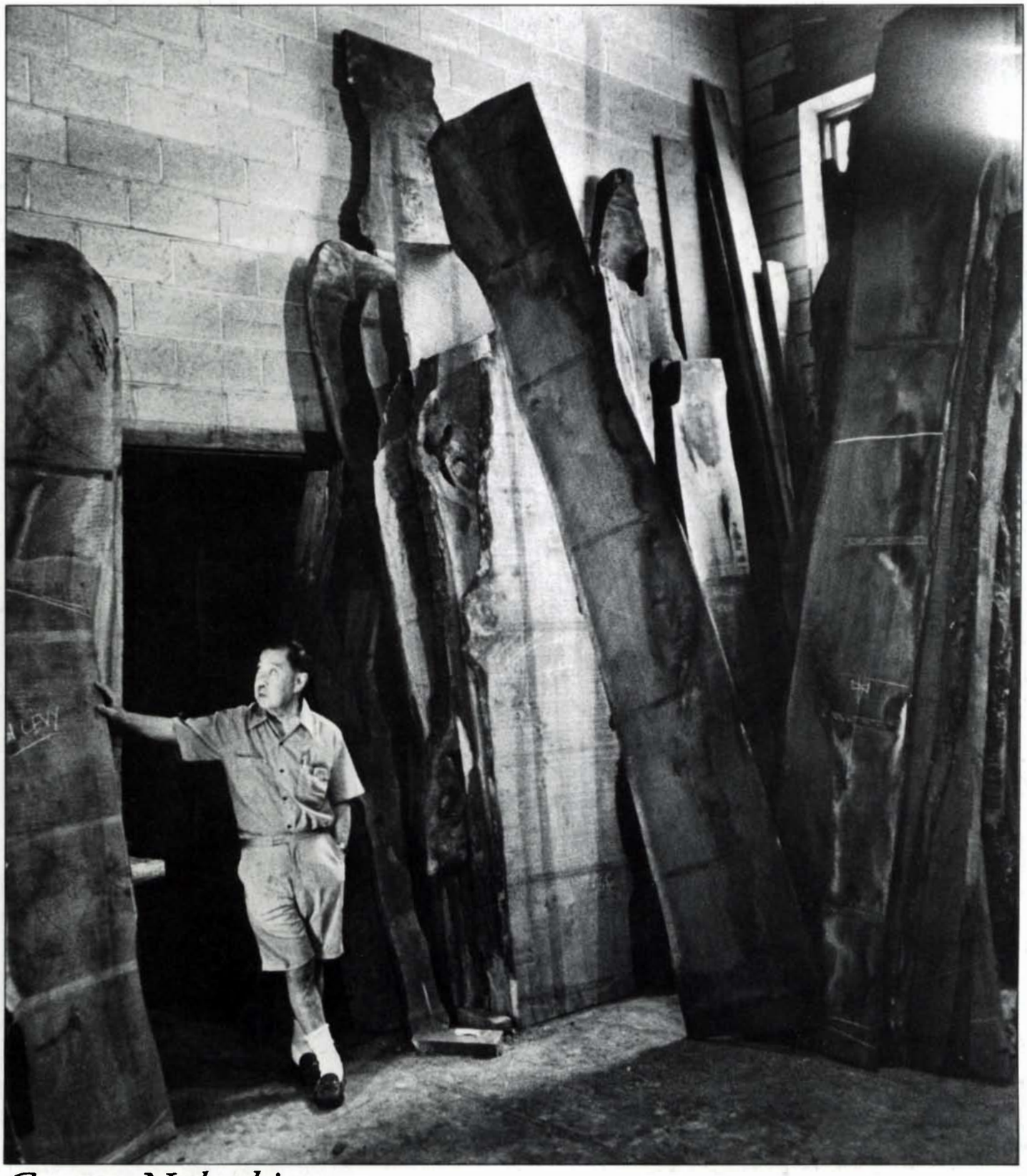
Fine WoodWorking



George Nakashima

JANUARY/FEBRUARY 1979, NO. 14 $2.50

There's a wealth of information and ideas in the back issues of Fine Woodworking

Our readers tell us they regard *Fine Woodworking* more as a reference resource than as a magazine because of the timeless and hard-to-find nature of its contents. And because there is so much material to cover (new ideas and techniques pop up all the time) we don't intend to repeat ourselves editorially. All thirteen back issues are now available and you can have a complete set for your shop.

Winter 1975, Number 1—The Renwick Multiples, Checkered Bowls, Tramp Art, Hand Planes. Carving Design, Decisions, Woodworking Thoughts, Marquetry Cutting, Which Three?, Library Ladders, A Serving Tray, Stamp Box, All in One, French Polishing, Birch Plywood, Bench Stones.

Spring 1976, Number 2—Marquetry Today, Split Turnings, Eagle Carvings, Hand Dovetails, Mechanical Desks, Textbook Mistakes, Antique Tools, Spiral Steps, Gustav Stickley, Oil/Varnish Mix, Shaker Lap Desk, Chair Woods, Back to School.

Summer 1976, Number 3—Wood, Mortise and Tenon, The Christian Tradition, Hand Shaping, Yankee Diversity, Plane Speaking, Desert Cabinetry, Hidden Drawers, Green Bowls, Queen Anne, Gate-Leg Table, Turning Conference, Stroke Sander, Furniture Plans.

Fall 1976, Number 4—Cabinetmaker's Notebook, Water and Wood, Hidden Beds, Exotic Woods, Veneer, Tackling Carving, Market Talk, Abstract Sculptures from Found Wood, Workbench, Ornamental Turning, Heat Treating, Mosaic Rosettes, Shaped Tambours, Buckeye Carvings, Hardwood Sources.

Winter 1976, Number 5—Stacking, Design Considerations, Keystone Carvers, Carcase Construction, Dealing With Plywood, Patch-Pad Cutting, Drying Wood, Gothic Tracery, Measured Drawings, Wood Invitational, Guitar Joinery, The Bowl Gouge, English Treen, Shaper Knives.

Spring 1977, Number 6—The Wood Butcher, Wood Threads, The Scraper, California Woodworking, Bent Laminations, Dry Kiln, Expanding Tables, Two Sticks, Stacked Plywood, Two Tools, Pricing Work, Going to Craft Fairs, Colonial Costs, Serving Cart, Woodworking Schools.

Summer 1977, Number 7—Cooperative Shop, Glues and Gluing, Winter Market, Three-Legged Stool, Lute Roses, Bowl Turning, Wharton Esherick, Doweling, Spalted Wood, Antiqued Pine Furniture, Solar Kiln, Carving Fans, Bending a Tray, Two Meetings, Index to Volume One.

Fall 1977, Number 8—Out West, Steam Bending, Triangle Marking, Painted Furniture, Chain-Saw Lumbering, Rip Chain, Getting Lumber, Sawing by Hand, Gaming Tables, Two Contemporary Tables, Wooden Clamps, Elegant Fakes, Aztec Drum, Gout Stool, Two Tools, Measuring Moisture, The Flageolet, Young Americans.

Winter 1977, Number 9—Repair and Restoration, Designing for Dining, Tall Chests, Entry Doors, The Right Way to Hang a Door, Drawer Bottoms, School Shop, Health Hazards in Woodworking, Basic Blacksmithing, Carving Cornucopia, Carving Lab, Routed Edge Joint, Shaker Round Stand, Cutting Corners, Small Turned Boxes, Unhinged.

Spring 1978, Number 10—Two New Schools, Wooden Clockworks, Hammer Veneering, Claw and Ball Feet, Block-Front Transformed, Hot-Pipe Bending, Furniture Galleries, A Two-Way Hinge, Laminated Turnings, Chain-Saw Carving, Circular Saws, Louvered Doors, Small Workbench.

Summer 1978, Number 11—Harpsichords, Spinning Wheels, American Woodcarvers, Drawers, Turning Spalted Wood, Scratch Beader, Leather on Wood, Notes on Finishing, Building Green, Parsons Tables, Hanging a Door, Pencil Gauges, Dulcimer Peg Box, Tiny Tools.

September 1978, Number 12—Community Workshop, Greene and Greene, Holding the Work, Scandinavian Styles, Tambours, Stains, Dyes and Pigments, Spindle Turning, Cleaving Wood, Whetstones, Sharpening, Cockleshell, Dust-Collection System, Sanding, Used Machinery, Wooden Wagon.

November 1978, Number 13—Making Ends Meet, Scientific Instruments of Wood, Making a Microscope, The Harmonious Craft, Laminated Bowls, Preparation of Stock, Tung Oil, Relief Carving, Roll-Top Desks, Shaped Tambours, Cylinder Desk and Bookcase, Basic Machine Maintenance, Portfolio: A.W. Marlow, End-Boring Jig, Scale Models, The Purpose of Making, Lumber Grading, On Workmanship.

To order the back issues, send us your name, address and payment along with a list of what you want. Each back issue is $2.50 postpaid. Connecticut residents add 7% sales tax. Make your payments to the Taunton Press, Inc. and send to the address below.

The Taunton Press 52 Church Hill Road, Box 355A, Newtown, CT 06470

Cover: After they have been air dried and kiln dried, planks are normally stored standing on end at George Nakashima's workshops. The ones on edge, foreground, are about 5 ft. wide and too long to stand upright, despite 16-ft. ceilings. More about Nakashima on page 40.

Fine WoodWorking®

JANUARY/FEBRUARY 1979, NUMBER 14

DEPARTMENTS

ARTICLES

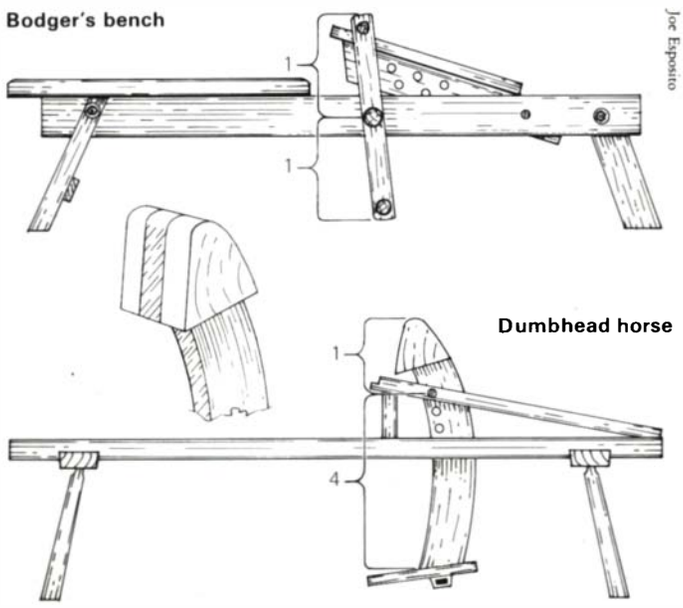
Fine Woodworking is published bimonthly, January, March, May, July, September and November, by The Taunton Press, Inc., Newtown, CT 06470, Telephone (203) 426-8171. Second-class postage paid at Newtown, CT 06470 and additional mailing offices. Postal Service Publication Number 105190. Fine Woodworking® is a registered trademark of The Taunton Press, Inc. ISSN 0361-3453. Subscription rates: United States and possessions, $12 for one year, $22 for two years; Canada, $14 for one year, $26 for two years (in U.S. dollars, please); other countries, $15 for one year, $28 for two years (in U.S. dollars, please). Single copy, $2.50. For single copies outside U.S. and possessions, add 25¢ postage per issue. Send to Subscription Dept., The Taunton Press, PO Box 355, Newtown, CT 06470. United Kingdom, £7.50 for one year, payable to The Taunton Press; mail to National Westminster Bank, PO Box 34, 15 Bishopsgate, London, EC2P 2AP. Address all correspondence to the appropriate department (Subscription, Editorial or Advertising), The Taunton Press, 52 Church Hill Road, PO Box 355, Newtown, CT 06470. POSTMASTER: Send notice of undelivered copies on Form 3579 to The Taunton Press, PO Box 355, Newtown, CT 06470.

There is no need for Drew Langsner's froe club or maul ("Cleaving Wood," Sept. '78, pp. 64-67) to be "unavoidably expendable." A properly chosen hickory or dogwood root maul will endure many years of constant use. It will wear down only by gradual pulverization and never by the splitting or shattering that is inevitable in stem-wood mauls.

When you dig up your maul rather than cutting it down, you have two important factors going for you. First, the circumference is largely composed of the end grain of the severed lateral roots. . . . Second, these lateral roots have their origin deep within the root stock, thereby binding the head of the maul together.

To make a maul like this, find a hickory or dogwood sapling that is about 6 in. in diameter at ground level. Dig out around it, cutting away the side roots with an old ax as you go. Hickories will have a long taproot that must be exposed by pulling the tree over. Dogwoods tend to have only shallow lateral roots. . . and are easier to cut loose. Wash as much of the dirt and sand off as you can and immediately peel off the bark. Rough-shape the entire affair with a sharp hand ax and finish up the handle (about a foot long) with a drawknife or rounder plane. As always, let it season well before you put it to work.

Mr. Alexander's shaving horse ("Holding the Work," Sept. '78, pp. 46-48) is indeed a fine beast for the chair bodger, or the cooper who works with short lengths of wood. But if, however, you need a general workhorse that will take any length of work and provide maximum holding power, please go with a dumbhead horse. The typical dumbhead, pivoting much closer to the business end, gives you a mechanical advantage of 4:1. A bodger's bench, which pivots in the middle, gives no such advantage. In addition to holding



the short stock of chair work with greater strength, the open sides of the dumbhead make life a lot easier when you're working with 7-ft long rake stails (handles) or shaving down similar lengths of white oak for making splits.

—Roy Underhill, Hillsborough, N.C.

In Sept '78, you permit a reader on page 10 to threaten you with economic sanction. Will you please cut that out? It embarrasses me. There is not an issue of *Fine Woodworking* that doesn't contain a sentence or two which alone are more than

Workbench Price Breakthrough!

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Until now, quality workbenches have usually been too expensive or too small. This huge 225 lb. Garden Way Home Workbench offers a 30" x 60", 2" thick work surface and is available direct from the factory at an incredibly low price. Made of solid rock maple, the Garden Way Workbench not only offers a spacious work area, sturdiness and extraordinary clamping versatility, but is a fine precision tool itself that can be as useful as having an extra "pair of hands" helping you in your shop.

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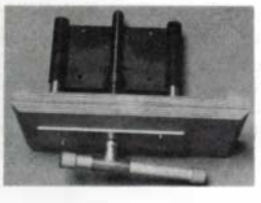

2 Powerful vise assembly—vise components are thick welded steel, with 9" x 18" laminated hardwood faces.

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LETTERS (continued)

worth the few pennies we pay for the privilege of going to school with the masters. Can we just give the carping critics what they deserve—silence?. . .

It is some years since I got my first Gottshall and learned how to build it right. There he is, on page 75. What would it cost me to go to Boyertown to see him? Plenty. Repartee is one of the things that makes life worthwhile. The classic case I know about is where the machinists send a needle within a needle within a needle back and forth. Yes, that is not verbal repartee but it is the kind of thing the competent do. . . .

—H.J. Giesbrecht, Wyoming, Ont.

Readers of Sandy Cohen's "Leather on Wood" (Summer '78, pp. 61-63) may be headed for disaster if they try to use potassium lactate on their leather. Potassium lactate will discolor sheep leathers and all the lesser grades of cowhide. That's why only the better grades are treated. And potassium lactate is not easily come by unless you use the addresses at the end of Mr. Cohen's article. It is not a well-known or generally recommended leather treatment. I've been an active leather carver for six or seven years and had never heard of potassium lactate. Since I live in the San Francisco Bay area, it took me only three business days to trace it, but I ran through pharmacies, tanners, leather suppliers (both wholesale and retail), chemical companies, bookbinders and finally old book restorers before finding another soul who was conversant with the proper use of this chemical on leather.

I'd like to pass along my conclusions based on my own knowledge of leather tanning, combined with what I've learned about the use of potassium lactate as a decay preventative. If the leather has already been tooled, embossed, modeled or is light in color I would not use it for fear of either discoloring the leather or causing it to lose its "memory" and, therefore, its shape. If the leather is fresh from the tannery, I'd consider using it only if the finished piece was to be of museum quality. Likewise for Formula 6: it lessens or removes the depth from a carved or modeled piece and furthermore is susceptible to water spotting.

In my own work, I prefer to use a thin coating of resolene, a semi-porous acrylic finish, followed by a light treatment with Feibing's "Care" to replenish the leather. "Care" will penetrate the resolene to preserve and soften the leather but will not affect the waterproofing. Further, since it's more "grease" than "oil," it doesn't affect the quality of any modeling or carving that has been done. Resolene and "Care" are not expensive. They can be purchased from local leather suppliers (check the Yellow Pages under "Leather") or by mail from Tandy Leather Co., 115 W. 45th St., New York, N.Y. 10036.

Finally, it's worth noting that smog is a danger to leather only if you are within three miles of a major urban area. A far greater danger, and one most likely to be overlooked, is the damage that results within five miles of the seashore.

—Wendy Hays, San Francisco, Calif.

I would like to make a comment on "Basic Machine Maintenance" by David Troe in the November '78 issue. In discussing the use of compressed air as an aid to cleaning inaccessible areas around machinery, he has suggested that, to avoid driving dust into other components, the line pressure should be a maximum of 40 psi. While I personally feel that his suggestion is reasonable and proper, nonetheless I must point out that section 1910.242 of the Occupational Safety and Health Administration Standards *requires* that "compressed air shall not be used for cleaning purposes except where reduced to less than 30 psi, and then only with effective chip guarding and personal protective equipment." I believe the maximum

Five major power tools packaged into one unique, big-capacity unit.

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Whether you're an experienced craftsman, a dedicated hobbyist, or a week-end "do-it-yourselfer", at one time or another, you've probably dreamed of owning a complete woodworking shop. And as anyone who has ever tried any woodworking project more complicated than nailing together a birdhouse knows, a table saw and maybe a couple of hand-held power tools just can't hack it!

At a minimum, you should have—in addition to that table saw—a top-quality vertical drill press, a lathe, a boring machine, and a disc sander. So equipped, the world of the true woodworking expert, and all its rewards, becomes your oyster!

But there are two problems. One is space. A woodworking shop with five separate major power tools takes up more space than a lot of people can manage to find in their basement or garage.

The second and larger problem is sheer cost. Those five precision power tools, purchased separately, have got to run you at least a couple of thousand dollars.

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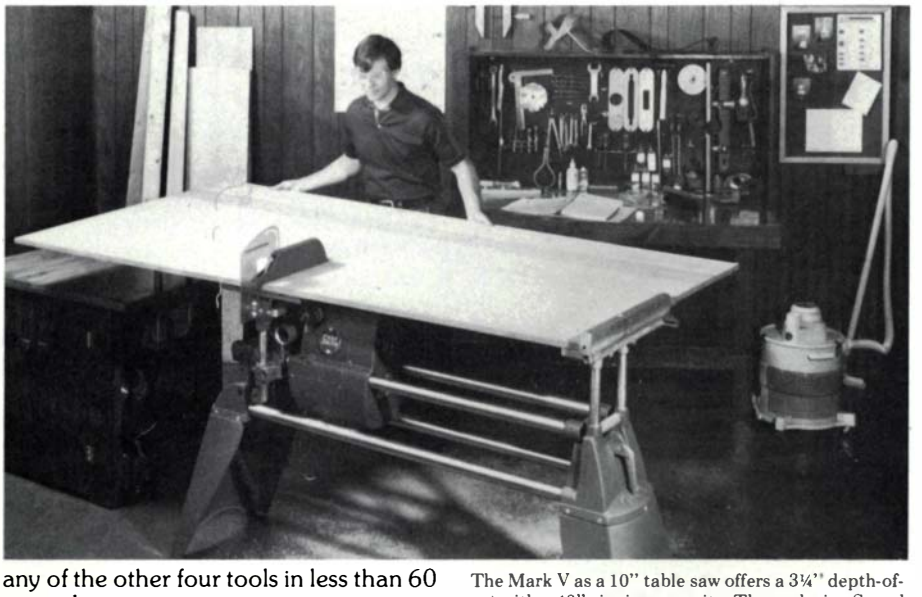
After only a half-hour of practice, even a novice can change over from one tool to any of the other four tools in less than 60 seconds.



With the 5-in-1 Mark V, you can perform literally dozens of sophisticated woodworking operations—including sawing, rabbeting, beveling, mitering, grooving, concentric drilling, spindle turning, doweling, edge sanding, and metal drilling. With optional accessories, you can perform more specialized operations such as mortising, dadoing, shaping, routing, molding and many others.

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LETTERS (continued)

fine for noncompliance is $1000, and that is a compelling reason why any person engaged in a commercial venture should use only three-quarters of Troe's suggested maximum.

—William G. Ovens, Potsdam, N.Y.

In response to Irving Sloane's advocacy (Sept.'78, p. 12) of boiling side slats for musical instruments as a prelude to pressing them up to a mold for bending, I would like to reiterate my preference for hot-pipe bending of these slats. It is my perception that boiling softens and carries away into the water those resins that both of us feel are responsible for the acoustical qualities of the material. Under the best circumstances, pressing a slat to a hot pipe most likely softens the resins but allows them to remain to resolidify in the wood upon cooling. A good side bender progresses rapidly and uses a deft, gentle touch, exposing the wood to almost instantaneous contact with the hot metal surface.

Hot-pipe bending, to my way of thinking, has it all over boiling/mold techniques for the quickness, simplicity and freedom that it allows. What you pay for this convenience is occasional fracturing and scorching. Practice makes perfect.

I acknowledge that people choose the techniques most suited to their facilities and inclinations. I don't believe that hot-pipe bending, a technique almost as old as instrument-making itself, recalls "a demonstrably false premise held with the most passionate conviction." I trust Sloane was being whimsical in bringing Kierkegaard into this matter.

—Bill Cumpiano, North Adams, Mass.

. . . Please—no more hogwash like that from Stephen Hogbin (Nov. '78, pp. 74-76). Leave that to *Craft Horizons* magazine. The objects Hogbin produces are interesting, novel and well-made. Showing examples of his work even has its place. . . but to use much printed space to show the "philosophical basis" for these doodads is a waste. . .

—Everett Traylor, Bettendorf, Iowa

I have been a subscriber of your magazine from the first issue and am a professional furniture maker. . . . "How-to" is really the least of my problems. Good personal design is my most important problem. Although our finished products are unalike, I was glad to read Stephen Hogbin's "The Purpose of Making." . . . I think what Hogbin talks of is the most important and rarest aspect of any craft. I would appreciate more food for thought in that vein.

—Peter S. Harvey, Stowe, Vt.

I've considered building a dust-collection system like the one described by Doyle Johnson (Sept. '78, pp. 76-78). But I have been stopped by a problem Johnson did not appear to consider—namely, the heat loss from the shop via the collector. His blower moves 450 cubic feet of air per minute from his shop to the outside. This would put an enormous burden on a heating system and probably cool off his entire house.

—Ron Ginger, Framingham, Mass.

This is for all of you who didn't get your respirator or dust mask on in time, and now an hour later or even a day later, you're sure you've gotten the flu. The degree of severity of course depends upon the species of wood and how much of it is currently stored in your sinuses. The antidote is a decoction of sage tea. My wife is an herbalist and has saved me many hours of suffering by crushing up a handful of fresh sage from the garden and adding it to a quart of water. Heat the tea to just this side of a boil and then drape a towel over your head with the open pot of steaming tea on your lap. Close up the air gaps and breath deeply through your nose for about five

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LETTERS (continued)

minutes, or until the tea is no longer steaming. The results are so remarkable that if it fails to work for you, you probably do have the flu.

—P. R. Presnell, Weitchpec, Calif.

I especially enjoyed Mark Lindquist's article on spalted wood (Summer '77, pp. 50-53), as I have been working with this type of wood for a number of years.

One trick that your readers might be interested in is to treat the inside of bud vases with a casting resin so that they will hold water. With the piece finished to the sanding stage, but still on the faceplate or chuck, I mix the resin (Castoglas resin from Brehler Ltd., Evanston, Ill., or from Castolite Ltd., Woodstock, Ill.) and pour it into the vase. The excess is then poured back out, making sure that all of the raw wood has been coated by the resin. After the resin has hardened, the lip of the vase is resanded on the lathe to remove any drips and then the outside is completed with the finish of your choice. In some porous woods such as poplar or white birch, two coats of resin may be necessary to ensure complete impermeability. Unfortunately, the chemical companies do not recommend the use of this resin in drinking mugs....

—Jack Fenwick, Montreal, P.Q.

What prompted this letter is Sandy Cohen's list of American and alleged British words (Sept. '78, pp. 26-27), some of which are not known in Britain either....Warp is warp here, cast is unusual. Quartersawn oak is quartersawn oak, and the appearance is "figured oak," never clash. Deal is a loose term for imported Russian softwood of fir and pine type, now more often called "Baltic redwood." Denatured alcohol is methylated spirits here. "Spirits of wine" is obsolete Victorian. Naphtha is naphtha here, but it has disappeared from the market. Burnisher is more likely burnisher than ticketer. Bath brick is a thing of the past. Jeweler's rouge is just that, and I have never heard of Armenian bole. I see Sandy Cohen claims to specialize in the history of the English language, and that may explain why some of his English terms are historical and not current....

—Percy W. Blandford, Stratford-upon-Avon, England

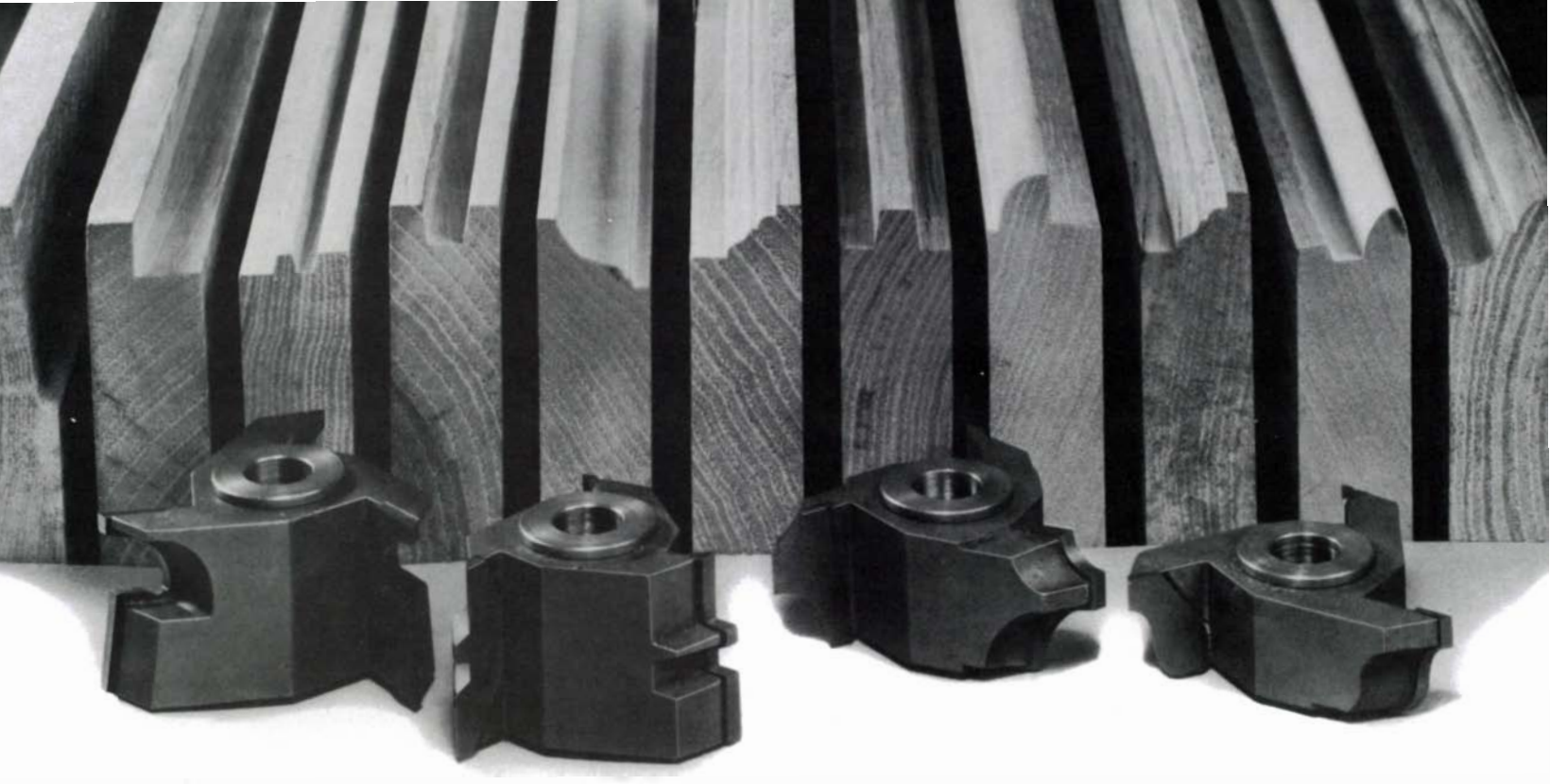
Here it is, chapter eleven zillion of the already enormous volume entitled "How I learned not to buy cheap tools" or "You get what you pay for." I do regular production runs of a small stool, which gets sanded on the top with a belt sander, 100-grit, before the final sanding. For years I bought Rockwell belts in boxes of ten at a cost of about 49¢ each. Each belt did 20 to 30 stools before it needed replacing. Alas, I can no longer buy belts in bulk now. They are coming through in neat little plastic packages at $1.15 each. After much experimentation with cheaper belts (the Sears belts that were on sale for about 40¢ lasted through five stools if I was lucky) I came upon 3M resin-bond closed-coat belts at $1.30 each. The first one I used did 120 stools, the second did about 100 and I'm still using the third.

Someday, I hope I'll be in a position to be able to walk into a hardware store and say, "What's the most expensive such-and-such you have?" instead of my usual opening, which of course is, "What's the cheapest?" Until I do I'm sure my book will have many more chapters added to it.

