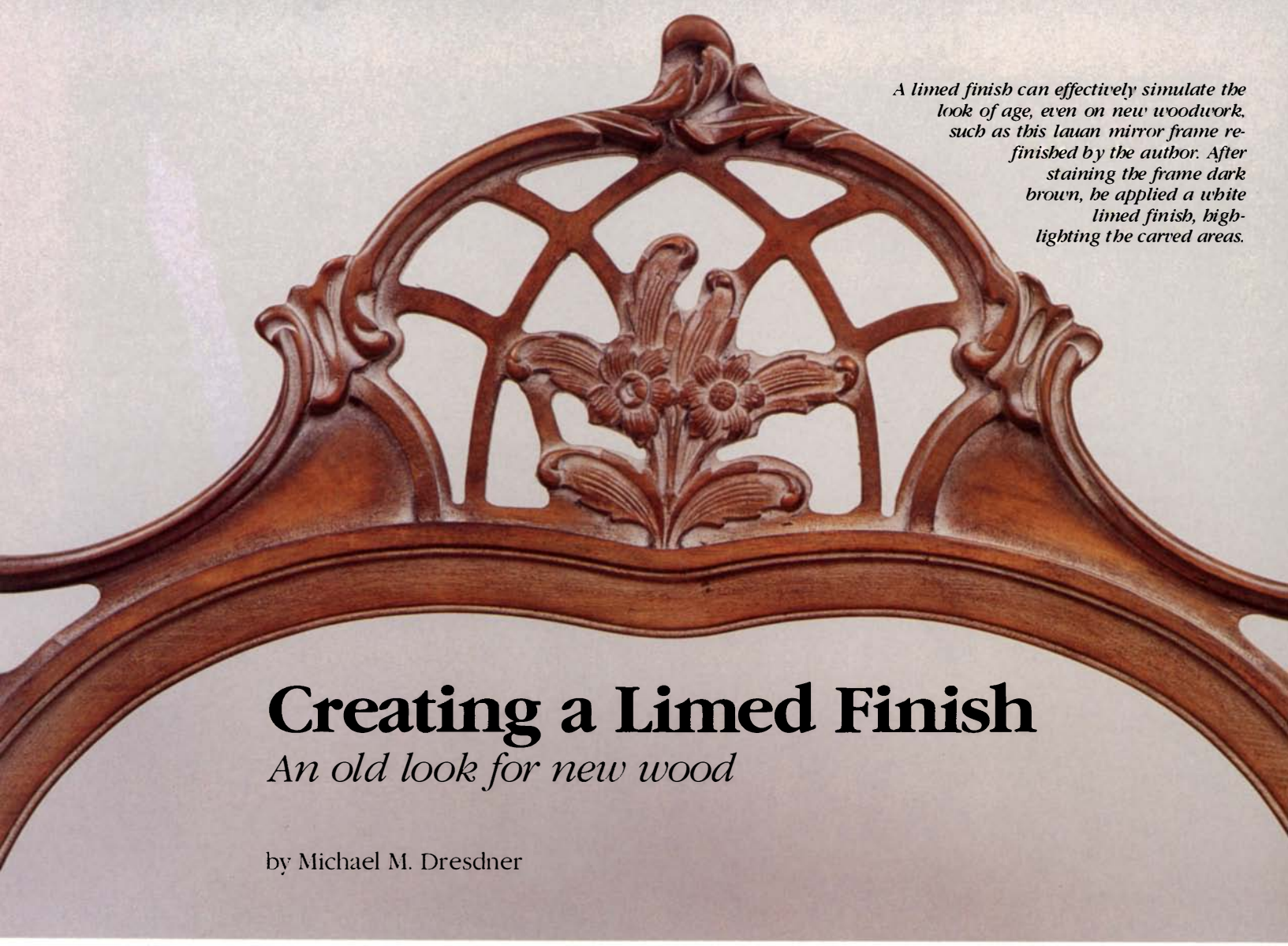
To finish the slip seat, I apply a thin, usually black, cambric cover to the bottom of the seat frame to protect the webbing and padding from dust and dirt. The material is attached with no. 3 tacks by following the same procedure used for the burlap. □

To finish the corners of the seat, pull the material toward the diagonally opposite corner and tack it in place as shown above. Cut toward the corner on either side of the just-installed tack to remove any excess material.

After cutting the excess material, the remaining material is pulled over the tack installed at the side of the frame toward the opposite side so that it is parallel to the front edge of the frame. Then, tack it with a no. 2 upholstery tack, as shown in the photo above.

Pull the material on the front of the frame parallel to the side of the frame and tack it. The corners of the upholstery are folded first at the sides and then at the front so the seams are visible only from the sides. A cambric cover on the bottom of the seat finishes the chair.

Don Taylor is a furniture designer and owner of Taylor Furniture Manufacturing and Upholstery in Deer River, Minn.



A limed finish can effectively simulate the look of age, even on new woodwork, such as this lauan mirror frame refinished by the author. After staining the frame dark brown, he applied a white limed finish, highlighting the carved areas.

Creating a Limed Finish

An old look for new wood

by Michael M. Dresdner

With its soft, ghostly white appearance, a limed finish imparts instant history to any new piece of furniture. And although it's one of the most common techniques used to create antique reproductions that mimic the appearance of aged furniture, in recent years, limed or "pickled" finishes have also become popular for new furniture, cabinets and flooring. A limed finish creates the look of a once-finished piece that was later painted over and then redeemed through an incomplete job of stripping. For the most part, it looks like a natural wood finish, but it has telltale traces of white, off-white or even colors trapped in the wood's pores or in the corners of carvings and moldings. Fortunately, a limed finish is easy to create, and the application techniques are accessible to even the neophyte wood finisher.

Traditionally, the limed finish was used to artificially age and darken oak (hence the often-used name "limed oak") to make it resemble a richer and more expensive wood, such as mahogany. The process involved soaking the wood in a mixture of lime, ammonia, lye and water until the color of the wood darkened. The name of the finish comes from the lime (calcium oxide) used in this mixture. Curiously, a modern limed finish has just the opposite appearance, with its "age" added by making the piece appear to have been painted and stripped, rather than just darkened.

In spite of its affiliation with oak, a limed finish works on almost any light-color wood. You can apply a coat of paint, usually white, and then wipe or sand off the bulk of it to allow the wood to show through. The finish can be applied to a raw, stained or sealed wood surface, depending on the desired final look. When the paint is dry, a light topcoat of satin or matte lacquer seals and protects the finish.

Selecting the paint—Because relatively little paint remains on the surface, almost any paint or pigment can be used for a limed finish—even those that are normally incompatible with the intended topcoat. Hence, you can use oil, Japan colors (available from Wood Finishing Supply Co., 100 Throop St., Palmyra, N.Y. 14522; 315-597-3743), latex, or enamel paints, pigmented white shellac or universal tints in virtually any vehicle, including lacquer. On raw wood, I prefer white latex or enamel paint, depending on what stain or dye I am using. On sealed wood, I like to use either white enamel or, for a faster-working finish, BIN, a white-pigmented shellac made by William Zinsser & Co., 39 Belmont Dr., Somerset, N.J. 08875; (201) 469-8100. BIN cannot be used over a shellac sealer, as it will redissolve it, so I generally use it on a piece sealed with a lacquer sanding seal. If you're working on a large surface and need lots of time before the paint dries, try using artists' white oil colors dissolved in mineral spirits and linseed oil.

Although white or off-white paint is most commonly used, most any light color creates a limed finish. In south Florida during the early '70s, pastel versions of limed finishes on pine became so popular that they were whimsically referred to as pickled pink pine. For convenience, I'll refer to the color as white throughout this article.

Applying the finish—After finish-sanding the wood, you must decide if you want to apply a stain, which will influence the color of

the translucent white paint that will be applied over it; for example, a raw umber will give the white a grayish cast, while burnt umber or sienna will yield a warmer pinkish or orange tone. In some cases, you may need a colored stain to counter the natural tint of the wood, which itself will affect the color of the white layer. If you do not seal the wood as part of the finish (as I'll describe), make certain you avoid compatibility problems: Applying a white latex paint over a water-soluble dye or an oil-base enamel over an oil stain will cause the colors to bleed through into the white material. Sealing the wood after applying the stain will prevent these problems.

Even though most limed finishes are applied directly over raw wood, you can also use the finish on wood that's been sealed first. Each approach yields a subtly different look, but the results are equally satisfying. For a limed finish on raw wood, liberally apply the white paint to the sanded surface. If a stain has been used, make sure it has dried completely. The white paint is handled rather like a glaze: It is first applied and then selectively wiped off while it is still wet. The paint that isn't wiped off settles into the pores and crevices of the wood, creating the aged look. If you take off too much paint, you can simply apply more. If you leave too much on, wait until the paint dries and sand some of it off with 120- or 220-grit paper. Rougher sandpaper will give a more consistent, visually textured look, while finer paper will create a more patchy appearance.

The limed-finish process is virtually the same for sealed wood. Seal the piece with one thin coat of shellac, lacquer or varnish, but do not sand afterward; the roughness gives the white overcoat a little more bite. Apply the white as before, but be certain to choose a paint that won't redissolve the sealer coat. Since the sealed surface lacks wood's absorptive qualities, you'll have a bit more time to work the glaze, and you can usually leave the right amount of white in the corners and low spots of the carvings before the paint sets up. If you want to remove more paint after it is dry, you can generally do it with steel wool or an abrasive pad, as the white won't adhere to the sealed surface as well as it does to raw wood.

When you're satisfied with the dry white layer, seal it with two coats of flat or matte lacquer or varnish, and smooth it with sandpaper or steel wool between coats.

Antiquing finishes—If you would like to further age the look of your finish, mix a bit of rottenstone into some paste wax and apply it over the completed finish. Wipe off the excess, but leave some of the residue in the corners of moldings and carvings to simulate the appearance of years of collected dust and grime.

One rather attractive variation of the antique finish is called "scrubbed oak." This involves distressing the wood before finishing by dinging it up with wrenches, short lengths of chain or a wooden mallet bristling with exposed nails and screws. To impart realism, limit the damage to surfaces that would be worn with normal use. Sand the surfaces lightly to remove any raised, broken wood fibers around the distressed areas. Stain the wood a very light burnt umber color, and then lightly seal it with one thin coat of vinyl sealer or shellac. Next, brush on white enamel paint and wipe off most of it, leaving just a bit more white than you would like to have.

Highlighting details—Another method of mimicing the furniture aging process is dry-brushing, which uses a paint brush that's lightly loaded with pigment to add dark highlights. Perhaps the best way to approach dry-brushing is to think of it as glazing in reverse. When you glaze a piece of furniture, you apply a colored liquid glaze and then wipe it off, leaving paint in the pores and details. Dry-brushing, on the other hand, highlights or darkens the sharp edges and raised surfaces of furniture. Anyone who has handled old furniture will tell you that once the protective layer of finish wears off the sharp edges of a nicely carved maple or walnut piece, the exposed wood quickly picks up dirt and oils and gradually darkens.

Although it's often referred to as a limed-oak finish, a limed finish can be applied to any type of wood. Here, a white ash sample, shown unfinished above, received a limed finish, which was applied directly to the raw wood.

Dry-brushing needs a rough surface to work on, so it's most often done either on raw wood or on chalky surfaces painted with white undercoat or BIN. On open-pore woods, such as mahogany, dry-brushing the flat surfaces will define the pores of the wood as the bristles catch on the edge of each pore and leave a tiny dark line. This allows you to intensify or even add realistic-looking grain patterns by creating thousands of small lines of color. Carvings, high spots and the sharp edges of panels and moldings pick up a color line that highlights the details. Often, a weak carving can be made to appear more crisp with careful dry-brushing.

My favorite brush for dry-brushing is black hog's hair, commonly known as China bristle. The brush should be rather springy and fit the hand comfortably, with the thumb on one side of the ferrule, the fingers on the other and the handle resting in the crook of the hand. I prefer a brush that is 2 in. wide, a full 3 in. long, and ⅝ in. thick, or what is referred to by brush makers as double thickness.

The first step is to mix the desired color by adding naptha or mineral spirits to Japan colors until you have a fairly thick but smooth liquid. With a small, stiff brush, such as a bridled glue brush, transfer a small amount of color from the can to a disposable mixing board; a scrap of wood will do. Load the brush by getting a small amount of almost-dry color on the tip by holding the brush at 90° to the surface and *lightly* scrubbing the tip in a circular motion through the dab of color until it appears dry. The brush will also appear dry, but it will be loaded with the Japan color. With light, sweeping movements, skim the tip of the brush across the surface of the wood, first on the flats and then on the carvings when the brush is slightly less loaded. The white surface will pick up color from the brush and impart a warm, translucent quality. When the brush stops transferring color, reload it with another dab from the mixing board. Each time color is added to the mixing board, give the color mixture a quick stir, since pigmented colors tend to settle rather quickly in the can. If no color transfers, load the brush a little heavier; however, if streaks show up, your brush is too heavy. When the dry-brushing is complete and the colors are dry, apply a protective topcoat as described for a regular limed finish. □

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Metalworking in the Woodshop

Materials and methods for better shop-built machines

by Roger Heitzman

Metal may not have the warmth and beauty of wood, but its strength and durability make it ideal for building tools and machinery. I've always made jigs and fixtures from solid wood and plywood scraps, but wood usually isn't tough enough for constructing motorized machinery, which must withstand terrific work loads and strain. Further, wood's natural tendency to expand and contract makes it unsuitable for highly precise jigs and tools. After teaching machinery-building seminars for the past nine years, I've concluded that most woodworkers, even those without special metalworking equipment, can build metal jigs and machines in their own woodshops. Few tools or special skills are required, and the money saved on a single machine can be well worth the time invested.

A lack of capital was the main reason I began building machines 10 years ago; my first project was a three-wheel, 30-in. bandsaw.

Doing metalwork in your home woodshop lets you save money and build custom machines, like the author's dual-spindle shaper shown here. The shaper has two workstations in a compact space, and the ½-in. and 1-in. spindles can handle a variety of cutters.

Even though I occasionally buy new machines now, I still prefer to build my own machines, jigs and tools because it enables me to customize the equipment to fit my specific needs as a cabinetmaker and furnituremaker. My dual-spindle shaper, shown in the photo below, for example, is a custom-designed machine I probably couldn't have bought ready-made. In this article, I'll discuss some of the metalworking methods I use, including the materials, layout, cutting, joining, drilling, machining and finishing. I'll also delve into safety issues you'll need to consider before you begin.

Materials—Metals for fabricating machine frames, tables, stands and other parts can be divided into two categories: ferrous and non-ferrous. Ferrous indicates iron-containing metals, such as steel, cast iron, high-speed steel (HSS) and stainless steel. These metals are strong, but they're also difficult to work. Non-ferrous metals, such as aluminum, brass and copper, lack iron and are generally softer than ferrous metals. Many non-ferrous metals—most notably aluminum—can have a tensile strength as high as steel yet are softer and more workable. Like metals, plastics come with a vast variety of characteristics, but most are easy to cut and shape. I have found that phenolic laminates (micarta), acrylics (Plexiglas) and certain nylon-like plastics (delrin and polypropylene) are the most useful for fabricating parts for jigs and machines.

Over the years, I've developed a certain logic for choosing materials for different components in a machine or jig. Since the ferrous metals are the most difficult to work, I limit their use to parts that demand high strength, such as frames, arbors and motor mounts. Here, steel angle iron, tubing and plate excel. For the more complex parts requiring precise machining or shaping, I use easy-to-work non-ferrous metals or plastics. Likewise, I often choose aluminum plate or sheet micarta for tables. The choice of material often depends on what I have on hand or can easily acquire. For anyone building their own machinery, the local salvage yard or scrap pile can be a treasure trove of raw materials.

Depending on the kind of machine you're building, you'll need a mandrel to mount and drive the blade or cutter, or an arbor for the sanding or grinding wheel, drum, etc. Mandrels and arbors are readily available from woodworking or machinery supply houses or from Mooradian Manufacturing Co., 1752 E. 23rd St., Los Angeles, Cal. 90058; (213) 747-6348. Most of these fittings come ready to bolt on your machine and need only a drive pulley and a V-belt to connect to the motor. Sometimes you can scrounge the running gear from an old machine, or buy and modify a kit machine to suit your mechanical needs (see "Building a Stationary Sander" on p. 88).

Safety—From the start, it's important to understand that working metal can be dangerous. This is especially true with ferrous metals,

which throw off lots of sparks when they are cut or ground. Whenever grinding, cutting or machining metal, you must wear goggles and a face mask to protect your eyes and lungs from flying metal chips and abrasive grit. Also, wearing sturdy work gloves will protect your hands from sharp edges and from accidental burns if you pick up a piece too soon after welding or cutting. Sparks can also be a fire hazard, particularly in a woodshop where sawdust, finishing materials and solvents are usually present. Before beginning any metalworking job, sawdust and wood scraps should be swept up and all flammable materials removed from the area. Whenever possible, those operations that generate sparks or flames should be done on a non-flammable surface in an area where there's no chance of igniting anything. Always have an operable fire extinguisher nearby and pay attention to where the sparks are going. In more than 10 years of making sparks in my woodshop, I have had only one small fire. I used an abrasive blade on my tablesaw for a few quick cuts without bothering to clean up the sawdust below. I was interrupted in mid-cut by a hot foot as the burning sawdust pile singed my tennis shoe.

Layout—As in woodworking, metal parts must be marked out prior to drilling, cutting or machining operations. For this job, I use many of my woodworking layout tools: combination square, try square, tape measure, awl and compass, and a few special machinist tools: a Vernier caliper, 6-in. machinists' rule, blue layout fluid, a hardened scribe and dividers. The caliper and rule come in handy for measuring parts that need more precision than is possible from a tape with 1/16-in. divisions. Blue layout fluid (available at any machine-tool supply house) makes layout lines more visible on metal; pencil lines don't show. After the blue is brushed on the metal, lines can be scratched with a sharp scribe. The dividers are used to scratch circles and curved lines, as well as to divide a length into equal parts or transfer precise measurements.

Cutting metal—The first step in building any metal project is cutting the stock to size and shape. Anyone who has spent much time cutting iron or steel with a hacksaw knows that ferrous metals are much harder to cut than non-ferrous metals. I've found three techniques that work well for cutting steel or iron parts. The first is cutting steel with an oxygen-acetylene torch, which is indispensable for working with large and heavy pieces. Its cutting speed is phenomenal, and it can cut curved or straight lines through very thick material with equal ease. However, unless you're an experienced welder (see the section on joinery), your cuts will probably look as if they were gnawed by some metal-munching animal. Hence, I reserve torch-cutting for rough work.