—Rick Silberman, East Calais, Vt.

The objections to soap as a lubricant for wood screws are duly noted ("Letters," Summer '78). I will not argue the point, and sit corrected. Beeswax is better.

In the narrower context of *Fine Woodworking*, however, the incident raises a point. Many "tips" are in fact shortcuts



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43-927	¾" Bead
43-928	¾" Flute
43-929	1" Bead
43-930	1" Flute
43-931	6" Hor. Panel Raiser
43-932	Stair Nose Cutters
43-933	Drawer Joint
43-950	½" Cove—5/16" Qr. Rd.
43-951	5/16" Cove—⅜" Bead
43-952	⅛" and ⅜" Qr. Rd.—¼" Bead

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or quick-and-dirty ways to do things. I so regard the use of any lubricant for woodscrews.

In that sense, I would say only that a proper-sized hole for a woodscrew will give maximum holding power and should permit relatively easy turning into place. In hard wood, this hole is the minimum or root diameter of the threaded portion for its whole length, or slightly less both ways. In softer wood the hole can be smaller but not to the point the screw cannot be seated properly without a lubricant. A hole too small risks, and generally will cause, the wood to split, thereby losing from one-third to as much as a half of its holding power. Usually the split cannot be seen. If a screw is too tight to drive by hand, the hole is probably too small (or the screwdriver is too small). While a lubricant will ease the task, it makes a split more likely, and of course the split makes it easier to drive the rest of the way (and encourages the screw to come loose in the bargain). For any wood, the shank hole should be the same or a very small amount smaller than the shank itself, and the threads should not engage both pieces. . . Personally, I dislike using any metal fastener, but there are times. . . .

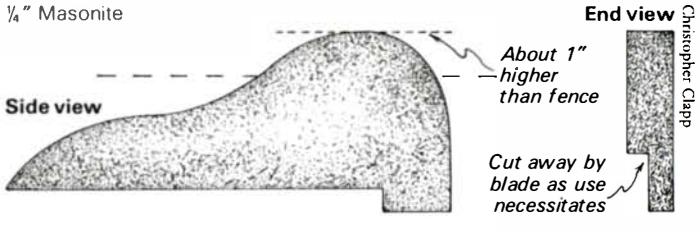
—Henry T. Kramer, Somerville, N.J.

May I call attention to an obvious (to a mathematician) error on p. 15 of the Nov. '78 issue. . . the tangent of 5° is 0.0875, not 0.875 as printed.

—Marsden A. Cook, Troy, N.Y.

Here is a pusher-holddown aid that I think gives reasonable safety and psychological security in repeated fine ripping cuts on the circular saw. Like a jointer holddown board, this pusher holds the stock firmly on the table ahead of the pushing "foot." Also, when made of tempered hardboard, a material that is ideal because it is homogeneous and strong in all directions, the foot of this pusher has sufficient strength to hold no matter how much of the side is cut away by ripping cuts narrower than ¼ in. Further, this pusher is elegant in that construction is simple and quick (about two minutes on band and circular saws), and material for it is cheap and easily available.

The pusher is made whatever length you feel is reasonable, necessary or pleasing to you, but its height is always just a thumb/forefinger hold higher than your rip fence. It is just



impossible for one to yield to the temptation to wrap the fingers around a handle, as in most other designs. Since there are no fingers up in the air, wrapped around a handle and unsupported to take a dipping arc over the blade as pressure on the push-stick is relieved at the finish of the cut, accidents are prevented. . . . Although, in practice, the thumb and hand are closer to the blade as the cut progresses than they would be with other designs, they are never in fatal proximity. The safety margin is in the stability of the hand, not in distance from the blade. Finally, although repeated fine ripping cuts are this pusher's specialty (I have ripped quite a number of 8/4 mahogany planks into thin, bendable strips for sideliner material in fiberglass cruising yachts), it can be leaned over at an angle but with the upper portion still against the fence to rip greater widths.

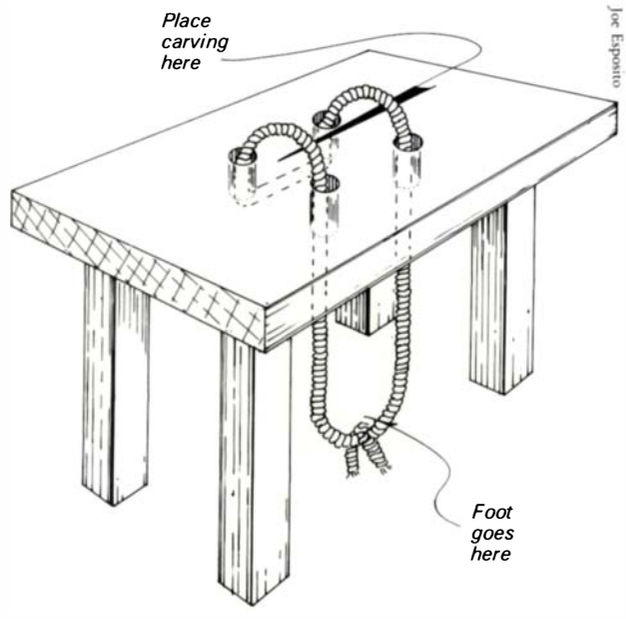
—G.L. Gilmore, Wilmington, Del.

METHODS OF WORK

Methods of Work *is a forum for readers to exchange the tools, jigs and tricks they've devised. Send precise details, sketches (we'll redraw them) and negatives with photographs, if any. We pay at the rate of $100 per magazine page, minimum $20, upon publication.*

Less is more

I have any number of expensive, cumbersome, time-consuming holddown clamps for carving, but this rig beats them all. I discovered it while visiting China last summer. It's an easy



way to hold down a piece that has to be moved frequently, for carving and fine work. It even could be made deluxe with straps and a foot rest.

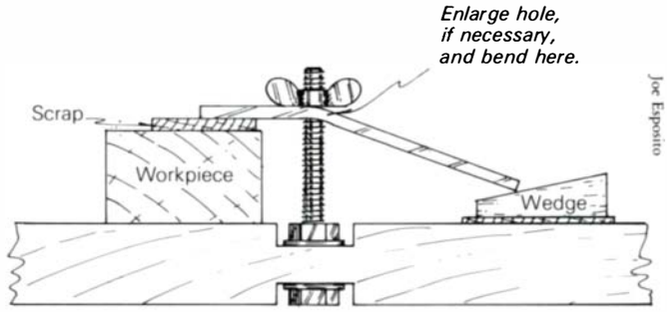
—W. D. Young, Scotch Plains, N.J.

Homemade clamp

An inexpensive and fast-acting clamp for securing work to jigs and bench tops can be made from a bolt, a straight mending plate of corresponding strength, a wing nut, two washers, a nut and a wedge. Choose a bolt of sufficient diameter for your application. If the wood in which the clamp is to sit is thick enough and a permanently protruding bolt will not be objectionable, a hanger bolt will make installation simpler. If you have to, enlarge the first hole from one of the ends of the mending plate to allow a loose fit with the bolt. Then bend the mending plate about 20° or so at the location of this hole.

To use, unscrew the wing nut so the work and a protective scrap piece can pass below the shorter bent edge of the mending plate. Keeping the bent section parallel to the work surface ensures even pressure and reduces the chance of marring the work. To engage the clamp, simply push in the wooden wedge.

To unclamp, first press on the thinnest part of the wedge



and rotate that point far enough to let you get your fingers below the plate. Then ease the pressure by lifting up the plate and withdrawing the wedge.

—Blake Raines, Springfield, Pa.

Cleaning with shavings

Cedar shavings make an ideal cleaner for chrome or any hard finish, such as paint or varnish. They will also leave glass sparkling clean.

You can get a good supply by fine planing or by filing with a Surform, which I use. If you want to store the stuff, keep in a dust-proof container and start with a clean shingle. Or you can take a chunk about the size of a sanding block from an ordinary cedar shingle and rub a high shine on old varnish or paint that is beginning to oxidize.

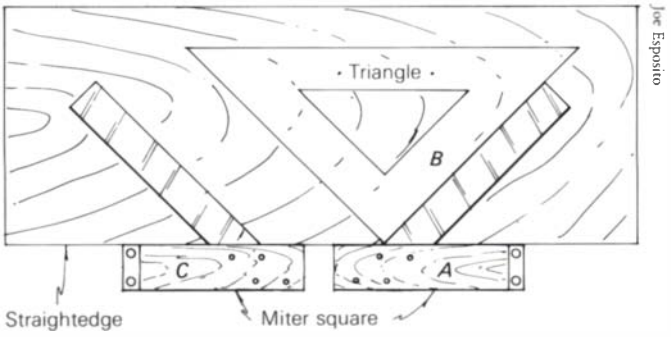
In case you have some real gunk to remove, immerse a fistful of shavings in water, rub the surface clean and then finish with the dry shavings. Everything usually comes out shining.

—Robert L. Johnson, Whittier, Calif.

Checking a miter square

I am getting weary of buying 45° miter squares from mail-order catalog firms and receiving ones of 44° or 46° instead. Veneering does not permit such a variance. The angle of a miter square can be checked with a perfect straightedge (a wide piece of carefully jointed ¾-in. maple will do) and a draftsman's triangle with an angle of exactly 90°.

First *(A)* place the miter square against the straightedge, as shown in the drawing at the top of the next column. Then *(B)* position the 90° angle of the triangle against the extended leg of the miter square. With the triangle secured, *(C)* flop the miter square to the other side of the triangle. Slide it against



Joe Esposito

the straightedge until it meets the triangle. Any resulting angle between the miter square and the triangle is twice the error angle of the miter square.

—C. Edward Moore, Bowie, Md.

Roughing out bowls

It is frequently suggested that in bowl turning, one should cut from large diameter to small diameter. I would like to call attention to a situation where the opposite may be preferable—this is the case when roughing the outside of a bowl with the faceplate attached to what will eventually become the top of the bowl. The method evolved from turning green bowls, where cutting from large to small diameter can be a jarring experience.

For inboard turning, I rough the outside of bowls with my *back* to the lathe, and thus with the headstock to my right. I cut with a deep gouge. Holding the handle in my left hand and resting the butt on my right hip steadies the gouge and supplies considerable power. I work from the base to the side

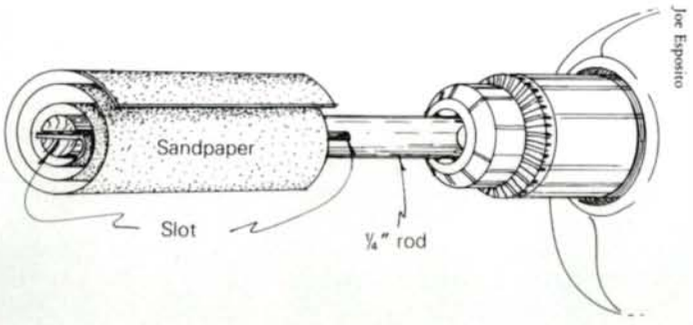
METHODS (continued)

of the bowl, slowly rounding over the nearest corner. The cut goes from small to large diameter with great ease and in my opinion, it's a case of "cutting wood as it prefers to be cut."

—Wendell Smith, Fairport, N.Y.

Sanding device

To sand holes or a flat surface, take a ¼-in. rod—the length depends on the depth of the hole or the width of the surface. Cut a slot down the center to hold a piece of sandpaper. Cloth paper is best, and you can use old sanding belts. Then



Joe Esposito

chuck the rod in a ¼-in. electric drill. Make sure the paper is wound the right way. The paper sands as it flaps. When the edge wears, it can be trimmed off.

—T. L. Trudell, Saginaw, Mich.

Bleaching walnut

Antique walnut furniture is usually a fairly even light brown color. I have had the problem of matching this color when replacing broken or lost parts with local walnut, which is dark

brown and heavily streaked. My solution is to sand the entire piece rather heavily to remove scratches and discoloration. Then I cut and sand new parts to final fit, and bleach them to a cream color with Blanchit wood bleach (available from Constantine's, 2050 Eastchester Road, Bronx, N.Y. 10461, at a cost of $4.10 for a 2-pint kit) taking care to protect my hands, face and eyes. Then I boil a batch of old walnut hulls in water to cover, let them steep some time to reduce the amount of water to about ½ the original amount, cool and strain. This makes a weak stain. I apply as many liberal wetting coats as needed to match the old wood.

—Albert J. Gnaedinger, Pocahontas, Ill.

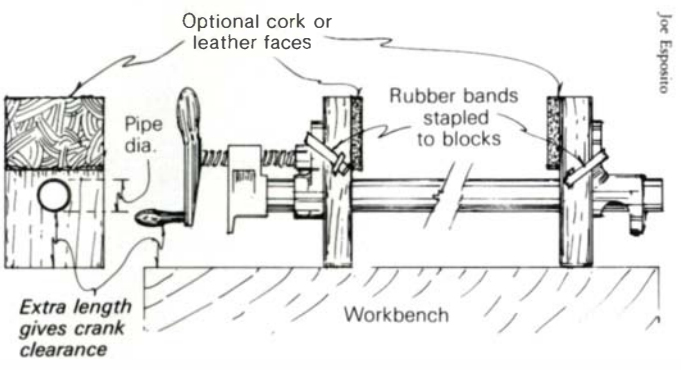
Drilling a dowel

If you have a lathe, it's easy to bore a centered hole in the end of a dowel. You can also do it on the drill press or radial arm saw, if you have a drill bit the size of the dowel to be bored and a block of scrap wood. First clamp the scrap underneath the drill chuck, and bore a hole the size of the dowel. Without disturbing the block, press the dowel into the hole. Change to the smaller bit and drill your hole—it's automatically centered.

—Larry Green, Bethel, Conn.

Blocks for pipe clamps

To avoid the frantic search for clamping blocks while gluing up, I have designed blocks that remain in place on my pipe clamps. I cut a hole in the block the same diameter as the



Joe Esposito

pipe. The block slides onto the clamp and is held in place with a rubber band, making it easy to remove. I made the blocks longer on the bottom to allow for the swing of the crank when the clamp is set on the bench and tightened. The blocks extend above and beyond the clamp to distribute pressure over a wide area, and to make a wider base for the clamp to rest on when set on the workbench.

—David Raynald's, Eugene, Ore.

Poor man's mallet

If you have an old baseball or softball bat stashed in the attic, then you also have a first-class hickory or ash mallet. Cut a tapered section about 15 in. long from the middle of the bat, such that the smaller end fits your grip comfortably. My own mallet tapers from 1⅛ in. at the handle tip to 2 in. at the head. This long mallet is shock-resistant and will replace the usual assortment of carver's mallets, since by regulating the position of your grip on the handle, you can in effect vary the hitting weight of the head.

The head of any mallet, including the bat mallet, can be saved from inevitable flaking and checking. Cut a piece of thick, stiff, unoiled leather large enough to wrap around the entire head. Dampen the leather until pliable, then finish the fitting on the head, stretching the leather and making a reasonably good joint where the edges meet. Glue the leather

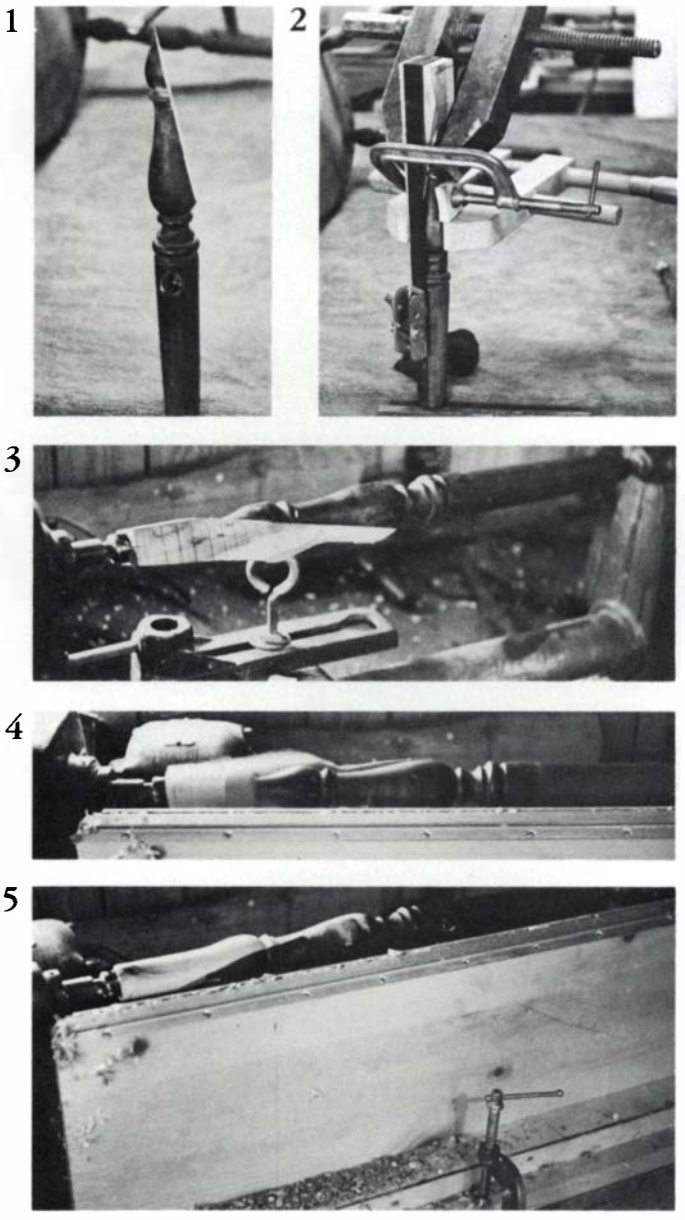
METHODS (continued)

on the head with water-based glue, using tacks to hold the joint (leave the heads proud). After complete drying, remove the tacks and trim the leather down to the head. A mallet treated in this manner should never need replacing—the leather is incredibly tough and will not lift away.

—William D. Woods, Phoenix, Ariz.

Repairing turned pieces

My method for repairing a broken Windsor chair leg leaves most of the original intact, though some might say that it is as much work as turning a whole new piece. (1) The damaged part of the leg is cut off on the table saw, and the exposed



diagonal face is made flat and true on the belt sander. (2) Then I glue on a piece of similar wood, keeping the grain parallel. I use yellow glue and a band clamp to keep the scarf joint from sliding. (3) The scarfed piece is bandsawn to rough shape and centered on the lathe. (4) The proper outline of the turning shows at the overlap as the piece revolves. (5) The completed turning, before staining and finishing. To avoid having to move the tool rest along the lathe bed, I replace it with a long piece of plywood that runs the length of the lathe. To this I fit a metal edge at about the same height as a line between points in the headstock and tailstock.

—Albert C. Landry, Richmond, Maine

BOOKS

The Craftsman Woodturner by Peter Child. *G. Bell and Sons Ltd., London, 1976, available from Woodcraft Supply, 313 Montvale Ave., Woburn, Mass. 01801. $18.50 cloth, 238 pp.*

The Art of Woodturning by William W. Klenke. *Chas. A. Bennett Co., 809 W. Detweiller Dr., Peoria, Ill. 61614, 1954. $8.60 cloth, 178 pp.*

Creative Woodturning by Dale L. Nish. *Brigham Young University Press, 205 University Press Bldg., Provo, Utah 84602, 1975. $7.95 paper, 248 pp.*

The Practical Woodturner by F. Pain. *Drake Publishers, Inc., 801 Second Ave., New York, N.Y. 10017, 1974. $7.95 cloth, $4.95 paper; 166 pp.*

Woodturning by Eldon Rebhorn. *McKnight Publishing Co., Box 2854, Bloomington, Ill., 61701, 1970. $11.96 cloth, 160 pp.*

Modern Woodturning by Gordon Stokes. *Drake Publishers, Inc., 1974. $6.95 cloth, $4.95 paper; 156 pp.*

Before we even begin talking about these six books, we first have to deal with the notion of reducing this most personal of crafts to writing. Turning is among the most delicate and sensuous of woodcraft skills. Isn't trying to learn it from a book like learning to make love from a sex manual?

The answer, regrettably, is "yes." The best way to learn woodturning is from a sensitive and experienced teacher, but a book is sometimes the only possible way. A good woodturning book should be simple and direct, with each process analyzed into its constituent operations so one can learn a little at a time. It helps if the book has drawings or photographs, but the reproduction should be of high quality. There's nothing more frustrating than poring over a photo and trying to figure out if that's the woodturner's thumb or the tool handle.

Next, I look for completeness. I'd like instruction on the whole process, from selecting tools and setting up the lathe to more advanced techniques, and I want advice on sharpening tools, choosing wood and finishing my work, though I wouldn't expect the kind of detailed information on the latter two topics that I can get elsewhere.

I also want a book that's orderly and well-indexed. I also like the little per-

sonal touches that give me a sense of the author and his attitude toward his work; that's what makes a book a book for me, rather than just a "manual." And finally, I appreciate suggestions for projects, the more imaginative the better. I may not follow them to the letter, but I'm always glad to see what other people have done, and to have my sadly limited inventiveness stimulated by other people's ideas.

By these standards, the most successful, or at least the most usable, of these books is *Creative Woodturning*. For one thing, it's bigger, and its 8¼-in. by 10¾-in. pages are used to advantage. Each process is broken down into a series of steps, and each step is illustrated with a photograph large enough to be seen clearly, even if the book is propped up behind your lathe and out of the brightest area of your working space. You sometimes get the feeling the book was put together for people who can't read. (For example, the sentence "Select a faceplate of proper size, and measure its diameter" is illustrated by a picture of fingers holding a ruler across the diameter of a faceplate.) But such excesses are more welcome in complex sections like building bowl blanks from staves or segmented rings, especially so when you compare this book with others that are stingy with illustration.

A good section of projects runs heavily to the kind of handsome household implement (covered bowls, bud vases, delicate trays) that ends up being too pretty or too specialized to use much. Everything else is here as well, from sharpening to sanding and finishing, including advice on turning green wood, glue chucking, and a separate section devoted to turning goblets, all superbly illustrated and clearly described.

If this book has a deficiency, it is in the area of personality. It's not a book to curl up with, nor to look to for a sense of the author's feelings about shaping wood. What is more important, to some of us at least, is that there is little evidence here of an author who wants us to understand why it's done this way, as well as how it's done. Still, when you cast your eye upon all those big, clear photographs, that may not seem a very important omission.

If Nish's book is the Percheron of this crowd, Peter Child's is the thoroughbred, classy and sleek. It uses a larger page and larger type than the others (though not as large a page as Nish's), it's printed on shiny coated paper, and the designer has been generous in the number and size of pic-

tures. All this is reflected in the price of the book, which is from $10 to $14 more expensive than each of the others. That is a lot, but with this book you get Peter Child, who seems to be the best-exposed proponent of woodturning in current circulation, at least to judge by the woodworking catalogs. Like other English turners who have written about their craft, he puts himself, his personal experience, and even a bit of his corny but genial English humor up front in his book. The overall effect is charming to some (and I am among them) and makes his book more inviting. Those who belong to the "just-the-facts-ma'am," school of literary criticism may feel otherwise.

Child is a proponent of "long and strong" tools, which have extra-heavy-gauge steel and thick handles that make them look like a cross between a crowbar and a baseball bat to those of us who use ordinary tools. Turners who are ready to lay out $20 for one of these monsters will learn from Child the delights of its use, which do sound beguiling, but there is much here for the rest of us as well, with our yard-sale lathes and Sears, Roebuck gouges. What is missing here includes a large selection of pictures of finished projects; instead, there is a more detailed treatment of a dozen or so projects, in a section titled "Practical Examples." Since this section includes also "Safety in the Workshop," the organization of the book is confusing. Another example: There is no section on sharpening tools, the information is spread throughout the book. Worst of all for a book like this, there is no index. Either get it all straight in your mind at the beginning and keep it there, or you're going to have to turn off the lathe and go hunting through the pages. I still like Peter Child, though, and I'm still planning to go to Sussex for the weekend, if I ever get to England, and if he'll have me.

The other two books in the English style, by Pain and Stokes, are more modest, but each offers the guidance of a genial and experienced woodturner for a modest price. Of the two, Pain's seems more detailed, but Stokes' *Modern Woodturning*, as the name might suggest, has a more up-to-date and more attractive (the two are not synonymous) layout. Its two-column format makes for easy reading, and pictures abound, though some are more shadowy and a bit harder to decipher than they should be.

Stokes' book is pleasant to read, conversational in tone and clear, but its index is rudimentary, it has no table of

contents, and it lacks even chapter headings, so finding what you want is difficult. The section on project ideas is so small it seems an afterthought, though many of the chapters on techniques teach by describing in detail how to do a particular project, like furniture legs, deep bowls or a spiral (including a double helix).

Pain's *The Practical Woodturner* is a better bargain. Pain explains why things are done, as well as how, and he has a pleasant, easygoing style. He offers no project ideas except a few for teaching, but he does present all the basic techniques, ideas about solving special problems (such as cabriole legs, special chucks for egg cups and napkin rings, fancy layered turnings), and some handy tips, like designs for homemade back-steadys for the lathe. The photographs are few, but the numerous drawings are clear and functional.

Both Pain and Stokes take a forthright stand against using the scraping method, as opposed to cutting, for work between centers. Stokes is particularly emphatic on this point: "There are two distinct methods by which wood can be shaped in a lathe, one of which calls for a considerable amount of skill and manual dexterity, and the other for nothing more than average intelligence. The first, and correct, of these methods involves cutting techniques with proper tools. . . . The second method is that of scraping wood to shape, and the man who can be satisfied with it is not in need of this book, or any other." Nish, the American, is characteristically more tolerant (or wishy-washy, depending on your outlook). He describes the two methods and concludes, "In summary, the choice is left up to the individual." Peter Child, unlike almost every other writer of a book on woodturning, prescribes the use of each method in its place.

The books by Klenke and Rebhorn, have at least one thing in common: Anyone who wants to learn woodturning from a book should steer well clear of them. Three or four sentences and one of those photographs, so common in this kind of instruction book, that look as if they were taken in a dimly lit high-school workshop are the only help you'll get here with using a gouge for roughing out stock. The sections on cutting coves and beads are a bit better, but compared to the painstaking instruction of Nish, Child, Pain and Stokes, it's almost like putting a loaded gun in the hand of a child.

The strength of Klenke's book is in its selection of projects, to which

roughly three-quarters of the book is devoted. They range from a darning ball to a four-poster bed, and include a dumbbell, mallets and gavels, an attractive little turned bench, a variety of bowls for nuts, fruit, salad and the like, a series of decorative finials, and many more. These are illustrated with small but legible measured drawings, in three views where necessary. An experienced turner would find enough inspiration and information here to carry out any of the projects.

Rebhorn's book is even more of a puzzle. It introduces you to the possibilities of woodturning without telling more than the bare minimum about how it's done. That minimum does not include any cutting techniques. Rebhorn urges the beginner to be satisfied with scraping, which he says is safer, more accurate, and can be learned with little practice.

If you have already mastered the turning techniques, you may be interested in this book, as in Klenke's, for its project ideas. Where Klenke's are generally classical in design, not to say old-fashioned—they include such things as a smoking stand and a "hair receiver" (whatever that is) for a girl's dresser—Rebhorn's are right up to date. An idea of his design preferences may be gotten from his suggestion that the containers of a certain shampoo might provide inspiration for project designs. The 58 project ideas, each with a clear photograph and rudimentary instructions, include the usual bowls, vases, and trays, but also a hamburger press, some novel small animal toys, a handsome top, an ingenious hand vise and a variety of tool handles.

Looking at these six books together makes one aware of two quite different approaches to writing about the craft. The American style, visible in the books by Klenke, Rebhorn and Nish, seems to have grown out of what might be called the "industrial arts" tradition. It was aimed at teaching groups, and probably primarily high-school students. The writing is impersonal and mostly confined to the hows of the process. At its best this style can be a vehicle for clear, straightforward instruction in the essential techniques. This is the case with Nish's *Creative Woodturning*. It can also be dull, cold and perfunctory, as in the case of the Klenke and Rebhorn books, which are interesting mainly, almost solely, for their design ideas.

The English style seems to have grown out of a quite different tradition, one in which the individual craftsman is still honored for his experience

BOOKS (continued)

and respected for the utility of his product. Child, Pain and Stokes seem to have greater self-confidence, and they express themselves with greater freedom about the right way and the wrong way, good work and bad work. Their writing reflects personal experience, and each of their three works offers a clear and detailed introduction that should be helpful to both the beginner and the more advanced woodturner.

—Phil Ginsburg

Chairmaker, a 22-minute color film. *Appalshop, Inc., Box 743, Whitesburg, Ky. 41858, 1975. Sale, $200; rental, $20.*

Dewey Thompson, the 80-year-old subject of this film, makes traditional post and rung chairs in Floyd County, Kentucky. In this short film he reminisces and rambles about his life and times as he works on a rocking chair. The perfectionist will find much to fault in Thompson's chairs—the shaving is crude and uneven, the bark seating is thick and without a recognizable pattern, the posts have split out above and below the mortises. But then, this film is about the "maker," not the "making." It is a fair-to-middling movie, which oversimplifies both the craftsman and his craft. Nevertheless, when this film gets to your neighborhood theatre, go see it—there is not much material available on post and rung chairmaking, and this to my knowledge is the only film.

—John D. Alexander, Jr.

The Craftsman, an Anthology, edited by Barry Sanders. *Peregrine Smith, Inc., Box 667, Layton, Utah 84041, 1978. $9.95 paper, 328 pp.*

The Craftsman, an Anthology is a representative selection of articles from Gustav Stickley's *Craftsman*, a monthly magazine, which from 1901 to 1916 circulated the basic tenets of the Arts and Crafts movement. Although these essays were written over 60 years ago, they are remarkably pertinent to the contemporary craft movement of the past decade or so.

The Arts and Crafts movement, which began in this country in about 1875, was fueled by the philosophic writings of the Englishmen John Ruskin (1819-1900) and William Morris (1834-1896). Gustav Stickley (1857-1942) was the first to apply the ideas of Morris pragmatically, to the manufacture of furniture and related accessories. He even became known as the "American William Morris" and

named his famous reclining chair after his English mentor.