The second cutting technique, the most available and economical for the woodworker, is the one I use most often: a metal-cutting abrasive blade. An abrasive blade is a thin, usually 1/8-in.-thick, hard-fiber wheel embedded with abrasive composite. The blade cuts by rapidly grinding through metal, leaving a straight, clean edge. Though abrasive blades mount on any circular-blade saw, such as a tablesaw or radial-arm saw, I've found them to work best in a motorized miter box or chop saw. As an abrasive blade cuts, it wears away just as a grinding wheel does, so it's wise to purchase several at a time. I use a 10-in.-dia. blade in my chop saw, and when the blade wears down to about 6 in., I set it aside for making odd cuts in tight places with a hand grinder. If you've never used an abrasive blade, you'll be amazed at how effective it is, even on hardened or high-speed steel.

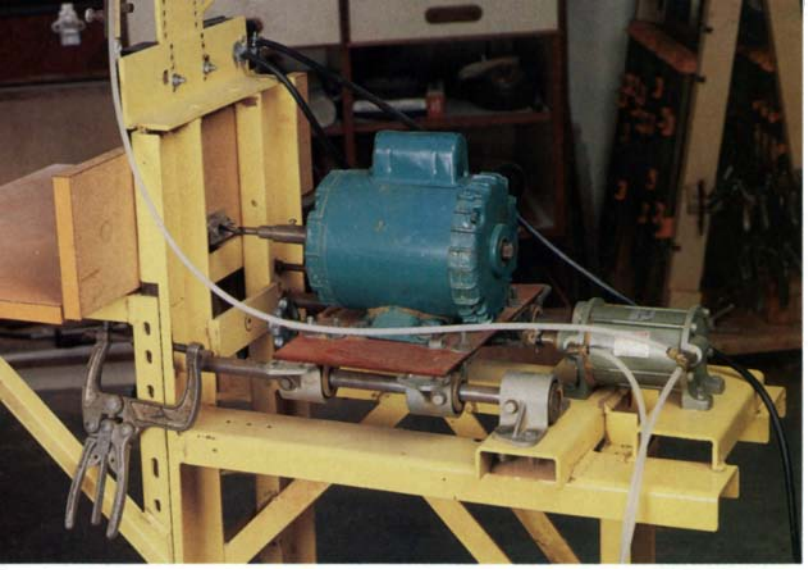
The third option is to bandsaw the steel. However, woodcutting bandsaws run at much higher speeds than metal-cutting bandsaws and need speed reductions for metal cutting. If you cut a lot of parts from sheet metal, fit your saw with a metal-cutting blade and a step-down pulley to reduce the blade's cutting speed to 200 feet per minute (FPM). A portable electric sabersaw equipped with a metal-cutting blade (different ones for ferrous and non-ferrous metals) is great for cutting curves or doing fretwork in sheet stock.

Cutting aluminum and brass is entirely different from cutting steel and iron. A cutting torch will not cut non-ferrous metals cleanly, but instead will melt them in an almost uncontrollable fashion. Abrasive blades are also ineffective here as they quickly clog with soft metal particles. Fortunately, a regular carbide-tipped circular sawblade will cut most non-ferrous metals with surprising ease. Blades with a standard triple-chip grind with zero degree hook work the best. For cut-off work, the chop saw excels at cutting through brass, aluminum and copper solid stock or tubing; the tablesaw will also work. But cutting non-ferrous metal with a radial-arm saw can be very dangerous because the blade tends to climb over the work. I once lost five sawblade teeth—I don't mean carbide tips, but entire teeth—while cutting a length of aluminum channel. A carbide blade on a hand-held circular saw is handy for cutting up large, unmanageable pieces.

You can also cut non-ferrous metals on a bandsaw with either a regular woodcutting blade or a bimetal blade (see *FWW* #63, p. 65). Equipped with a six-tooth bimetal blade running at standard woodcutting speed—2,000 to 3,000 surface feet per minute (SFM)—my homemade bandsaw will take virtually any size aluminum or brass stock and cut curved or straight lines with equal ease. The only problem you're likely to encounter is from the soft metal sticking to the teeth and fouling the cut. Aluminum is especially bad, but the problem can be reduced by running the blade against a block of paraffin wax between cuts. If loading occurs, the metal deposits must be picked out of the teeth with an awl or brushed out with a stiff wire brush or file card.

Joinery—Once you've cut your materials to size and shape, the next step is to fasten them together. Generally, I weld the pieces or join them with mechanical fasteners. Welding is the process of joining two pieces of metal, usually mild steel, by melting the meeting edges, ends or surfaces in a controlled way until the metals flow together into a continuous seam. Brazing is a similar process that joins two metals with a third, softer metal, typically brass or silver. Though welding and brazing may seem intimidating to a woodworker, they're the strongest and quickest methods for joining metal. Welding is always my first choice for machine frames and other assemblies that must endure lots of force or punishment. If you don't already know how to weld, learn by taking a course at a local community college or vocational training school. An oxygen-acetylene gas welding outfit or electric arc welder aren't prohibitively expensive, and they can also be rented or leased. You can also pay a local trailer hitch or welding shop to weld your project.

You can also join materials with mechanical fasteners, such as bolts, machine screws and nuts, which are economical and accessible to anyone with a wrench and a drill. Mechanical fasteners are great because they allow parts to be realigned or disassembled, and they eliminate metal distortion and warping problems that can be created by high welding temperatures. These fasteners also allow you to join dissimilar materials that can't be welded, such as aluminum to steel or plastic to aluminum. On most projects, such as my horizontal boring machine, shown in the top photo on the following page, I weld only the frame and bolt all the other parts, including the table, arbor and motor, to the frame. Make sure to use lock washers, anti-vibration nuts or thread-locking compound when bolting any motorized project, since



After welding the tubular-steel frame of his homemade horizontal boring machine, the author mounted the motor-and-carriage assembly with nuts and bolts to allow the components to be realigned or replaced as needed in the future.

A router equipped with a carbide bit can easily machine nonferrous metals. Here the author machines a square edge on a thick piece of aluminum plate with the router guided by a rail jig cobbled up from plywood scraps.

vibration can rapidly loosen even heavily torqued nuts.

To complement regular nuts and bolts, I often use a tap-and-die set to thread rods and shafts or to tap holes for joining components. A good-quality tap-and-die set, with sizes ranging from #4-40 through ½ in., costs about $50 and lets the woodworker-turned-metal worker make special threaded parts. For instance, threading is essential for fabricating any screw-in parts, such as hold-downs and blade- or pulley-tensioning devices. If you're fastening parts to a single plate or channel, simply drill and tap holes and bolt the part in place. This is especially handy if there's no room to put nuts on the other side. You can use a tap-and-die set to make your own hand knobs or T-handles, which are terrific for loosening and tightening adjustment screws without a wrench or screwdriver. Hand-tapping is tedious, but you can speed the process by chucking the tap in a variable-speed, reversible electric hand drill. Don't try it on ferrous metals though, and only with small taps in aluminum or brass. Thread cutting generates a surprising amount of heat, so be sure to keep the rod or hole well lubricated with thread-cutting lubricant or light machine oil. I like the sulphurized oil sold as thread-cutting oil in most hardware stores.

An often overlooked but important type of mechanical fastener is the pin, which is excellent for attaching handles, gears, pulleys or knobs to round shafts. The most familiar variety is the cotter pin, but I have found the roll pin and split pin to be especially useful. These small, round pins, 1/16 in. and larger in diameter, are made of hardened spring steel that's rolled into a small cylinder. After two parts are fitted, say a knob on a shaft, drill an undersized hole through both parts and hammer the pin to secure the pieces. If you want to separate the pieces, you must drive the pin out with a punch.

Making holes—Before you can tap a hole or use any mechanical fastener, you must bore holes. Boring holes in metal is much like boring in wood, but metal requires a slightly different technique and few special tools. HSS twist drills are most commonly used. These drills typically come in fraction index sets ranging from 1/16 in. dia. through ½ in. dia. in 1/32-in. or 1/64-in. increments. In addition, metal shops have special numerical- and letter-index drill sets. Numerical drills, #1 through #80, are sized in very small increments (0.001 in. to 0.002 in. between adjacent sizes) and are often called for when drilling holes for tapping.

Exact and efficient boring in metal almost always demands a drill press, which makes quick work of boring to exact depth and achieving square or angled holes in all metals. Before boring, use a center punch to create a dimple where you want the hole. This prevents the drill from drifting or skating across the surface. As you bore, don't advance the drill too quickly or you will overheat the tip and ruin the drill's temper. Also, use cutting fluid or oil liberally, which will extend the life of the drills and make boring easier. If you're boring a large hole, make a smaller pilot hole first. When making a small workpiece, bore the holes before cutting the part out of a larger piece of stock, which is easier to clamp. Likewise, if the location of a hole must be dead accurate, boring the larger stock will allow you to adjust the final distance of the hole from an edge or corner by trimming the part relative to the hole. For counterboring holes in aluminum, such as to recess the head of a machine screw or Allen head cap screw, I've found that simple wood-boring spade bits work exceptionally well. Just counterbore before boring the final hole through, and don't use a spade bit much larger than ½ in.

I use only two speeds on my press for most boring operations in mild steel: 1,350 RPM for drills up to ¼ in. dia. and 750 RPM for larger drills. But you can calculate the optimum drill press RPM with the following formula: $RPM = CS \div (0.25 \times D)$, in which D stands for the diameter of the drill and CS is the ideal cutting speed for a particular metal. CS is about 250 for aluminum, 200 for brass and 80 for mild steel. Consult a tool or machinery manual for drilling speeds for other materials.

Milling—Machine shops use industrial milling machines to flatten tables, square edges of mating parts, cut channels and grooves for sliding parts or shape edges. This machinery is complex, often large and always expensive. However, you can machine precision parts with only woodworking tools: mainly the router, stationary disc sander and drill press.

In my shop, I mill aluminum, brass and plastic parts with a router equipped with a straight carbide bit guided by the shopmade plywood routing cradle, shown in the bottom photo at left. The jig consists of two identical ¾-in. plywood rails, sized longer and wider than the piece to be routed. The rails are spaced as far apart as the thickness of the workpiece and then nailed to a thin strip at

the bottom. A separate jig must be made for each thickness. The workpiece—only non-ferrous metals and never steel—and jig are then clamped in the workbench vise with the workpiece slightly above the rails and parallel to them. With the end of a straight bit set flush with the router base, the router, supported by the rails, passes over the work and leaves a smooth, flat surface. This feels much like routing wood; however, you must take much smaller cuts and keep the rate of feed slower.

Equipped with a carbide bit, the router can shape or trim most non-ferrous metals and plastics. You can template-rout precision parts with straight or curved edges using a flush-trim bit against a masonite or particleboard. A router mounted on a trammel can plow curved or round slots and grooves. For example, you can cut a slot for a tilting mechanism, as I did in my stationary belt sander (see "Building a Stationary Sander," beginning on the next page). When performing any of these routing operations, make sure to clamp the workpiece firmly, especially aluminum or brass, and *never* attempt any of these operations freehand.

Though files are indispensable for many metal-shaping and smoothing operations, abrasive belts and discs used with power sanders can produce fast results with less effort. A belt sander will quickly remove scratches from an aluminum table and the disc sander will flatten edges on aluminum or steel that are even acceptable for mating parts. With a 50-grit aluminum oxide disc on my 16-in. disc sander, I can sand a square edge on a straight or convex aluminum part, as shown in the top photo at right. An oscillating spindle sander handles the concave parts. Caution: *Whenever you sand aluminum, wear a dust mask because aluminum dust is toxic.* If you're sanding a lot of aluminum, wear gloves to prevent absorbing it through your skin.

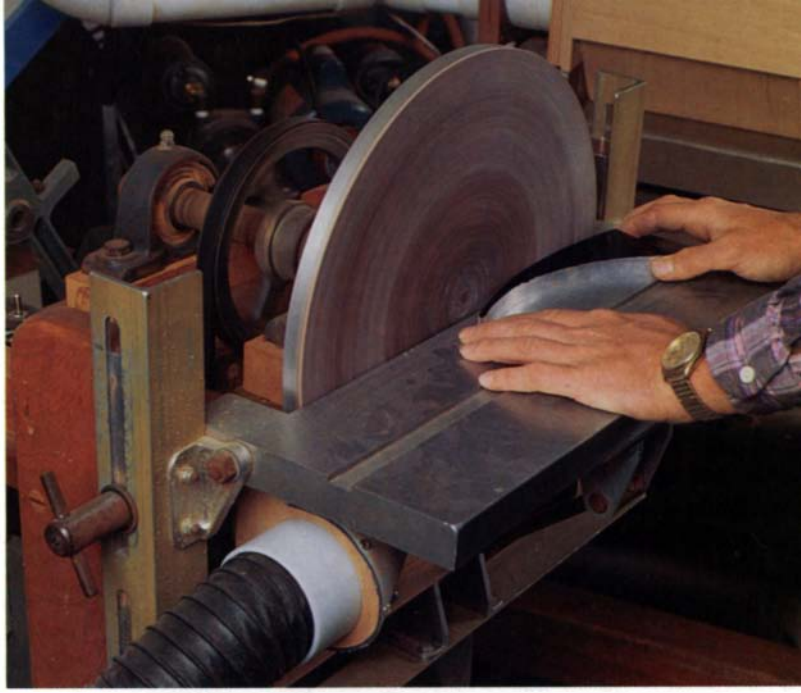
A metal-cutting lathe is a luxury few woodworkers can afford. However, you can still turn accurate round parts, such as bushings, pulleys, spacers and handwheels, from non-ferrous metals and plastics with woodshop machines. You can make a round disc, for instance, using a stationary disc sander. First, rough-cut a slightly oversize disc from sheet stock and bore a hole in the center. Take a 1-ft.-long 2x4 with squared edges and screw the disc to its face, close enough to the end so the disc overhangs. If the disc will be used as a wheel, mount the ball bearing in the center and bolt through it. With the edge of the 2x4 held flat on the sander table, slowly feed the rough disc into the downward-rotating side of the sander until the disc spins. Check the size often until you have a round disc exactly the diameter you need. The drill press can also function as a small lathe for turning parts. Use a hand file, hacksaw or sanding blocks to shape the part mounted in the chuck, spinning at about 800 RPM.

If you need a perfectly round hole that's bigger than your largest drill bit, you can mill it using this simple template method. Start with a square of ¼-in.-thick tempered masonite and drill a hole of the desired diameter in the center with an adjustable circle cutter. Then, temporarily screw the template to the work over a starter hole that's been drilled out with a series of smaller holes. Finally, rout the workpiece using a flush-trimmer bit in the router table, as shown in the bottom photo at right.

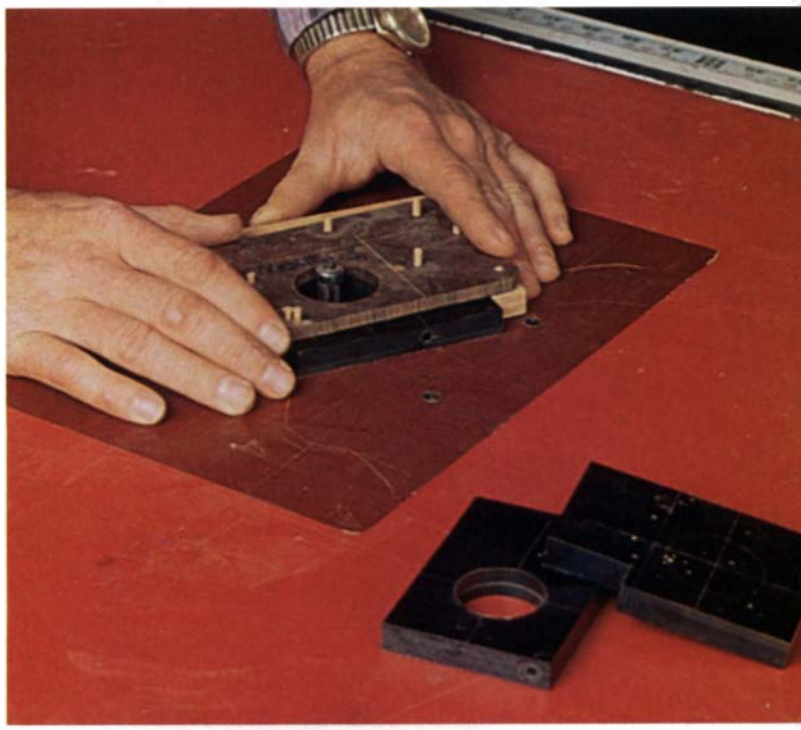
Finishing metals—It's a good idea to paint any contraption you build from steel to prevent rust. Start by cleaning the steel with mineral spirits, and then spray or brush on a metal primer followed by a topcoat of a rust-inhibiting paint, like Rustoleum. Some paints, like Flecto Ferrothane (available at paint stores), are designed to be applied directly to new metal without a primer.

Among the non-ferrous metals, brass will tarnish, but this usually isn't a problem with small parts, like handles and knobs. Aluminum is a champion in terms of corrosion resistance, and indoors it will stay clean and shiny with a minimum of upkeep. To add decorative detail to aluminum or brass, try engine turning: chuck a rubberized-abrasive rod (Cratex brand, available from hardware stores) in the drill press and press the spinning rod against the part to create a pattern of overlapping rows of circular polish marks.

While metal may not exhibit the warmth and beauty that wood does, its strength and durability make it invaluable for building quality machinery. Making sawdust will always be my first vocation, but making sparks runs a close second. □



Abrasives offer an efficient means for shaping and polishing metals in the woodshop. Equipped with a dust mask to prevent him from breathing toxic dust, Heitzman, with his homemade disc sander, finishes an edge on a curved aluminum part.



Template-routing is a handy method for making large holes in metal or plastic parts. The template is temporarily pegged to the workpiece that has a hole already roughed out. The template guides the bearing of a carbide flush-trimmer bit in the router table.

Roger Heitzman is a furniture designer/craftsman with a shop in Scotts Valley, Cal.