At the core of the Arts and Crafts movement was the cult of hand-craftsmanship, a reaction to the Victorian fashion of ornate curves and excessive frills, where decoration took precedence over function. The forms of the Arts and Crafts movement, on the other hand, were based on comfort, function and durability. The movement was also a social protest against the evils of industrialization—dehumanization of the worker and loss of pride in the product—and viewed the Middle Ages as a golden age, "when art and work were forms of religion."

Stickley seems to have loved his magazine even more than his furniture factory (where all the pieces were completely hand-constructed with all wood joinery) and wrote many of the articles himself. The ones in this anthology cover a broad range of design-related topics, from hand-constructed bungalows, handmade books and furniture to metalwork, glass, pottery, leather, textiles and more. The editor has also selected articles on the general philosophy of the Arts and Crafts movement and written a lucid introduction. The articles are chronologically arranged to illustrate the growth and increasing sophistication of the magazine over its life. The photographs, etchings, drawings and epigrams give the reader a good idea of how the publication originally appeared.

Everyone interested in high-quality workmanship of any kind will be excited by this much-needed anthology. One hopes the entire *Craftsman* series will eventually be reprinted—complete runs are exceedingly rare. It is not only an invaluable guide to the thought processes of the Arts and Crafts period, but an excellent repository of do-it-yourself articles on house plans, weaving, hammering copper, building furniture and so on. The Arts and Crafts movement encouraged individual expression on all levels, and as a consequence, *The Craftsman* contains many practical articles aimed at the amateur. Especially interesting for woodworkers are Stickley's hints on design, construction and woodfinishing, including the recipe for his fumed "golden oak" finish.

—Carol Bohdan

Phil Ginsburg is executive director of the New Hampshire Council for the Humanities; John D. Alexander, Jr.'s book, Make a Chair from a Tree, *was published this fall by the Taunton Press; Carol Bohdan is publisher of* Nineteenth Century *magazine.*

Q & A

The editors invite questions from readers about cabinetmaking, finishing and wood technology. The answer men are: cabinetmaker and designer A.W. Marlow, author of several books about making fine traditional furniture; George Frank, a retired woodfinisher with 50 years of experience in America and Europe; R. Bruce Hoadley, professor of wood science at the University of Massachusetts (Amherst); and Tage Frid, professor of woodworking and furniture design at Rhode Island School of Design. We're happy to publish reader comment on the answers, for woodworking is an art more than a science, and there is always more to learn. Send questions, answers and comments to Q&A, Fine Woodworking, *Box 355, Newtown, Conn. 06470.*

Several readers report they have been unable to find small quantities of potassium dichromate crystals (suggested by George Frank in Sept. '78 for chemically changing the color of wood). Companies listed under "Laboratory Equipment and Supplies" in the Yellow Pages are more likely to deal in small quantities than companies listed under "Chemicals." If your phone book doesn't have these listings, try asking the local high school for the name of the company that supplies the chemistry lab. If you can't find a nearby source, a company that will sell small quantities of potassium dichromate crystals by mail is American Scientific and Chemical, 2019 Walker Ave., Box 18116, Houston, Tex. 77003. Four ounces cost about $5.

There is also confusion about the safety of using potassium dichromate. Dr. Michael McCann, of the Art Hazards Information Center in New York City, says it can cause skin ulcers and severe allergic reactions. He advises wearing goggles and rubber gloves when using it. Some chemical suppliers say that selling the chemical to hobbyists is forbidden by Food and Drug Administration regulations, but an FDA spokesman said that potassium dichromate—neither food nor drug—doesn't come under its jurisdiction. One chemical salesman said companies who sell industrial chemicals in large quantities are often reluctant to sell to hobbyists because they might hurt themselves and sue. Many companies also find it easier and cheaper to sell only 100-lb. sacks or box-car loads.

For those who plan to experiment with potassium dichromate, George Frank suggests the following procedure: If you dissolve 50 grams of potassium dichromate crystals in a half-liter of (preferably) rain water, you will have a concentrated solution. Keep this in a bottle and experiment on scrap wood with more dilute solutions. To start, take another half-liter of water

Q & A (continued)

and add to it two-tenths of your concentrated dichromate. Saturate the wood. Take up the excess liquid with a well-squeezed sponge and let the wood dry thoroughly, for half a day at least. Then check how close you are from your goal. Be patient and know that the greater part of woodfinishing is experimenting.

What finishing techniques are recommended for solid wood kitchen countertops? My objectives are durability and avoiding food poisoning and staining. Also, I work with some wide boards and flitches and have heard that I should place relief cuts in the unexposed faces of these pieces to eliminate warping. How does this work?

—Brad Miller, Bangor, Maine

Would you apply today's technology—as 95% of kitchen builders do—you would cover most of your countertop with plastic laminate. It will very durably prevent food stains and food poisoning. You could reserve an area about 24 in. square in your countertop (or anywhere else in your kitchen) for a butcher block. This could be either the commercial variety from the lumberyard, or the professional type, where end-grain maple is the working surface. For finishing, buy some paraffin wax (the kind mother used to seal her fruit preserves), melt it and coat your block with this melted wax. It will gel quickly. Then, with a dull scraper, scrape off as much of the wax as you can. The remaining thin coat will offer a safe protective coating to your butcher block. The process could be repeated as the need arises. *—George Frank*

For finishing a kitchen counter, I use linseed oil, letting it dry 24 hours between each coat. For the first coat, use one-half raw linseed oil and one-half turpentine, and soak the top. For the second coat, use boiled linseed oil. Leave it on for about two hours, sand it with the oil on, then wipe off the excess. For the third coat, mix half boiled linseed oil and half Japan dryer, but be careful not to coat too large an area at once because all of a sudden it will get tacky and dry quickly. Remove excess oil by scrubbing with a piece of burlap across the grain to force the mixture into the pores of the wood. Clean with a dry cloth, then rub with steel wool, and the countertop is finished. Don't leave the oily rags inside the house, though, because they may start a fire. This finish doesn't stain easily, but don't leave a wet beer can on it overnight. It is an easy finish to repair: Just scrape and sand the mark out and oil it

Q & A (continued)

again. I know that linseed oil is not recommended for salad bowls, but for countertops it's fine.

I would not put relief cuts in the bottom of the board. It is not necessary. Just be sure the underside of the counter is sealed. —*Tage Frid*

EDITOR'S NOTE: Japan dryer is available from Mohawk Finishing Products, Amsterdam, N.Y. 12010, at $4.50 a quart.

I want to build a built-in bookcase consisting of cabinets in a base with the top piece 5/4 by 19 in. by 160 in. long. The problem is that I will have to end-join the boards in order to get this length.

—J.J. Gilmartin, Mountainside, N.J.

In end-joining boards, I butt-joint them with a spline in the joint about 1½ in. into each end of the boards. But remember, the grain of the spline must run in the same direction as the board. Glue the ends together first, then join, and glue the boards together lengthwise, and stagger the end joints.

—*Tage Frid*

Joining boards in length is certainly not good construction. You did not mention the length of your boards. Possibly two cases identical in width will be the solution, or maybe one 8-ft. section and a 5-ft.-plus section to make up the 160 in. Two cases used side by side now could also be attractive if used separately in the future. —*Andy Marlow*

Do you have a source for plans for a roll-top desk, the type that was popular in offices at the turn of the century?

—John Richardson, Oakland, Calif.

Refer to *Mission Furniture: How to Make It*, by H. H. Windsor, pp. 56-60 (Peregrine Smith, Inc., 1877 E. Gentile St., Box 667, Layton, Utah 84041, $5.95, paper). This book was reviewed in *Fine Woodworking*, November '78.

I have recently acquired some carvings made of linden wood. Prior to my receiving them, they had been on display. The pieces are dusty and the wood is dry and brittle. What would be the best way to clean them and what can I do to preserve their quality?

—Robert Tabor, Garfield Hts., Ohio

I find it handy to blow dust out of finely detailed surfaces by using pressurized gas (I think it's freon) in cans sold in photographic stores. My brand is called Dust-Off. Care must be taken on fragile projections with cross grain, since the blast of gas can build up quite a bit of force against an unsupported surface. For stubborn places, teasing with a camel's hair artist's brush (or

Q & A (continued)

maybe a fine bristle brush) should take care of any surface dust.

If other residues or foreign materials are involved, the approach depends on whether the carvings are unfinished or not. If there is no finish, a non-swelling solvent such as acetone applied with a small brush should get into irregular areas. I would avoid using cotton swabs or cloth having loose fibers, as these always seem to get caught on the minute wood fibers. If the carvings have a finish, the dry brushing and gas blast should be tried first; if surface dirt remains, test different solvents (water, turpentine, etc.) on very small areas with a soft brush to see which one gives the best results. —*R. Bruce Hoadley*

I use a Sandvik cabinet scraper, and am able to turn a nice sharp edge, but the edge doesn't seem to hold for any length of time. How long can I expect to use the scraper on a wood like maple without reburnishing the edge?

—*Robert Kinghorn, Excelsior, Minn.*

The usual reason for a scraper blade getting dull fast is that the working angle between the surface and the blade is too small and will roll the burr back. The right angle is about 70° to the surface. —*Tage Frid*

I have a chance to get what I believe is a type of hickory or butternut tree. The wood is medium brown with very pretty grain like walnut, and the nuts are oblong (2½ in. long, 1¼ in. in dia.) while in a green shell. The leaves are similar to black walnut. How long do I let it dry before having it milled, and do I leave the bark on, and how about insects getting at it before it dries out? Where can I get information on types of trees I am not sure of?

—*Terry Trudell, Saginaw, Mich.*

Your tree sounds like butternut. Since hickory is one of our hardest hardwoods, and butternut is moderately soft (similar to yellow poplar), the distinction should be easy once the wood is dry. I would make a razor-blade cut on the end-grain surface, and using a magnifying glass, compare the cell structure with known pieces of hickory and butternut. The logs should be milled as soon as possible. Removing the bark will discourage boring insects. The boards should be set into stickered piles as soon as possible to initiate surface drying. The drying must be regulated to avoid defects, and I suggest you review the Winter '76 and Spring '77 issues of *Fine Woodworking* for suggestions.

Most large bookstores carry suitable tree identification books. The one I

Q & A (continued)

find especially informative and easy to use is *The Tree Identification Book* by George W. D. Symonds, published by William Morrow & Co., 105 Madison Ave., New York, N.Y. 10016.

—R. Bruce Hoadley

I used to buy colored wax to fill up small holes like countersunk nails and such, but I can't find any in this area.

—Jim Smith, Vancouver, Canada

Melt equal quantities of beeswax and paraffin wax in a double boiler, add dry powdered colors, then for every ounce of wax add a drop of linseed oil. You can make small paper tubes with one end closed and pour the well-stirred liquid into them. The oil will cause the wax to remain malleable. You can buy prepared burn-in sticks in a wide variety of colors, wax-like stain pencils, and dry pigments from Mohawk Finishing Products, Amsterdam, N.Y. 12010. *—George Frank*

Regarding finishing an aromatic cedar chest: it seems that a compromise is necessary between sealing the wood and still allowing for the cedar smell. Some people have suggested sealing only the exterior, but isn't half a sealing the same as none? If it is impossible to properly seal the cedar, how much warpage can I expect for a ⅞-in. thick, solid cedar, 2-ft. by 2-ft. by 5-ft. chest?

—Paul A. Palo, Port Hueneme, Calif.

You won't have warpage trouble if the grain on all four sides runs laterally. The inside doesn't have to be finished.

—Andy Marlow

Supplies

Exotic materials and unusual supplies are a constant problem for the woodworker, and we'd be pleased to publish notices of what you can't find. Here are more leads to the reader inquiries published in previous issues:

—Pure unthinned tung oil: J.H. Oliver & Company, 387 West Govan, Grenada, Miss. 38901.

—Harp strings: Roland Robinson, Robinson's Harp Shop, P.O. Box 161, Mt. Laguna, Calif. 92048, custom-makes strings. Linrud Harp Co., 14960 Blackburn Rd., Riverside, Calif. 92503, sells nylon for strings. In Nov. '78, p. 33 , we misspelled the names of two firms that sell harp strings. They should have been: Lyon and Healy Harp Salon, 109 W. 57th St., New York, N.Y. 10019, and Robert Morley Co., 4 Belmont Hill, London, S.E. 13, England.

—Another finish for cups and mugs: mineral oil, used sparingly. Reader H. J. Giesbrecht of Wyoming, Ont., tells us that too much will soak into the

Q & A (continued)

wood and frustrate the sealer.

Readers can't find:
—American smoketree *(Cotinus obovatus)* yellowwood *(Olaptris lutea)*, and pawpaw *(Asimina triloba)*.
—Leather inserts for an old desk top.

Follow-up

Re the supply question concerning Pterocarpus indicus *in the Nov. '78 issue: It's called amboyna when it comes from Molucca, angsana and sena from Malaya, and New Guinea rosewood from New Guinea. It is also best-known as narra, from the Philippine Islands. I searched for a long time for this—it is most difficult to come by. I suggest the reader look for narra from several sources. I would also be interested in knowing what the reader is using this for, as perhaps I could offer some alternative in exotics.*

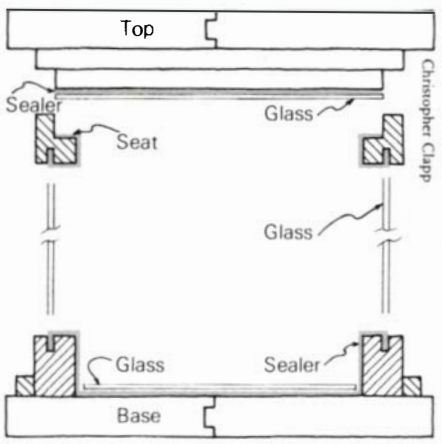
—Ray Millman, Jr., Plymouth, Mass.

Concerning the question about removing ink stains on an old roll-top desk (Sept. '78), Factosol 1619 (sold by the Sales Dept., Standard Oil Company, 101 Prospect Ave., Cleveland, Ohio 44115) removes these stains quite nicely.

—E.P. Disbro, Pepper Pike, Ohio

EDITOR'S NOTE: Factosol 1619 is available in minimum quantities of five gallons.

Mike Mills wrote about making a terrarium with wooden top, bottom and stiles (Sept. '78). I have constructed several terrariums and have encountered the same problems with moisture. After experimenting with lacquers, marine varnishes and waxes, I eliminated the stiles and used a silicone adhesive to join the glass sides. I was careful to use quartersawn lumber and monel screws. There are three separate units: top, seat and base. The seat and base are rabbeted to accept the glass sides. I lined top and base with glass squares, attached with a fine coat of the



Q & A (continued)

silicone sealant. Then a bead of silicone was put around the edge of the glasses and a film was spread on all interior wood edges. Further, I lined the seal between top and seat with sealant. This terrarium has not shown any signs of dimensional change or deterioration. The rabbeted parts provide the strength; the sealant protects the wood.

—Richard Legge, Jr., Rochester, N.Y.

Re Alton R. Stephenson's question about getting glue off wood (Nov. '78) when glue squeezes out of a joint, do not wipe it, as this pushes it into the pores of the wood. Let it harden, then cut it away with knife or chisel. This will leave the wood clean.

—Wm. Quinn, N. Fond du Lac, Wis.

I read the letter by Theodore Romaine about restocking a Springfield, 45-70 trapdoor carbine (Nov. '78) and had to respond. My first project was restocking a M1883 trapdoor rifle and I had no real experience or training for the job. First of all, write to Brownell, Inc., Box 1, Montezuma, Iowa 50171, and order the catalog of gunsmithing supplies ($2.50, free for licensed dealers). There definitely are special tools you'll need. I have many power tools, but the stock can be made with mostly hand tools. You must have a pattern stock. If your new stock doesn't match the original in every detail, all your work will be for naught. Beg, borrow or steal an original stock from another trapdoor carbine (either M73 or M84). A contour gauge and outside calipers are also musts.

Inlet the barrel into the stock first and do everything else from that. It will help to have the blank cut square, or at least symmetrical about a vertical center line. Then inlet the barrel along this line, and the stock should come out straight and without twist from nose to butt. Next, bring the outside to final dimension and contour, starting at the nose and working toward the butt (this direction could be reversed if the blank is square). Use the contour gauge, calipers and yardstick often. To do the outside shaping many tools can be used, but my constant companion is a double-ended Swedish rasp (#553, p. 88, Brownell's catalog).

Now you can inlet the lock. Remember, the inside should look as authentic as the outside. Various Dremel or Foredom burrs (rotary cutters) in a drill press are best for the job in my opinion. The butt plate, trigger guard, barrelband, etc. can be inletted in different orders. The ramrod channel, tang screw hole and sideplate screw holes must be done carefully. There is no room for error. The part of the ramrod channel exposed to the outside can be done laboriously by hand or with a rotary cutter. Drill the remainder with a 3/16-in. drill bit brazed to a 36-in. rod.

Some other things you'll need: Jerrow's inletting black (paint it on all metal parts to be fitted to wood), a Curl-Cut, a Surform barrel inletting tool (all available from Brownell), and carvers' chisels are all necessary for the barrel inletting and other parts as well. You will not need any checkering tools.

Finish the stock as you would other wood projects. Stain to a medium brown with a slight reddish tint. Finish with boiled linseed oil only. A high lustre or plastic finish was never seen on army-issue arms.

I'm sure there are some things I have forgotten entirely and many I have slighted. Just remember always to proceed with caution and try to solve all problems mentally before actually jumping into the stock.

Using a semi-inletted trapdoor carbine stock would cut your time by about 98%. Dixie Gun Works, P.O. Box 130, Union City, Tenn. 38261, sells them in walnut.

—Dan Pestal, Wahoo, Nev.

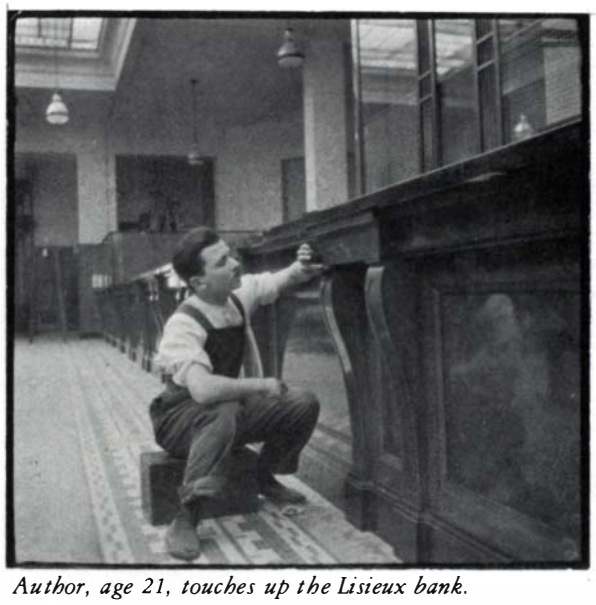
Adventures in Woodworking

FERNAN BANKS ON AMMONIA

by George Frank

EDITOR'S NOTE: Adventures in Woodworking is a new feature, an opportunity for our well-seasoned readers to recount the high points in their woodworking lives. This inaugural adventure comes from consulting editor George Frank, who goes back to 1924 to relive a very early triumph in a very long career.

If you've had a woodworking adventure you'd like to share with our readers, write it down and send it in. We've never met an old-timer without a tale to tell, but you don't have to be old to get your story into this space. You just have to have a good story. A suitable length is between 500 and 1,500 words, which amounts to between two and six typewritten pages, double spaced. This story has 850 words. If you have photographs or drawings, please include them. We'll pay $100 for each adventure that is accepted for publication.



Author, age 21, touches up the Lisieux bank.

Since no one could pronounce his name—Ferdinand Schnitzspan—his customers simply called him Fernan. We, his workers, addressed him as "Patron." He was a giant Alsatian and in the early 1920s he ran a good-sized woodfinishing shop in Paris. All his men liked him; I, then a youngster of 21, loved him like a father.

This was the time when France was rebuilding after World War I, and the Banque de France was Fernan's best customer. New branch offices were being built and opened up in every important town. The furnishings of these banks were made in Paris, and Fernan had the contract to finish them. The style was always the same, and the wood was invariably oak. The only allowed difference was in the finish, or more exactly, in the staining. The architect could select one of four colors, ranging from No. 1, the lightest, to No. 4, the darkest.

Early in June we shipped out all the woodwork for a bank to be installed at Lisieux, a town closer to Deauville than to Paris. This branch was supposed to open up on July 16, just after the Bastille Day holiday. Around July 10 there was a big upheaval in our shop. The telephone did not stop ringing, telegrams arrived, people were coming and going like chickens without heads, and all of us sensed that something was amiss. By noon the secret was out—the Lisieux bank was stained too light. Fernan had made an error. His order had called for color No. 3, but he made us use No. 2, a lighter one. The architect was adamant: He wanted the color he had specified and told Fernan in no uncertain terms to come and darken up the bank before the opening date.

Fernan had a car built to carry four people, but the next morning he and six of his best men somehow squeezed into it, along with all the material needed, and headed for Lisieux. We arrived around 9 A.M. and entered the bank. There was no question about the error nor about the size of the task on our hands. Even if we worked 24 hours a day, it would still take 10 to 15 days to restain and refinish the bank. After hashing over every possibility, Fernan and his men decided that the situation was hopeless—the job simply could not be done in the remaining few days.

There was one fellow who did not open his mouth, me, but whose mind was working furiously. Although I was the youngest and the least experienced member of the group, I had had more school learning than the other six combined. In evening courses I had studied woodfinishing for two years. Now,

when doom settled on our small company, I touched Fernan's sleeve and very timidly said, "Patron, I think I can do the job by tomorrow night . . ."

Six pairs of eyes looked at me, not knowing whether I was joking, dreaming or trying to be funny. I explained that the job could be done by gas. If we could create a strong enough concentration of ammonia gas in the bank, there was a great chance that it would go through the thin layer of finish and react with the tannic acid in the oak to darken the wood.

Since there was no other choice, my plan was accepted. We sealed all doors, windows and openings. Then we made about 30 simple alcohol burners, consisting of a board about 10 in. square, with a small bowl containing about a half pint of alcohol in the center. Three long nails held up a small pail over the bowl. With wet towels over our faces, we poured the strongest ammonia we could find into the pails, lit the alcohol and scurried out of the bank, leaving all the lights on and closing and taping up the last doors. By the time the alcohol had burned out, all the ammonia had evaporated, and there was such a concentration of gas in the room that no living thing could remain. Then we went to sleep.

Sleep, no one could. We played cards and drank an awful lot of Calvados, a local apple brandy. Every hour we checked whether the gas was working. It was not, at least not fast enough for us to see. But the next afternoon the architect joined our group with a sample in his hands. Peeking through the window he was shaking his head approvingly and said; "This is it. Please don't make it any darker."

It was not easy to re-enter the bank and to get rid of the ammonia gas. Our noses and eyes were running, but my tears were tears of joy. We touched up the small areas that were unaffected by the gas, and the bank opened up as scheduled.

But I was not there to see it. Fernan said, "You, fellow, I don't want to see you for a week. Go and have a good time at Deauville," and stuck about a month's pay into my hand.

On July the 15th I lost my last franc at the roulette table. Luckily I had my return ticket, and on the 16th I was back and happy at my workbench. □

George Frank, 75, has accumulated a vast store of anecdotes and finishing tricks in his more than 50 years as a woodfinisher on two continents.

Guitarmaking School

Rigorous course blends the traditional and the innovative

By Richard Starr

Many woodworkers feel the need to develop their skills in depth in a specialized area. Few of us can afford the time to accept an apprenticeship even if one could be found. The well-established schools of woodworking are expensive and require years of commitment. Short courses in subjects like turning and joinery are offered by community centers and by enterprising individuals (sometimes in their home shops). Many of these are substantial, but they don't offer the opportunity to become involved for long enough to get a real understanding of what it's like to work in the field.

If you play the guitar or consider instrument-making a challenge, there are several intensive courses in guitarmaking that are reasonably affordable and don't require an impractical commitment of time. The School of Guitar Research and Design Center in South Strafford, Vt., is one such independent guitarmaking school. It offers a six-week course that is well thought out and complete.

The $1000 tuition for the course includes six classes per week for six weeks, comfortable accommodations with cooking facilities, and all materials. Everything is supplied to make a finished guitar, including strings. GRD is not a luthier's supply house and does not see its graduates as a market for guitar wood and fittings.

The woodworker who takes the GRD course will be one of eight students. The group is likely to include professional musicians who have never built anything of wood, seasoned guitar repairmen who wish to build a complete instrument, and amateurs with little experience but a sincere interest in the guitar. The curriculum gives beginners a knowledge of the necessary woodworking techniques, while stretching the skills of experienced woodworkers. All that is required is a genuine interest in learning to build guitars and a willingness to work hard.

"It was an incredibly intense experience," said one student, who now makes his living at guitar repair. "They warned me when I got there about the intensity and pressure of the course. But I never expected to enjoy working 14 hours a day for six weeks."

"It is definitely a course for serious adults," says Charles Fox, who established the school in 1973. "We start students right at the top, building state-of-the-art guitars. Nothing is watered down. The course is organized so that every student gets a substantial foundation in guitarmaking."

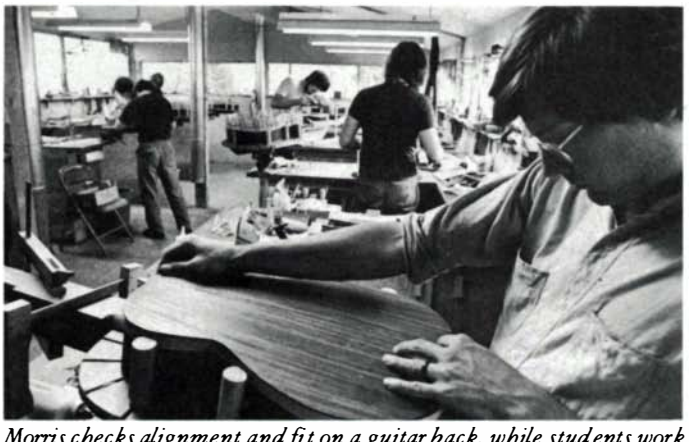
Besides running the school, Fox, with several assistants, is building a commercial line of guitars. These electronic and acoustic instruments are built by hand in a studio adjacent to the teaching shop. The school uses this small production facility to demonstrate how guitars can be built efficiently without compromising the hand-built quality. This interaction between the school and the production studio has grown to make GRD a focal point for sharing ideas among luthiers. Innovations in the studio can be incorporated into the teaching program, while school alumni can share their new methods and consult with the Center for solutions to problems.

It seems incongruous to the visitor that all this activity can be taking place in rustic wooden buildings located on a peaceful Vermont hillside. Students find that the tranquility helps them work hard, with a minimum of 20th-century distraction. With a student group consisting of musical people of various abilities, entertainment generates itself in the dormitories. When the need for cultural stimulation arises, participants discover that it is a short drive to Hanover, N.H., and the Dartmouth College campus. The school attracts students from great distances, and several have experienced their first snowfalls while making a guitar in the depth of a Vermont winter.

The course is taught by George Morris, an experienced guitar builder with a background in cabinetmaking. I asked him how the school manages to pack so much information into 36 days of classes. Morris explained that it is mostly due to careful organization. Every day is planned to be full, and progress occurs according to a rigorous schedule. Students know what to expect each day. Here is a rough outline of the course: The first week is spent designing the instruments and exploring tools and wood. The next two weeks involve making all the major parts of the guitar: the neck, sides, back and top. During the fourth week, guitars are assembled, bound, trimmed

Photos: Richard Starr

Students watch closely as George Morris shapes the braces on a steel-stringed guitar top.



Morris checks alignment and fit on a guitar back, while students work on their projects.

There are a number of reputable guitar-making schools in this country. But because no teaching or building method is indisputably superior, virtually all have their enthusiasts and critics. William Cumpiano, a veteran luthier from North Adams, Mass., advises prospective students to investigate thoroughly before enrolling, and to interview the instructor or at least examine one of his instruments. Has the instructor worked at least five years full-time in guitarmaking or technical wood trades, apart from his present classroom duties? Do his own guitars reflect what you consider refined, clean, tastefully designed woodworking? Do they show an understanding of traditional methods, no matter how innovative they may be? Is the shop well organized—for working, storage of wood and tools? And is the instructor forthcoming or restrained with this information? If these questions are answered to your satisfaction, your chances of emerging from the course with a well-designed, completed guitar are good.

and fretted. The remainder of the course is devoted to ornamental inlay, careful finishing and setup. Throughout the course, time is taken for lectures and discussions covering acoustics, organizing a shop and making a living, the history of the guitar and other pertinent topics.

Such a formal structure may suggest rigidity, but in the context of the school, it frees the student for creative effort. Participants design every detail of their guitars. "We expect them to decide a lot of things," says Morris. "We don't simply hand them a pattern and a method. They can choose among many alternatives in both design and procedure." Yet the creativity must take place within certain limits. Students make basic classical or steel-stringed guitars without major technical deviation from the standard styles. As Fox explains, "Guitars made here should be seen as a point of departure for all kinds of experimentation in students' later instruments." Alumni stress the importance of experimentation. "Fox and Morris make guitars themselves and can experiment a lot," said one student. "There are lots of their mistakes around the shop, which are used as examples. They show you how to make more than one kind of guitar and encourage you to go in *any* direction."

The school uses the traditional Spanish "integral-neck" method, still considered the most substantial structure, as its basic construction technique. Students are taught to bend sides freehand on a hot pipe, though a simple and ingenious side-bending jig is also employed. No molds or forms are used in assembly, which gives the students maximum freedom to create the shape of their instrument. Care is taken to teach an approach to three-dimensional sculptural design, and some particularly beautiful instruments have been made by students in this course.

What of the musical qualities of these instruments? In the judgment of one alumnus, all eight guitars made during his session were quite good, and two were unusually fine. A professional musician turned repairman, he said the course "gave me the guitar I still play," and he considers it the best of his instruments. As Morris put it, "Every student goes home with a guitar at least as good, and often better than those available commercially. Beginners make mistakes, of course, but they learn that every mistake is correctable."

Fine craftsmanship is central to guitar-building. I asked several alumni if they felt that their experience at the school has affected the way they approach other projects. One student felt that it helped him work more carefully. He commented, "Guitar-building is the finest woodworking I've ever encountered, involving the same kind of attention to detail and relationship to the material, the same close tolerances as fine cabinetwork."

But another student warned against taking the course simply as an exercise in craftsmanship. "The craft experience is of value, but you must be interested in guitars. You must have an interest in the music itself." Fox agrees, but he points out that some of the greatest instrument-makers of the past couldn't play a note.

The guitar-building course at GRD is a demanding experience. The woodworker must perform at a consistent level of precision that exceeds the requirements of most other kinds of woodworking. It it important to learn that you are capable of such efforts, and having learned it, you are likely to approach other work with new eyes. At the very least, you will leave GRD with a high-quality guitar and an encapsulated experience in instrument-making. You will possess new skills, some of which are applicable to other fields of woodworking. And you may find that you have the foundation for a whole new profession. □

Richard Starr, of Thetford Center, Vt., is a frequent contibutor to Fine Woodworking *magazine.*

CLASSIFIED

Fully equipped, well-established REFINISHING business. Sale includes corner building. Annual gross: $35,000. Mark Wilch, 1615 Madison Street, Denver, CO 80206.

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Apprentice or experienced WOODWORKER: Position available and seeking resumes. Brian Snow, Box 571, Stoughton, MA 02072.

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SELECT HARDWOODS. For price list send self-addressed stamped envelope to William F. Brooks Hardwood Supply, RFD 2, Box 71, Ludlow, VT 05149.

WALNUT AND OAK DOWELS. Furniture Parts, Toy Parts. Catalog 25¢. Woodworks, Box 79238, Saginaw, TX 76179.

BOAT LUMBER—Teak, Mahogany, Oak, Maple, KD, good quality. Other Species Available. F. SCOTT JAY & Co., Inc., P.O. Box 146, Pasadena, MD 21122. (301) 544-1122.

TUNG OIL. The hardest-drying natural finish. Available in gallons, quarts and pints. Write for a brochure on this amazing ancient China Wood Oil finish. Sutherland Welles Ltd., Box 639-FW, Woodbury, CT 06798.

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IN SAN FRANCISCO, tools and supplies for the wood craftsman. SEABRIGHT HARDWARE, 1749 Noriega St. (415) 731-1274. Inca dealer.

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ANTIQUE WOODWORKING TOOLS—Illustrated quarterly catalog—$3/year. The Tool Box, 5005 Jasmine Dr., Rockville, MD 20853.

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NEW AND USED BOOKS on wood, woodworking, carving, turnery. We deal only in woodworking. Frequent catalogs. 50¢. R. Sorsky Bookseller, 520 E. Garland, Fresno, CA 93704.

FIVE-DAY WORKSHOPS: (February 26-March 2)—Basic Joinery, Ed Hillenbrand; (March 5-9)—Contemporary Furniture, Stephen Crump. CRAFTS CENTER, Cedar Lakes, Ripley, WV 25271.

WOOD & TOOL EXCHANGE

For Sale

Black walnut slabs for sale. Prices vary according to piece. Many to choose from. Will consider swaps. Brian Burns, 1263 Stanford Ave., Palo Alto, CA 94301. (415) 327-5335.

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Woodworkers floor-model sander, 3-phase, 8-in. x 9-in. pneumatic drum, 6-in. x 11-in. Vonnegut brush heads. Dust Collector, 9-in. inlet with 5 hp 3-phase motor. Make an offer. Would prefer tool trade. Tim Frater, P.O. Box F, McGregor, IA 52157.

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Wanted to Buy

Need rip fence for Shopsmith model 10ER. Contact K. Mulligan, 2908 Brookwood Place, Ft. Collins, CO 80525. (303) 484-6099.

Complete tailstock assembly for Walker Turner lathe. Must be 6 in. from bed to center point. Also faceplates: 1-in. 12 thread RH and LH. D. Zweig, 16 Vineyard Lane, Westport, CT 06880.

Stanley #77 rod and dow turning machine, with cutters. Contact W.J. Robidoux, 332-5th Street West, Cornwall, Ontario, Canada. State price and condition. Photo appreciated. Also, I would like to find a supplier of tapered wood reamers.

Stanley planes new or old. All types wanted from Nos. 1 to 444. Higher prices paid for Nos. 1, 9, 51, 52, 54, 62, 64, 72, 85, 87, 97, 104, 105, 141, 144, 164, 196, 212, 340. Wood planes bought also. Ivan E. Bixler, 6943 Cozaddale Rd., Goshen, OH 45122.

Delta combination 8-in. saw and 4-in. jointer. J. Dockendorff, 144 Old Hickory Road, Orange, CT 06477. (203) 795-9091.

Want any tools made by the Barnes Co. of Rockford, Illinois before 1930. Jack. W. Warner, Route 1, Box 68-B, Spearville, KS 67876.

SITUATIONS WANTED

Apprenticeship sought with luthier/guitar repairman. Have basic woodworking skills, and desire to learn both electric and acoustic. Willing to relocate. Please write Robert B. Peterson, 2512-19th Avenue, Rockford, IL 61108.

Apprentice cabinet and furniture maker seeks position with master craftsman. Have basic knowledge and skills. Fast learner and hard worker interested in lifetime career. Resume on request. Please write: Mark J. Miller, 104 McKenney Drive, Beaver, PA, 15009.

Would like to visit, interview and photograph fine wood craftsmen in South, East and North in 1979 to compile material for a book on the state of the art. Contact Michael Billert, 1206 Kings Highway, Dallas, TX 75208. (214) 946-1048.

The CLASSIFIED RATE IS $1.50 per word, minimum ad 15 words. Payment must accompany order. The WOOD AND TOOL EXCHANGE and SITUATIONS WANTED rate is $1.00 per line, minimum three lines. The exchange is for private use by individuals only. Commercial accounts must use Classified. Allow 30 letters or spaces per line, including name and address. Send to: The Taunton Press, Advertising Dept., Box 355, Newtown, CT 06470. Please inquire for DISPLAY CLASSIFIED RATE.

EVENTS

This column is for gallery shows, major craft fairs, lectures and exhibitions of general interest to woodworkers. To list your event, let us know at least three months in advance.

Selections 1979: Wood—Western states professional and student exhibit. Juror: Sam Maloof. Entry deadline, March 7, exhibition dates, May 7-25. Julian A. McPhee Gallery, California Polytechnic State University, San Luis Obispo 93407. Contact Selection '79 Committee, Art Department, CPSU.

9th Annual Craft Fair—Sponsored by the Craft Center, juried. Entry deadline, Feb. 1; fair dates, May 19-20. Contact Registrar, Craft Center Fair, 25 Sagamore Rd., Worcester, Mass. 01605.

Fifth Woodturning Symposium—Instructors include Mark and Melvin Lindquist, Alan Stirt, Jay Weber, Garth Graves and Richard Starr. March 23, 24, 25, The George School, Newtown, Pa. Contact A. B. LeCoff, 2500 North Lawrence St., Philadelphia, Pa. 19133.

Young Americans: Fiber, Wood, Plastic, Leather—Jan. 28 to March 11, Rochester Institute of Technology, One Lomb Memorial Dr., Rochester, N.Y. 14623.

The Harmonious Craft: American musical instruments—A wide-ranging exhibition of traditional and innovative instruments. Through Aug. 5, Renwick Gallery, Smithsonian Institution, Washington, D.C.

Renwick Multiples—Contemporary pieces, now on national tour. Feb. 25 to March 23, Valdosta State College, Valdosta, Ga.

Out of the Woods—Woodworking exhibition by Ontario craftsmen. Opens March 5 at Cambridge Public Library, 20 Grand Ave., N. Cambridge, Ont., Canada.

Workshop—Mark Lindquist will demonstrate turning spalted wood and chain-saw sculpture, Feb. 10 and the morning of Feb. 11. Lindquist will lecture at 2 PM Feb. 11. Greenville County Museum of Art, 420 College St., Greenville, S.C., 29601.

Faculty Show—R.I.T. College of Fine and Applied Arts, Jan. 13 to Feb. 2. Bevier Gallery, Rochester Institute of Technology, Rochester, N.Y. 14623.

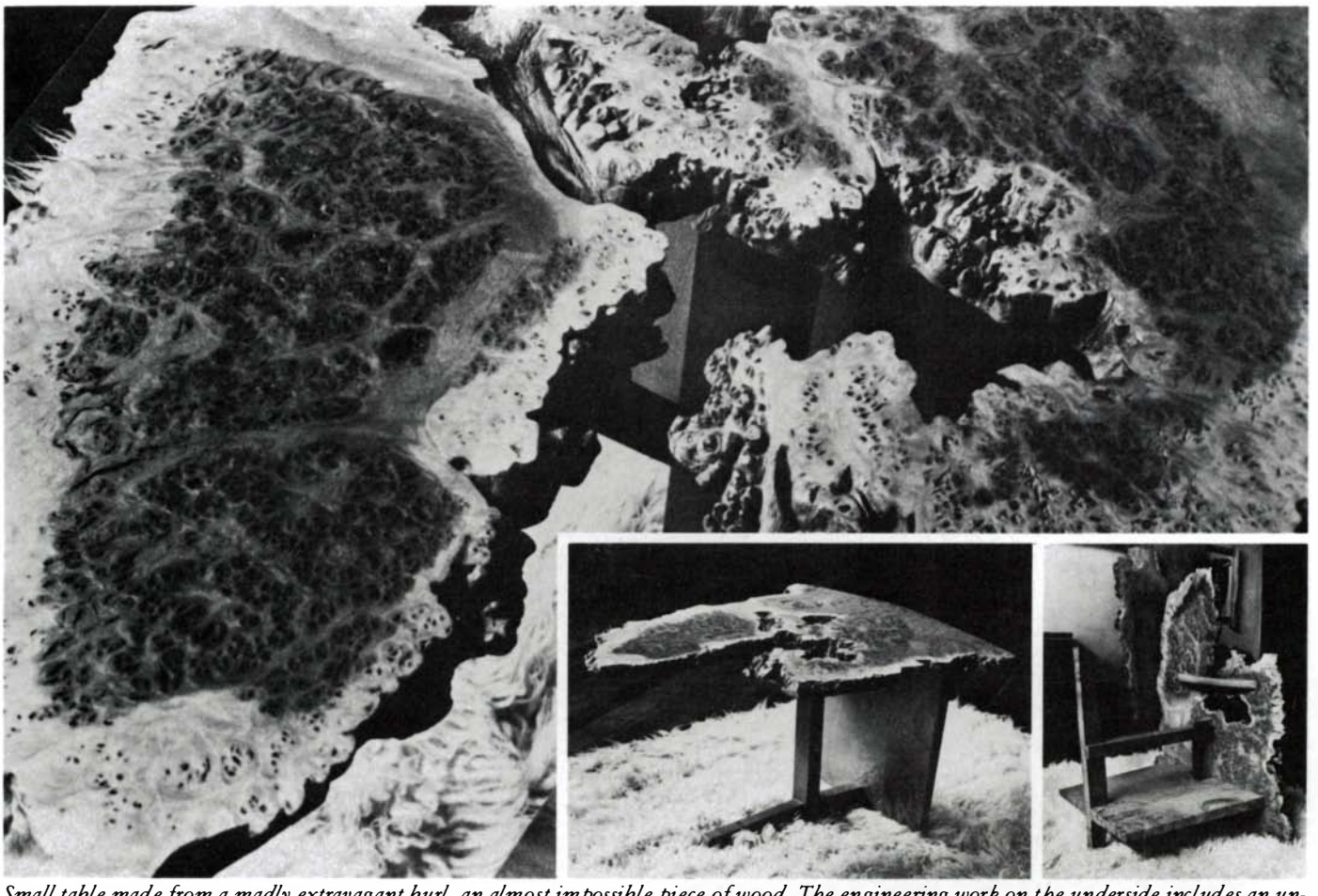
Texas Crafts—Representative works of 17 Texan craft artists, all media, now on tour. March 3 to April 8, Tyler Museum, 1300 Nahon St., Tyler, Tex. 75701.

Winter Market—Professional craftsmen from states east of the Mississippi River. Juried, sponsored by American Craft Enterprises. Open to trade Feb. 21-22, open to public Feb. 23-24. Civic Center, 201 W. Baltimore St., Baltimore, Md. 21201.

Sarasota Spring Festival of Crafts—Wood, pottery, jewelry, fiber, glass, leather. March 9-11, Civic Center Exhibition Hall, 801 N. Tamiami Trail, Sarasota, Fla. 33577.

Wood: A Contemporary View of a Traditional Material—seminar featuring seven speakers. Feb. 24, 9 AM to 5 PM, 145 Dwinelle Hall, Univ. of Calif., Berkeley, $25. Write to U.C. Extension, 55 Laguna St., San Francisco, Calif. 94102.

Fine WoodWorking January/February 1979



Small table made from a madly extravagant burl, an almost impossible piece of wood. The engineering work on the underside includes an unobtrusive bridge supporting the fragile wood. Conventional bridle joints connect the base elements, with screws holding the top in place.

George Nakashima

For each plank there's one perfect use

by John Kelsey—photographs by Richard Starr

Scattered all over the world are landmark trees of great age and stature, monuments as old as civilization. They are usually past their prime, in the ordinary commercial sense, when they fall before advancing asphalt or the simple weight of age. They are discards, unless a woodworker like George Nakashima gets them. His aim, he likes to say, is to give such trees a second life as useful furniture, perhaps to fashion beauty, and by this work to achieve harmony with the natural forces that grew the tree in the first place.

Nakashima says he has spent the last 40 years getting to know lumbermen all over the world, buying English walnut and oak planted during the reforestation directed by Elizabeth I, Carpathian elm from Turkey's border with Russia, American black walnut from New Jersey, teak, laurel and rosewood from India. He buys hundreds of logs a year and ships most of them to a band-saw mill in Maryland to be cut into planks. He likes to be there for the cutting, this ageless Druid, standing hands-in-pockets near the sawyer.

The huge log is maneuvered onto the saw carriage, gripped by heavy dogs, while Nakashima quickly figures where to cut and how thick. As with a diamond, the first cut commits you, success or firewood. He explains this to me in the gloom of his lumber shed, surrounded by monolithic planks standing on end. We are at the end of a long day of interviewing, in which he has stipulated an emphasis on his ideas and broad experience, not on technique. But now that we have finished the formalities, he loosens up and starts to tell how. He has been polite and controlled, and suddenly he is animated. He produces chalk to scribble the end view of a log on the face of a walnut plank, with the dogs that hold it top and bottom to

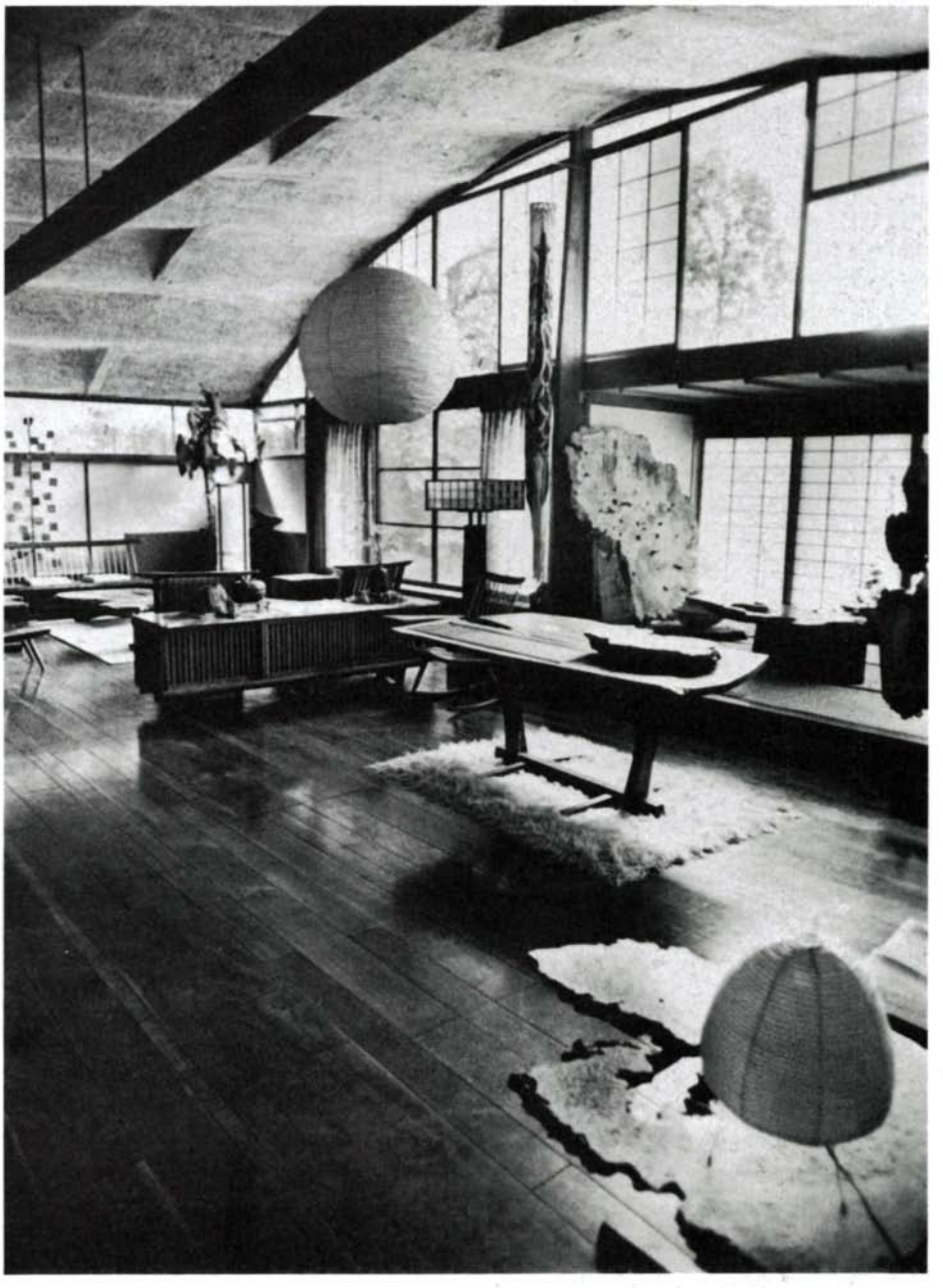
the traveling saw carriage. "You have to know how to cut and how thick to cut, and you have to decide very fast," he says. He can usually tell what the color and figure will be like before the log opens, he says, but there are always surprises. "You cut one way and you get something, you cut another way and you get entirely something else. You can lose a whole log by wrong cutting. Terribly hard-ball business, saws screaming like a hundred banshees all the time."

The planks near the heart, perfect material if you know how to season it, revealing the complete history of the tree, are Nakashima's specialty. He described the mature tree as being with a soul, "absolutely godlike" and in many ways preferable to people: It has no insatiable ego, it does not talk back. But he cannot pause to admire these magnificent planks, for the saw cuts beyond the heart, and the log drops on its face in the noise and flying dust, to be turned, dogged and sawn some more. "Nothing easy, no place for students," Nakashima chuckles. He's already told me that the planks will be stickered outdoors to dry for two or three years, then gently kiln-dried without steam to set the fibers so the wood can be worked, then brought here to New Hope, Pa.

The brief moment passes, he puts the chalk away. We just look at the hundreds upon hundreds of colossal planks leaning against the walls of this concrete block shed. I feel like a dwarf huddling in the forest, in the filtered light of late afternoon. Over there are planks five hundred years old and more, five feet from bark to bark, some burly, some branching, some blasted, and their length is twelve or sixteen feet, I cannot estimate. I am astounded. Two more sheds adjoin this one, and he has a warehouse of timber in Philadelphia, yet Nakashima is worrying about the supply five and ten years hence. Suddenly I realize the truth of what he has been telling me all day: Nakashima really believes there is one perfect use for each flitch of timber, and his task—his duty—is to recognize it.

* * *

Bucks County, Pennsylvania, an hour's drive north of Philadelphia, has been a center of fine cabinetmaking since Colonial days, and it still is. The land is hilly hardwood forest and brush, cut by farms running down to the Delaware River.



The Conoid Studio, inside and out, and some of the wood standing around the walls. The arching roof is a thin, undulating shell of reinforced concrete, which flattens out to a line at the rear of the structure. The building mostly serves as a showroom and as Nakashima's private office and studio. The raised platform at the right of the interior view is equipped for the traditional Japanese tea ceremony.

If one has skills...

FWW: What do you say to a young person who wants to become a woodworker?

Nakashima: "That happens so often, we have a waiting list of maybe 300, and I say to them we aren't taking on anybody.... It cost me maybe $500 a month to break in a new man, I'm out of pocket that, and then if he goes in two years I'm out maybe five or ten thousand dollars, and very often he doesn't even say thank you. I'm not in that kind of position, so I tell them the thing to do is go to some craft school like Rhode Island, or the best is to go to Germany or Japan where they have real apprenticeship programs, and several people have taken me up on that.... There's so many of the young wanting to do that, but it's almost all completely romantic, they have no idea of what is involved, what they're getting into and actually what they want.... Skills are maybe the finest resources any nation can have, and we don't have that in this country and that's why things are getting so bad. This country prides itself on automobiles and can't even make a decent automobile, a sad situation. Whereas if one has skills, one could make the slums bloom with no money at all, simply by work and skills."

Nakashima lives on Aquetong Road off U.S. 32, a couple of miles from the fashionable town of New Hope. You can visit on any Saturday afternoon from one o'clock to four-thirty except in August. Nobody will be working in the shops, but you can get the lay of the place and go into the Conoid Studio, Nakashima's showroom and office. It contains examples of the 75 or so catalog items made here: tables large and small, chairs for dining, rocking and lounging, benches and stools, cabinets, beds, desks and lamps. Dozens of planks stand around the walls, destined to become single-board or bookmatched dining tables, although some have been there for years, awaiting their perfect use. The basement is another storehouse, this one filled with smaller treasures: the burls and stump sections of trees from all over the world, which will become coffee and end tables. Special tables are Nakashima's specialty, and if you want one he will help you select the plank and chalk your name on it. His catalog puts it this way: "Lumber with the most interest sometimes poses the most difficult problems, and so often the best figuring is accompanied by knots, areas of worm holes, deep openings, cracks, checks and other so-called defects...Just short of being worthless, a board often has the most potential and can be almost human in thát respect." One of the cabinetmakers working here put it more plainly: "The more knots and holes, the more money."

* * *

George Nakashima was born in Spokane, Wash., in 1905. He spent the summers of his youth wandering in the mountains of the Pacific Northwest and believes his passion for building and preserving nature's riches began then. He studied forestry, went to MIT for a degree in architecture, then he traveled: to Paris at the time of Le Corbusier and the Bauhaus ("outlived its usefulness by 1940, no vitality to it, yet it influences designers even today...absurd"), to Japan to trace his own roots (where some of his furniture is in production and quite popular), to India to work as an architect, and then to live in an ashram as a disciple of Sri Aurobindo. Then, with World War II imminent, back home. By then he had learned something of the traditional ways of working stone and wood in Asia. The contrast with American building methods produced a resolve "to get into something I could handle from beginning to end," and he set up as a cabinetmaker in Seattle, working alone.

Then Pearl Harbor. Nakashima, along with his wife and infant daughter, was sent to an internment camp in Idaho. The time was not entirely lost. There was wood, "and a very fine Japanese carpenter, so I became his designer and his apprentice at the same time." Influential friends got Nakashima out the following year and helped him set up to make furniture in a rented shed in Bucks County. By 1946 he owned the three acres where his ten buildings now stand.

Somehow, between 1945 and 1955, Nakashima grew from a one-man shop to his present enterprise, which he considers just the right size. It is difficult, from this distance, to figure out exactly how he did it. He does not advertise and does not seem to seek publicity, although he has a gift for getting it. Hundreds of magazine and newspaper articles have been written about him—they fill several fat ring binders—and at least one doctoral thesis. He won a gold medal for craftsmanship from the American Institute of Architects in 1952, put a line of furniture into production with Widdicomb in 1958, and shared (with four other contemporary woodworkers) a prestigious exhibition at the Smithsonian Institution in 1972. Yet his marketing methods contradict all conventional wisdom. There is only one price—no wholesale, retail or decorator's discount. He does not sell through galleries—you have to write or come to New Hope to order, and many customers return, six months later, to pick up their furniture.

The prices are reasonable compared to the usual run of art furniture and high-style factory goods; Nakashima calls them "upper middle bracket." He posted an increase of 5% to 10% last June, after two years without change. "What happened was we had this Rockefeller job (about 200 pieces for a new, Japanese-style house in Pocantico Hills) and were doing well. Everything was kind of top of my line, you know...but then we were back to our normal business, our overhead had gone up and our prices hadn't kept up with it."

At the low end, a three-legged Wohl table, measuring about 26 in. by 20 in. by 21 in. high, is $75 if the top is glued up of several boards and $115 if it is a one-piece free-edge top. Special coffee and end tables, on the other hand, are priced according to the wood and seem to run toward $500. A Conoid dining table, measuring about 84 in. by 40 in., with a two-board bookmatched top, would cost about $1,300. A New chair costs $165, and $220 with arms; a Conoid chair is $220, and $315 with a one-piece seat cut from figured stump or crotch wood.

* * *

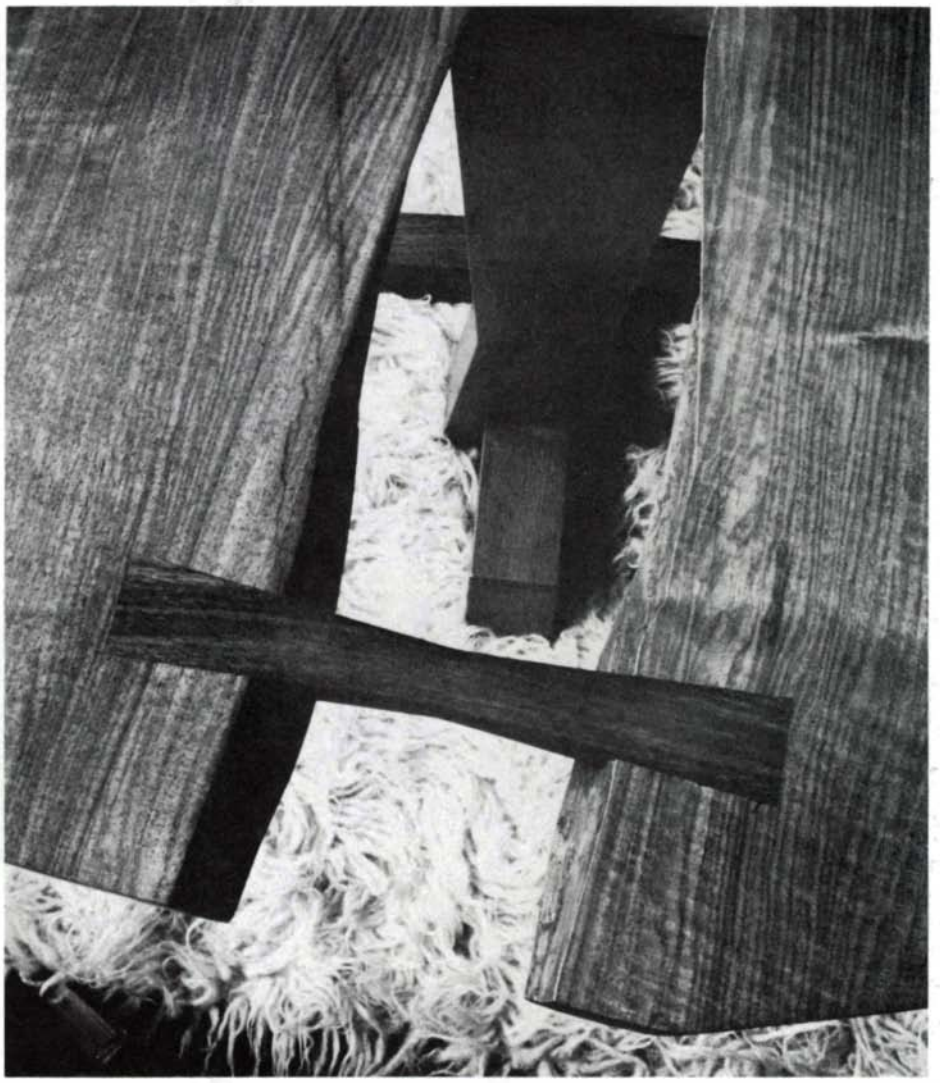
Nakashima frequently says his two years (1937-1939) as a disciple of Aurobindo "is actually the key to my madness.... Unless I had started out in the ashram, I wouldn't be doing what I am today. As a matter of fact, I think the only salvation the West has, the only salvation for the world, is the teachings of Sri Aurobindo."

I ask him several times to explain the connection between Indian philosophy, his own goals and making tables. He is

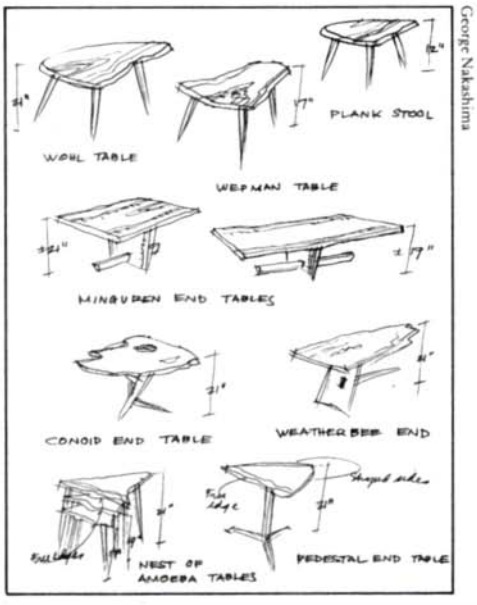
The Minguren Museum, where Nakashima displays premium slabs of world timbers, most of his original prototypes and treasured artifacts. The roof is another architectural adventure, taking its form from a hyperbolic paraboloid.