Building a Stationary Sander

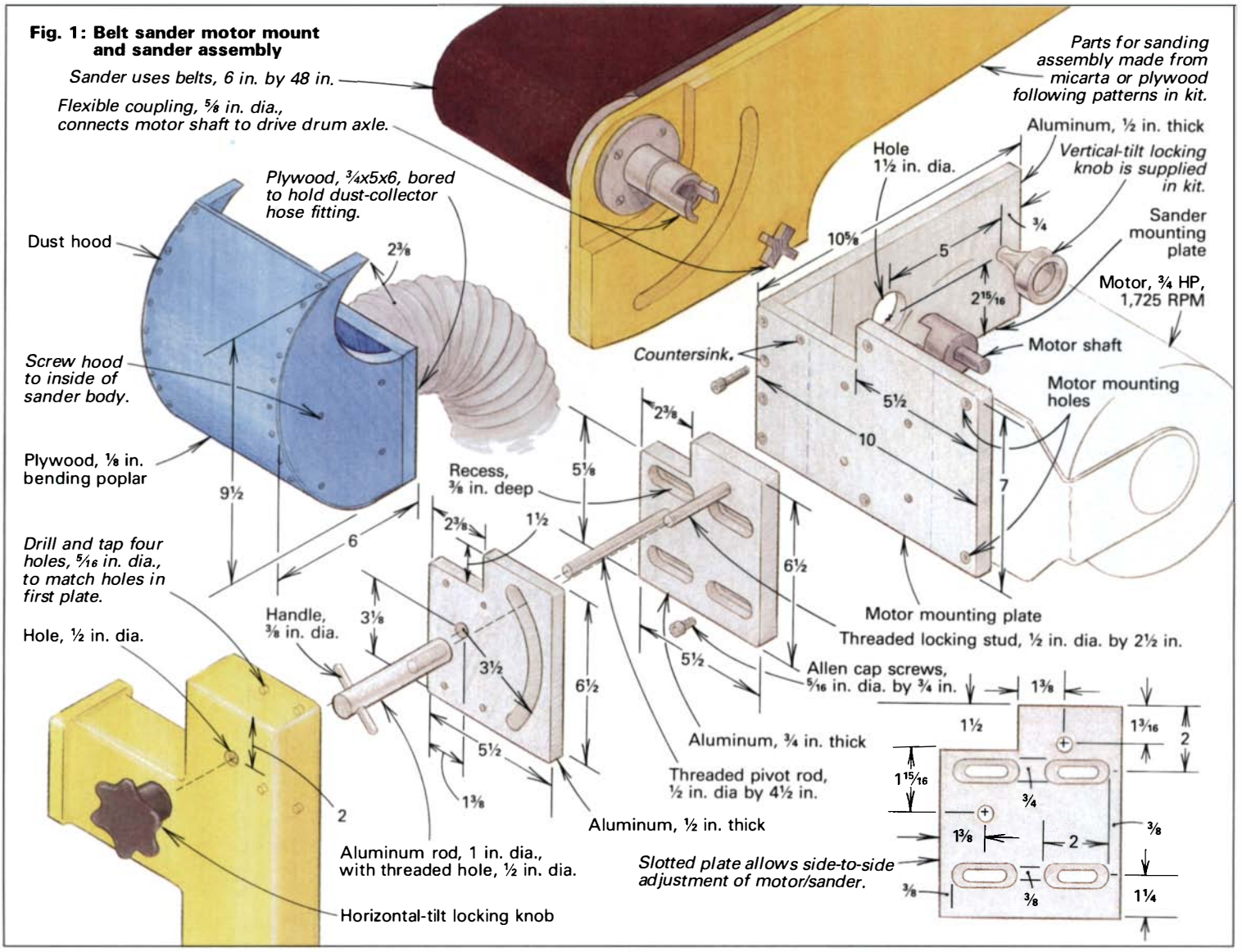
by Roger Heitzman

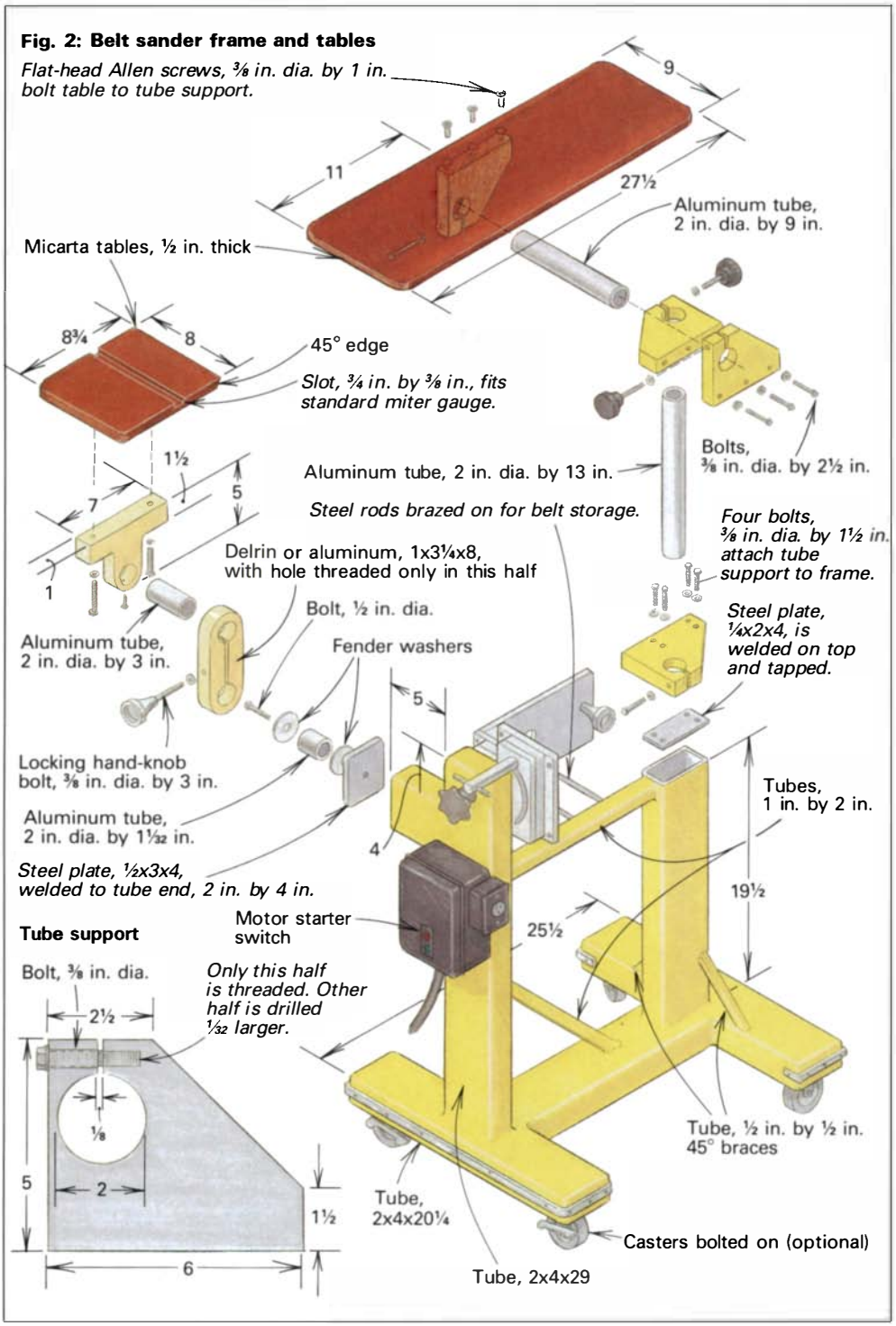
Although I've built more than half a dozen woodworking machines from scratch, it's often desirable to take an easier course and start with premachined parts or kits. I was in a friend's woodshop one day and noticed an old stationary belt sander, which he had built from a Gilliom kit, gathering dust in the corner because he had replaced it with a newer, larger-capacity sander. After negotiating the sale, I took the sander home, figured out how I could modify its basic design to suit my needs and built the sander shown in the photo on the facing page. The Gilliom was designed to pivot in one axis, to sand vertically or horizontally, but what I really needed was an edge sander. Therefore, I designed a mechanism to allow the entire sander and motor to pivot the belt along its long axis for edge sanding the long edges of a panel—a very convenient operation. The four main components of the tilt mechanism, shown in figure 1 below, are machined from aluminum plate, drilled, tapped and assembled using techniques outlined in "Metalworking in the Woodshop," beginning on p. 84. The motor and sander bolt to the motor bracket that attaches to the pivot bracket through a slotted plate, which holds the main pivot shaft and tilt-position locking stud. The slotted holes in the plate allow the entire motor/sander to be shifted from side to side so its weight can be adjusted for balance, which makes pivoting easier. The pivot bracket bolts the entire assembly to the stand. All the motor mounting and fastener holes and slotted holes are countersunk so the Allen bolt heads don't hang up when the mechanism is pivoted.

I built the stand with 2-in. by 4-in. steel tubing braced with a smaller-size square tube. After cutting the parts to length with an abrasive wheel in the chop box, I arc-welded the stand together. I also welded several ½-in.-dia. steel rods on one side of the horizontal brace as hangers for belt storage. In addition, I added casters for mobility, and two retractable feet to stabilize the sander once it's in position.

The original kit sander only has one table, but with my expanded edge-sanding capacity, I needed two adjustable tables, as shown in figure 2 on the facing page. I made both the vertical sanding and edge sanding tables from ½-in.-thick micarta. I bolted the edge sanding table to an adjustable support that provides side-to-side movement for positioning the table when bevel sanding and up-and-down motion for sanding on different areas of the belt. I

Fig. 1: Belt sander motor mount and sander assembly





Starting with parts from a Gilliom belt sander kit, the author welded a steel stand and machined aluminum and plastic parts to create a customized sander. Both a special tilting mechanism and direct motor drive allow the sander to do horizontal, vertical and edge sanding.

built the table supports from heavy, 2-in. OD aluminum tubing and 1-in.-thick mounting blocks I found at a local surplus yard. The vertical sanding table is articulated on an oval-shape arm, machined from delrin (aluminum would also be good) that attaches and adjusts via short sections of aluminum tubing. The vertical table has a slot machined in it to fit a standard saw miter gauge. Except for the two lock knobs I scrounged from the Gilliom kit, I used threaded hand knobs, available from MSC Industrial Supply Co., 151 Sunnyside Blvd., Plainview, N.Y. 11803; (800) 645-7270, to lock all the adjustments on both tables. I elected to do without an angle scale and pointer for either table: I set angled sanding operations with a bevel gauge.

The 6-in. belt sander itself is built pretty much as it comes from the Gilliom kit, except you don't need to make any of their table or stand parts (the kit is available for $99.50 from Gilliom Manufacturing Inc., Box 1018, St. Charles, Mo. 63302; 314-724-1812). When I rebuilt the sander I bought from my friend, I machined most of the new parts from micarta because it's stable and durable. The exception is the belt platen, which I made by laminating particleboard to a 1¾-in. thickness as the kit recommends. To keep the belt running effortlessly, I stapled graphite cloth (available from Derda Inc., 1195 W. Bertrand Rd., Niles, Mich. 49120; 616-683-6666) over the top of the platen. The assembled sander bolts to my homemade L-bracket I described earlier, via the kit-supplied spindle-mounting flange.

I used a ¾-HP motor to power the sander, switched on and off by a mechanical electrical motor starter that's bolted to the stand. A magnetic starter would be better, but it's more expensive. The standard Gilliom kit uses a belt-and-pulley drive setup, which I converted to direct drive via a flexible drive coupling, available from W.W. Grainger Inc., 5959 W. Howard St., Niles, Ill. 60648; (312) 647-8900. Call or write for the address of the regional distribution center nearest you. To control the sander's copious dust production, I made a dust hood from scrap plywood with a hole for a vacuum-hose fitting, and bolted this to the inside surface of the sander's carriage panel, as shown in figure 1 on the facing page.

I tested the completed sander and was so pleased with how well it worked I decided to give it a deluxe finish. I first used body putty to smooth over the rough welded seams and fillets. After sanding the entire frame smooth, I cleaned all the metal surfaces with mineral spirits, and then I sprayed the frame with one coat of metal primer and two final coats of yellow gloss enamel. My stationary belt sander is definitely the nicest looking machine in my shop, which in part accounts for why it's one of my favorites. □

Roger Heitzman teaches an annual seminar on building machinery through the Baulines Crafts Guild. For more information, call the Guild at (415) 331-8520.

Drawings: Roland Wolf

Eastern white pine, left, with its light color and even grain, continues to be the cabinetmaker's first choice in pine because of its easy working and even finishing characteristics. The light color of western yellow pine, center, is very similar to that of white pine, but it also exhibits some of the contrast between latewood and earlywood that produces the showy figure of southern yellow pine, right.

Pine

Capturing the special charm of a common timber

by Jon Arno

Pine is so relatively inexpensive, readily available and easy to work that it is often dismissed as a wood for beginners to practice on until they're experienced enough to work with more expensive hardwoods. This theory is wrong. Pine is a very respectable cabinet wood with a long tradition in American furniture-making. And although some species of pine are easily worked, others can be fairly difficult to handle and a nightmare to finish.

While there is no such thing as "good" pine or "bad" pine, generally speaking there is a right pine for any given project based on the wood's structural properties or its traditional use. To get the most out of pine, therefore, you must know something about the limitations and applications of the more than 30 native North American species. Fortunately, for practical purposes, these species can be divided into three main groups: white pine, western yellow pine and southern yellow pine, as shown in the photo above.

Although white pine is structurally the weakest and least durable of the three groups, it has the best working characteristics. Eastern and western white pine are virtually interchangeable and are ideal woods for colonial New England pieces. Sugar pine, a type of white pine, is a pleasure to work because of its uniform, fine texture and sweet aroma, but it is inappropriate for period reproductions due to the large, dark resin canals that produce flecks in the grain pattern.

The southern yellow pine group contains the hardest and heaviest of the pines. These pines have showy figures with high contrast between the soft earlywood and the hard latewood. This group is most frequently used as construction timber, but is authentic for some antebellum furniture as well.

Ponderosa and lodgepole are the dominant species of the western yellow pine group, and are the species most commonly found at lumberyards. These pines have a tamer figure, with more earlywood and thinner bands of latewood than southern yellow pine, and are softer and easier to work. In fact, unfinished western yellow pine looks similar to white pine, but the abrupt transition between earlywood and latewood requires different finishing techniques.

Grades of pine—With experience, it is not difficult to distinguish the various pines by sight and feel, but normally they are clearly labeled with a grade stamp (see sidebar on p. 93). Because of the great demand for pine in the construction industry, there is a premium on long, clear and structurally sound boards. Clear white or sugar pine, when you can find it, can cost as much as walnut. This economic reality often forces woodworkers to use the lower grades of wood. Usually clear stock is not that essential; knots that are tight and structurally sound can add charm and character to some furniture styles, as shown in the photo on p. 92. Just make sure the knots are at least 1 in. from the ends of the boards, where they won't interfere with joinery. Avoid knots ringed with a black line, as they will almost surely work loose or fall out.

If you need clear pine for repairing period pieces or reproductions, you can get fairly sizable sections from lower grades of stock. Pines produce branches in whorls 18 in. to 24 in. apart along the main trunk, which results in beautifully figured clear wood between the whorls, as shown in the photo below. My rule of thumb is to buy plenty of the lowest grade of wood that will yield at least 50% usable material for a given project. When I need long, clear pieces, I buy the top grade for just those pieces, provided I can get both grades in the same type of pine. Unless the piece is going to be painted, don't mix pines from the different groups because they don't generally finish the same way, and grain patterns and colors will vary considerably. You should also buy your stock from lumberyards that allow customers to select their own wood. Woodworkers can usually find the right kind of light, soft pine even in a pile that has already been picked over by construction contractors, who tend to prefer the stronger heartwood that is too resinous and bland for furniture. If you only need short, clear pieces, you can use boards with loose or missing knots.

Working with pine—Pine's scent is one of the most pleasant fragrances in the world, but this benefit only compliments the primary pleasure of working with a wood that machines with so few problems. You do need sharp cutting edges and sawblades to prevent tearout with a soft wood like pine. Pine is also resinous enough to gum up cutting edges, so clean the blades frequently. But the resin has little effect on most glues; glue joints will be stronger than the wood itself. In addition, pine's spongy texture absorbs shock and, while pilot holes are needed for screws, nails can be driven into all but the hardest southern yellow pines without splitting the wood.

Even though pine is a soft wood, you can build furniture for rough, daily use by taking a tip from woodworkers of an earlier era and bulking up the design. Thicker stock makes for rugged components and stronger joinery, which traditionally has included everything from dovetails to butt joints and nails. Because pine has always been a timber of choice for utilitarian pieces, the joinery has tended to be simple, cheap or easy. Mortise-and-tenon and dovetail joints were preferred in colonial days as alternatives to scarce and expensive nails and screws. Pegged joints were frequently used, but as iron and steel became more readily available, square-cut nails and screws proved to be a more convenient choice. The Tremont Nail Co., Box 111, Wareham, Mass. 02571, manufactures a line of historically accurate square-cut nails and other fasteners.

When cutting joints like dovetails or mortises and tenons, you have to compensate for pine's spongy, easily compressed texture by cutting the pieces to fit a little snugger than you would if you were working with hardwoods. Also, minimize test fitting the joints to avoid excessively compressing the wood before final assembly. Tenons should be cut as large as possible and slightly longer than those used with hardwoods. A mortise cut in ¾-in. stock should be no wider than ¼ in. Using stock a full 1 in. thick or heavier will not only leave more material for the walls of the mortise, it will also allow for a thicker tenon. Cut dovetails with wider pins and at a slightly greater angle than you would for hardwoods—a 1:5 ratio should work well. This angle will reduce the likelihood of failure due to compression of the wood. However, the greater the angle, the greater the chances that the corner of the tail will split, so don't go overboard.

In developing your designs, remember that early American pieces were generally built with stock of various thicknesses rather than with today's standard ¾-in. stock. It was easier to get odd sizes of stock years ago when the woodworker could order virtually any thickness from the local sawmill. But even today it's worth the extra effort to plane down thicker stock or add edge moldings to achieve a thicker appearance.

Applying finishes—Perhaps the greatest challenge in working with pine is to select an appropriate finish and apply it properly. As with any other wood, preparation is the key to the quality of the final finish. Because pine is usually predimensioned—hardwoods are commonly bought rough—you might think that sanding with 120- or 180-grit paper would be sufficient. These fine abrasives don't cut deep enough, however, to remove the chatter marks left by fast-feed, high-speed commercial planers. The results are blotchy lines across the boards when stain is applied. I have found that belt sanding with 80-grit prior to assembly and then finishing up with progressively finer-grit paper yields dependable results. For more authentic reproductions, handplane the wood, and then use a scraper to remove any planing marks.