Bookmatched Indian laurel slabs, the best from 30 logs. They'd make a table 12 ft. by 6 ft., if the right customer came along.

Single-board Conoid table, about 3 ft. by 7 ft., walnut. Nakashima said this table was made for a musician. 'We shipped it to him and he said it didn't look right in his room, so he wanted to send it back and do something else. I said fine and made him another table which wasn't nearly as nice, but it pleased him. And now we have the table and wouldn't sell it for plenty of things. You know we often do that sort of thing—make total losses to our advantage. We've even sold a piece of furniture to people who, I've felt later, didn't appreciate it, so we buy it back.'



The butterfly key, used to edge-join two planks and to control actual or potential checks, has been known since Egyptian times. In Nakashima's shop, the butterfly tapers about 5°, and about 1° in thickness. The bottom of the key, which is thus a hair smaller than the top, is scribed onto the wood. The recess is cut with an electric router about ¾ of the way through the board, and cleaned up with a sharp chisel. Then the key is glued and forced into place, with a single screw driven into each end from below for insurance. It's made about 1/16 in. proud of the surface, so it can be finished flush after the glue has set.



George Nakashima

Above, some prototype chairs in the Minguren Museum. Center, a page of coffee and end tables from Nakashima's catalog. Right, Roger Foster wipes the tung oil off a free-edge maple table. The usual finish is five coats of tung oil, each soaked on and allowed to set for an hour, then wiped off hard. The final coat is sanded with 280-grit and polished with steel wool. Compressed air is used to blow excess oil out of crevices in the wood. Working surfaces sometimes get a thin top-coat of polyurethane.

obliging, willing to approach the question from several directions, although it is clearly all but impossible to explain:

"It's the concept that's important to me, that's basic. It's one's relationship to divine sources and to nature which formulates, I think, a form. It was the concepts of the Shakers that produced Shaker furniture, it was the concept and the life of Louis XIV that produced the kind of furniture he ended up with. . . . I'm a karma yogin from way back, karma yoga is the yoga of action. I'am an activist, in my small way I get things done. . . . I've improved my environment and improved my life and I've done things for people that improved their lives, and created an environment out of nothing. I don't destroy anything. I don't even borrow any money. I think as long as you're creating there's a legitimacy. I think the object of life is to create. I don't hurt anybody. I don't take anything from anybody, I just try to leave the world a better place than I found it. I am essentially a follower of Sri Aurobindo, who believes in the transformation of man, and also in the transformation of society, the transformation of nations and of civilization."

Today Nakashima is more businessman than woodworker, although he says he still occasionally builds a piece of furniture, just to keep his hand in. He operates his enterprise in a very traditional way, the master craftsman overseeing a squad of ten journeymen who build furniture to order, one piece at a time. His wife, Marian, manages the finances. His daughter, Mira, 37, shares (and probably will inherit) the customer relations, the design work, and shop coordination. His son Kevin, 24, is learning the business side.

The heart of the business is procuring timber and deciding exactly what to do with each plank, or exactly which plank to use for some particular job. This aspect Nakashima cannot relinquish, although he says he is passing on responsibility as quickly as possible. "There was a time when I'd have to find every board, every piece of wood that went into a chair frame. But now we have a catalog and I tell them to go to such and such a bin and pick it out. Even so, we're cutting seats right now and I work very closely with the men in cutting seats, to decide which board goes into a chair seat and which board goes into something else."

It has to be a perfect edge...

Nakashima on tools and workmanship:

"You know it takes two years to learn how to sharpen a chisel properly, and even now after 30 years I don't think I have a man in the shop who can sharpen a chisel properly. We have a power grinder, and a lot of the men use it even on a good chisel, which is just absolute barbarism. Our good men. I don't try to make them do it my way, they do get a good edge on it, but they could get a better edge if they knew how to use a stone properly. First of all, an oilstone is no good, it has no quality, it doesn't have the feel that a good waterstone has. . . . Most people use only the center of the stone, and then they get the belly, they don't know how to go from one end to the other without bellying the stone. . . .

"Most of the men like to use a Japanese saw that cuts on the pull stroke, but I think there's only one of them who can sharpen it. Most just keep using it until the teeth give out. You have to have a special file. A Japanese saw has a gullet besides the teeth, you have to gullet. Good Japanese carpenters, I've seen them, if the saw starts to go bad they take the teeth completely off and put the teeth all back in. That takes tremendous skill. . . .

"These things aren't that easy, you know. For a good piece of Japanese architecture, very fine work, a carpenter could spend a day surfacing one post, for instance. You take one stroke of a plane—and it has to be a hand plane, and has to be wood, can't be a metal plane—the plane is pulled, and then after each stroke you sharpen the blade. It's not that it's dull, but it can be sharper. It has to be a perfect edge, there can't be the slightest feather to it. . . ."

As the day proceeds, our interview is interrupted several times by a cabinetmaker with a question. Each time, it concerns what board to use, or where to find the right plank among the thousands on hand.

Nakashima has it all at his fingertips, although he admits, grinning, that he sometimes tucks a special piece of wood away and loses it for years. After that, his job is design, particularly of the single-board and bookmatched dining tables, and of the special coffee tables. He cuts and trims the planks with his white chalk, locates the butterfly keys that will control checking, specifies the base and its proportions and where it will attach.

* * *

Some of the buildings at Nakashima's embody his experiments in thin-shelled reinforced concrete construction, while others are more conventional. But they are all unobtrusive, wood and masonry of human scale, integrated with the land. They have large doors and windows, wooden decks, with gravel paths and stepping stones, and the trees are close by.

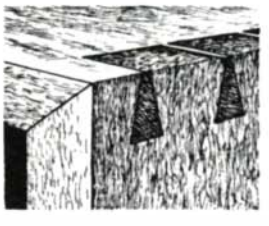
The main workshops are several small buildings connected inside, an *L*-shaped agglomeration with the largest room, for machines, at the knee of the *L*, cabinet shop to one side, table shop and finishing rooms to the other. Patterns and tools hang on hooks over cluttered benches; slabs, boards and offcuts too big to discard stand wherever there is room; here a rack of clamps and there a shelf of portable power tools, the cords neatly coiled. All the sawhorses are wrapped in corrugated cardboard to cushion the work. A small blackboard on the back of the door lists jobs in progress and their due dates. The wooden floors, although swept daily, are littered with shavings and sawdust. In short, the place is a busy cabinet shop, cluttered yet orderly, and comfortable.

The ten men who work here are all of two types: European-trained craftsmen and Nakashima-trained local men. None are art-school graduates, and none of the hundreds who write to Nakashima seeking apprenticeships are ever taken on. Most of the men have been here 15 or 20 years, or seem as if they will be.

Adam Martini, who came here from Austria 20 years ago and mostly makes chairs and lamps, explained why he stays: "He leaves you alone, you do the best work you can with the best material in the world, there's no pressure and there's always work." Jim Radcliffe, who grew up in New Hope and has worked for Nakashima for 24 years, added, "It's not like being in a factory, there's no assembly line. You work at your own pace, and each piece is a challenge because the wood is different. Each table with a one-piece top—there's no other like it. I figure I've made 2,000 Conoid bases for one-board tables over the years, and that's a lot. But the proportions change to suit the wood, each one is different."

The men have specialties they pursue when the order flow allows it. If there are coffee tables to be made, Gene Morgan makes them; if Kornblut cases, Bob Lovett makes them. But no one has a specialty that only he can do, and any of them will do whatever needs doing at the moment. Generally, a man makes each whole piece of furniture himself and is responsible for it. The principal concession to production methods is stockpiling of chair seats and spindles (the rough-turning and bandsawing is jobbed out to local millwork shops) and of the linear elements that make up table bases. Joints cannot be cut in advance, because the exact dimensions are likely to differ each time a piece is made, according to the

Each order comes into the shop as a dimensional sketch noting any variations from the catalog design. This one is for a Kornblut case, named after the customer for whom it was first designed. A Kornblut is 18 in. by 18 in. by 22 in. high, in walnut with rosewood doors, back and base, and costs $440 or $580, depending on whether the walnut is American, French or Persian. The gauge, top, is used when planing tapered legs.



Machine room, top, has three table saws, two thickness planers (one 32 in. wide) and two jointers (one 24 in. wide), two band saws, a lathe, a drum sander and a stroke sander. In the adjoining bench room, above, is a rosewood carcase (foreground) that will become a horizontal wall-mounted cabinet with sliding doors, a special commission. The corner joint is a through dovetail (inset) with mitered ends, an attractive detail that also hides the through-plowed door grooves. The usual shop practice is to cut the tail angles first, using a tilt-arbor saw, rout the waste almost to the line and finish with chisels. Then the pins are scribed and cut with a fine Japanese saw. The miters are left a little fat, the joint is closed as far as it will go, and the saw is run through the miter to create a perfect fit.

New chair with rockers, top, is a Windsor derivative with H-stretchers, made in walnut or cherry with hickory back spindles. The back rest is steam-bent from green stock, then dried for about six months. Chairmaker Adam Martini, center, stores all the spindles for a set of chairs over a heat lamp to dry and shrink the wood before he whittles the tenons. After assembly with white glue, Martini pins the leg and stretcher tenons with small diagonal dowels, to keep the joint together should it ever loosen. Of the Conoid chair, bottom right, Nakashima says, 'I started this chair because I felt you only needed two legs, then I put the base on it because it had to be supported and it seemed to work out because so many homes are carpeted. Legs on a carpet floor are a bad solution, you can't move the chair, whereas this one will slide on the carpet.'

wood and the client's specifications. Thus when an order for six New chairs is to be filled, Martini makes exactly six chairs. When he's shaved and fitted the legs and stretchers to the first seat, he sits on it to shave the spindles for the back. Nakashima usually doesn't dictate how the work is to be done, only to what standard. If it doesn't come out right, it will be done over again.

* * *

Of the several trends in contemporary design with wood, two are at opposite poles: stacked furniture, where the wood is a beautiful and convenient medium for expressing a sculptural idea, and furniture such as Nakashima's, where the whole point is to let the wood itself dictate the form. Nakashima is most forceful when he inveighs against design as it is usually thought of, the expression of a personal idea, "where you start with a concept and then you try to execute it in almost any material. Most of it would be much better in plastic or concrete . . . and it shouldn't be done with wood, it's the wrong use of wood." He thumbs a book of photographs and says, "Fast modern contemporary furniture, I want no part of it. People wanting to express themselves, it's just simply crap. That's what's causing all the ills of our society, individualism with nothing to express. You tear your guts out to express yourself and it ends up in frustration and a terrible environment." I push him on this and he explains that the wood is a product of nature, of something beyond man, "a gift we should treasure and use in the most logical and beautiful way, and personal expression is quite illegitimate. It's an arrogant conceit, and we have too much conceit in our society."

Looking at a small table salvaged from a madly extravagant and extremely fragile burl (shown on p. 40), I see what he means: The wood is merely displayed, utterly simple. It is as if the tree had given away a part of itself and there it sits, without human intervention. We know that someone has sliced the stump into boards and saved this ruined piece from the firewood pile, cleaned it up and defined its edges, and given it a true, oiled surface. But this work does not intrude, there is no precious molding or delicate dovetail to announce the craftsman's ego. The tabletop seems to have evolved directly from the material, and as Nakashima says, it is probably the only thing that could have been done with such a piece of wood. Nonetheless, something is holding it off the ground, a base tucked well back and unobtrusive. It's not a gnarly branch or root section (which Nakashima calls "gauche barbarisms"), it's a designed intersection of vertical slab and horizontal runner. I ask how this base evolved from the material and Nakashima explains that it is "almost purely an engineering job, it's just to support the top and to do it in a way that's satisfying to me. I don't mean that I'm beyond design, but I don't design from the approach of art school, I design from the material."

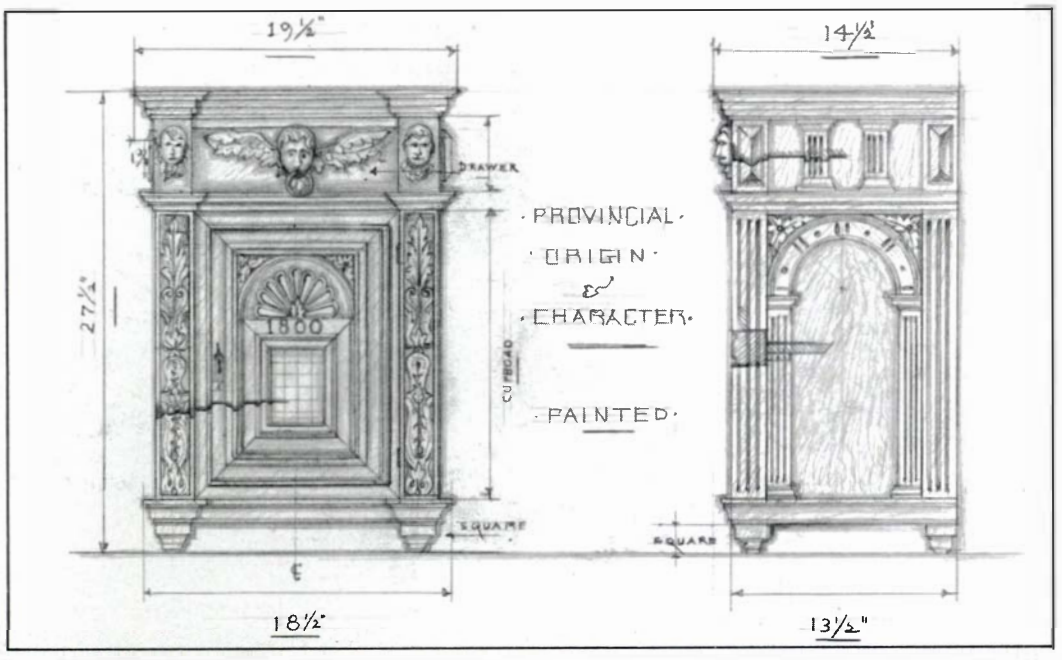
FWW: Are you working from a tradition, are you consciously part of a tradition?

Nakashima: Well, if I'm in a tradition it's a mixture of early American and Japanese. I think I work very much in the Japanese idiom, the use of materials, the type of materials, but what we do also has roots in America.

FWW: You imply that aside from being a skilled craftsman and aside from knowing the material intimately and being able to design with it, there's another dimension here.

Nakashima: Yeah, it's a spiritual one, and I think it actually comes first. . . . □

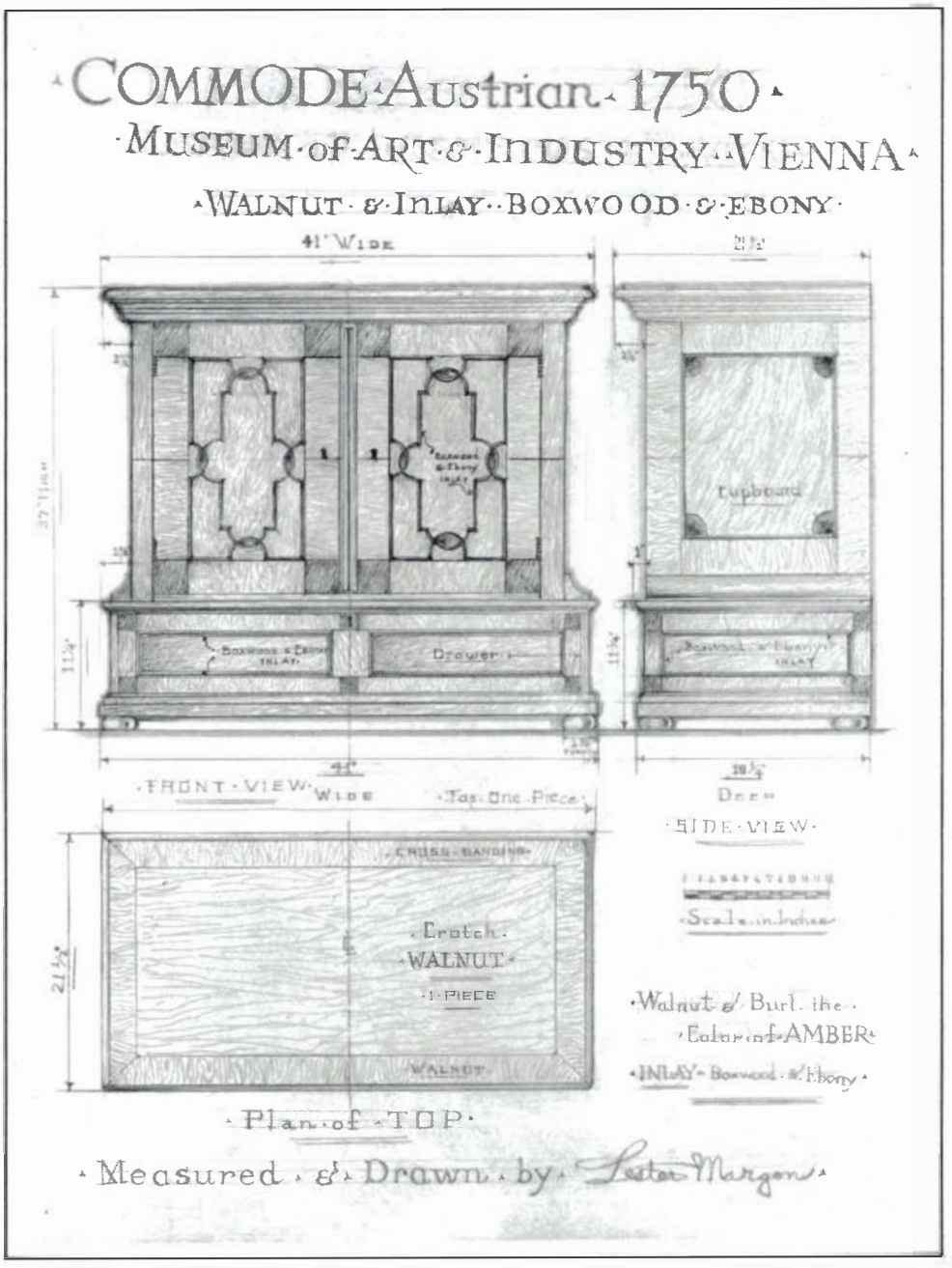
Lester Margon's Measured Drawings



Norwegian cupboard, 17th century, Sandwig Collection, Lillehammer.

Lester Margon, 85, is known to furniture designers and craftsmen for his five books of measured drawings of museum pieces (Winter '76, pp. 46-49). As a young man, he studied interior design and decorating at Cooper Union Art School in New York. Margon worked for Schmieg-Kotzian and W. & J. Sloane in New York City and many furniture manufacturers in Grand Rapids, Sheboygan and Chicago. He traveled all over Europe and made 400 measured drawings of furniture masterpieces. Much of this furniture was bombed during World War II, and Margon's drawings remain the only authentic records. The Norwegian cupboard and the Austrian commode shown here are the last two to be published; many of the others may be found in his books.

Margon's books include *Construction of American Furniture Treasures* (1949), $4, reprinted by Dover Publications, Inc., 180 Varick St., New York, N.Y. 10014; *World Furniture Treasures* (1954), Reinhold Publishing Corp. (out of print); *Masterpieces of American Furniture* (1965), $15, *Masterpieces of European Furniture* (1967), $14, and *More American Furniture Treasures* (1975), $15, all distributed by Hastings House Publishers, Inc., 10 E. 40th St., New York, N.Y. 10016. □



Tapered Lamination

Slender curves have necessary bulk for joinery

by Jere Osgood

Thin layers of wood are easy to bend. Several thin layers, all with the grain running in the same direction, can be bent on a form and glued together. The resulting curved laminate is much stronger than a piece sawn from solid stock would be, and much less wasteful of material. It is also stronger than a steam-bent piece, because the glue adds to the strength of the wood. Lamination has the additional advantage of stretching rare or highly figured boards, since the best stock can be resawn and used to face all the legs of a chair or table.

I discussed the basics of simple bent lamination, the necessary forms and the gluing techniques in the Spring '77 issue of *Fine Woodworking* (pp. 35-38). This article will cover layers of wood that are not of uniform thickness—tapered laminations and double tapered laminations. These techniques permit you to make a curved piece whose width and thickness vary, whereas a simple bent lamination can vary only in width. If the design requires cutting through the thickness of a layer of wood at any point along a curve, the whole part is weakened. The severed layers no longer contribute to the strength of the assembly. The problem is avoided by tapering the layers of wood, so the variation in thickness is built right into the lamination. It is important to make each layer of wood as thick as possible although still thin enough to follow the desired curve. It is much better to resaw stock to optimum thickness than to use many layers of thin veneer.

I know that my methods are liable to appear fussy or confusing to people who are accustomed to bandsawing curves from heavy, solid stock, but they will appeal to assemblers and people who enjoy complicated joinery. I prefer to spend time on the planning and drawing, instead of on carving huge amounts of waste from unformed heavy stock. Once a curve has been laminated, it is hard to alter the outward shape. It is simple to revise the shape of a bandsawn part. Because accurate previsualization comes with experience, I don't find being locked in a disadvantage. When I teach, I mention many times the absolute necessity of making full-size shop drawings. Many part-time woodworkers don't do this, but it is the key to seeing the shape of the finished, three-dimensional object. And it is the only way to be sure from the start that the joinery is possible.

This method of working has also been criticized as less than true to the material. Obviously I don't agree, and I don't think the things I make are any less woodlike than more traditional construction. If anything, a simple chest with curved sides and a bow front (obtainable by the compound staved lamination system, the subject of a future article) is much more like a curving tree than is a chest with flat board sides, carved to represent folded linen. Although I make contemporary furniture, I should add that this method has nothing to do with style or design. Tapered laminates can make a traditionally curved leg, and compound staved laminates could be put to good use in producing a French bombe chest.

Tapered lamination Once you have made a shop drawing—for example of a table—and decided that a tapered lamination would make the strongest leg, you need to figure the measurements of the thickness-planer jig that will produce the necessary laminates. From the shop drawing, you need to know the thickness of the curved leg at both ends, and the length of the curve if it were straightened out.

To find the length, draw a center line on the curved part. Set a pair of dividers at an inch or less and walk the dividers down the center line. To decide the number and thickness of the layers of wood, look first at the small end of the leg. Suppose it is 1 in. thick—eight layers, each ⅛ in. thick, would be

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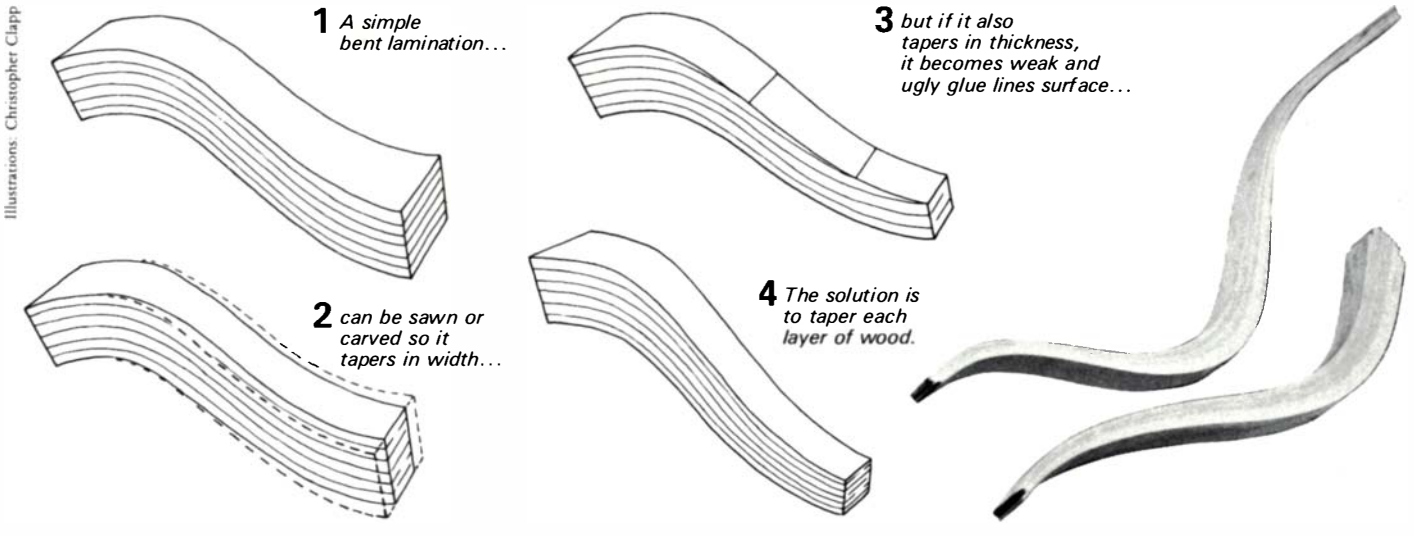
Jere Osgood teaches woodworking and furniture design at Boston University's Program in Artisanry.



Photos: Jere Osgood

Ash legs of table are single-tapered lamination. Table top is teak, and measures 57 in. diameter. Table is 29 in. high.

convenient. Now look at the thick end, perhaps 2½ in. thick, and divide by eight to get 5/16 in. Bear in mind here that the thin layers must turn the curve you have drawn, both at the thin end and at the thick end. There are no rules, but a little experience will give you a feel for the bending radii of different woods of various thicknesses.

The thickness-planer jig is a sloping platform that carries the stock through the machine. It should be a few inches longer than the finished length of the stock, and the laminates should be cut to the same oversize length. If each laminate is to taper from ⅛ in. at one end to 5/16 in. at the other, the slope of the jig has to express the difference, or 3/16 in.

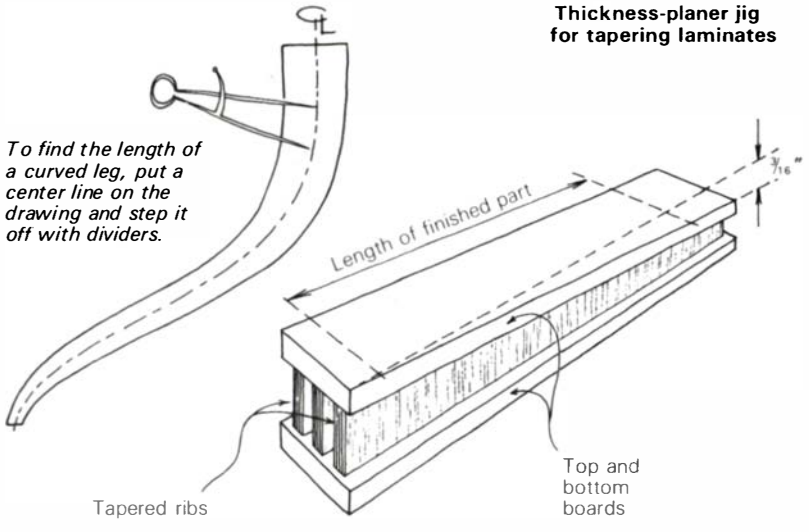
The most accurate way to make a thicknesser jig is with top and bottom boards of some sort of plywood and several central ribs of plywood or particle board running the length of the jig. Since the support ribs are all exactly the same, I would nail or tape them together and carefully cut them as a package on the band saw or with a table-saw taper jig. Spread the ribs out on the base and glue them down, then glue on the top board. It might seem easier merely to sandwich a 3/16-in. wedge between two boards, but it isn't. The boards would deflect under the pressure of the planer's feed rolls and create a hump on the finished leg. Remember, each little error in the thicknesser jig multiplies by the number of layers in the lamination. Saw the stock for the laminates thicker than the thick end of the taper, and plane it smooth on one side before tapering in the thicknesser. This ensures uniform pieces. Feed the thinner end of the jig into the machine first, and you'll find that it doesn't require a stop block—the feed pressure against the taper will easily hold the laminates in place.

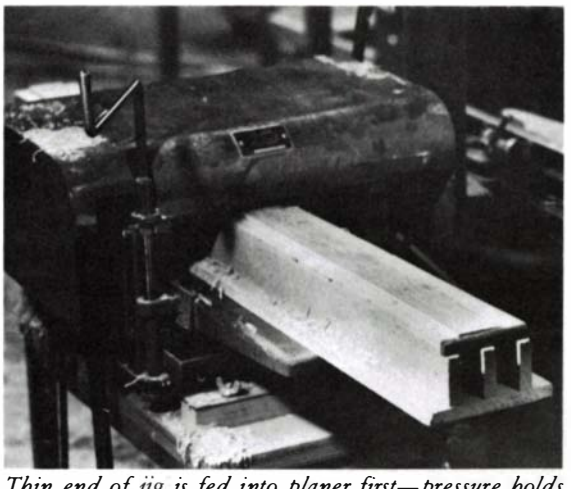
If you plan to use a one-part, open-face gluing form, the form line can probably be taken directly from your original shop drawing. Remember, though, to face the form with several layers of hardboard and to use more hardboard between the clamps and the laminates to even out the pressure. Account for the thickness of the hardboard in your layout. I'll return to forms later, after giving layout directions for a two-part form, which provides the most even pressure in gluing.

After the laminates are made, clamp them into a package that includes a piece of ¼-in. hardboard (or two ⅛-in. layers) on each side as a form liner. Trace the outline of the whole package onto a piece of drawing paper, or be more precise by measuring the thickness of the ends with calipers and transferring the size to the paper. Now draw in a center line and cross it with uniformly spaced perpendicular sections. I usually make them an inch apart and number them.