Further surface preparation will depend on the type of finish to be applied, and there are many choices. As a common utility wood, pine was often left raw to develop a natural patina, or simply rubbed with linseed oil or beeswax to protect the surface. Other finishes have ranged from shellac to varnishes to paint, each with its own peculiar problems due to the basic nature of pine. Pine's aggravating characteristics include the wood's natural resins, solvents that will dissolve many finishes, and showy figures caused by a large variation in grain density, ranging from as low as 0.28 specific gravity for the soft earlywood to as high as 0.78 for latewood. If pine is not sanded properly, the variation in

Depending upon the width needed, 18 in. or more of clear eastern white pine could be cut from this piece of #4 Common bought at the local lumberyard. By selective cutting, even boards with missing knots can provide beautifully figured, high-grade lumber.

This cabinet of #4 Common ponderosa pine, the cheapest grade available, was stained, but not sealed, to emphasize the figure.

grain density can result in wavy surfaces and uneven absorption of stains and finishes.

Shellac is one of the primary weapons in combating pine's finishing problems. As a final coat, shellac tends to spot or cloud when exposed to moisture, and has generally been superseded by harder, more durable varnishes. However, shellac is alcohol based and therefore not affected by pine's natural turpenes, so it can be used to seal knots and prevent the turpenes from bleeding into the modern topcoat varnishes. Turpentine- or mineral spirit-base finishes may not harden or dry if they are contaminated by the turpenes. A single coat of 3-lb. cut orange shellac works well as an undercoat; an additional coat serves as a very heavy-bodied sealer that compensates for pine's grain swelling tendency by building to a glassy-smooth surface. Shellac can help control color variations and stain penetration as well when used by itself or in conjunction with other finishes, as will be explained in the following discussion.

Oil and/or beeswax are common finishes on early American pieces. Oil finishes, unprotected by varnish, oxidize, absorb dust and grime, and eventually turn almost black. Beeswax or clear finishes on eastern white pine develop an orange patina known as pumpkin pine. Because time is an essential ingredient in developing this mellow appearance, pumpkin pine is hard to duplicate. A technique I have used to simulate this patina is to first wipe on a tint coat, made by dissolving ¼ oz. of raw sienna oil pigment in a quart of mineral spirits. When this is dry, seal the surface with several coats of orange shellac rubbed out with 0000 steel wool. The shellac further softens the color and creates an authentic, traditional look, since the finish was used as early as the late 1600s.

To achieve the darker look of oxidized oil or to make yellow pine resemble white pine, staining is necessary. Applying stain directly to yellow pine will result in a reversal of the grain contrast as the soft earlywood absorbs most of the stain and very little stain penetrates the hard latewood. To temper this high contrast, apply a wash coat of diluted shellac, one part of 3-lb. cut white shellac to two or three parts alcohol, prior to staining. The shellac penetrates into the earlywood and reduces its porosity, while a light sanding, once the shellac is dry, removes most of the sealer from the latewood. Now stain penetration of the earlywood is reduced, but the latewood will absorb the stain at nearly its original rate, so the color contrast between the two areas will be less obvious. Because stain penetration is decreased, you may have to use a darker stain to achieve the desired results. To reduce yellow pine's natural hue and make it look more like white pine, the stain should be made slightly redder by adding about ½ oz. of burnt sienna pigment per quart of stain. A coat of orange shellac applied over the stain, but prior to the final varnish coat, will also give this finish a warmer tint.

Distressed finishes—Although I prefer a reproduction piece to look as it did when it was new, it is possible to simulate centuries of use by distressing edges, feet and work surfaces by rubbing them with sand or otherwise denting and abrading selected areas. By applying the finish before the piece is distressed, a more natural antique appearance can be duplicated. Once the piece has been abused to taste, apply a final coat of either black paint or dark brown stain and immediately rub it off, but leave some of the pigment on the wounds and in corners. The previously applied finish makes this rub coat, designed to simulate the grime of ages, easy to lighten with rags and turpentine if the contrast first appears too vivid.

While pine is often stained, historic evidence indicates that paint was a more traditional finish. Some of the fancier pieces were painted in several tones, with lighter tints on panels and darker, complimentary colors on frames. Also, pine was often painted to simulate the natural figure of more prestigious woods. A base coat was applied and then mottled, sometimes in conjunction with another tint or pigment, using a dry stiff-bristle brush, rags, feathers, combs or crumpled paper to achieve a grain-like appearance. Although with paint you don't have to worry about what species of pine is used, the knots should still be sealed with shellac to prevent their resins from bleeding.

Generally, early American pigments were somewhat loud, and it is helpful to visit museums to get a sense of the colors that were popular for certain period pieces. Milk paint was the primary vehicle for these pigments and its lack of opacity and tendency to raise the grain gave it a character all its own. While milk paint is still available (Van Dyke's, Box 278, Woonsocket, S.D. 57385; 605-796-4425 or The Old Fashioned Milk Paint Co., Box 222, Groton, Mass. 01450; 508-448-6336), a reconstituted, syrupy mix of non-fat dry milk colored with universal pigment or acrylic artist's pigments will achieve comparable results. This homemade variety is not moisture resistant, but it can be protected with a coat or two of varnish. Also, making your own milk paint allows unlimited choice of colors. Although the colors aren't authentic, flat latex paints can be used. Since they tend to raise the grain on raw wood, they simulate the look of milk paint better than oil-base paint, but a satin varnish topcoat is needed to provide a little luster.

A scrubbed pine or limed look can be achieved by rubbing a thin, almost transparent coat of oil-base white paint on raw wood and sealing it with satin varnish. This finish compliments even the racy figure of yellow pine. The paint tends to soften the grain's contrast, while the wood's natural yellow tones mellow out the paint's stark white pigment to achieve a rich, creamy beige finish. (For a further discussion of limed finishes, see "Creating a Limed Finish" on pp. 82-83 of this issue.)

A very striking appearance can be achieved by layering coats of different color paints and then sanding through to expose the lower layers at points where normal wear would occur. Any combination of two or more colors can be used. Apply two coats of the first color and then a coat of clear varnish between each succeeding coat of different color paint. This allows for a greater margin of error when sanding down to expose a previous layer. A final coat of satin varnish will enhance durability and soften contrast. □

Jon Arno is an amateur woodworker and wood technologist in Schaumburg, Ill. For more information on various types of pine, see "The Great American Pines," FWW #46, pp. 62-64.

Grade stamps: understanding the language of pine

Until early this century, woodworkers in eastern North America could buy pine with relative confidence that they were getting white or yellow pine from the vast pine forests of New England, the Great Lakes region and the South. While there are subtle differences between the southern yellow pines and the northern yellow pines, there is only one eastern white pine. The wood of this pine, *Pinus Strobus,* is so much softer and uniformly textured that it was the preferred species for cabinet work and interior trim and was easily distinguished from other pines.

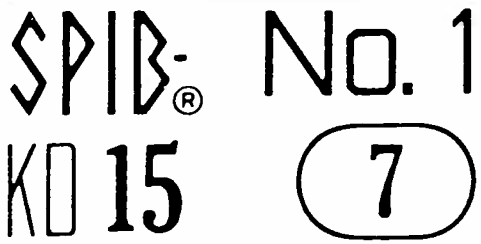
As the eastern forests became exhausted, supply shifted to the west, introducing not only two more white pines, western white and sugar pine, but also the western yellow pines, predominantly ponderosa and lodgepole. Further compounding the situation, these western yellows proved to be softer and have a milder figure than the yellow pines of the east, making them very acceptable for most interior trim and finish work. Although unfinished western yellow pine looks a lot like eastern white pine, staining yellow pine emphasizes the grain variation between earlywood and latewood much more than it does with white pine.

It is possible to distinguish the western yellow pines from true white pines by subtle differences in the weight, color and texture or by a faint, dimple pattern commonly found on the flat sawn surface of ponderosa pine. But the far easier approach for distinguishing pines is to look at the grade stamp, which provides five categories of information that indicate the grade or quality of the material, the species or group of species, the moisture content when surfaced, the certifying association and the processing mill number.

Grading standards have been established by regional lumber associations, which also help their members market products. There are currently nine organizations in the United States that have been certified by the American Lumber Standards Committee Board of Review and 10 more in Canada, but for purposes of identifying species, it is only important to be able to break them down into three regional groups corresponding to the natural ranges of North American pines. For this purpose the initials of their trademarks are often descriptive enough. For example, WWP stands for Western Wood Products Association (1500 Yeon Building, 522 S.W. Fifth Ave., Portland, Ore. 97204-2122; 503-224-3930), while SPIB represents the Southern Pine Inspection Bureau (4709 Scenic Highway, Pensacola, Fla. 32504; 904-434-2611) and NELMA identifies the Northeastern Lumber Manufacturers Association (272 Tuttle Rd., Box 87A, Cumberland Center, Maine 04021; 207-829-6901). These non-profit organizations are generally very helpful, and they offer brochures, usually for a nominal charge, on grading rules and procedures as well as other information on the lumber industry. The American Lumber Standards Committee Board of Review (Box 210, Germantown, Md. 20874; 301-540-8004) also offers a facsimile sheet that contains information on all of the 19 approved agencies, as well as samples of each agency's grade stamp.

Identifying lumber grades: Understanding the grading systems used for pine is complicated by the similar but not identical guidelines used by each of the associations throughout the country. And although these various grades are generally comparable, the situation is further complicated because the nomenclature used to describe the grades varies by species and area of the country. For example, grading for Idaho white pine is expressed as Choice & Btr, Quality, Sterling, Standard or Utility. This compares roughly to C & Btr, D, #2 & Btr, #3 Common or #4 Common grades used for the other western pines. Corresponding grades for southern yellow pine are C & Btr, D, #1, #2 and #3 while NELMA uses C Select, D Select (or more commonly D & Btr), Finish, Premium, Standard and Industrial. For a better understanding of these grades, you can order a copy of the grading rules from the agency in question.

A piece of premium-grade eastern white pine processed by NELMA-approved-mill no. 107 would bear this stamp. S-Dry indicates surfacing was done at 19% MC or less.



The SPIB in this stamp identifies not only the agency, Southern Pine Inspection Bureau, but also the species, southern pine. This stamp would be used by mill no. 7 on a #1 grade board, kiln dried to 15% MC or less before surfacing.

This grading stamp of the Western Wood Products Association would be used on a #2 grade lodgepole pine board that was surfaced with 15% MC or less at mill no. 12. WWPA can further pinpoint the origin of the material through the mill number if needed.

In many cases, the abbreviations used on the grade stamps are self-explanatory, but a few require interpretation. IWP stands for Idaho White Pine, one of the nicest of the western pines and almost indistinguishable from eastern white pine. Two Ps used back to back designate ponderosa pine. In recent years, however, there has been a trend toward mixing species and a lot of ponderosa is shipped with lodgepole, designated as PPLP. Another commonly encountered stamp is S-P-F that stands for Spruce-Pine-Fir and comes almost exclusively from Canada; however, some of the Eastern mills are starting to use an S-P-F Eastern stamp. As the mixed-species stamps become more prevalent, it becomes more difficult to determine exactly what type of wood you are dealing with, so the association trademark becomes the only clue as to the species involved.

While the association's trademark, included as part of the grade stamp, normally provides all the geographic information needed to close in on a probable species, you can probe still further by asking the association for information about the mill number in the grade stamp. By locating the mill, you can establish specific areas of origin.

Determining moisture content: The moisture content of the lumber at the time it is surfaced is also specified in the grade stamp. Three different levels are specified: S-Grn indicates the moisture content (MC) was above 19% when surfaced; S-Dry or KD-19 means surfaced dry at 19% MC or less; and KD-15 or MC-15 denotes 15% MC or less. The drier the lumber is when surfaced, the more dimensionally accurate it will be when purchased. Also, there is a greater tendency for lumber surfaced green to be twisted, warped or bowed.

Although the usefulness of these markings is becoming diluted, they are still very helpful in identifying at least the major group to which a particular pine belongs. Armed with this knowledge, the woodworker can make an intelligent choice of pine for furniture-making or repair work. *–J.A.*

The simple shape of the author's carved spoon makes it an easy but quite useful beginner's project.

A shaving horse securely and safely holds the blank for rough shaping with a drawknife. When cutting on the pull stroke, the author uses the drawknife with the bevel facing up.

To cut with a push stroke, Greear turns the handles away from his body and cuts with the bevel down. This avoids flipping the drawknife side to side, a dangerous move with such a long, sharp blade.

When cutting away from the body, be sure the hand holding the knife is behind the blade. Supporting the work with a bench and stop makes this cut easier to control.

When cutting toward the body, use short controlled strokes. To minimize the chance of injury, be sure the thumb is positioned so the handle of the knife hits the base of the thumb before the blade.

Carving Wooden Spoons

Serving up the basics

by Delbert Greear

A spoon is a familiar object, and its simple curves and concave and convex surfaces provide a good introduction to knife cutting and other woodcarving techniques. At its simplest, a spoon is no more than a straight stick with a shallow dish on one end. Such a spoon is easy to carve from a small tree limb or board with just a few tools. More elaborate spoons can also challenge carvers at all levels.

While it's possible to carve an entire spoon with just a regular knife, it's a slow and tedious process, particularly when hollowing out concave areas. I like to work wood while it is still green, splitting a plank of the appropriate size out of a log and roughing it out with a hatchet. I then transfer the work to a shaving horse, as shown in the center photos on the facing page, and use a drawknife for the bulk of the carving.

I enjoy this type of woodworking and heartily recommend it as a welcome break from the sometimes hectic modern world. Others may choose to skip some of the handwork and rough out spoon blanks on a bandsaw before moving to the shaving horse. Either way, after roughing out the shape of the spoon, I hollow the bowl with a gouge, and then refine the spoon with drawknife and knife. Finally, I sand the spoon until it is smooth and pleasant to touch, and then coat it with mineral or vegetable oil or my brew of beeswax and mutton tallow.

Maple and birch are choice woods for spoons of all kinds because they carve easily when green, but set up hard when cured. Many other woods, such as apple, are harder to carve but make good spoons. There is a certain charm to owning a spoon and knowing the parent tree still lives, and orchard prunings make this possible. Spoons and similar small objects can be carved without ever having to cut a tree by using prunings or pieces of the thousands, if not millions, of trees that fall to the chainsaw and bulldozer for no other reason than to get them out of the way of some project or another.

Selecting a good knife—The first necessity for any whittler is a good knife. Opinions on the best knife vary considerably, as do knives and woodcarvers, so you must experiment to find what works for you. A good whittling knife, in my opinion, needs a smooth, contoured handle that doesn't chafe or slip out of your hand. A 2-in. to 3-in. blade is sufficient for most carving. A longer knife is harder to control because the long blade merely moves your hand farther from the cutting action, so you'll need more force to make the cut and put more strain on your hand and wrist. Safety is also a concern; a mistake with a 2-in. blade can cause a serious cut, but a similar mistake with a 6-in. blade can be frightful.

I like to whittle with a fixed-blade Sloyd knife that has a single blade with a slightly rounded end, as shown in the bottom, right photo on the facing page. The upward curve at the end makes the blade more maneuverable, and it is less likely to split the wood than one with a narrow, sharp point. The blade itself doesn't have to be hard steel, but it should be of good quality, and it should hone easily and hold an edge well. Avoid whittling knives with hollow-ground blades because they tend to dive into the wood and don't carve or cut chips as well as a rounded or wedge-shape edge. It takes some luck, or a lot of looking, to find a simple knife that works well and rests comfortably in the hand.

Most of the rough-carving techniques on a small object, such as a simple spoon, should be accomplished with "away" cuts, as shown in the bottom, left photo on the facing page. Shaping the round dish end of the spoon, however, calls for "toward" cuts, as shown in the bottom, right photo on the facing page. Making these cuts can be inherently dangerous, but there are a few rules that, if followed religiously, make these strokes more safe.

When cutting away from your body, hold the stock against a solid piece of wood, such as a tree or stump, and not another area of your body. For cutting toward your body, make controlled muscular movements that have a definite range and stopping point—well short of any flesh. For example, pull the knife with your shoulder and upper arm muscles so your elbow reaches your body before the blade reaches your holding hand. For detail work, pinch the tool toward the thumb of the hand holding the knife so that the knife handle hits the heel of the thumb before the blade does. This also provides good leverage when making short strokes, especially across the grain.

Never depend upon the momentum of the knife to complete a stroke. A knife is not an ax nor should it be used as one, even on a small scale. Pay close attention to the grain of the wood. Slicing into a diving grain binds up the blade and requires the use of excess force that might send the blade skipping along the wood.

Drawknife safety—The shaving horse (see *FWW* #56, p. 58 and #38, p. 12) is generally set up for a pulling stroke with the drawknife, as in the center, left photo on the facing page. To avoid tearing the wood in curved sections of the handle, you'll frequently have to reverse the direction of cut and push with the knife, as in the center, right photo on the facing page. The drawknife is best pulled with the bevel up and pushed with the bevel down, which saves turning the blade from side to side—a dangerous maneuver.

Pulling a sharp drawknife looks a little frightening to the uninitiated, but it is fairly safe if the shaving horse's work surface is long enough and the foot pedal is within easy reach of the operator. The drawing motion is self-limiting—when the biceps are flexed, the arm only goes back so far. The threat of injury does exist, and I urge anyone learning how to use a drawknife and shaving horse to work slowly and carefully.