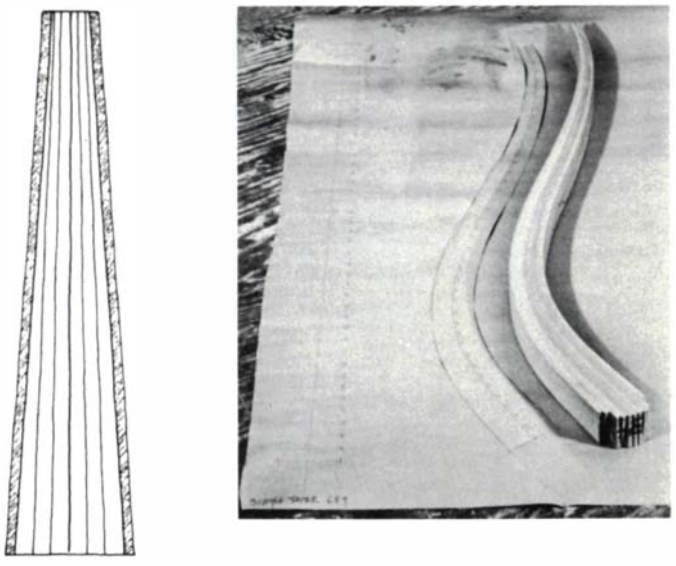
From the full-size shop drawing, transfer the center line of the curved part onto a heavy piece of drawing paper. If you

Thickness-planer jig for tapering laminates

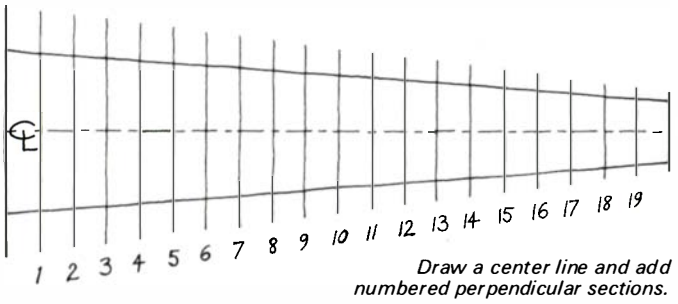




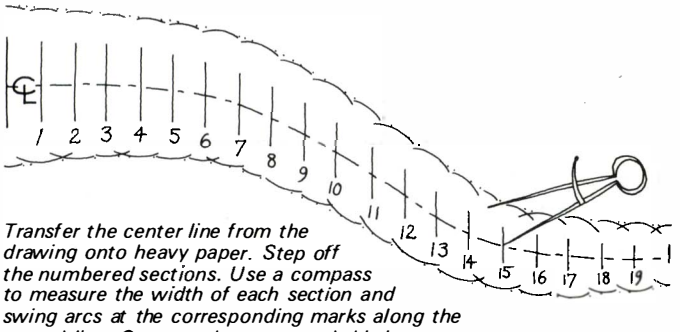
Thin end of jig is fed into planer first—pressure holds laminates in place, and no stop block is required.



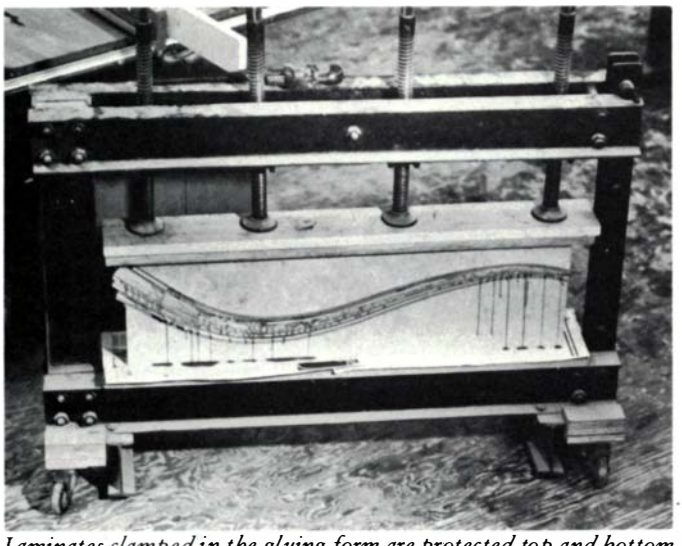
To lay out a two-part gluing form, clamp the hardboard facings and the tapered laminate into a package and trace its outline.



Draw a center line and add numbered perpendicular sections.



Transfer the center line from the drawing onto heavy paper. Step off the numbered sections. Use a compass to measure the width of each section and swing arcs at the corresponding marks along the curved line. Connect the crests and this is your pattern.



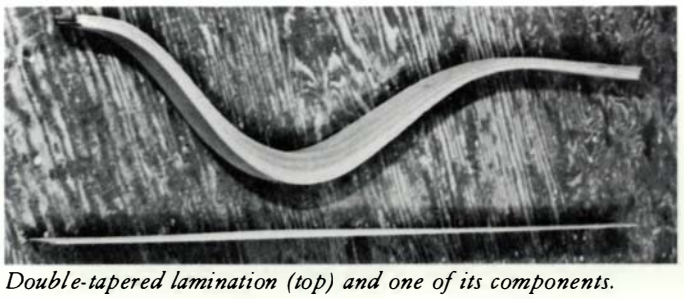
Laminates clamped in the gluing form are protected top and bottom by a hardboard liner.

anticipate a problem with springback, now is the time to consider it: Bend the center line a little farther at each end to compensate. Now on the center line walk off with dividers the same spacing you used for the perpendiculars on the flat package, and transfer the numbers too. With a compass, transfer the width at each numbered section, one section at a time, and swing arcs on both sides of the center line. The radius of each arc is the distance from the center line to the edge of the package of laminates, plus the layers of hardboard. When all the arcs are drawn, connect their crests with a flexible curve or a thin, springy piece of wood. This now is the pattern for the gluing form. For a narrow part such as a chair or table leg, I would bandsaw the form itself from a solid block glued up of several layers of chipboard or plywood. After gluing, check the finished leg against the shop drawing. If there is any difference, alter the drawing to conform, as this slight change might alter the measurements and the joinery of the piece of furniture you are making.

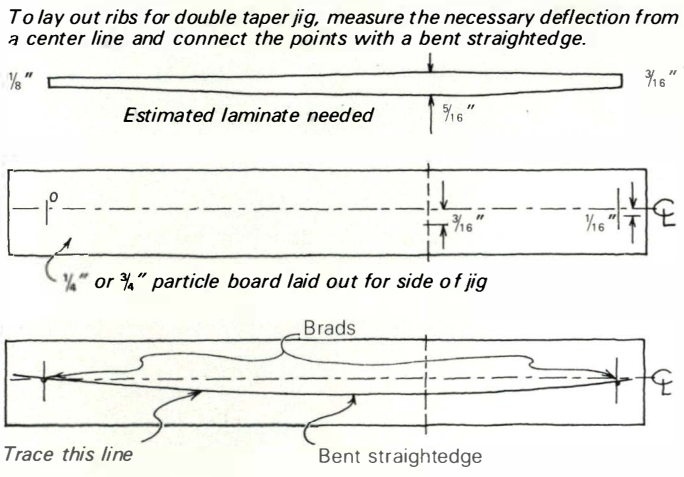
Double-tapered lamination A double-tapered lamination is often used for chair legs, where lightness is required along a delicate curve that might reflect the shapes of the human body. The curve still must be very strong, and the part must thicken at the joints. For example, the back leg of a chair might be of one thickness where it touches the floor, another at the seat rail, and a third thickness at the top. The laminates have to bend easily to the curve and must not have an odd thinness at one end. The initial calculations might yield laminates ⅛ in. thick at one end, ¼ in. at the middle, but only 1/32 in. at the other end. This would be too fragile to machine, and you would have to decrease the number of laminates. This would make them thicker, perhaps too thick to turn the radius—you must revise the design.

For the sake of the discussion, suppose you arrive at a laminate that is ⅛ in. thick at the top end, 5/16 in. at its thickest point and 3/16 in. at the bottom. Use dividers to take the overall length of the curved piece from the shop drawing, as before. This will also locate the thickest point along its length. Now you can make a thickness-planer jig as before, except its top surface will be curved. The machine's feed rolls force the stock against the curve and the resulting laminate will taper uniformly from thin to thick and back to thin. To do it, start with a piece of plywood or particle board that is 3 in. overlong and perhaps 3 in. wide. Draw a center line. Subtract the thickness of the laminate at the small end from the thickness limits. The ⅛ in. becomes zero, and the other two differences represent deflection from the center line along the length—in this example, 3/16 in. and 1/16 in. Mark these points along the center line. Put a brad into the particle board on the center line at one end, and another 1/16 in. down from the line at the other end. Set a good steel or wood straightedge on the brads, and push it down to the 3/16-in. mark at the thickest point. Draw a line carefully along the bent straightedge. Now bandsaw several rib supports along this line (in a package, as before) and glue them to a base board. Face the top of the form with a couple of layers of hardboard, glued together and glued to the ribs.

With the stock planed on one side and in place, feed the thin end into the planer, as before. Unlike a single taper, where planing downhill makes tearout unlikely, a double taper sometimes shreds. Therefore cut extra stock before you start to plane, and carefully check the grain direction of each



Double-tapered lamination (top) and one of its components.



piece. If the grain tears out on the first pass, try reversing it on the jig. It may seem like a good idea to make the jig and the stock wide enough for several legs to be sawn out of a wide laminate. This usually doesn't work—tearout becomes a more serious problem, and inaccuracies in side-to-side thickness creep in.

It is usually better to glue up a double taper on a one-part form, facing both sides with hardboard and using as many quick-set clamps as will fit along the curve. A two-part form would give more uniform pressure, but the complications of making and testing may not be worth the effort.

Notes on laminating Press forms can be made of particle board, plywood or any sturdy material that can be sawn evenly. Form stock is better if it has no strong grain for the band-saw blade to track off into—construction fir is unsuitable. Forms are difficult to sand or rasp clean without introducing error. It is better to use them straight from the saw.

When making forms, you can save material by spacing the parts. For example, three ½-in. layers of particle board could be spaced out to 3 in. with two ¾-in. spacers. But be sure you don't weaken the form so much that it might break in the clamps or the press.

Forms must be lined with a hardboard-type material (Masonite is one brand name), and the thickness of the liners must be accounted for in layout. You can use ¼-in. hardboard, or several layers ⅛ in. thick, tempered or untempered, depending on the tightness of the curve. Thin plywoods are not suitable because they have a grain direction (due to the uneven number of plies and the wood itself) that interferes with bending to a particular curve.

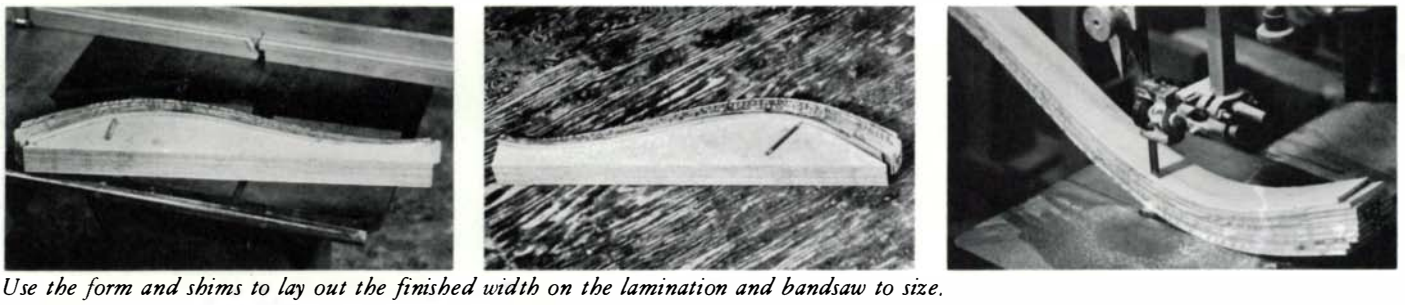
Double-tapered laminates are clamped to a one-piece form.

A two-part gluing form must be precisely cut or it is not worth the bother. If the curve is difficult or the taper becomes a complicating factor, use a one-part open-face form with several layers of hardboard to distribute the clamping pressure. Attempts to pad out forms with layers of rubber, felt or cork don't work, although small discrepancies can be repaired with two or three layers of brown paper or newspaper.

Forms and hardboard facings should be waxed. This gives easy slippage as the wood bends to the curve, and prevents dry glue from sticking. Use plastic-resin glue or Urac 185 (American Cyanamid Co.), or a two-part resorcinol formaldehyde, because these glues don't suffer cold creep. Yellow glue and white glue aren't suitable because they will allow the wood to creep under strain. Spread the glue uniformly with a paint roller or a good brush. Be sure the shop is warm enough for the glue to cure.

It is easier to align the layers of wood, and to dry-clamp the setup to be sure it will work, if the forms and the laminates are the same width. If the width of a finished part is to be 2 in., make the stock and the form about 2¾ in. wide. When the glue has set it is easy to cut a ¼-in. layer off both sides of the blank and joint or hand-plane the sawn faces. This avoids the necessity of scraping off squeezed-out glue and the risk of nicking a good plane iron on hardened dribble.

After some experience with these methods, it is tempting to introduce all sorts of perturbations and various odd lumps of wood to go around joints here and there. But I have found that it is better not to introduce many complex forms, and to prefer simpler design. □



Use the form and shims to lay out the finished width on the lamination and bandsaw to size.

Improving Planes

Simple modifications eliminate most common problems

by Robert Foncannon

A finely tuned and smooth-running plane is perhaps the most precise and satisfying tool the woodworker has. I know of no other hand tool that can, with a few easy strokes, remove a shaving only a few thousandths of an inch thick and leave a surface almost as smooth as glass. All the planes in my collection are inexpensive cast iron—they are readily available and are easy to adjust and use.

Unfortunately, most iron planes are not ready for use when purchased. The blades are never adequately sharpened and are rarely set properly into the plane body. The sole of the plane is often not true and usually bears coarse machining marks that impede smooth strokes. The metal adjustment mechanism is potentially very precise, but standard production tolerances allow far too much play. Fortunately, all these faults can be reduced or eliminated. The only power tool necessary for the work is a small bench grinder, with perhaps a cloth buffing wheel in place of one of the stones.

Proper shaping and sharpening of the blade are easy, quick and absolutely essential. Begin by whetting the back surface of the blade on a fine carborundum-type stone, which will cut rapidly without clogging. Hold the blade flat against the stone, bevel up, and whet until the back side is flat and all the machining marks are erased for at least ⅛ in. away from the edge. This step ensures a smooth cutting edge later on. Now, with a try square and a carbide scribe, lightly mark a line slightly to the rear of the cutting edge, on the side just whetted. This line is used during grinding and will ensure a square edge.

Probably more tools are ruined during grinding than at any other time. Following three simple rules will simplify the grinding process and ensure success: Set up the grinder guide system properly for the cut desired, use the correct grinding wheel and dress it properly, and remove metal very slowly to avoid overheating. A blade that has turned blue from overheating will not hold an edge. Grinding the blue away merely masks the damage already done.

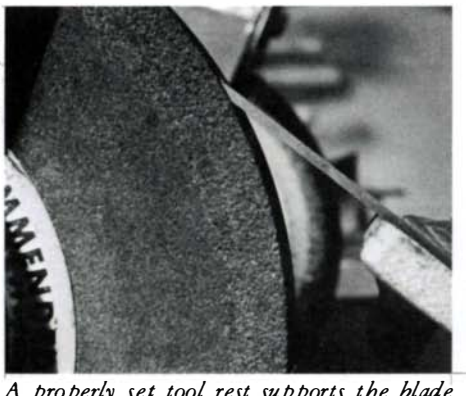
In this case, setting up the machine is simple. The tool rest should be positioned so the plane blade intersects the wheel at the desired bevel angle. This allows the blade to be fully supported by the tool rest and restricts each cut to exactly the same angle. I grind all my planes to a 25° angle, though others may vary this a degree or so. A 100-grit wheel is best. It will produce a smoother surface than a coarser wheel, thus requiring much less whetting. Before grinding, be sure to dress the wheel square across its entire surface with a silicon-carbide wheel dressing stick. This not only trues up the wheel to prevent blade bouncing, but also exposes a fresh cutting surface that is less prone to overheating.

Now lightly apply the blade to the wheel. Keep it flat against the rest and in continuous motion to avoid overgrinding and overheating any single area. Dipping the blade often in water helps prevent overheating, though it is not necessary if the grinding proceeds slowly enough. With a little practice and the help of the scribe mark, grinding a straight, square hollow-ground edge is easy. Whetting normally follows next, though I usually complete this step after the other modifications are finished in order to avoid accidently spoiling the edge during handling.

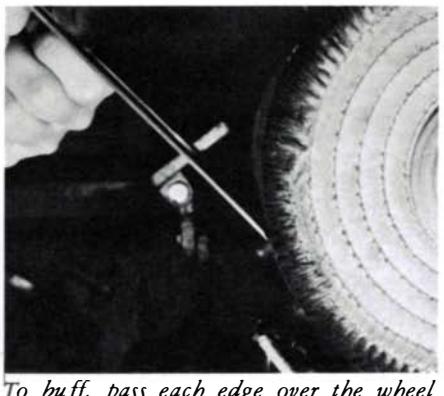
I use a fine-grit India stone for whetting. One side of the stone should be reserved for plane blades and jointer knives exclusively. When this side gets too cupped for proper sharpening, it may be resurfaced by the same method used for surfacing plane soles, described later. The blade should be sharpened on the beveled side, with both edges of the hollow grind touching the stone, until a very small wire edge is formed. Then alternately take a few strokes on each side until the wire falls off. I usually whet plane blades lengthwise down the stone, allowing both edges of the hollow grind to touch the stone, which helps reduce rounding. Whet with a light touch and observe closely, because with proper grinding little whetting is needed. At this point the blade will be roughly as sharp as when new, but not nearly sharp enough for a smooth cut on tough wood.

After whetting, I buff the edge on a stiff cloth wheel

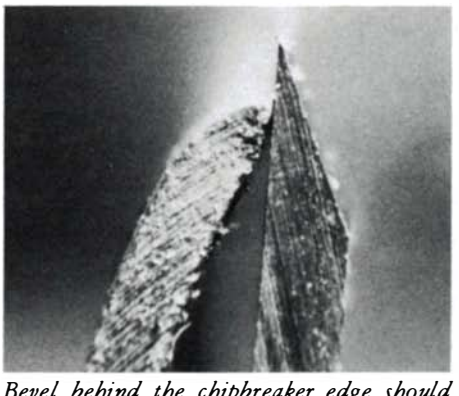
Photos: Nancy Satake



A properly set tool rest supports the blade and fixes its proper angle to the stone.



To buff, pass each edge over the wheel several times with moderate pressure.



Bevel behind the chipbreaker edge should just clear the blade.

mounted on my grinder. The debate over whether to buff or strop is not new. I prefer buffing because it is faster and easier, and the edge it produces will easily shave hair from the back of my hand. I also expect the buffed edge is more durable—less prone to micro-chipping because of its smooth shape. The smoothness also makes a buffed edge less prone to bending.

I load the buffing wheel lightly with tripoli compound and pass each side of the edge over the wheel several times with moderate pressure. The wheel smooths off microscopic ridges rearward of the cutting edge to reduce friction and quickly hones the blade with almost no effort.

Once the blade has been properly ground and whetted, regrinding should not be necessary for quite a long time. Whetting should be done only when buffing is not sufficient to bring the edge back to razor sharpness—generally the edge can be buffed ten to twenty times before it requires whetting, if the blade is not allowed to become too dull each time.

You should regrind when the edge becomes chipped, indicated by a ridge on the piece being planed and by a visible nick in the blade, or when the hollow-ground portion of the edge has been completely flattened by whetting. Regrinding at this point makes the edge easier to whet, because only the leading and trailing portions of the ground edge are in contact with the stone.

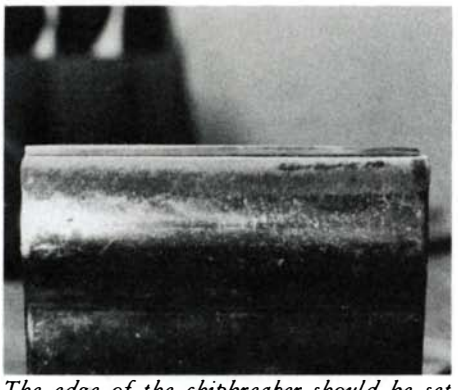
The chipbreaker should receive attention next. Its front edge should be exactly perpendicular to the side of the plane blade, and its nose should be sharp—not rounded as most production breakers are. The underside of the breaker edge should be filed or stoned to a slight negative bevel, so when it is assembled to the blade the rear of the bevel clears the blade by about 1/64 in. The breaker edge should be set back from the blade edge about 1/16 in. (less for fine cutting and more for coarse). Proper shape and adjustment of the chipbreaker will help the plane clear itself of debris; improper shape and adjustment will cause problems by promoting clogging of the throat. In some severe cases the top of the breaker edge may need to be filed and polished to make a smooth path for the escaping shaving.

Next, dress the front and rear of the blade opening in the sole so both are parallel and perpendicular to the edge of the plane. This is done by scribing a line on the plane sole perpendicular to the side of the plane and parallel with the opening, and then filing to the scribed line. Use a fine file, remove the metal very slowly, and file away only as much metal as is necessary to square up the opening. Removing more may result in too wide a throat and cause the blade to gouge. A square opening eases adjustment and simplifies the next step—squaring up the blade support surface.

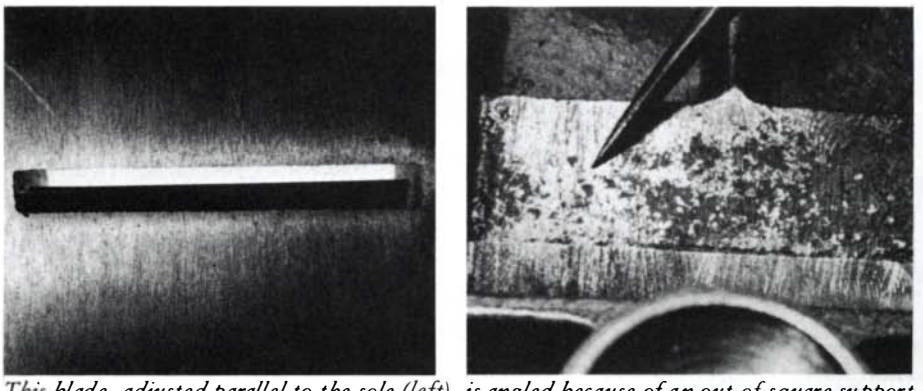
Many inexpensive planes have blade supports that are not square. This forces the woodworker to set the blade to a compensating angle to get an even cut. Squaring up this surface allows the blade to be set in straight. To make this adjustment, assemble the plane in the normal manner. Use the adjustments and sight along the sole of the plane so that the blade protrudes slightly and is parallel to the plane sole. Now check to see if the blade is parallel with the back of the blade opening and perpendicular with the side of the body. If not, carefully file the support surface under the side of the blade that is farthest forward to produce the proper fit. If the plane has an adjustable frog, see if it can be adjusted to align the blade. The metal on the base of an adjustable frog, or its mating surface on the plane body, may be too rough to permit precise adjustment. File away the roughness on the mating surfaces. The frog should be loosely installed several times during the smoothing process to ensure that the sliding surfaces remain parallel.

After the blade, the blade opening and the blade support have been squared, the width of the blade opening (the throat) should be adjusted, if possible. With the blade in the working position, throat width should be less than 1/16 in. for a block or smoothing plane, and up to 3/16 in. for a jack plane. A narrow opening reduces chatter, especially on end grain, and gouging, but it also diminishes the allowable depth of cut and increases clogging. A block-plane throat can often be adjusted by sliding the front sole plate. On larger planes, the frog is usually movable. When moving the frog, make sure the blade remains parallel to the blade opening. This is important, and should be checked while using the plane. The opening should be as narrow as possible without clogging.

You must be able to set the plane blade to the desired depth of cut. Most new planes have a frustrating amount of play in the mechanism, often a full turn of the knob, despite the theoretical advantages of mechanical coupling over the tedious adjustment of traditional wooden planes. There are three basic types of adjusting mechanisms, and fortunately all of them can be improved with a few simple modifications. The secret is to locate the exact source of the sloppiness. For instance, in the horizontal-screw block plane, play occurs because the fingers engaging the screw are narrower in width than the slot in which they ride. Disassemble the plane and slightly twist the fingers so one is forward of the other. When reassembled, one finger will press on the rear of the slot and one on the front, eliminating the play. The vertical-screw



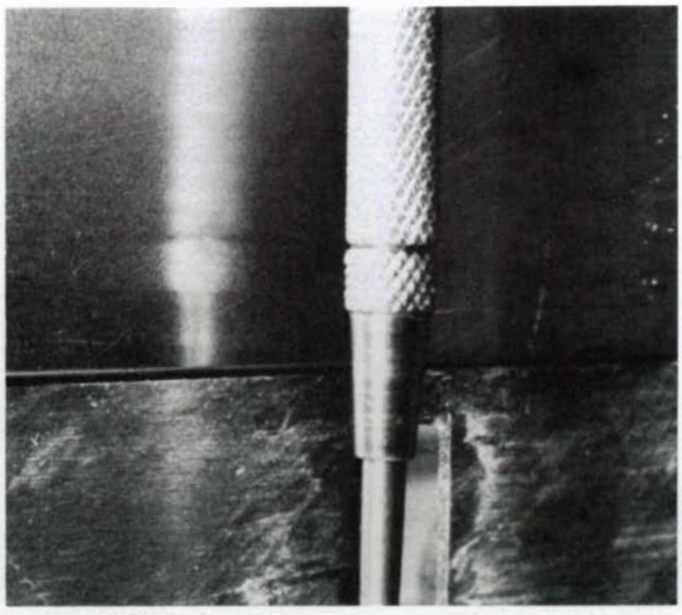
The edge of the chipbreaker should be set back from the blade edge about 1/16 in.



This blade, adjusted parallel to the sole (left), is angled because of an out-of-square support surface. To remedy, remove metal from the high side of the support surface (right).

It's usually necessary to modify the adjustment mechanism to eliminate slop. Offsetting the fingers on the horizontal-screw block plane (left), bending the top finger downward to the nut on the vertical-screw block plane (center), and bending a finger rearward on large horizontal-screw planes (right) help eliminate play. The mechanisms of larger planes are similar to the ones shown here.

To true a plane sole, tape sandpaper to a flat surface and don't rock the plane from side to side. A little water prevents clogging.



The effect of careful polishing on the sole (top) is obvious. Use either crocus cloth or a buffing wheel.

block plane similarly has too large a gap between the fingers of its adjusting lever and the thumb nut. Pinching the fingers together with the thumb nut removed will eliminate most of this play. The horizontal-screw adjusting mechanism commonly found on larger planes has two shortcomings. First, the arms are again too narrow for the width of the slot in the thumb nut, and second, the top ends are too narrow for the opening provided in the chipbreaker. The solution again is simple—just bend one arm forward in relation to the second arm at the top. This bend will tighten up both areas at the same time. No longer will it require two revolutions of the screw to reverse the direction of blade movement.

The final step in plane optimization is the treatment of the plane sole. Most iron planes are finished on a belt sander. They have sharp corners that can mar work, a rough sole that is hard to slide along wood, and the sole may even be convex at the mouth, or dubbed off at the front and back. These problems are easy to solve.

First, smoothly round the corners of the leading and trailing edges of the sole with a fine file. Some woodworkers prefer to square off the rear of the sole (normally slightly rounded) before rounding the edges. The side edges should also be rounded, but to a lesser degree. The sole of the plane should then be ground flat and polished.

The best way to true the sole is to tape a sheet of 240-grit silicon-carbide paper to a flat surface (table saw or jointer table) and slide the plane in a circular motion over the paper. Be certain the plane does not rock from side to side. Turning the plane end-for-end and lapping in the opposite direction prevents a too-regular pattern and helps produce consistent results. When truing large planes, it may be necessary to tape several sheets together to get enough surface. Use a small amount of water to lubricate the process and keep the paper from clogging. This operation will quickly show up high spots, usually around the edges, and should be continued until all high spots are leveled and there is an even pattern across the entire sole. Next, use wet 400-grit paper and stroke the plane linearly to remove scratches left by the coarser paper. Using 600-grit paper as a third step reduces polishing time later on. A cloth-backed abrasive, such as commercial aluminum oxide, can be used dry in place of the 240-grit silicon-carbide paper. It is more expensive per sheet, but it is more durable and will hold up to the pressure of lapping.

After truing, the sole should be polished. Crocus cloth can be used in a circular motion to polish the sole to a mirror finish, but this is time-consuming. It is faster to polish the sole on a buffing wheel loaded with black emery compound followed by tripoli and rouge. This will quickly bring the sole to a mirror finish. A coat of paste wax will finish the process and leave the sole smooth and slick. □

Robert Foncannon, 29, of East Lansing, Mich., is an electrical engineer who spends his spare time rebuilding used woodworking equipment.

Restoring Bailey Planes

Wood-metal hybrids are worth the trouble

by George C. Gibbs

Photos: Barrie Swenson

Restored smooth plane has metal mechanism, wooden body.

In the late 1860s, Leonard Bailey began manufacturing wooden-soled planes with iron adjusting mechanisms. Stanley acquired the pattern, and these planes were sold in huge quantities until 1943. Cabinetmakers often preferred the resilience of wood to the harder iron soles of the newer planes, as I do. Many of these planes have survived, and I've found that they offer an excellent alternative to the rather tedious adjustment of all-wood planes and the impossible price of European wooden planes with metal screw mechanisms. Bailey planes frequently turn up in antique shops and at auctions and flea markets, although those in good, usable condition command high prices from collectors. But a great many more are in mediocre to deplorable condition and therefore quite reasonably priced. Since most of their problems lie in the beechwood block and not in the metal mechanism, they are quite easily made well again.

Before you buy the remains of a plane, examine its cast-iron body. If there are any cracks, reject it—they could be brazed, but the body is liable to warp. Next, make sure the plane is complete. The iron can be replaced if it is missing or rust-pitted, but the cap iron and lever cap must be intact. It helps if the knob and handle are in usable condition, but you can make replacements or salvage them from a plane that can't be repaired.

After you buy a suitable plane, begin with its wooden block. Some blocks require only a pass or two over the jointer to true up the face, although this has the undesirable side effect of opening the throat. Most will need more extensive surgery, either a new sole or complete replacement. Of the several ills that can befall a beechwood block, the most common is checking. Even small checks can render the cheeks of the block out of square, but all you need to do is joint the cheeks to square them up. Otherwise checking is no problem.