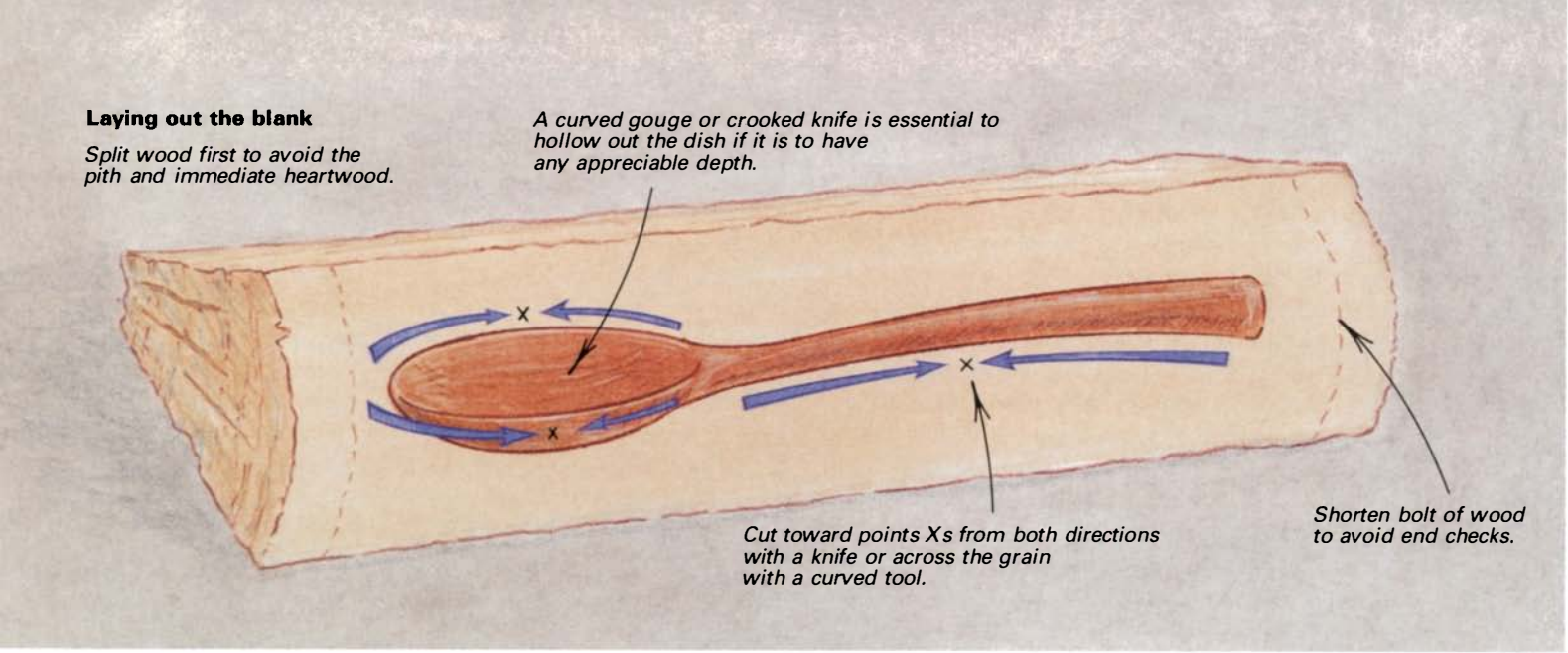
The main danger in pushing the drawknife is to the fingers. It's easy to nick your fingers when you flip the blade over, especially if the handles are set close to the blade. Actually, the few serious cuts that I have seen or heard about with this tool resulted from dropping it or otherwise mishandling it when the blade was not being used. A secure place to hang or set the drawknife down is, therefore, of importance. Balancing this tool precariously on the stage of a shaving horse is an invitation for trouble.

As with the carving knife, the drawknife is not meant to be driven by momentum, but by steady muscular force. Chopping, prying and jerking are not only bad form, but are dangerous.

Carving the dish—Once the overall spoon shape is roughed out with a drawknife, you are faced with the problem of hollowing out the dish. Holding a spoon or ladle safely while gouging out the bowl can be difficult on the average shaving horse since it is necessary to carve from many different directions. One solution is to drill a few holes at various places in the worktable and put pegs in them for stops. This keeps the spoon or ladle from twisting when it is clamped sideways. If you are fortunate enough to have a workbench, you may wish to clamp the spoon's handle while it is still rough in order to hollow out the bowl. Other jigs, which can be as simple as a bent nail in a stump, work just as well.

Hollowing the bowl is difficult to do with an ordinary knife, so you will probably want to invest in a gouge or crooked knife, which resembles a regular knife except that the end of the blade is curved upward. I use a gouge that is bent upward along its length as well as across the end of the blade, as shown in the photo on the following page, for roughing out spoons as well as bowls. From long familiarity, I am comfortable with this tool, but if you are new to spoon carving, I suggest that you also give the crooked knife a try. It is perhaps the safer tool for hand-held carving.

Unlike the straight carving knife, curved-edge tools cut more



Carve out the spoon with a gouge, working from the sides down to the middle. Cut across the grain as much as possible, as cutting with the grain can result in uncontrolled splits that dive into the wood.

smoothly across the grain. Scooping out chips with a gouge parallel to the grain often results in binding and tearing. As the blade exits the wood, it actually cuts against the grain—just as a knife cuts toward a diving grain. Cutting across the long grain, on the other hand, shears the fibers of the wood and lets the blade exit cleanly.

Recurved spoons and fancy ladles—A straight spoon is very handy for stirring and in a pinch it will do for serving and eating as well, although it is a little awkward for these tasks. Some curvature in the handle adds balance to the spoon and a corresponding upsweep in the bowl is handy for scooping food out of a pot or pan. Occasionally you will find a piece of wood that is shaped just right for such a spoon, but this is unusual. To carve recurved spoons, one must learn how to make curved shapes from straight-grain stock.

Newcomers to spoon carving may experience some difficulty with inside curves. You must cut toward the bottom of these curves from both directions, as shown in the drawing above. As with the bowl, if the recurve is sharp and deep, you may want to use the gouge or crooked knife to clean the burr at the bottom of the cut.

Recurved spoons have aesthetic appeal as well as practical value. A fancy soup ladle is a showpiece of the carver's art—and perhaps the epitome of the recurved spoon. Carving a ladle requires time and effort, even after you have achieved skill carving smaller spoons.

Long-lasting spoons—I scrape and sandpaper my spoons until they are smooth and free of splinters. After they are dry, I heat them and rub in a homemade finish of beeswax and mutton tallow, which is melted together in equal proportions, to penetrate and seal the wood. Mineral oil and some vegetable oils also make good finishes, as do commercial finishes especially formulated for woodenware.

Wooden bowls and utensils occasionally receive some bad press as being dangerous to your health. Although wooden chopping blocks seem to be the principal culprits as documented sources of food poisoning, wooden spoons, platters and bowls are generally banned from eating establishments, probably because they eventually crack and these cracks can harbor old food and thus breed bacteria. One way to avoid this is to make a spoon thin. A thin spoon dries quickly and has little time to mildew and sour, and the wood is also more flexible to accommodate expansion and contraction without cracking. Personally, I don't believe that smooth, well-sealed and well-cared-for woodenware is dangerous in the home kitchen. A nicely made wooden spoon or ladle is often easier to clean than a metal one with rivets and seams that can harbor food particles.

A wooden spoon that goes through regular cycles of wet and dry will not be protected from cracking unless it is well designed. The trick is to balance the forces in the wood, while still maintaining the needed strength. Avoiding the pith of the log, as shown above, and carving thin bowls are important here. A living tree is in a state of dynamic tension with itself and with the forces around it, such as wind and gravity. A piece of green wood inherits a share of this tension and other stresses develop as the wood dries. In a well-designed carving (of hollowware especially), woodcarvers can release much of this tension while conserving and emphasizing the natural strength of the wood. Although scientific principles are involved (see *Understanding Wood* by R. Bruce Hoadley, The Taunton Press, 1980), this process remains an art that can only be learned through experience.

Salad spoons—Salad spoons offer woodcarvers more chances to exercise their artistic muse. Salad spoons are best carved and used in sets. Traditionally one piece of the set is a spoon and the other a fork, or rather a sort of "spoon-fork." Carve the spoons with broad handles to give them balance, an easy-to-grip end and a place for decoration. I enjoy carving salad spoons to match a serving bowl, and these sets seem to be popular items for sale. I generally stick to symmetrical shapes, but don't hesitate to use your artistic skills here, as decorative salad spoons can make even a modest dining table seem rich. □

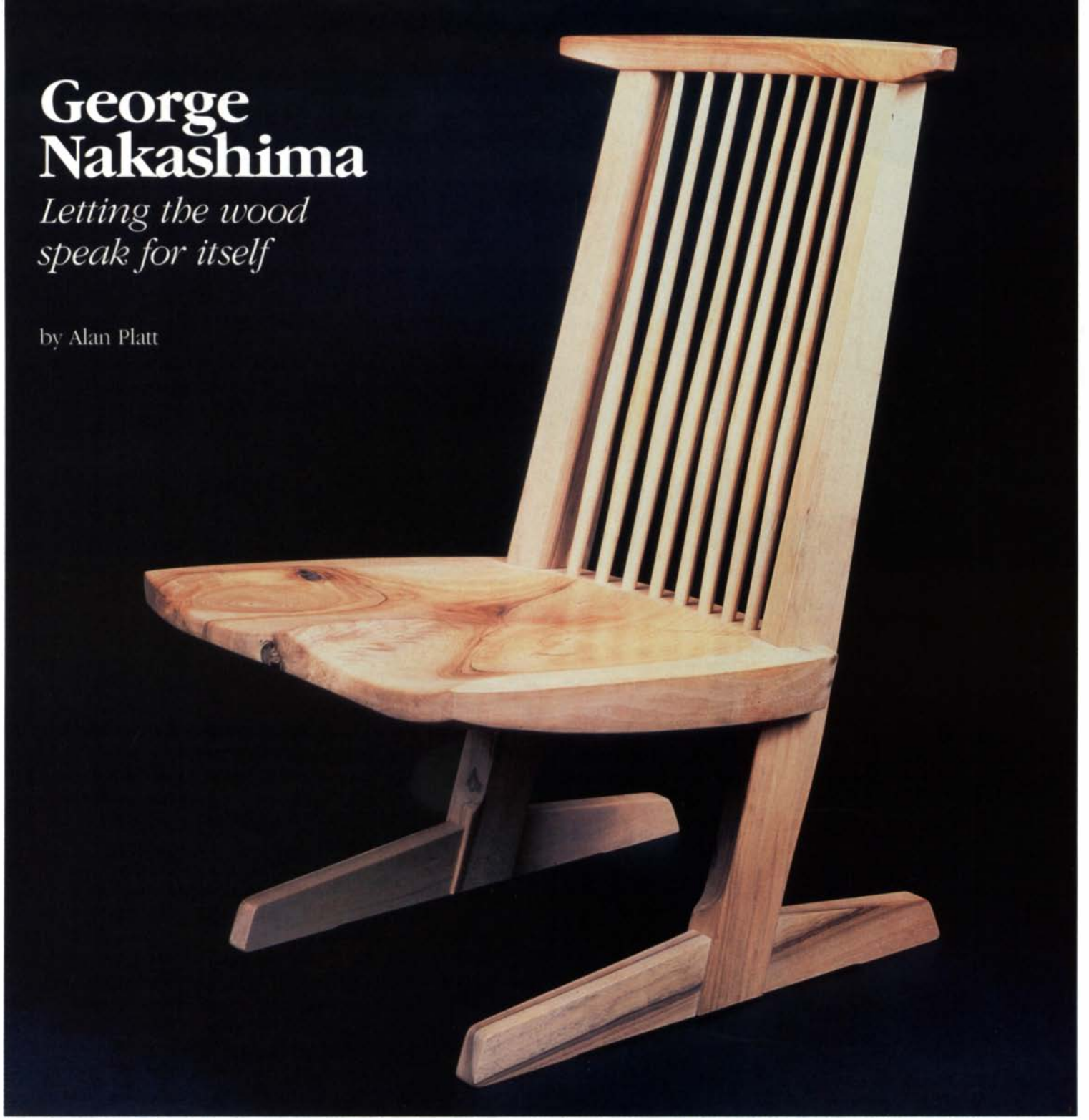
Delbert Greear is a woodworker in Helen, Ga.

Drawing: Roland Wolf

George Nakashima

Letting the wood speak for itself

by Alan Platt



Nakashima's 1980 Conoid chair, above, designed as a lounge chair, is a bit larger (33¼Hx22½W26½D) and has a lower seat than his dining chairs. The chair's cantilever construction and simple lines emphasize its basic seating function. Its dominant features are the unfinished English walnut seat and frame and the hickory back spindles.

Until recently, my only exposure to the work of George Nakashima was through magazine articles and books, especially Nakashima's own, *The Soul of a Tree.* I was skeptical about Nakashima because of what I perceived as his excessive preoccupation with mysticism and an inordinate, reverential awe of wood. I had missed the point. Earlier this year when I saw about 50 of his pieces at the American Craft Museum's "George Nakashima: Full Circle" retrospective exhibition, the work itself made it clear, in a way words and photographs had failed. Clearly Nakashima's goal was to let the wood make its own statement. Sam Maloof captured this essence in the exhibition's catalog: "He [Nakashima] once wrote, 'Wood is a material related to man, a material that fills a need in human consciousness by drawing one into the fine relationship with nature and time—to produce beautiful things or inspiring things or simple good things.' All this is seen in his work. There are no frills, no tricks, no embellishment, no added color."

Nakashima's designs derive from the wood itself, and, in his view, it is the woodworker's responsibility to discover the intended purpose of each board or burl. This doesn't mean that design is ignored. Chairs, of course, require seats and legs; tables, cabinets and benches need supporting bases. But Nakashima engineers solutions that allow the wood to dominate; supporting frames and structures are subordinate, sometimes incidental, but always unobtrusive.

The retrospective brought together pieces from various stages of Nakashima's 40-year career. Evident throughout is the unwavering commitment to simplicity and consistency, which has allowed Na-

Photos: George Erml, courtesy of American Craft Museum

Built in 1945, this cypress Brogren stool, above, has hand-shaped legs, with cross sections that mirror the amoeba-like shape of the seat. Nakashima fastened the legs to the seat with a wedged through-dovetail tenon. The stool measures 15Hx17Wx15D. The twisted sea grass in this American black walnut chair and matching stool, above, right, contrasts strongly with the mass-produced, molded plywood furniture that was popular when the piece was built in the post-war years. The frames are mortise-and-tenon construction and pinned with maple dowels. Many of Nakashima's natural-edge pieces are made from logs cut lengthwise, but the slab for this 1988 Arlyn table, right, is a transverse cut through the massive Redwood root. The huge (89 in. by 91 in.) burl top is supported on a 26-in.-high walnut base; beams attached to the underside of the top act as tenons and fit to mortises cut into the base.

kashima to ignore the pressures of the burgeoning fads and gimmicks, which produced art furniture that stressed metal, plastic, paint and sculpture at the expense of function. The Conoid chair (1980), for example, shown in the photo on the previous page, remains every bit as functional and elemental as his early Brogren stool (1945), shown in the photo above, left, or Grass-Seated chair and stool (1944), shown in the top photo above, right.

Nakashima is perhaps best known for using natural-edge slabs for tables and room dividers, and I wasn't disappointed with the examples of this work in the exhibition. Among the pieces displayed was the massive 89-in. by 91-in. Arlyn table, shown in the bottom photo above, right. Built in 1988 from a redwood burl, it was spectacularly displayed at the foot of a double flight of stairs and could be viewed from overlooking balconies. Approaching it was like seeing more and more stars as your eyes become accustomed to the darkness; from a distance, the contrasting colors of the early and late woods dominated, but as I got closer, those colors set off the highly figured grain, giving the wood's surface a three-dimensional quality.

The smaller Minguren I table, shown in the bottom, left photo on the facing page, is no less interesting. The East Indian laurel butterfly joints—a favorite of Nakashima's—provide visual relief to the table's English oak burl top and function to arrest further splitting. Nakashima also uses free-form slabs to advantage in other settings, as seen in the Lounge chair, shown in the bottom, center photo on the facing page, which apparently is based on early Windsor chairs, and the Music stand, shown in the bottom, right photo on the facing page, which Nakashima built for his daughter, Mira. The Windsor tradition is again evident in the backrest of the bench Nakashima built for Nelson Rockefeller (see the top photo on the facing page).

Now 84 years old, Nakashima, who was born in Spokane, Wash., earned a B.A. degree in architecture from the University of Washington, Seattle in 1929 and received a master's degree in architecture from Massachusetts Institute of Technology in 1930. He subsequently traveled widely—Europe, China, India and Japan—before returning to America, just before the outbreak of World War II. After Pearl Harbor, Nakashima was interned for a year in a detention camp in Idaho before he was permitted to relocate to New Hope, Pa. Since 1944, Nakashima, his wife, Marian, daughter, Mira, and son, Kevin, have lived in New Hope. His small, 10-man woodworking shop is still a family-run enterprise, which continues to turn out one-of-a-kind pieces. □

Alan Platt is an amateur woodworker in La Grangeville, N.Y. George Nakashima's The Soul of a Tree *is published by Kodansha International/USA Ltd., 10 E. 53rd St., New York, N.Y. 10022.*

The backrest of the 1961 bench, above, is clearly related to the Windsor tradition. A single East Indian rosewood butterfly adorns the fairly straight-grain, natural-edge walnut bench slab. Nakashima made the bench for Nelson Rockefeller's Pocantico Hills, N.Y., home.

In this Minguren I table, below, left, Nakashima used the natural irregularities of English oak burl to visually relieve the circular form of its top. The decorative East Indian laurel butterfly joints help arrest further splitting. Nakashima's butterflies taper slightly from top to bottom to ensure a tight fit when installed and glued. The butterflies are usually cut thinner than the slab, and screws are run up through the bottom of the slab into each wing, providing additional holding power. This 1962 Lounge chair, below, center, with its free-form, Oregon myrtle burl writing surface and sculpted walnut seat, is also reminiscent of Windsor designs. Nakashima's touch is evident in the "inverted" crest rail and the wedged, protruding tenons of the outermost back spindles. Nakashima designed this Music stand, below, right, in 1971 for his daughter, Mira. The music holder is a maple burl; the stop at the bottom is East Indian rosewood and the adjustable pedestal and base are American black walnut.

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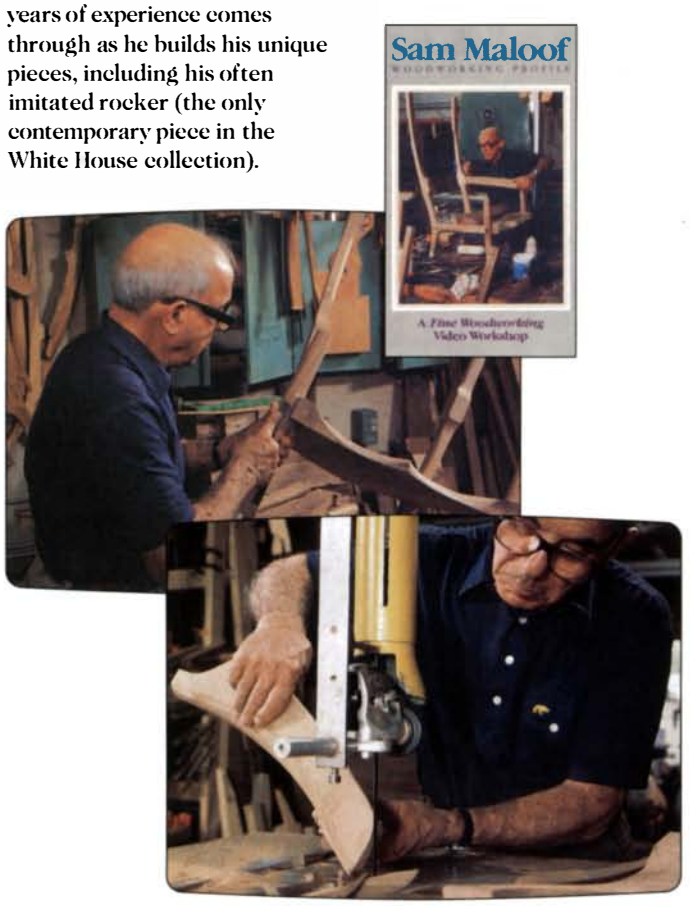

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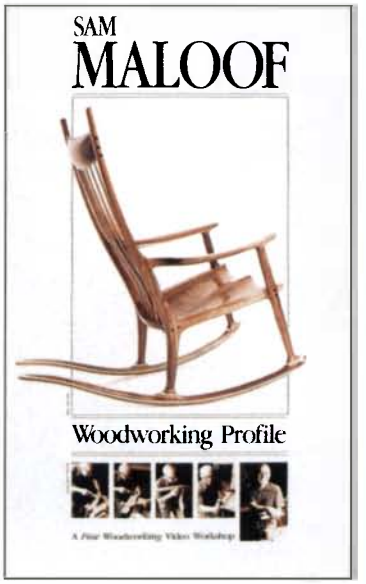

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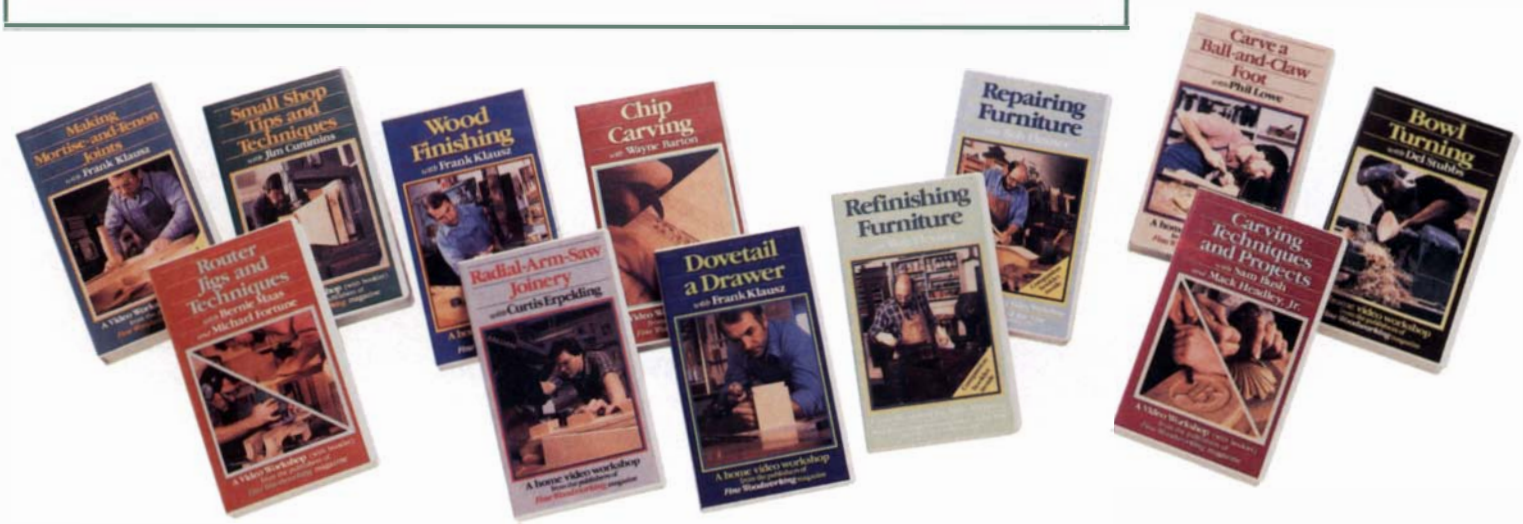

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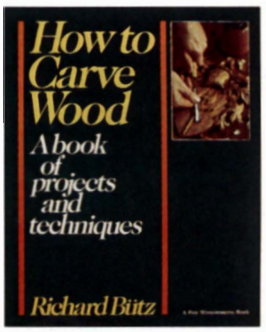

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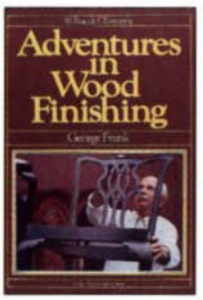

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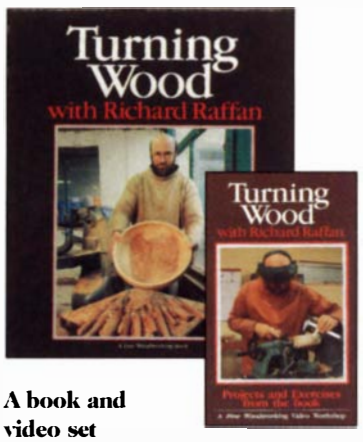

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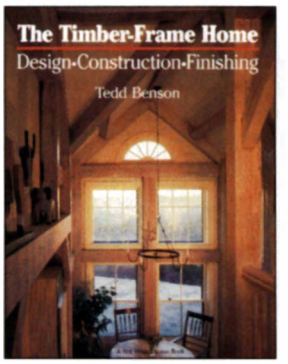

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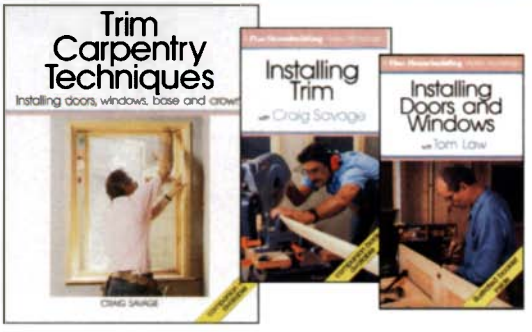

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COMPLETE SET of *FINE WOODWORKING*, excellent shape, missing #42 and #64. Bert Wolfe (216) 345-5511.

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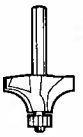

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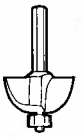

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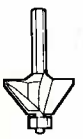

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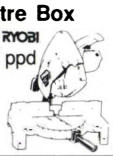

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READER SERVICE NO. 69

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.

***ALASKA:* Juried exhibit**–International Turned Objects Show, Jan. 6–Feb. 25. Anchorage Museum, Anchorage. For more info., contact Sarah Tanguy, International Sculpture Center, 1050 Potomac St. N.W., Washington, DC 20007. (202) 965-6066.

***ARIZONA:* Exhibit**–New works in clay, wood and bronze by Christine Federighi, thru Oct. 28. The Hand and the Spirit Gallery, 4222 N. Marshall Way, Scottsdale, 85251. (602) 949-1262.
Juried Show–Arizona Association of Fine Woodworkers annual woodworking show, Nov. 5. Los Olivos Adult Center, 28th St. and Devonshire, Phoenix. For more information, contact Jim Stephenson, AAFW Box 44264, Phoenix. (602) 993-0441.
Seminar–Woodcarving seminar with Jack Bayman, carver and artist, Jan. 8–13. Students will go through process of carving, burning and painting a male cardinal. For info., contact Dave Rushlo Woodcarvers Supply, 2530 N. 80th Pl., Scottsdale, 85257. (602) 994-1233.

***ARKANSAS:* Show**–Turned Wood Object Show, Oct. 21–Nov. 25. Gallery B, Little Rock.

***CALIFORNIA:* Auction**–Arts and Crafts auction, Oct. 21. The Ebel Club, Los Angeles. Contact The Arts and Crafts Shop, 1417 Bridgeway, Suasalito, 94965. (415) 331-2554.
Juried show–Artistry In Wood '89, thru Oct. 29. Weekends only. The Sonoma County Museum, 425 Seventh St., Santa Rosa. (707) 579-1500.
Juried exhibit–"The Fine Art of Woodworking," thru Oct. 29. For info., contact Highlight Gallery, 45052 Main St., Box 1515, Mendocino, 95460. (707) 937-3132.
Juried show–"California Woodworking 1990," Jan. 12–Feb. 9. Open to California woodworkers. Entries deadline: Oct. 31. For info., contact Bill Docking, 3501 Teton Dr., Fullerton, 92635. (714) 526-7100.
Show–The Woodworking Show, Nov. 10–12. Los Angeles County Fairgrounds, 1101 W. McKinley Ave., Pomona. For information, contact Helen Fillman, 1516 S. Pontius Ave., Los Angeles, 90025. (213) 477-8521.
Classes–Building the Norwegian pram, Nov. 11–12, Nov. 18–19. National Maritime Museum Assoc., Building 275, Crissy Field, San Francisco, 94129. (415) 929-0202.
Show–The Woodworking Show, Nov. 17–19. Convention & Performing Arts Center, 202 C St., San Diego. For info., contact Helen Fillman, 1516 S. Pontius Ave., Los Angeles, 90025. (213) 477-8521.
Class–Building the Sea Lion sailing pram, Nov. 25–Dec. 2. Weaverville. For information, contact Ross Molyneux, Box 1637, Weaverville, 96093. (916) 623-3161.
Class–A day with Sam Maloof, Nov. 18. Alta Loma. Learn the how and why of Maloof's work and techniques through discussion and demonstration. For info., contact Susan Parkhill, Univ. Extension, Univ. of CA, Riverside, 92521. (714) 787-4102.
Benefit–1st Bruce McQuilkin fund-raiser, Dec. Sponsored by Baulines Craft Guild to benefit apprenticeship program for a deserving woodworker. For exact date, information or to make donations, contact Patty Rose, Baulines Craft Guild, Schoonmaker Point, Sausalito, 94965. (415) 331-8520.
Workshops–Various workshops including Japanese woodworking, joinery and sharpening. Contact Hida Tool Co., 1333 San Pablo, Berkeley, 94702. (415) 524-3700.
Show–Decor Art Buyers Caravan show, Jan. 20–22. Long Beach Convention Center, Long Beach. For more information, contact Paul Karel, 408 Olive St., St. Louis, MO 63102. (314) 421-5445.

***COLORADO:* Juried exhibit**–The 5th annual juried exhibition, thru Oct. 29. Colorado Springs Pioneer Museum, Colorado Springs. Contact The Woodworkers Guild of Colorado Springs, 918 N. Royer St., Colorado Springs, 80903. (719) 632-8548.

***CONNECTICUT:* Workshops**–In Brookfield: making a shoji screen with Toshio Odate, Oct. 21–22; tablesaw techniques with William Gundling, one day classes Nov. 11 & Nov. 12. In Sono: designing & building fine tables with Richard Tannen, Oct. 28–29. Contact Brookfield Craft Center, Box 122, Route 25, Brookfield, 06804. (203) 775-4526.
Juried show–11th Annual Holiday Exposition of crafts and fine art, Nov. 4–Dec. 23. Featuring works in wood, fibers, basketry, metals, glass, clay and textiles. Mill Gallery, Guilford. Contact Patricia Seekamp, Guilford Handcrafts Inc., Box 589, Guilford, 06437. (203) 453-5947.
Exhibit–Post-Modern Architectural Furniture Exhibition, Nov. 11–Jan. 7. Brookfield Craft Center, Box 122, Route 25, Brookfield 06804. For information, contact John Russell, (203) 775-4526.
Exhibition–Faux & Troupe LÓeil Finish Exhibition, thru Nov. 12. Brookfield Craft Center, Box 122, Route 25, Brookfield 06804. (203) 775-4526.
Juried exhibition–21st annual Celebration of American Crafts, Nov. 13–Dec. 23. All types of media. For info., contact The Celebration, Creative Arts Wokshop, 80 Audubon St., New Haven, 06510. (203) 562-4927.
Exhibits–"A Celebration of Color," holiday collection of crafts, Nov. 15–Jan 6; Tommy Simpson's work, wood and jewelry, Nov. 15–Jan. 6. Contact The Elements, 14 Liberty Way, Greenwich, 06830. (203) 661-0014.
Workshop–Bird carving, Nov. 16–19. Guilford Handcrafts Inc., Box 589, Guilford, 06437. (203) 453-5947.
Sale–11th annual holiday sale, Nov. 24–Dec. 24. Work from potters, jewelers, woodworkers, glass artists, leather workers, quilters and garment designers. Brookfield Craft Center, Box 122, Route 25, Brookfield, 06804. (203) 775-4526.
Juried exhibit–Wesleyan Potters annual exhibit and sale, Nov. 25–Dec. 10. Work in every craft medium by selected craftspeople. Wesleyan Potters Craft Center, 350 S. Main St., Middletown, 06457. (203) 347-5925.

***FLORIDA:* Juried show**–4th Annual Starke Festival of the Arts, Oct. 28–29. For information, contact Nancee Clark, Box 1530, Gainesville, 32602. (904) 395-5159.
Show–The Woodworking Show, Oct. 27–29. Curtis Hixon Convention Center, 600 Ashley Dr., Tampa. Contact Helen Fillman, 1516 S. Pontius Ave., Los Angeles, CA 90025. (213) 477-8521.
Seminar–"Overview of New Technology for Executives," Nov. 2–3. Palm Beach. Will give information on the proper use of high technologies for the woodworking industry. For info., contact Carlos Martinez, Woodworking Machinery Project, Italian Trade Commission, 1801 Ave. of the Stars, Suite 700, Los Angeles, CA 90067. (213) 879-0950.
Seminar–"Application of Technology," Nov. 29–Dec. 1. Orlando. Will focus on those technologies appropriate to the manufacturing environment for wood processing, panel processing, assembly and packing, environmental concerns and more. Contact Carlos Martinez, Woodworking Machinery Project, Italian Trade Commission, 1801 Ave. of the Stars, Suite 700, Los Angeles, CA 90067. (213) 879-0950.
Show–Holidayfest '89, Dec. 8–10. West Palm Beach. Entries for exhibiting accepted until Nov. 8. For information about exhibiting or attending this city-sponsored event, contact Kelly Husak, (407) 659-8004.
Show–An Art of Deception: American Wildfowl Decoys, Dec. 24–Feb. 17. Orlando Museum of Art, Orlando. For information, contact Susan Flamm, Museum of American Folk Art, 444 Park Ave. S., New York, NY 10016. (212) 481-3080.

***GEORGIA:* Juried exhibition**–International Woodworking Fair Design Competition, Aug. 24–27. Deadline for entries: Jan. 15. Contact Shirley Byron, International Woodworking Machinery and Furniture Supply Fair, 8931 Shady Grove Court, Gaithersburg, MD 20877.

***ILLINOIS:* Show**–18th annual Midwestern Wood Carvers show, Nov. 4–5. Belle-Clair Exposition Hall, Belleville. Work from approximately 140 woodcarvers across the U.S. & Canada. Contact Don Lougeay, 1830 E. D St., Belleville, 62221. (618) 233-5970.

***INDIANA:* Workshops**–Second Saturday workshops and classes including woodworking, router seminars, sharpening techniques and scroll saw classes, thru April. Edward B. Mueller Co. 3940 S. Keystone, Indianapolis, 46227. (317) 783-2040.

***IOWA:* Show**–Wood Workers Fair '89, Oct. 27–29. Iowa State Fair Grounds, Des Moines. For info., contact Tom Bach, Wood Workers Fair, Box 1422, Des Moines, 50305. (515) 278-2126.

***LOUISIANA:* Juried show**–Lafayette Art Association annual competition, Oct. 9–Nov. 10. For information, write Sara Parker, Lafayette Art Gallery, 700 Lee Ave., Lafayette, 70501.
Fair–Art & Craft Fiesta, Nov. 11–12. Cajundome. Contact Lafayette Art Gallery, 700 Lee Ave., Lafayette, 70501.
Fair–Louisiana Crafts Council Holiday Crafts Market. Nov. 25–26. New Orleans Botanical Garden, City Park. For info., contact Louisiana Craft Council, Box 1287, Baton Rouge, 70821. (504) 928-1980.

***MARYLAND:* Juried festivals**–Sugarloaf's 14th annual autumn crafts festival, Nov. 17–19. Sugarloaf's 12th annual winter crafts festival, Dec. 8–10. Both at the Montgomery County Fairgrounds. For information, contact Sugarloaf Mountain Works Inc., 20251 Century Blvd., Germantown, 20874. (301) 540-0900.

***MASSACHUSETTS:* Show**–Woodworking World New England show, Oct. 20–22. Eastern States Exposition, Springfield. For more information, call or write CDI Productions, Box 796, Plymouth, NH 03264. (603) 536-3768.
Workshops–Traditional joinery, tool sharpening and reconditioning, modern applications, marking and layout. Nov., Feb., Jan., April. Four consecutive Saturdays. Contact

Photo: David Browne

Winter classes in woodworking begin January 8 at Oregon School of Arts and Crafts in Portland. Stephen Grove, head of woodworking at the school, made this "Bench for Two."

READER SERVICE NO. 47

Andover Historical Society, 97 Main St., Andover, 01810. (508) 475-2236.
Exhibition–Directors Choice, thru Nov. 18. Featuring the work of 26 artists including furnituremakers Wendell Castle and George Nakashima and woodturner Bob Stocksdale. The Society of Arts and Crafts, 101 Arch St., Boston. Contact Pamela Shaffer, (617) 266-1810.
Exhibition–Twenty Years of Contemporary Craft, thru Jan. 19. The Society of Arts and Crafts, 101 Arch St., Boston. Mon.–Fri., 10 A.M. to 6 P.M. For information, contact Pamela Shaffer, (617) 266-1810.
Exhibit–An Education in Craftmanship, thru Jan. 4. Vault Gallery of The Boston Co., 1 Boston Pl., Boston. Featuring the work of students, graduates and instructors at the North Bennet Street School. For information, contact Sally Miller, North Bennet Street School, 39 N. Bennet St., Boston, 02113. (617) 227-0155.
Exhibition–Fantasy and Whimsy, thru Jan. 13. Boston. Mixed-media exhibition featuring Paul Sasso, Bill Accorsi, Lee Schutte and others. Contact The Society of Arts and Crafts, 101 Arch St., Boston. (617) 266-1810.
Juried exhibit–Shaker Workmanship '90, July thru Oct. Hancock Shaker Village. Entries deadline: Jan. 15. Will include Shaker and Shaker-inspired tools and containers related to textile use or production. For details and application, contact Cheryl Anderson, Hancock Shaker Village, Box 898, Pittsfield, 01202. (413) 443-0188.

MISSOURI: **Show**–Midwest Woodworkers' Association show, Nov. 25–26. Columbia Mall. For information, contact Karl Haak, Box 7093, Columbia, 65205.