The screw holes in the block for attaching and aligning the frog mechanism are liable to be stripped. If the block is otherwise sound, you can drill them out, plug them and reset the screws. Or you can install a threaded metal insert in the block and replace the old wood screws with machine screws. The accuracy and dependability of the plane rest largely on the ability of these screws to hold the frog tightly in place.

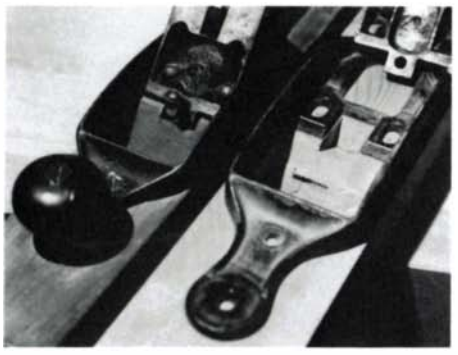
The least visible ailment is a warped or twisted block. Check it by placing the plane sole down on a truly flat surface, such as a saw table. If much twist is evident, it will be easiest to replace the entire block, since correcting twist will require flattening both the top and bottom surfaces.

Minor dings, dents and gouges in the cheeks and top of the block, while unsightly, don't affect the usability of the plane. But if an otherwise good block needs more than 1/16 in. removed to true up the face, a new sole is the best remedy. Take off all the metal parts and soak them in kerosene or mineral spirits to dissolve accumulated grime. Next, measure the block's thickness. This is critical because the repaired block must match the adjustment range available in the mechanism. Then joint or plane at least 1/4 in. of wood from the whole bottom of the block.

Any close-grained hardwood will serve for the new sole. Beech is best, but hard maple, cherry, birch, lignum vitae or rosewood will do very well. Prepare the stock about 1/16 in. thicker and wider than its finished size, but cut it exactly to length. The grain should run out toward the back of the plane, so it will polish itself in use. Glue the new sole to the bottom of the block with white or yellow glue and several clamps.

After the glue has cured, joint the new sole to the original thickness, being careful to maintain a true surface parallel to the top of the block. Then plane the sides of the half-sole flush with the original block, taking off a little extra if necessary to maintain squareness.

The next step is the most critical: cutting the mortise. The bevel and alignment at the rear of the mortise must be maintained, but this is easily done by guiding the flat side of a chisel against the remaining original bevel. To avoid splintering the new bottom when piercing, extend an accurate line from the rear of the mortise down one cheek at 45° to locate



Old plane (left) and old mechanism with a new block. Note the relief for the metal boss at base of frog.

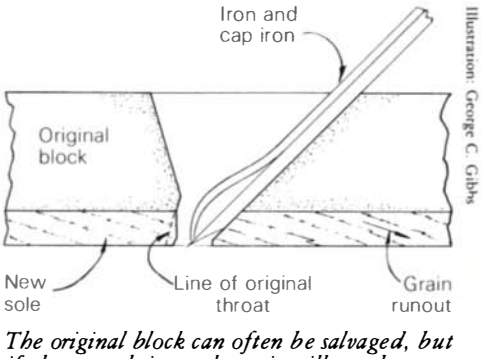
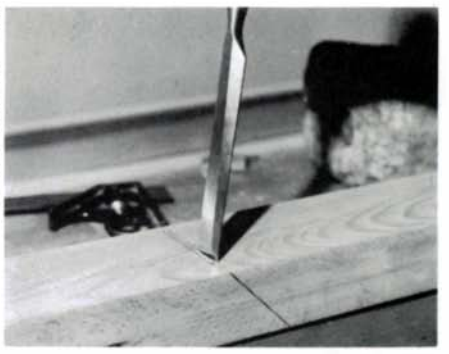
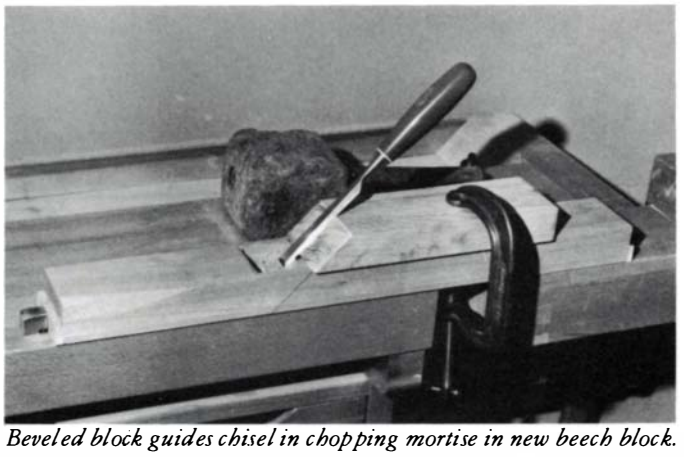


Illustration: George C. Gibbs

The original block can often be salvaged, but if the mouth is too large it will need a new sole. Orient the grain so it runs off the back, and keep the throat narrow.



To avoid splintering, transfer the mortise bevel to the sole, locate the mouth and chisel a narrow channel.



Beveled block guides chisel in chopping mortise in new beech block.

the rear edge of the opening on the sole. Then cut a ⅛-in. slot the width of the iron and about ⅛ in. deep into the bottom, just in front of the scribed line. Now continue to cut the mortise from the top, into the slot in the bottom. Keep the cut as narrow from front to back as possible; it will gradually be opened up later to fit the iron.

Finish cleaning the metal parts and reassemble the plane, carefully aligning the frog with the bevel at the rear of the mortise. Make sure the frog is tight. Try the iron with cap attached, and open up the throat of the mortise until it is barely large enough to allow the shavings to clear. Do not try to follow the original bevel at the front of the mortise, as the throats of most old planes are too large for fine cabinetwork.

Polish the cheeks and the bottom with very fine sandpaper and a flat sanding block, and lightly chamfer all the sharp edges. My favorite finish is a coat or two of tung-based penetrating sealer, followed by several coats of hard paste wax. Avoid building finishes such as shellac or varnish.

The amount of spit-and-polish applied to the metal parts is up to you, but for good results at least clean and lubricate with light oil all the moving parts and threads, and carefully grind and hone the iron.

Making a new block is somewhat more involved, although the procedure is similar. Beechwood is traditional, and it may be laminated if thick stock is not available. Avoid glue lines and edge grain on the bottom of the sole. The new block should be the same length and width as the original, but its length may be varied—it is perfectly possible to turn a jack plane into a jointer and vice versa, although a smoother is generally too small to convert. It will be necessary to clamp a guide block to the new block before cutting the mortise. Use 8/4 hardwood the width of the plane and long enough to keep the clamp out of the way, with an accurate 45° bevel on the business end. Use the remains of the original block to position it from front to back. Index the flat side of the chisel against the guide angle. If your chisels are too short to reach the bottom past the guide, go as far as you can to establish the bevel and then remove the guide. Again, be careful not to make the throat too large.

Before mounting the frog, chisel out a relief mortise for the boss at its front, and possibly a relief for the thumb screw as well. Use the original block for an indication, and from here proceed as described for a new sole. □

George C. Gibbs, 43, makes period furniture and once did it for a living. He is now drafting-room supervisor for a Denver firm that manufactures retail-store showcases and fixtures.

Box-Joint Jig

Router template indexes cuts

by Patrick Warner

The box joint is being used less and less today and it's no wonder, considering the setup complications, the danger of holding workpieces vertically on table saws, the indexing hangups and the assembly problems. After studying most of the classical box-joint cutting methods and tools, I decided to design and build a template jig that could be used with a router. (For the table-saw method of making this joint, see *Fine Woodworking,* Winter '76, page 34.)

I've made dozens of boxes and drawers and have found that most don't measure more than 12 in. high and 36 in. on a side. Most stock used for small boxes is ⅜ in. to ¾ in. thick. I made my jig to accommodate these dimensions with no changes in setup.

In designing the jig, I aimed for simplicity of operation, safety, rapid setup and indexing, accuracy, precision, repeatability, and latitude in box sizes. I built it into a table that's split to allow the stock to be held vertically—the jig is on one side of the split, the press screws are on the other (see photo below). The table is both portable and stable, and has a utility drawer, my first box made with the jig.

The template, the heart of the jig, is made out of laminated phenolic—it's smooth, slippery and strong. The stock should be no more than ¼ in. thick, to use up as little of the vertical travel of the router as possible. I had mine milled at a local machine shop, although I first squared up the stock on a

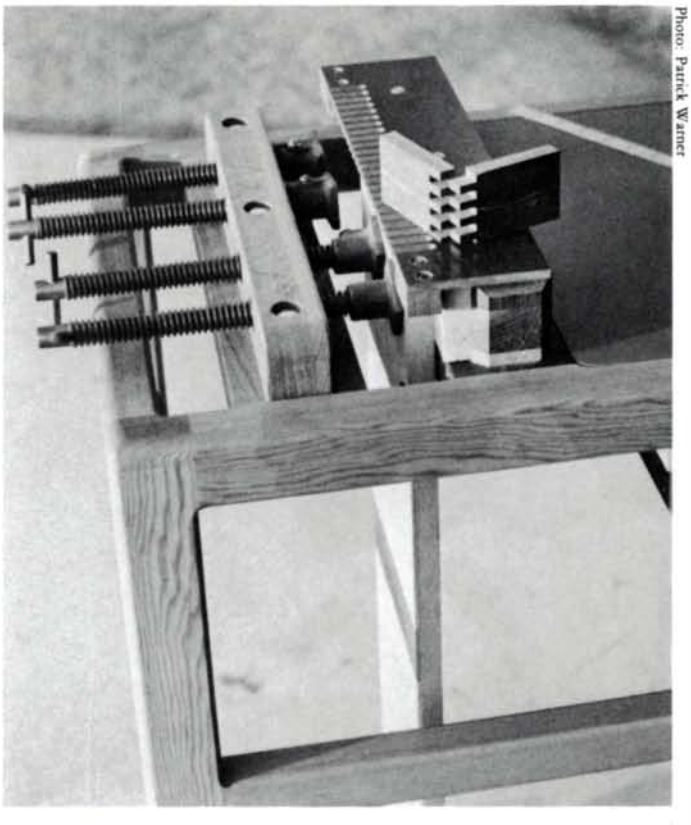


Photo: Patrick Warner

jointer and carbide saw. The slots, 1⅛ in. deep, were milled with a 5/16-in. end mill, leaving pins 3/16 in. wide on ½-in. centers. A milling machine will easily hold ± .001, and I suspect ± .0025 is tolerable. Job shop time should not exceed 30 minutes, if the stock is presquared.

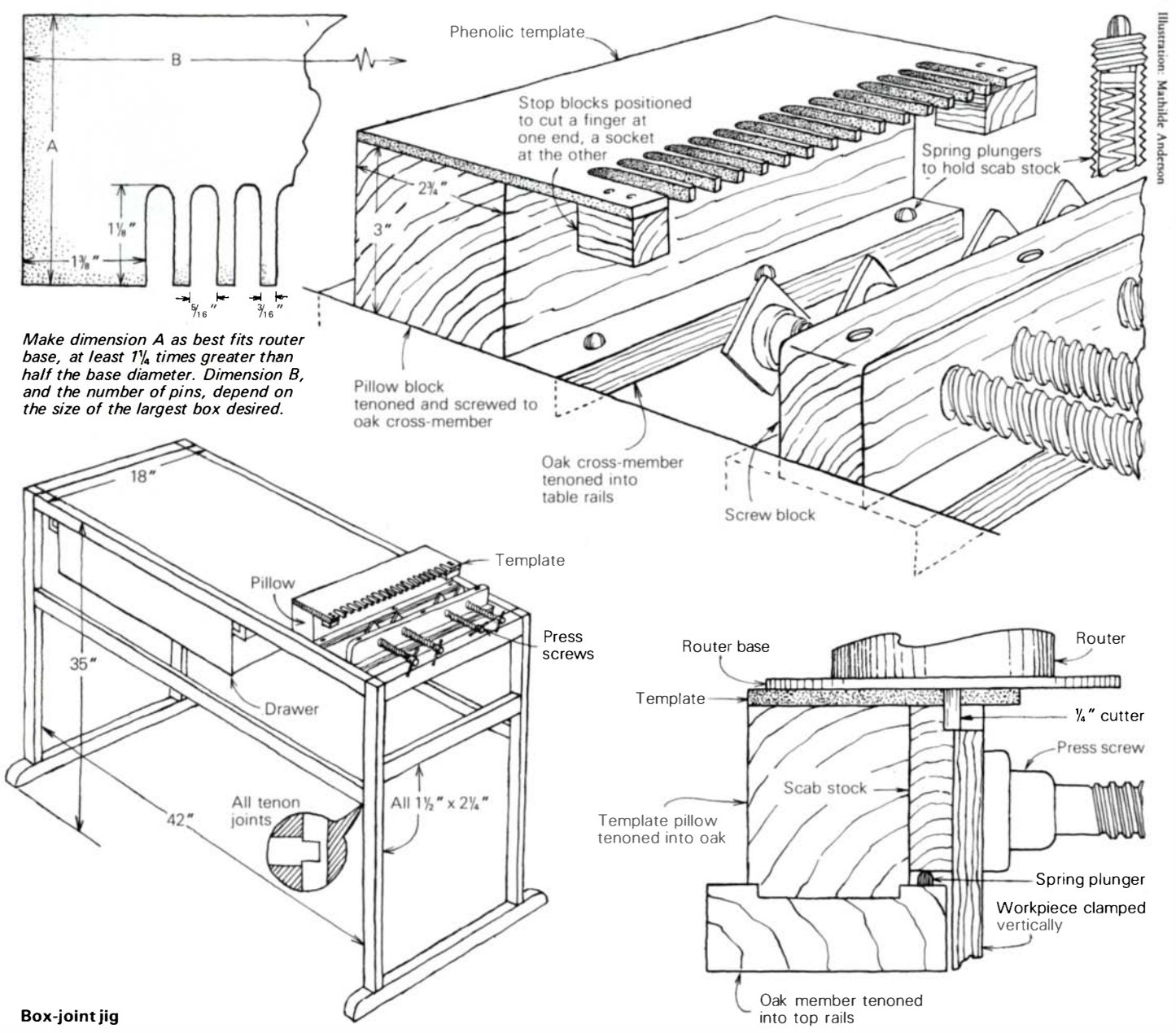
The template overhangs a pillow block, which is tenoned to an oak cross-member. Stops on either end of the template index the workpiece. When indexed on one end the yield is a pin; the other end yields a socket. The workpiece is clamped vertically against a piece of scab stock, and each side of the box is cut separately. The router with its 5/16-in. outside-diameter template guide and ¼-in. bit traverses the tines of the template, as in dovetail-cutting jigs.

The scab stock backup board is especially important because without it the router bit will tear out the back side of the panel. One scab board will usually accommodate the four corners of one box because it can be used turned upside-down and backwards. The scab board is located to guarantee the entry of at least half of the diameter of the bit, and is held snug against the template with standard spring plungers (available for about $2 each from Vlier Engineering Corp., 2333 Valley St., Burbank, Calif. 91505).

If the template has been cut well but the first joint doesn't fit, the outside diameter of the template guide can be turned down. As a final measure, the router bit can be ground to correct the error in the fit. The router bit should be a ¼-in. carbide two-fluted straight-faced bit that needs sharpening, so if it doesn't fit you pay for sharpening only once.

To make the table frame for the jig, I used clear kiln-dried fir: 2x8s yield three pieces about 2¼ in. wide. I mortised and tenoned all frame members, which measure 1½ in. by 2¼ in. in cross section. I mounted the working parts of the jig on an oak member for stiffness and dimensional stability, then tenoned the member into the table rails. The four press screws that hold the work against the stock have custom-made handles so I could locate the nuts on 2½-in. centers without the handles interfering. Wetzler Clamp Co., 43-13 11th St., Long Island City, N.Y. 11101 made mine for $7.50 each. □

Patrick Warner, 35, of Escondido, Calif., has been working in wood part-time for four years and hopes to be making furniture full-time within the next two.



Box-joint jig

Five Chairs: One View

A critique of design, craftsmanship and comfort

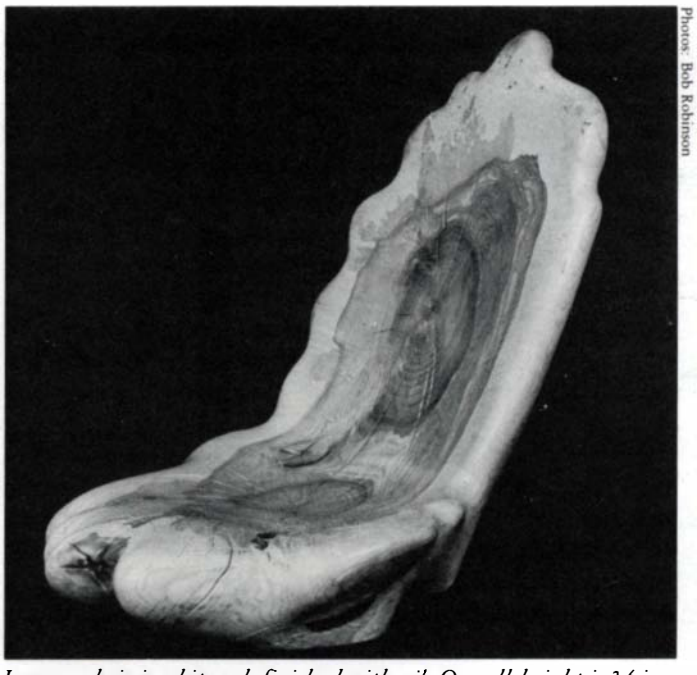
by Robert DeFuccio

The designer and maker of wood chairs is confronted with several major problems that must all be solved equally well for the piece to be wholly successful. The design must be esthetically pleasing, well executed and fit the average adult body as well as possible. The chair must also function in the area for which it was designed. One also hopes it will be durable, safe to sit in and fresh in appearance. All this is not easy to achieve. The history of wood chairs from ancient Egyptian, Greek and Roman times shows that chairmaking has changed little and that solutions to problems are limited. The weight, strength and density of a piece of ebony cut today are the same as they were in ancient Egypt. Basic construction details of chairs found in Tutankhamen's tomb, such as the pinned mortise and tenon, are exactly the same as mortise and tenon joints used today. Because the physical limitations of wood have led to such a refinement of form over the past 3,200 years of chairmaking, today's designer-craftsmen are confronted with the added challenge of being original in competition with a vast and rich global design heritage.

The design of chairs hinges on certain anthropometric data available from libraries and publishers of design books. Also useful are charts and diagrams illustrating the ideal average dimensions necessary to achieve seating comfort. Important considerations for the design of a conventional side chair or armchair are: seat height, 17 in. to 18 in.; seat pitch, 3° to 5°; arm height, 7 in. to 9 in. above seat; back pitch, 9° to 11°; minimum distance between arms, 18 in. It is possible that these dimensions may change for different types of chairs. They are also based on averages, but are nevertheless a reliable guide.

In critiquing the chairs shown in the photographs on the following pages, I measured each chair and made comparisons to what is considered average for men between 17 and 45—69½ in. tall, 163½ lb. These measurements are given in *The Measure of Man: Human Factors in Design*, by Henry Dreyfuss (available from Watson Guptill Publications, 2160 Patterson St., Cincinnati, Ohio 45214, $18.95). I also sat in each chair for my own reaction. (I am a bit slighter than average). All five chairs command healthy sums of money and all five pieces exhibit fine and exacting craftsmanship, yet the design and comfort of all the chairs is not, in my opinion, up to the existing level of craftsmanship.

Robert DeFuccio, of Spinnerstown, Pa., is an industrial design consultant for the Gunlocke Co., Wayland, N.Y., and Thonet Industries, York, Pa. He's designed chairs now in production at Knoll International and Stow/Davis Furniture Co. DeFuccio is also a craftsman—he makes his own prototypes of chairs for production—and is teaching woodworking and furniture design at Philadelphia College of Art. The chairs discussed here were shown together at the Richard Kagan Studio, 326 South St., Philadelphia.



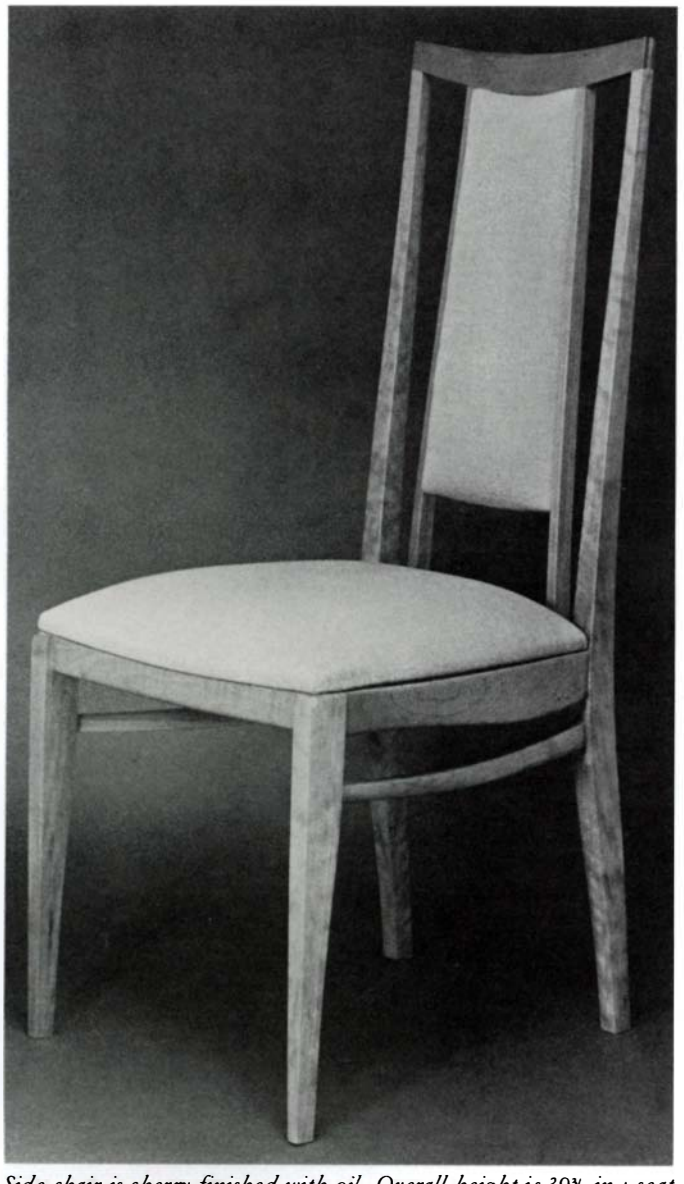
Photos: Bob Robinson

Lounge chair is white ash finished with oil. Overall height is 34 in.; overall width is 25 in.; seat height is 8 in. Price is $1,200.

Is this carved lounge chair by Jon Brooks, New Boston, N.H., a piece of sculpture or a functional low chair? Decide for yourself. This weighty and voluminous trunk of white ash has been carefully carved and shaped to yield an unusual lounge chair. Its continuous form, when related to conventional chair design, suggests a bucket or shell without upholstery. It probably possesses an optimum seating position, though I was unable to find it. All the ones I tried, whether off to one side, or with a leg tucked under me, or sitting with my legs straight out in front of me, were less than comfortable. I found myself slipping out of the chair because of the absence of pitch to the seat; a greater seating angle and more scooping of the seat would help prevent this. This chair will probably work for a select few only—those who would be pleased to own an object whose derivation is so evidently a tree trunk, complete with its beautiful grain, natural character and drying checks, and those whose physical stature is probably not unlike that of its creator, since I assume the chair fits Jon Brooks better than it does me.

A seat height of only 8 in. destines the chair to be owned by people under the age of 30. It is difficult to get into and even more difficult to get out of. Its lack of padding will also limit its appeal, because the wood is unyielding to the body and its form will not easily permit the use of pillows.

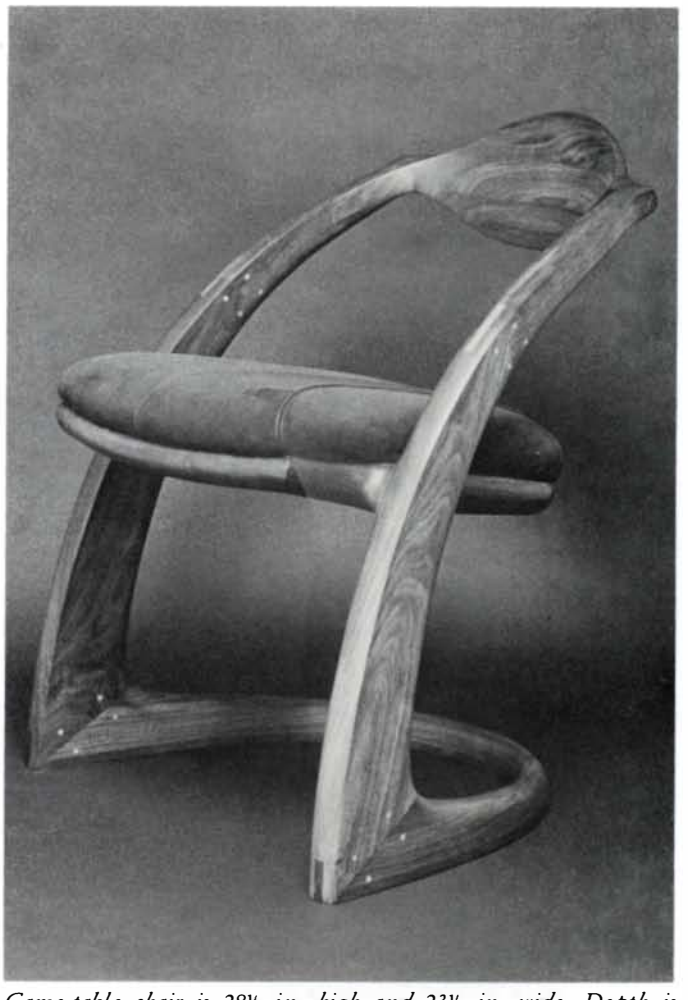
Working within the confines of the given log had to be somewhat limiting, yet Jon Brooks has created an interesting form and executed it with care and expertise.



Side chair is cherry finished with oil. Overall height is 39¾ in.; seat height is 19⅛ in.; seat depth is 16¼ in; seat pitch is 2½°; back pitch is 5½°. Price is $2,500 for a set of six, excluding upholstery fabric.

The side dining chair made by Jere Osgood, Somerville, Mass., is pleasing to look at and slightly reminiscent of the Scottish architect Charles Rennie Mackintosh's high-back chair designs of the early 1900s. It is delicately scaled and nicely proportioned, although the seat is slightly short and not pitched enough. The heavily padded back upholstery, which places the person too far forward on the seat, shortens it even more. The crown of the seat seems too high and the at-rest dimension of 19⅛ in. from the floor is actually higher than necessary. The suspension for the seat is a Pirelli-type rubber webbing. I don't think a webbed seat is really necessary to provide the comfort expected from this type of chair.

Structurally this chair is sound, though I would recommend more lateral support for the front legs by increasing the depth of the front rail where it joins the front legs.

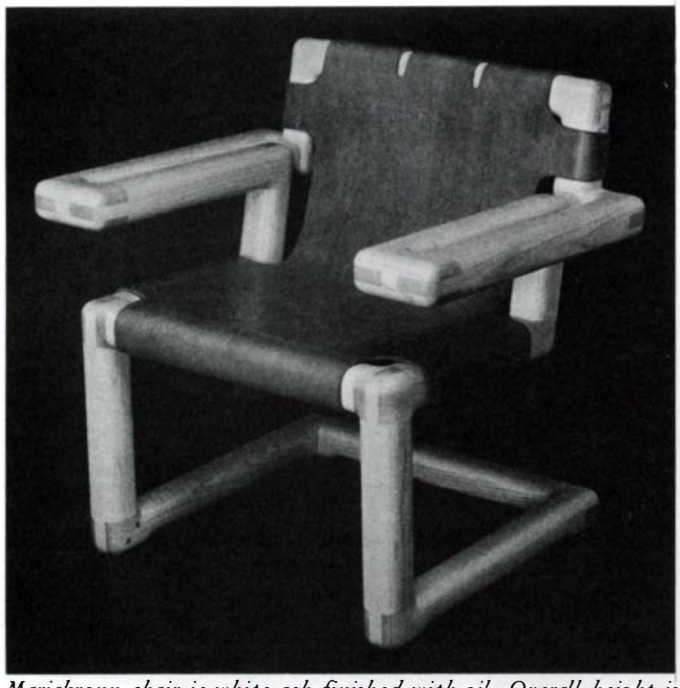


Game-table chair is 28½ in. high and 23¼ in. wide. Depth is 21¾ in.; seat height is 19 in.; seat depth is 19½ in.; seat pitch is 11°; back pitch is 14°. The finish is oil. Price is $500, excluding upholstery fabric.

This game-table chair by Wendell Castle, Scottsville, N.Y., is neither an armless chair nor an armchair. The extensions of the legs that join the back don't function as arms, yet they prevent the usual freedom of sitting positions offered by any armless chair. Sitting sideways or even off center in this chair is difficult or altogether impossible. The dimension between the arms at seat height is 17¾ in.—confining for a normal-sized person. The quick tapering of the seat from front to back accentuates this narrowness.

The back rail of Castle's chair, a beautifully executed curve, is carved to fit the small of the back and is very comfortable. It is the nicest element of the chair, though it is slightly overpowered by the large seat, which is upholstered in suede, a material that collects dust, lint and dirt. After considerable use, the area experiencing the most wear will lose its nap and contrast sharply with the unworn areas. The seam lines in the seat seem unnecessary, as they are not technically essential to the upholstery, and the seat appears puffy, its relationship to the frame awkward.

Construction details include a curved laminated veneer arc at floor level connecting the legs. The legs are splined to the curved floor rail and pinned with maple dowels. The seat frame is tongue-and-grooved and tenoned into the legs. The back is stacked and tongue-and-grooved into the legs.