NEBRASKA: **Show**–Cottonwood Quilter's Guild show, Oct. 27–29. Elkhorn Middle School, Elkhorn. Featuring the Omaha Woodworkers Guild as guest artists. For information, contact Joanne Traise, 1803 S. 169th Circle, Omaha, 68130.

NEW HAMPSHIRE: **Auctions**–Antique and Craftsmans Tool Auctions. Listed sale, Oct. 21; small antiques and collectibles, Nov. 4; listed sale, Nov. 11. All at Danforths 4 Corners, Hillsboro, 03244. For information, contact Richard Crane, RFD 2, Box 339, Hillsboro, 03244. (603) 478-5723.

NEW JERSEY: **Juried exhibit**–The Super Crafts Star Show, Oct. 20–22. Giants Stadium Club, East Rutherford. Contact Creative Faires Ltd., 134 Fifth Ave., New York, NY 10011. (212) 645-1630.
Show–South Jersey Wood Carvers 4th annual fall woodcarving show, Nov. 18–19. NJ National Guard Armory, Route 38, Mt. Holly. Over 50 carvers. 10 A.M. to 5 P.M. For information, contact Jack Raleigh, (609) 829-8731.
Show–The Woodworking Show, Dec. 1–3. Garden State Park, Route 70 & Haddonfield Rd., Cherry Hill, 08034. For info., contact Helen Fillman, 1516 S. Pontius Ave., Los Angeles, CA 90025. (213) 477-8521.

NEW MEXICO: **Exhibition**–"Bellas Artes 1989," thru Oct. 31. Featuring over 17 artists including woodturners. For more info., contact Bellas Artes, 301 Garcia at Canyon Road, Santa Fe, 87501. (505) 983-2745.

NEW YORK: **Show**–Woodworking World New York show, Oct. 27–29. Westchester County Center, White Plains. For info., contact CDJ Productions, Box 796, Plymouth, NH 03264. (603) 536-3768.
Show–Woodworking World Central New York Show, Nov. 3–5. NY State Fairgrounds, Syracuse. For information, contact The Image Group, Box 367, Plymouth, NH 03264. (603) 536-4068.
Workshop–"Woods," Nov. 9–Dec. 14. New York University. Introduces students to the various materials used in cabinetry. To register, contact the Division of Arts, Sciences and Humanities, 332 Shimkin Hall, New York City, 10003. (212) 998-7130.
Exhibition–International Art Horizons, New York '89, Dec. 27–Jan. 14. Art 54 Gallery, Soho. International art competition. Deadline for entries: Nov. 17. For application, contact International Art Horizons, Department PR, Box 1091. Larchmont, 10538. (914) 633-6661.
Exhibit–The Tactile Vessel: New Basket Forms, thru Nov. 21. American Craft Museum, 40 W. 53rd St., New York, 10019. (212) 956-3535.
Workshops–Hand Tool Workshops, Nov. 18–19 & Dec. 16–17. Learn sharpening techniques, joinery, furnituremaking, instrumentmaking and more. The Luthieric, 2449 W. Saugerties Rd., Saugerties, 12477. (914) 246-5207.
Workshops–Various workshops and classes including using your router, wood finishing and intermediate woodcarving, thru Dec. Constantine, 2050 Eastchester Rd., Bronx, 10461. Contact Gertrude Constantine, (212) 792-1600.
Workshops–Various woodworking-related classes and workshops, thru Dec. The Craft Students League, 610 Lexington Ave. at 53rd St., New York, 10022. (212) 735-9732.

NORTH CAROLINA: **Show**–42nd annual Southern Highland Handicraft Guild fair, Oct. 20–22. Asheville Civic Center, Asheville, 28815. Over 150 craft booths with a turned wood theme. For information, contact Alice Hardin, Box 9545, Asheville, 28815. (704) 298-7928.
Workshops–Various woodworking and woodcarving workshops. Oct.–Dec. For info., contact Campbell Folk School, Brasstown, 28902. (800) 562-2440.
Workshop–Furniture Design with Jim Kirkpatrick, thru Nov. 10. Contact The Penland School, Penland, 28765. (704) 765-2359.
Juried show–16th annual High Country Christmas Art & Craft show, Nov. 24–26. Asheville Civic Center, Asheville. All media represented. For information, contact High Country Crafters, 29 Haywood St., Asheville, 28801. (704) 254-0070.
Juried exhibit–International Turned Objects Show, thru Dec. 3. South Highland Handicraft Guild, Asheville. For more info., contact Sarah Tanguy, International Sculpture Center, 1050 Potomac St. N.W., Washington, DC 20007. (202) 965-6066.
Class–Ladderback chairmaking, Jan. 8–12. For information, contact Drew Langsner, Country Workshops, 90 Mill Creek Rd., Marshall, 28753. (704) 656-2280.

OKLAHOMA: **Show**–5th annual Wonderful World of Wood show, Nov. 10–12. Southroads Mall, 41st St. & S. Yale, Tulsa. Sponsored by the Eastern Oklahoma Wood carvers Association. For information, contact Alyce Amend, 6322 S. 72nd East Ave., Tulsa, 74133. (918) 496-8290.
Workshop–Woodturning with Alan Lacer, Nov. 11–18. Contact Francis Tuffle, Vo-Tech, Oklahoma City. (405) 722-7799.

OREGON: **Show**–Annual western conference of the Timber Framers Guild of North America, Oct. 20-22. Fort Worden, Port Townsend, Washington. For info., contact the Timber Framers Guild, Box 1046, Keen, 03431. (603) 357-1706.
Show–The Woodworking show, Nov. 3–5. Memorial Coliseum Complex, 1401 N. Wheeler St., Portland, 97227. Contact Helen Fillman, 1516 S. Pontius Ave., Los Angeles, CA 90025. (213) 477-8521.
Show–Holiday show, Nov. 5–Dec. 24. Featuring work by national artists. Contemporary Crafts Gallery, 3934 S.W. Corbett Ave., Portland, 97201. (503) 228-2308.
Show–Holiday show, Nov. 9–Dec. 31. Hoffman Sales Gallery. Fine crafts from around the country. Contact Oregon School of Arts and Crafts, 8245 S.W. Barnes Rd., Portland, 97225. (503) 297-5544.
Show–Siskiyou Woodcraft Guild's 10th annual wood-

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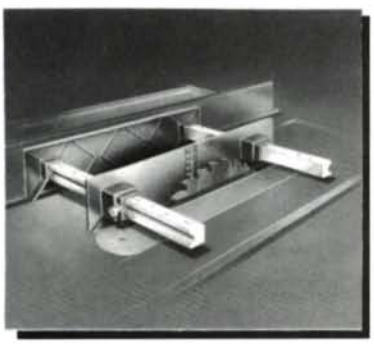

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working show, Nov. 24-26. Oregon Shakespeare Festival's Great Hall, Main St. Including chairs, furniture, instruments, bowls, doors, frames and wooden jewelry. Contact the Siskiyou Woodcraft Guild, 60 5th St., Ashland, 97520. (503) 482-4829.
Classes–Basic through advanced woodworking classes, beginning Jan. 8. Portland. Three Sunday seminars on special topics offered. Three-year certificate as well as part-time training in woodworking available. For more information and to register, contact the Oregon School of Arts and Crafts, 8245 S.W. Barnes Rd., Portland, 97225. (503) 297-5544.

PENNSYLVANIA: **Show**–The Woodworking Show, Oct. 20–22. Pittsburgh ExpoMart, 105 Mall Blvd., Monroeville. Contact Michelle Troop, 1516 S. Pontius Ave., Los Angeles, CA 90025. (213) 477-8521.
Show–Art Buyers Caravan show, Oct. 21–23. Valley Forge Convention Center, King of Prussia. Contact Paul Karel, 408 Olive St., St. Louis, MO 63102. (314) 421-5445.
Juried exhibit–17th Annual Lancaster Designer Craft Market, Oct. 28–29. Millersville Univ., Millersville. Crafts include woodturning and woodcarving. Contact Terri Lipman, 437 Lombard St., Dallastown, 17313. (717) 244-8438.
Show–John Harvey, designer and furnituremaker, artist in residence, Oct. 30–Nov. 10. Indiana Univ. of PA. For info., Contact Dept. of Art, Sprowls Hall, Indiana Univ. of PA, Indiana, 15705. (412) 357-2530.
Juried exhibit–Juried exhibition of contemporary crafts, thru Nov. 5. Luckenbach Mill Gallery, Historic Bethlehem Inc., 459 Old York Road, Bethlehem, 18018. Contact Lynn Berkowitz, (215) 691-0603.
Juried show–State Craft Market '89, Nov. 11–12. Memorial Hall, York Fairgrounds, York. Featuring 150 juried members of the PA Guild of Craftsmen. Admission: $3 adult, children 12 and under free. Contact Pennsylvania Designer-Craftsmen, Box 718, Richboro, 18954. (215) 860-0731.
Juried exhibit–International Turned Objects Show, thru Nov. 13. Port of History Museum, Philadelphia. Contact Sarah Tanguy, International Sculpture Center, 1050 Potomac St. N.W., Washington, DC 20007. (202) 965-6066.
Show–Woodworking World Central Pennsylvania show, Nov. 17–19. Harrisburg Farm Complex, Harrisburg. For more info., contact CDI Productions, Box 796, Plymouth, NH 03264. (603) 536-3768.

SOUTH CAROLINA: **Exhibit**–American Wildfowl Decoys, Dec. 24–Feb. 17. Gibbes Art Gallery, Charleston. For info., contact Museum of American Folk Art, 444 Park Ave. S., New York, NY 10016. (212) 481-3080.

TENNESSEE: **Classes**–Guitar repair program, thru Oct. 27; electric guitar construction, Oct. 30–Nov. 24; guitar repair program, Nov. 27–Dec. 22. For information on registering, contact The Apprentice Shop, Box 267, Spring Hill, 37174. (615) 486-2615.
Juried exhibit–From Here to There: Vehicles for New Forms/New Functions, Feb. 24–May 19. Deadline for entries: Dec. 30. For information, contact Arrowmont School of Arts and Crafts, Box 567, Gatlinburg, 37738. (615) 436-5860.

TEXAS: **Show**–Woodworkers Club of Houston annual show and charity sale, Oct. 20–21. Greenspoint Mall, Houston. For info., contact Bill Sallans, 1131 Glourie Dr., Houston, 77055.
Workshops–Woodworking fair and seminars, Nov. 10–12. Wood World, 1360 Floyd Rd., Suite 101, Dallas, 75243. (214) 669-9130.
Workshop–Timber frame home design workshop, Nov. 11–12. Nacogdoches. Participants will learn the basic elements of designing a timber frame home. Contact Wynter Chauvin, Red Suspenders Timber Frames, Route 7, Box 8383, Nacogdoches, 75961. (409) 564-9465.
Fair–Holiday celebration, Dec. 17. Univ. of TX at Austin Winedale Historical Center. Contact the Univ. of TX, Box 11, Round Top, 78954-0111. (409) 278-3530.

VIRGINIA: **Show**–14th annual juried Richmond Craft & Design Show, Nov. 17–19. Holiday Invitational show and sale, Nov. 27–Dec. 23. Contact Barbara Hill, Hand Workshop, 1812 W. Main St., Richmond, 23220. (804) 353-0094.

WASHINGTON: **Seminar**–Western conference of Timber Framers Guild of North America, Oct. 20–22. Fort Worden, Port Townsend. For information and to register, contact the Timber Framers Guild, Box 1046, Keene, NH 03431. (603) 357-1706.
Exhibition–Arts Alive celebration, Oct. 28–29 & Nov. 4–5. La Conner. Display and demonstration of furniture and carvings, exhibits of past and present woodworking tools, future woodworking techniques. Contact K. Howell, 7202 S. Pass Rd., Maple Falls, 98295.
Shows–"Influences '89" and "Woodturners of the Northwest," thru Nov. 5. Contact the Northwest Gallery, 202 First Ave. S., Seattle, 98104. (206) 625-0542.

Competition– 10th annual box competition and container show, Nov. 16–Dec. 31. Contact the Northwest Gallery, 202 First Ave. S., Seattle, 98104. (206) 625-0542.
Workshops–Various boating workshops and seminars, thru Nov. For info., contact Northwest School of Wooden Boatbuilding, 251 Otto St., Port Townsend, 98368. (206) 385-4948.
Demonstrations–Artist demonstrations and displays of woodworking, fine furniture and textiles including container and seating show, Nov. thru Dec. Contact Artwood Gallery, 1000 Harris Ave., Bellingham, 98225. (206) 647-1628.

WISCONSIN: **Exhibition**–Reseated, March 4–May 13. Deadline for entries: Nov. 15. Featuring works that use the chair as medium, subject matter and/or object. Works in all media and sizes including installation, video and functional furniture. Contact Reseated, Exhibitions Dept., JMKAC, Box 489, Sheboygan, 53082. (414) 458-6144.

CANADA: **Exhibition**–Woodworking Machinery & Supply Expo, Oct. 27–29. Exhibition Place, Toronto. For more info., contact Show Manager, WMS '89, 999 Summer St., Stamford, CT 06905. (203) 964-0000.
Meetings–Canadian Woodturners Association monthly meetings, throughout the year. Meets the second Tuesday of each month. For information on becoming a member of the Association or attending the meetings, contact Bob Stone, Box 8812, Ottawa, Ont., K1G 3J1. (613) 824-2378.

FINLAND: **Show**–Craft Today USA, thru Oct. 29. Taidetollisuusmuseoi, Helsinki. For more info., contact American Craft Museum, 40 W. 53rd St., New York, NY 10019. (212) 956-3535.

FRANCE: **Exhibition**–Rencontres Internationales de la Marqueterie Contemporaine, Nov. 16–26. Paris. Contact Salle Polyvalente de la Roquette, 15, Rue Merlin, Paris, 75011.

GERMANY: **Show**–Craft Today USA, Nov. 30–Feb. 25. Museum fur Kunsthandwerk, Frankfurt. For information, contact American Craft Museum, 40 W. 53rd St., New York, NY 10019. (212) 956-3535.

U.S. VIRGIN ISLANDS: **Festival**–26th Arts Alive Festival, Nov. 24–26. Tillett Gardens. For information, contact Rhoda Tillett, Box 7549, St. Thomas, 08801. (809) 775-1405.

The Woodturner's Art by Ron Roszkiewicz & Phyllis Straw. *Macmillan Publishing Co., 866 Third Ave., New York, N.Y. 10022; 1986. $35, hardback; 286 pp.*

This book takes beginners through a quick apprenticeship in turning by assigning a series of projects and pieces designed to teach traditional techniques. If readers use *The Woodturner's Art* as a workbook and they practice, they can master many of the skills that are most valuable to contemporary turners. One area that I felt was neglected in the discussion of basic cutting techniques, however, was the principle of shear cutting.

The book has good tips about drawing, template making and planning the work, in addition to a well-organized, step-by-step sequence on cutting various shapes. The author talks about tools and fixtures, but keeps it fairly simple and points out that you don't need a lot of exotic tools to get started.

There are also brief discussions about the history of turning, which I feel are important. The black-and-white photographs are well done, as are the illustrations, and the book's overall layout and organization are clear and easy to follow.

I recommend *The Woodturner's Art* for people who already know cutting principles and sharpening, but want a step-by-step curriculum that, with practice, will help them master clean, turned, functional objects. *—Giles Gilson*

Contract Joinery by Ken Austin. *Linden Publishing Co., 3845 N. Blackstone, Fresno, Cal. 93726; 1988. $15.95, paperback; 169 pp.*

Despite the continual imposition of ever-more-stringent building codes in all parts of the country, carpentry is still a relatively unregulated business open to anyone with the price of a hammer—as testified to by the unending stream of new self-help woodworking/building books that appear every month. Most of these books are apparently designed for the enthusiastic amateur and lack any real depth or finesse when it comes to the niceties of construction woodwork. And indeed it is rare to find much sophisticated woodwork in contemporary building; such high-caliber work usually requires a specialist closer to a furnituremaker than a carpenter.

Contract Joinery reflects the different state of affairs that exists in Britain, where few houses are wood framed and where woodwork is consequently limited to what is referred to in the United States as finish carpentry or millwork. Contract(or's) joinery is much more regulated and is, in general, of a much higher quality in Britain than in America. Woodworking may be limited to doors, windows, stairs, paneling and interior partition walls, but a trade school apprenticeship and examination are required before it may be practiced.

This book was originally designed as a test for apprenticeship programs and, as such, it contains much detailed information on high-quality joinery, which should prove invaluable to anyone concerned with expensive, custom projects.

Although metric measurements and British terms are used, the clear text and abundant illustrations make procedures easy to understand. The opening chapters on tools and materials seem little more than a recap of what should have been taught in the classroom and can hardly be relied upon to initiate beginners. However, the subsequent chapters can help competent carpenters become accomplished joiners.

Although most of the woodworking in the book is designed for masonry buildings, the techniques presented for building and fitting doors, windows and their frames range from simple to sophisticated and include jointing curved members, building linings to conical heads and calculating paneling to splayed jambs. These tips are universally applicable wherever the highest-quality work is needed.

Two chapters on staircases and handrails, although stated as being only a brief coverage of the most salient points required by British building regulations, will nevertheless provide a very thorough grounding in the geometry and construction of open newel staircases, dog-leg stairs, stairs with winders, half-turn open stairs, open-step stairs, and even curved and helical stairs. The section on handrails, while at first glance more complicated than a degree course in advanced geometry, is, in fact, remarkably clear and easy to follow.

Particularly interesting to the American builder may be the chapter on laminated beams and plywood constructions. American furnituremakers will also like the last chapter on ecclesiastic joinery and furnishings; although the style may be archaic, the techniques are readily adaptable to more contemporary designs and could prove useful additions to anyone's construction vocabulary.

Since the avowed purpose of *Contract Joinery* is to further the learning process, each chapter ends with a series of questions, the answers to which are at the back of the book. Consequently, anyone who reads this book and gets most of the answers right will find little that will prove impossible in today's world of fine house-joinery. *—Graham Blackburn*

Designing and Building Outdoor Furniture (with 47 projects), 2nd ed. by Percy W. Blandford. *TAB Books Inc., Blue Ridge Summit, Pa. 17294-0850; 1988. $12.95; 216 pp.*

The one distinction that sets outdoor furniture apart from all other furniture is that it can be left to the mercy of the elements and remain functional for many years. In *Designing and Building Outdoor Furniture*, Percy Blandford gives several approaches to making durable furniture that are intended to be of interest to both the novice and the experienced craftsman. The 47 projects included in the book cover a wide range of styles. Throughout the book, there are many worthwhile tips and practical methods of work that help workers foresee and overcome potential problems.

The book is divided into two areas: the introduction to the tools, methods of joinery and design; and the projects themselves. Most of the first section is of a general nature with a few methods that relate directly to a certain project. I think most of the projects are geared toward the skilled craftsman. The designs for the projects include the basic bench and picnic table variety that are fairly universal, along with some very nice slat chairs and tables and folding chairs with canvas seats that would be fun to build.

While the text describing the construction and assembly of the furniture is clear and logical, the arrangement of the diagrams is not. Most of the line drawing diagrams are not on the page of reference and have to be hunted down two or three pages ahead. I found myself constantly flipping back and forth between the text and the diagram as each reference appeared. In addition, the individual pieces in each diagram are labeled with a letter, making it difficult to visualize just how one piece relates to another upon assembly.

Although *Designing and Building Outdoor Furniture* does deliver what its cover title states, I would have been much more enthusiastic if the diagrams were clearer and if there was a better indication of the degree of difficulty for many of the projects. One chair requires 16 mortise-and-tenon joints, which can be rather taxing for the novice. Also, I never did find the plans for the children's playhouse or the planters that the back cover said are to be found among the projects and described in detail. *—Brian Tinius*

Giles Gilson is a woodturner and designer in Schenectady, N.Y. Graham Blackburn has a woodworking shop in Santa Cruz, Cal. Brian Tinius is a woodworker in North Hollywood, Cal.

Photo at left: Reuben Wade; photo below: Peter Kramer

American Crafts Awards

Janice C. Smith's chest of drawers, above, and Peter Kramer's bench, right, received merit awards in the furniture category of the second annual American Crafts Awards, which was co-sponsored by *Metropolitan Home* magazine and Kraus Sikes Inc., publisher of *The Guild: A Sourcebook of American Craft Artists.*

Photo: Thom Padick

The nearly 100 exhibitors at the ICF Fair, held last May in New York City, included just a handful of designers working predominantly with wood. The low tables, left, by James Van Etten of Perkasie, Pa., attracted interest for their modular design, which allows them to be arranged into a variety of shapes. The spidery-leg hall table, below, was built by Dave Boynton, a partner in Porter Street Cabinetmakers of Montpelier, Vt. Marc Coan of Albuquerque, N.M., showed a line of faux marble mirrors and tables like those in the photo at right.

Photo above: David Haas; photo below: Ken Burris

A Contemporary Furniture Fair

The first International Contemporary Furniture Fair, recently held in New York, N.Y., was a study in extremes. Large contract furniture companies from Italy showcased contemporary room settings with black leather upholstered couches alongside chrome-and-glass coffee tables. In neighboring booths, artists, designers and craftspeople representing one- and two-person shops featured furniture made from wood, rope and aluminum, much of it impractical or uncomfortable. The large companies seemed to be stretching the term contemporary back in time to cover the last 30 years, while in some cases, the small shops were carrying the term forward in time

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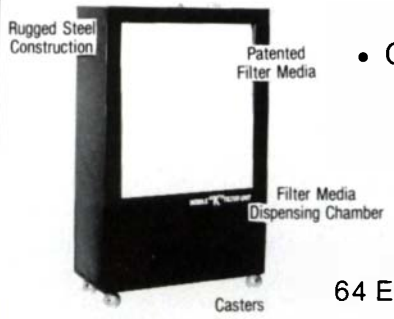

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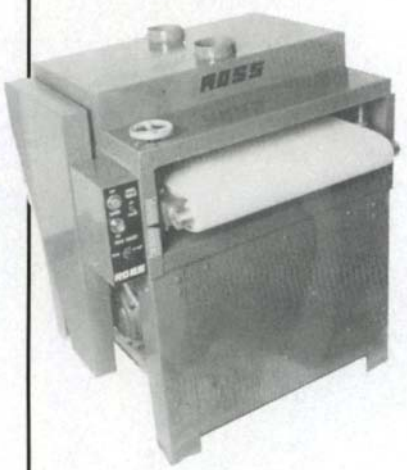

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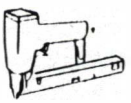

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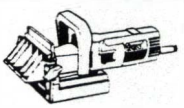

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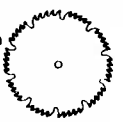

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and space to include furnishings from other planets and earth after the holocaust.

To be sure, last spring's Fair included something to suit most any taste, but noticeably absent were many of the best of the current generation of designer/craftsmen whose woodworking training is based on traditional forms, but whose furniture has evolved to include new materials, shapes and colors—work that is uniquely contemporary but that has a chance of still looking good in 5, 10 or 20 years.

It's a shame that the mainstream of contemporary furniture was not very well represented. Not only did some good makers miss a chance to establish valuable contacts, but they also lost an opportunity to help educate the design and retail trades to both the quality and design of contemporary furniture.

The next International Contemporary Furniture Fair is scheduled for May 20-23, 1990 and will once again be held at the Jacob Javits Convention Center in New York City. The Fair is co-sponsored by *Metropolis* magazine, 177 E. 87th St., New York, N.Y. 10128, and George Little Management Inc., 2 Park Ave., Suite 1100, New York, N.Y. 10016. For information about the ICFF, contact George Little Management Inc.

—Jim Boesel

The New Yankee Workshop

Norm Abrams, the knowledgeable carpenter on the PBS television series *This Old House*, now has his own PBS television series, *The New Yankee Workshop*. In this series, Abrams goes to various New England historical sites, such as the Hancock Shaker village and Nantucket in Massachusetts, and shows us the original pieces of furniture that inspired his adaptations. I find his design interpretation, however, to be heavy-handed, lacking grace and style inherent in the originals. Rather than faithful reproductions, Abrams' designs are just versions of classic New England furniture. With a little more thought, they could have been done better.

The book, *The New Yankee Workshop,* was written to accompany the television series and includes all the projects shown on PBS, along with chapters on setting up shop and finishing. Both the book and the television series are slanted heavily toward the carpenter's point of view and stress using power tools versus developing hand-tool skills.

Norm's projects are apparently oriented toward the ubiquitous tool of the modern woodshop: the screeching, ear-piercing, portable electric router. I admit that I even use two routers in my furniture shop and I am sometimes lazy about using ear protection, but never when I am using a router. I have never seen Abrams use ear protectors when using any of his power tools during his new show or on *This Old House*, where I first saw him. PBS does *The New Yankee Workshop* viewers a disservice by not stressing proper safety techniques.

In viewing the program, I repeatedly see Norm do things that an experienced woodworker might get away with for many years, until that first careless moment, when a hand slips or a piece of wood kicks back. Again, I've never seen Norm use a push stick with his tablesaw, and it often appears that his hand is dangerously close to the sawblade. What we are watching is often very dangerous, even in the professional shop. These techniques should definitely not be tried in the confines of the home workshop of the weekend builder, to whom this show is directed.

The joinery on many of the projects is suspect, as evidenced by tenons that are too short, and there is a general disregard of wood as a material that expands and contracts. For instance, in chapter 5, on p. 72, photo #5, Abrams is building a bedside table, and he is cutting cheeks for a very short tenon by holding the apron vertical against the fence. While we all know that you can do it this way, it is not necessarily the smart way to do it, and it certainly is not the safe way. A store-bought or shopmade tenoning jig should be used for best and safest results. In the same chapter, on p. 68, photo #2, a breadboard-style edge is being applied to cover the end-grain of the tabletop "to give the top a finer look." Having seen Norm apply glue on the television series, I know that even the copious amounts of glue he uses won't keep the joint together over a long period of time; a correctly made breadboard end requires mortise-and-tenon construction that allows wood movement. Plywood is often used for cabinet bottoms with solid wood sides and I can't see how some of the projects will stay together after a few seasons of expansion and contraction and old Yankee weather.

Occasionally, Norm will show you a valuable trick or two, but novices will have trouble figuring out what constitutes safe and unsafe tool practices. Although the show and the book are edited and put together well, they are seriously flawed by the questionable safety practices and construction techniques.

A more viable approach to a program such as *The New Yankee Workshop* would be to combine machine and power-tool techniques with a hand-tool approach. As most experienced woodworkers know, this practice works well and can also be done in a part-time or weekend workshop without a huge expenditure of money. Most woodworkers acquire tools over time and as needed. A more thoughtful approach to building fine furniture rather than a carpenter's approach on how to make fast furniture would be a more valuable PBS program.

—John McAlevey, Warner, N.H.

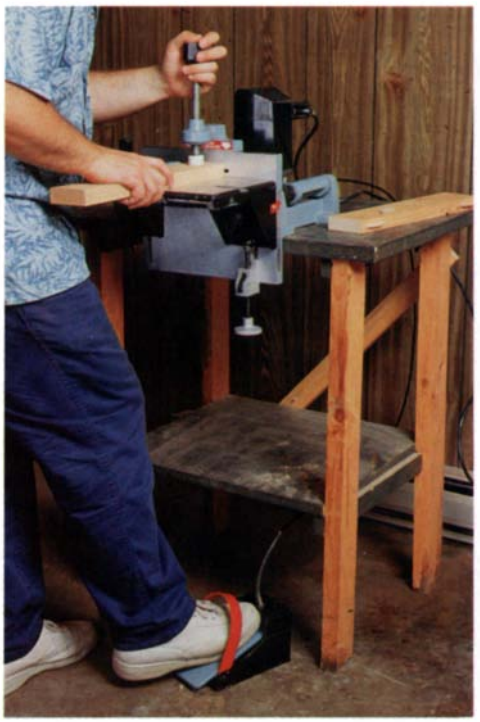
Product reviews

The Delta 32-100 Stationary Plate Joiner, *Delta International Machinery Corp., 246 Alpha Dr., Pittsburgh, Pa. 15238.*

Even if you already own a portable biscuit joiner, you'll like the speed and convenience of the new Delta 32-100, the first stationary plate joiner available in this country. Unlike hand-held units, the 40-lb. Delta fastens to a workbench and allows the user to operate the jointing machine with a foot pedal, leaving both hands free to align the workpieces. At a list price of $649, the Delta 32-100 offers the small production shop an economical way of making biscuit joints accurately, yet more quickly than with a portable unit.

To use the Delta 32-100, first set the depth of cut for any of the three standard biscuit sizes (#0, #10 or #20). Next, adjust the height of the 8-in. by 12-in. alloy table, which will determine the distance from the slot to be cut and the edge or end of the workpiece. Slots may be centered on stock up to 10 in. wide or made 5 in. from the edge of a panel. The workpiece can be hand held and positioned or clamped to the machine via a screw hold-down and positioned with an adjustable stop. To cut a slot, turn on the machine's motor, and then step on the cable-operated foot pedal to plunge the blade into the workpiece. A spring then returns the blade behind the fence, and you're ready to begin your next slot.

Generally, I found the Delta a pleasure to use. The bicycle brake-type cable worked smoothly, without shudder or vibration, and the plunging action felt very positive. The ma-



Delta's 32-100 stationary plate joiner's foot pedal action cuts slots while leaving the operator's hands free to hold the work.

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chine's 110v, 10-amp motor is about twice as powerful as most portable plate joiner motors, and the "Super-Torque" belt drive powers the six-tooth carbide blade at 10,000 RPM, yet keeps the noise level down around 89 dB to 90 dB, making it one of the quietest plate joiners I've ever used.

Also, the Delta 32-100 is convenient. There are quick-release threads on both the table height-adjustment screw and the screw-type hold-down. The hold-down clamp is very easy to use on either horizontal or vertical work: The adjustable table, as well as the fence, has machined slots that accept the clamp.

What looks like the tool's miter gauge is an adjustable stock stop that slides in a slot in the table, to reference square or mitered work either from the right- or left-hand side. It locks into place with a screw on the underside of the table. The stop is one feature that makes the Delta much quicker for repetitive cuts: Just set the stop for the first board, and then butt the next boards up to the stop to get a duplicate cut. Another time-saving feature is the Delta's fence, which is marked to show the exact width of the slot, as well as its centerline. This allows you to eyeball the location of a slot, without having to take the extra step of marking the slot's centerline on the board.

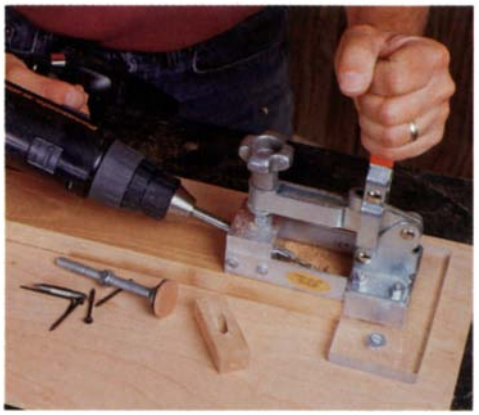
In addition to cutting regular 90° slots, the Delta 32-100 is capable of cutting slots in beveled stock thanks to a steel metal tilting table that comes with the unit. This is handier and more accurate than the adjustable fences on most portable plate joiners because the workpiece can be clamped to the table. The levers that lock the tilting table in place are spring loaded, so they can be positioned out of the way after they're set.

To me, the real beauty of the Delta stationary machine is that with all but the largest boards or panels, it's easier to bring the material to the machine rather than vice versa. If you need to cut slots in the middle of a panel, you'll still need to use a portable plate joiner. But this limitation doesn't outweigh the 32-100's advantages for production-level slot cutting of manageable-size workpieces. After you've experienced this stationary tool's speed and accuracy, you'll probably rely less on your portable plate joiner anyway.

—Hugh Foster, Manitowoc, Wis.

Portable jig for angle screwing face frames: Port-A-Guide, *Kencraft, 821 N. Westwood, Toledo, Ohio 43607.*

Most production kitchen cabinet shops use a large and fairly elaborate face frame table to quickly drill angled holes for screwing frame parts together from behind. Then, assembled frames are glued and nailed to the cabinets. The Port-A-Guide is a nifty little tool that lets you assemble face frames the way the big boys do, without spending a couple



With Port-A-Guide and a ⅜-in. drill you can drill angled holes and screw face frames together in the shop or on-site.

thousand dollars on specialized equipment.

The basis of the Port-A-Guide system is an aluminum guide block that allows you to drill an angled hole with a standard ⅜-in. portable electric drill. A hold-down clamp secures both the guide block and the work as you drill the angled holes with the combination carbide-counter-bore and steel-spur bit included with the kit. The guide block is then removed and a clamping shoe is installed in its place to hold the parts together tightly as the screws are driven. The Port-A-Guide can also be clamped to a saw horse or a tailgate mounted platform, making it ideal for on-site repair or remodeling of cabinets.

The Port-A-Guide QJ-5, which I have described, comes with 100 screws and good instructions for $84.95. A variation on the QJ-5, which will sell for under $50, is due out in 1990. It will have a double-hole guide block that will save time when drilling two holes side by side, but will use a regular C-clamp (not included) instead of the hold-down clamp.

—George Posey, Camas, Wash.

Two scuff pads: Scotch-Brite from 3M and Automotive Scuff and Clean Pads from Norton, *3M, Consumer Specialties, 3M Center, Building 225-4S, St. Paul, Minn. 55144; Norton Co., 1 New Bond St., Worcester, Mass. 10615-0008.*

There's a product on the market that woodworkers should know about, ¼x6x9 pads similar to the green scouring pads for washing dishes. The pads are impregnated fibrous mats, a kind of synthetic steel wool. Generally available from automotive finishing suppliers, the pads are offered by 3M as Scotch-Brite and by Norton as Automotive Scuff and Clean Pads and cost about one dollar each. The two grits available are color coded, with maroon representing the coarser of the two grits while the finer grit is gray.

The maroon grit worked very well for scuff sanding the sealer coat on projects, and the results were similar to those you would get from steel wool, but without the steel hairs or the white sanding powder. While the pad worked well on flat surfaces, I was particularly pleased with the thorough job it does on irregular surfaces and inside corners. I used the fine gray pads, about a 320-grit equivalent, on the next to last coat for that super-smooth finish.

The pads didn't snag and tear the wood as steel wool can. Also, their cutting action was more aggresive and they weren't as prone to clogging as sandpaper. The pads will eventually clog, but they are easily cleaned with water or the appropriate solvent for the finish you are sanding. After dipping in solvent, I squeezed the pads out and dried them with my air nozzle. Use the same precautions as you would when spraying any solvent.

As another experiment, I applied a silicone-base filler with a maroon pad and achieved excellent results as the wood dust from the sanding action helped fill the open pores. When the pad began to clog, I just dipped it into a little thinner and then worked the filler that had been freed by the solvent into the wood.

I've found that the maroon pad quickly and easily removes the surface rust that sometimes develops on tool surfaces without using messy solvents. I estimate the pads last about five to six times as long as a good sheet of sandpaper. They hold up much better on sharp corners and edges that would destroy sandpaper or steel wool. And they don't seem to get dull, but they do clog just a bit. A quick clean out with water or solvent and I'm right back in business.

Although the pads are more durable than sandpaper, they can still be cut for half-sheet use. I even tore off an edge of one of my pads and gave it to my wife to try on her worst pots and pans. It worked great and brightened the surfaces with ease. It also removes teflon, but I won't go into just how I know that. She has been using that ragged corner for several months now. Maybe one day I'll even tell her that I have a full case of the pads in the basement.

—Robert M. Vaughan, Roanoke, Va.

EDITOR'S NOTE: 3M does not endorse Scotch-Brite for woodworking; it offers Final Stripping Pads and Between Coats Finishing Pads that perform as described above, which are designed specifically for woodworking applications. For information on these products, Flexible Sanding Pads and its other woodworking products, contact 3M.

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'd like to hear about them. How about writing to us? And, if possible, send photos (preferably with negatives) to Notes and Comment, Fine Woodworking, ***Box 355, Newtown, Conn. 06470.***

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Shall We Dance

Fred Astaire's style and grace created vivid and lasting images for many movie lovers. For Seattle, Wash., furnituremaker Hank Hölzer, Astaire's films stand out as his "earliest recognition of artistic expression." His "Fred Astaire Cabinet—Ginger Remembers," shown above and at right, captures the dancer's style with the same understated elegance that was Astaire's trademark. Precise hinge placement allows the painted plywood doors to swing past the cabinet's curved sides, which Hölzer made by laminating three pieces of ¼-in.-thick medium-density fiberboard. The ebony bow tie pulls and the black lacquer toes on the bleached western maple base add just enough detailing to leave no doubt about whom Ginger is remembering. As an added tribute to Astaire, the cabinet (43x32x15) also includes two framed drawings by Seattle, Wash., artist Bill Johnson.

Photos: Mark Van S