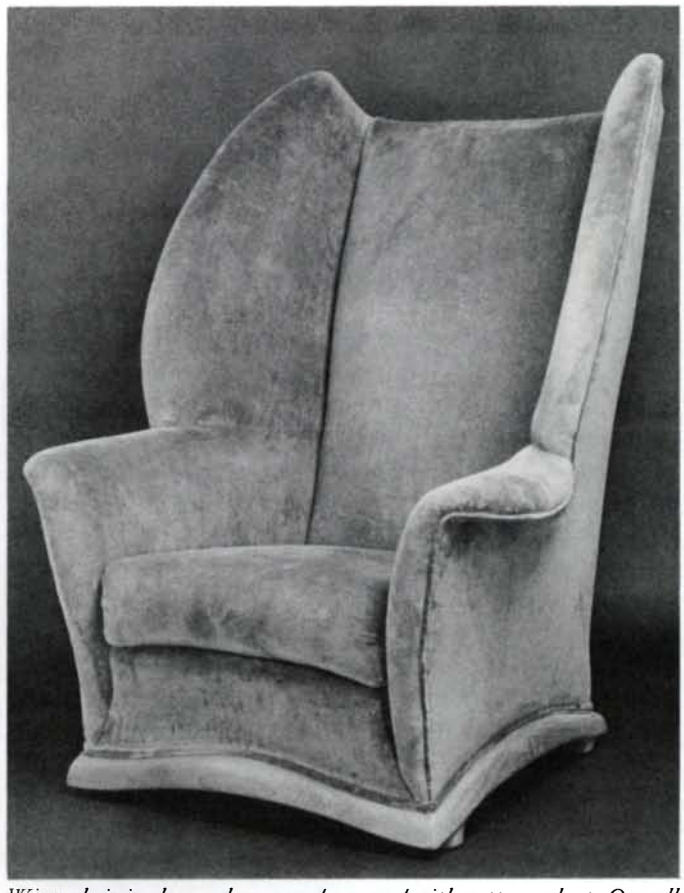


Mariabronn chair is white ash finished with oil. Overall height is 28 in.; overall width is 29 in.; depth is 23¼ in.; arm height is 22¾ in.; arm width is 5½ in.; arm height above seat is 7 in.; distance between arms is 17¾ in.; seat height is 16 in.; seat pitch is 6½°; back pitch is 11½°; actual seat depth is 14½ to 15 in. Price is $850.

It is ironic that Richard Kagan, Philadelphia, Pa., selected beautiful curly white ash for his Mariabronn chair. This form relies upon a certain bulk from its wood members to achieve the necessary strength to support the seat and arm cantilevers. The visual result is a chair that appears heavy. His design might be more suited to steel tube, which would produce a flexible, stronger and lighter frame.

Kagan has filled the upper part of his chair frame with a continuous 10-oz. cowhide sling to provide a seat and back platform. I like the way Kagan has cut away the sling, providing straps to wrap around the supporting wood members. The negative spaces created work well with the rest of the chair, but the ¼-in. thick sling tends to push the occupant out of the chair because of a lack of space for the posterior—a common problem with most sling chairs. The leather will stretch after a period of frequent use, making the entire sling sag. As a result of the leather stretching, the seat and back rails will telegraph through to the finished top surface. Because the leather arrives from the tannery with only one surface finished, the craftsman must then finish the back surface and all exposed edges to a degree that is compatible with the level of craftsmanship exhibited on the rest of the chair. This is not easy to accomplish, but Kagan has done a reasonable job in trying to deal with this problem.

A unique feature of the design is the double-member arm. The space between the members is visually appealing, but I found my own arm movement limited when I sat in the chair. I also feel the chair would be more comfortable if the curve of the back rail were more pronounced. All of the joinery, which is superbly executed, is of the single joint or open mortise-and-tenon variety. Kagan has taken into account the unevenness of most floors, and has relieved the underside of the leg members so the chair rests only on four points. He has created a chair that strives to be minimal, but is not because of the nature of the wood. His chair makes demands for cross-sectional size and bulk that do not help the overall design.



Wing chair is cherry show wood covered with cotton velvet. Overall height is 43½ in.; overall width is 34 in.; seat height is 15⅝ in.; arm height is 21 in. Price is $1,500.

The idea of a contemporary wing-chair design is a good one, and Alphonse Mattia, Belmont, Mass., has made a fine attempt at a workable solution to the problem. There are, however, some difficulties. The first impression is that it should be very comfortable. It is not. The vertical wings, too deep where they meet the chair arms, restrict the user's arms and push them too far forward. Another problem is the lack of heel room. Upon rising from a chair it is natural to pull your legs in under you, but the cherry trim pieces and the lack of space between the floor and underside of the chair prohibit such movement. I found the seating area of the chair generally too confining. The seat dimension at the rear, 17½ in., is not enough for a roomy lounge chair. The allotted seating area needs enlarging.

The amount of foam, padding and cushioning material in this chair should make the seat and back more comfortable than they are, but the foam is hard. The limited durability of cotton velvet makes it a questionable upholstery. I believe that every effort should be made initially to use the best grade of fabric possible. Some factors determining selection include color, texture, fiber content, durability, type of backing, ability to resist stains and price. A wool blend would probably be more suitable. It would cost between $15 and $30 per yard, adding considerable cost to the overall price of the piece, but well worth it. This is especially significant when the cost of reupholstering such a chair is considered. □

World Globe

Jig cuts segments for hollow sphere

by Steven A. Hartley

I had been thinking about making a wooden world globe long before I seriously planned the project. I pondered its size, the kind of wood and the surface treatment I would be able to give it, and as I did so my enthusiasm grew. But putting the idea into action presented the problem of making a sphere from which to make the globe. A fair amount of research revealed nothing about wooden spheres, let alone world globes of wood. Thus the method offered here is the result of my own trials and errors.

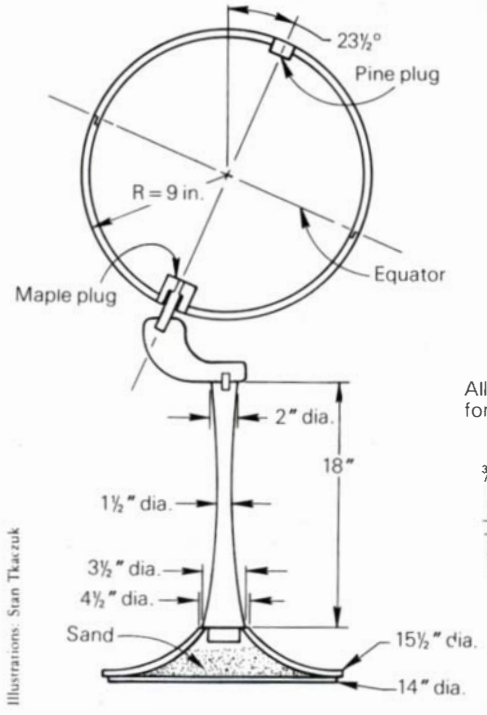
My globe is a hollow sphere made of 76 identical segments, each of them a quarter-circle in section, cut from 1½-in. thick sugar pine. I made the sphere in two halves, rabbetted together at the equator. It is 18 in. in diameter and the wall is a uniform ¾ in. thick. First I bandsawed the segments to their quarter-circle profile. Then I used the table saw and a jig I devised to make them wedge-shaped.

Make the segment layout template out of ¼-in. Masonite, as shown. Its width represents the thickness of the finished globe. Use the template to lay out stock for 76 segments plus a few extra, paying attention to the grain direction of the stock. You want a strong globe, so you must leave the long fibers of the wood relatively intact. The pieces may be cut freehand on the band saw, but stay close to the line, especially on the outside radius. This will save handwork later on.

Cutting the segments After the segments have been bandsawn, make the segment slicing jig. The drawing is dimensioned to fit my Rockwell saw—you may have to revise it

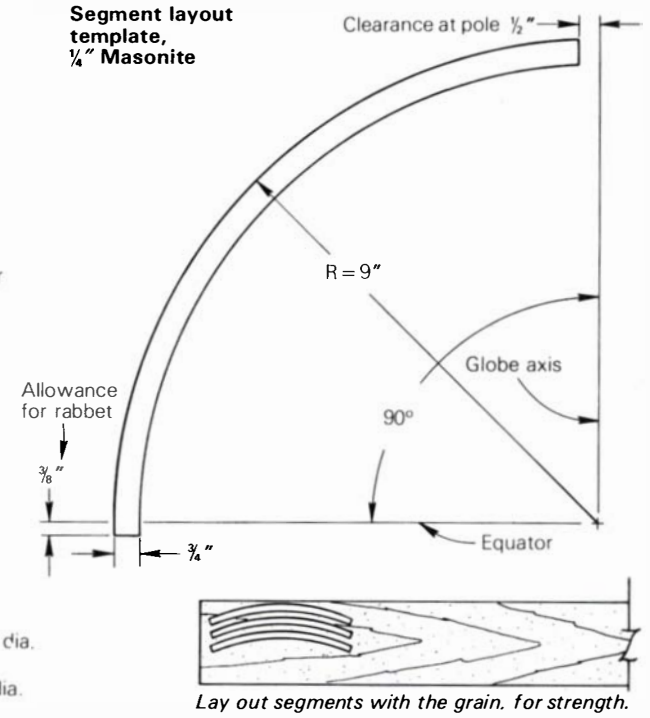
Photos: Steven and Tina Hartley

Hollow globe has carved ocean currents, smooth continents.

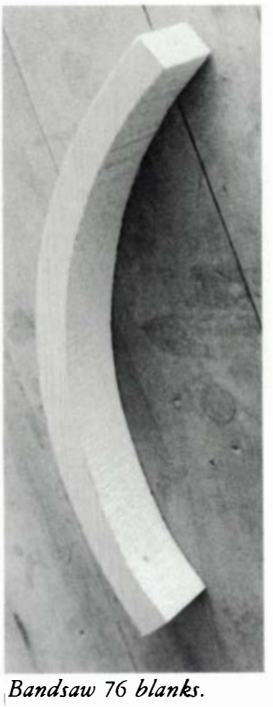


Illustrations: Stan Tkaczuk

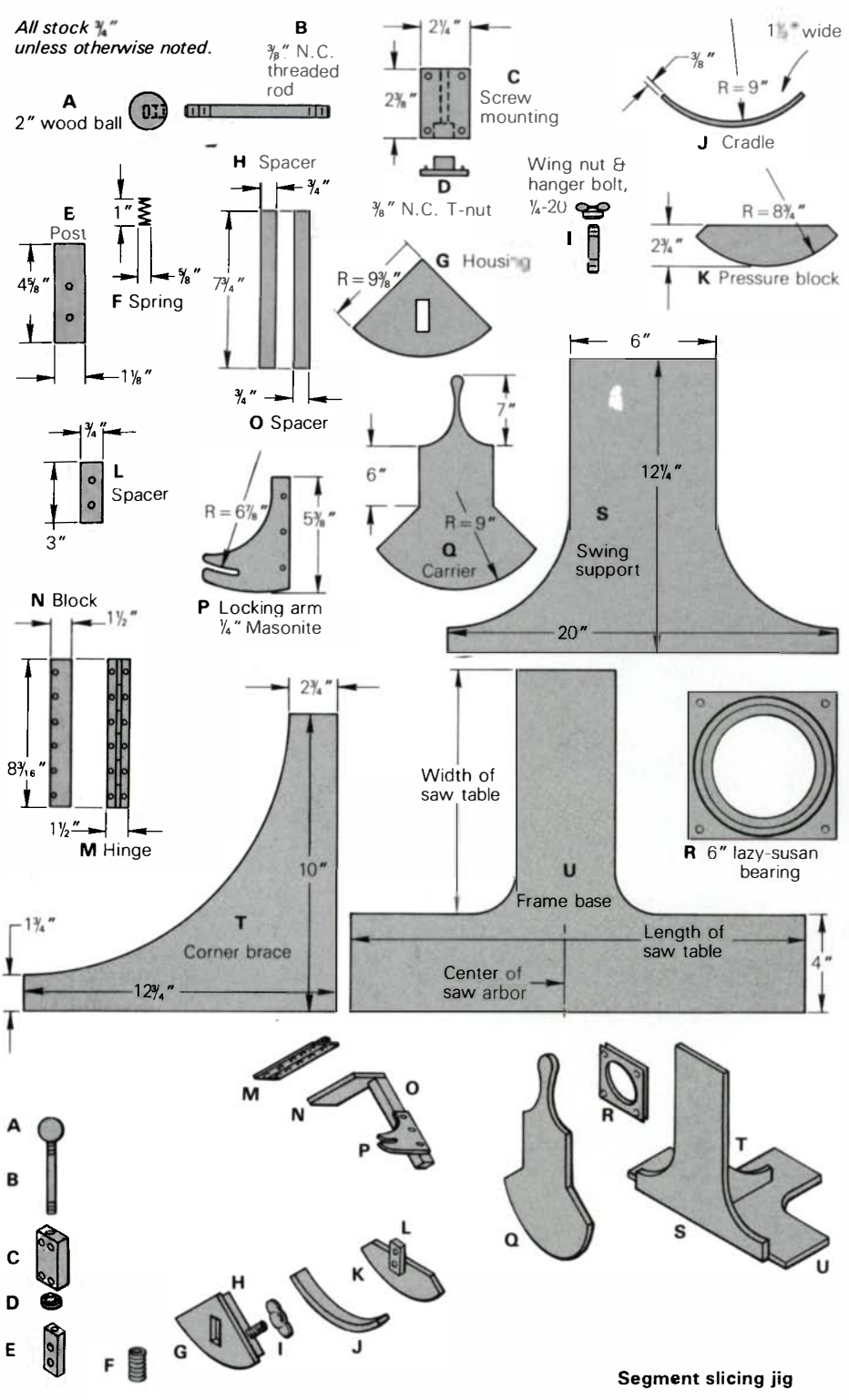
Segment layout template, ¼" Masonite



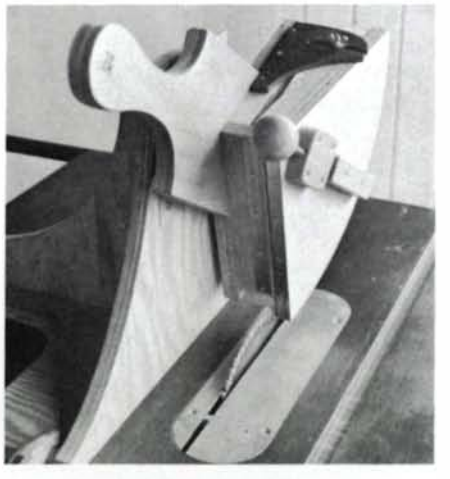
Lay out segments with the grain, for strength.

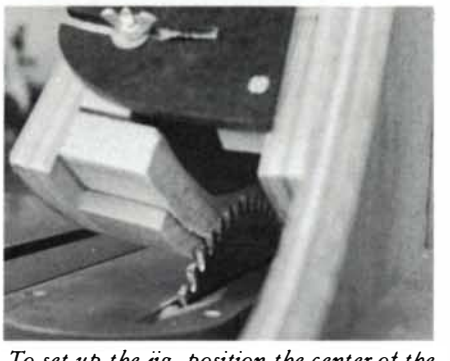


Bandsaw 76 blanks.

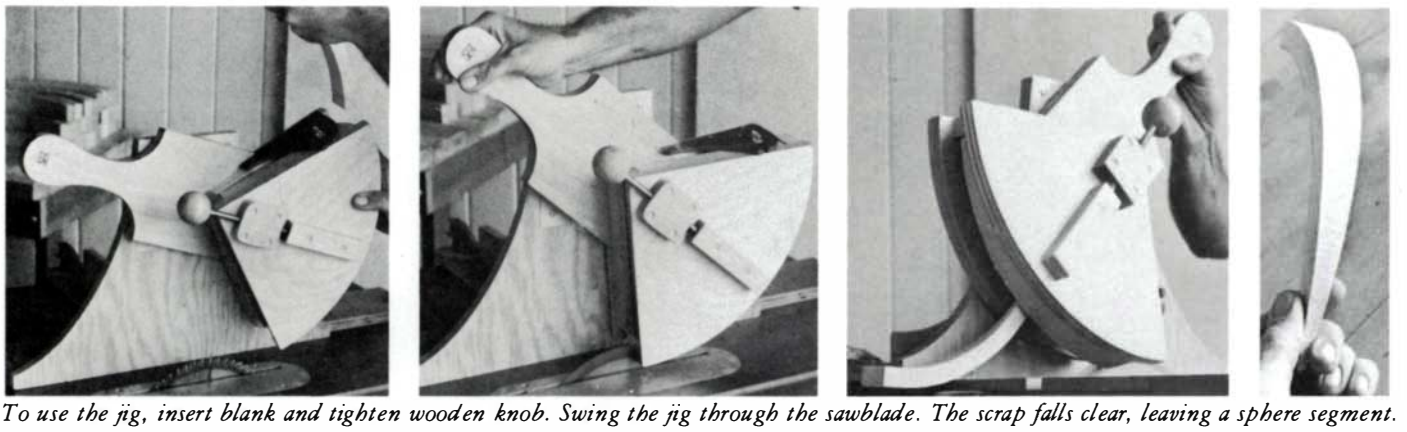


Segment slicing jig





To set up the jig, position the center of the hinge pin directly above left side of sawblade (top). Align the center of the swing bearing with center of saw arbor (center). Set carrier for segment width at equator (bottom). Segment width is the circumference of the globe divided by the number of segments—for an 18-in. globe of 76 segments, it is 1.488 in.



To use the jig, insert blank and tighten wooden knob. Swing the jig through the sawblade. The scrap falls clear, leaving a sphere segment.

to suit your own saw. All materials in the jig must be perfectly flat to ensure smooth operation. A 6-in. lazy-Susan bearing attaches the carrier to the frame. Check the bearing for play between its two plates. If it is loose, you'll have to crimp the inner lip with pliers.

The cradle portion of the clamping mechanism, which is only ⅜ in. thick, should be made of maple or birch, because it is subjected to constant pressure in use. This part *(J)* will be cut to final shape while the jig slices the first segment.

The hinge that attaches the clamp section to the carrier represents the axis of the sphere. The distance between the clamp section and the sawblade at the rear end of the cradle represents the widest point of each segment at the equator. This is determined by dividing the number of segments into the circumference of the sphere. In the case of my 18-in. globe this dimension is 1.488 in., or about 1 31/64 in. This measurement is most critical and should be checked periodically while cutting the segments.

The segment clamping device applies uniform pressure to the segment and holds it firmly while cutting. You may think that the tightening screw should be placed over the pressure block for more direct pressure. I tried this and found it difficult to operate because it was too close to the swing handle. Placement as shown holds fine and is easier to operate. Remember, you have to loosen and tighten the screw 152 times to make a sphere.

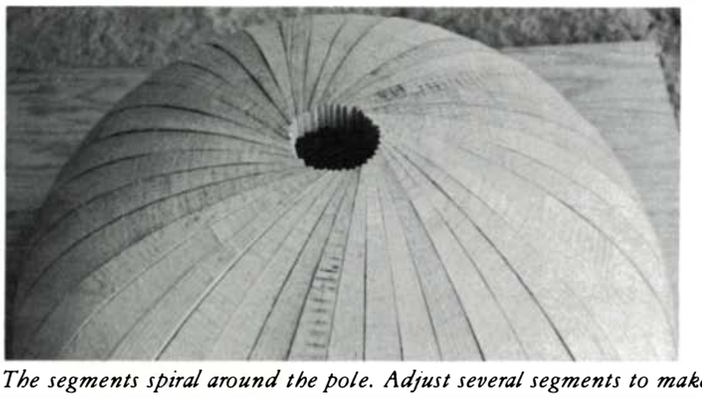
Oil the bearing and wax all moving parts before assembly. They should be close-fitting yet move freely. Clamp the jig to the saw table so that the center of swing is over the center of the saw arbor. The carrier must be parallel to the sawblade, and the blade must be square with the table. Elevate the blade ⅛ in. above the mounted segment.

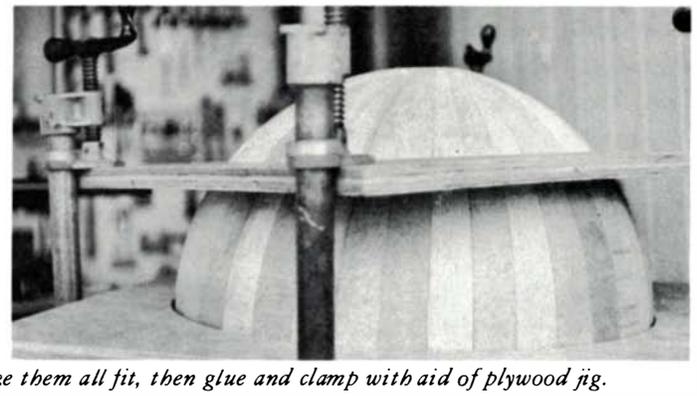
To use the jig, swing it up above the front of the blade and hold it there by grasping the clamp section. Now slide a segment in from the front. Clamp it in place with the edge closest to you flush with the edge of the jig. Your hand on the tightening screw will hold the jig in position while you reach for the swing handle. Turn on the power and carefully swing the segment through the saw in one continuous motion. The scrap will fall clear of the blade when the cut is completed. Then swing the segment back through the saw to its starting position for the next cut. Be sure to hold the sawn segment while loosening the clamp, lest it slide through into the blade. Repeat this process, cutting all 76 segments. Save the scrap—it will be used to make the base for the globe.

Assembling the sphere When all the segments are cut, make an assembly fixture from three pieces of plywood. Cut a circular hole 18 in. in diameter out of one of the pieces of plywood, and secure it on top of the base piece. The third gets a hole around 14 in. in diameter. This piece will be used to apply clamping pressure.

Set up a hemisphere in the assembly fixture. The accuracy necessary to have all of these pieces fall together perfectly is beyond the capabilities of the segment jig and the table saw, so some variation is almost certain to occur. If you're within ⅛ in. oversize or undersize at the equator, you are as close as you could expect—within .0065 in. per segment.

If you are slightly oversize, trim several segments, using the jig. Do not try to alter one segment to accommodate the





The segments spiral around the pole. Adjust several segments to make them all fit, then glue and clamp with aid of plywood jig.

Whittle a plug to fill the hole, then bore a clean 2-in. hole at each pole to receive turned plugs. The hemispheres are shaped with a compass plane and Surform, then a rabbet is routed at the equator.

whole error. If you are a little undersize (as I was), cut a few pieces oversize. Either way, try random pieces until the proper fit is achieved. Notice that the segments spiral around the pole. This is because they were sawn on only one side. Cutting the other side would require another jig.

When all the segments fit, the hemisphere may be glued. I used yellow glue (aliphatic resin). Apply glue to as many segments as you can easily handle at once. Then, leaving the complete hemisphere in the assembly fixture, clamp until dry. Repeat this until the entire hemisphere is glued. Assemble the other half of the globe in the same way.

In order to get a clean hole at the poles, whittle a plug to fit and glue it in place. Locate the center and bore a hole about two inches in diameter through both poles of the globe. Cut plugs to fit these holes and glue them in place. To ensure a snug fit, mount the plugs in the lathe and turn a slight taper. I used a pine plug at the north pole and a maple one at the south pole, where the globe is fixed to its stand. At this stage the hemispheres could be mounted on a faceplate and turned true on the lathe. I chose to shape them by hand because my lathe is too small to handle parts of this size. They are quite easy to shape by hand with a circular plane or a Surform.

Sandpaper is usually avoided on surfaces that will be carved, because small particles of grit get into the wood and rapidly dull the tools. I admit, however, that I did succumb to this temptation to get a smooth surface. To avoid grit, I cut open a cloth sanding belt of closed-coat 60-grit and used it lightly, shoeshine fashion. After sanding I thoroughly dusted the surface with a brush. My gouges didn't seem to suffer. The purist who finds this shortcut disgusting will have to make a ball plane ("Methods," Winter '76, pp. 14-15).

A rabbet joint joins the two hemispheres. The rabbets provide a perfectly circular, positive fit that holds well. To cut the rabbets, fit a disc of ½-in. plywood inside the hemisphere to create a flat bearing surface. A snug fit and a few dabs of glue will hold it. Set up the router with a circular guide and a sharp straight bit. When the rabbets are done, remove the plywood insert by cutting through it with the router. Then glue the hemispheres together.

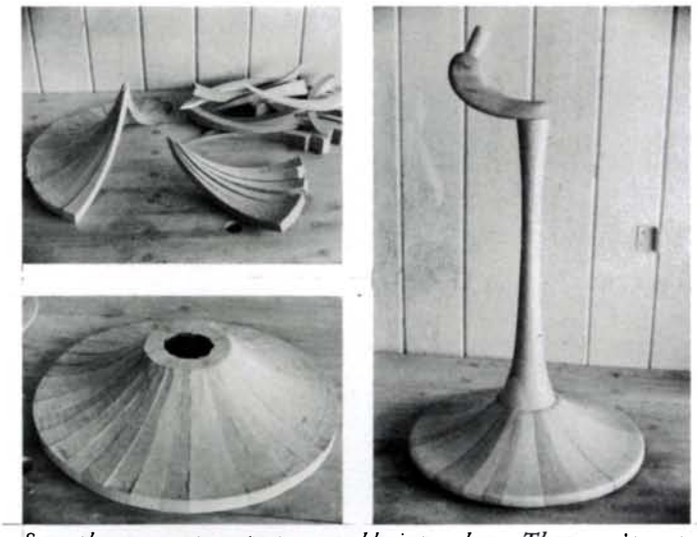
Carving the surface A printed world globe is absolutely essential for laying out the geographical areas. First, mark the lines of latitude and longitude. The sections formed by these lines provide a grid that corresponds to the printed globe. The design can now be drawn on this grid section by section, as with the squares method of pattern transfer. Regional maps, which you can find in an atlas, will help you with the small details.

I made a cradle to hold the globe for layout and carving from the plywood pieces of the assembly jig. A length of foam weatherstripping glued inside the circular cutout held it very firmly, without marring the surface.

The carving is done with ordinary gouges. I decided to carve the oceans in low relief, cutting in the direction of the currents as indicated on the printed globe. I also carved out large lakes and major rivers, leaving all the land area smooth. Of course one could exaggerate the vertical scale and carve the land in relief, although the mountain peaks would be extremely fragile. One could also reverse the relief, making the highest points of the land the lowest parts of the carving. Either way, it is easy to underestimate the size of the job—an 18-in. sphere has more than 7 sq. ft. of surface area.

Outline the continents and islands with a 1-mm No. 11 veiner. Then, using the same tool, carve a border around the land masses. For lakes and rivers and around small islands, overlap the tool marks for a fine texture. Very small islands

Use the latitude-longitude grid to transfer the world map from a printed globe. Outline the continents with a small veiner, then work in the coastal waters. The arrows indicate the major ocean currents—you should follow them when rendering the ocean with a small gouge of medium sweep.



Save the segment scraps to assemble into a base. They won't mate perfectly, so make two halves and then plane them to fit. The stem is turned and the mounting post is carved.

that are no more than a speck on the globe may as well be overlooked—they would be lost among the tool marks.

A 4-mm No. 9 gouge is used for coarser texture as you carve away from the land areas. Finish the mass of the ocean surface with a 10-mm No. 7 gouge. Start with long, bold strokes following the curves of the currents, then fill in with shorter, overlapping cuts. When all the carving is done, a light sanding of the land areas will remove pencil lines and smooth the surface.

Making the stand The globe stand consists of three parts: the base, the stem and the mounting post. The base is made by gluing together the scrap pieces produced by cutting the globe segments. They have to be hand-fitted because they are not the right size to form a perfect circle and cannot be recut on the jig. Make two halves, then plane them to fit. Saw the peak off flat, then shape the base with a Surform or circular plane. A disc of ¼-in. plywood is then fastened to the bottom and covered with felt.

The stem is turned between centers on the lathe. I suggest gluing up ¾-in. stock to maintain a segmented appearance.

The mounting post is cut on the band saw and then carved to shape. Join the stem, post and base with dowels. For stability, fill the base with sand before you mount the stem to the base.

Finishing The globe and stand should be sealed with a very thin coat of shellac, then lightly sanded with fine, worn paper. To obtain greater contrast, you can stain the carved areas. I stained mine using raw sienna colorant mixed with shellac and thinned with alcohol. First outline the land areas with a fine brush, then fill in with a larger brush. When dry, wax the entire globe. The stand should be quite a bit darker than the globe to make it less conspicuous. You may want to stain it to match the furniture in the room where the globe will be displayed. Whatever approach you take in finishing, it should be emphasized that the lighting of your globe will make all the difference in the world. □

Steven A. Hartley is a professional woodworker whose hobby is woodworking. He is supervisor of the display prop and fixture department at Disney World in Orlando, Fla.

Koa Table

Cove cuts emphasize joinery

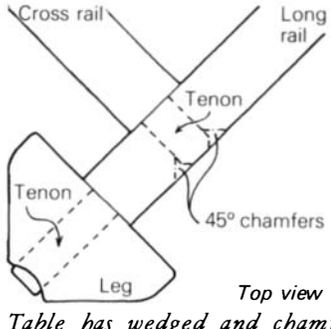
by Ben Davies

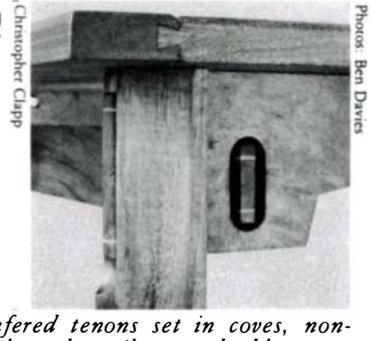
The rail-to-leg joint on this small table is a variation of the through mortise and tenon. The leg itself is triangular and rotated 45° from the usual orientation of a square table leg so that the tenon passes through the triangle from base to apex. A cove is cut in the leg at the tenon's point of projection, recessing the end of the tenon back a bit into the leg. The tenon is wedged and the end chamfered all around.

The rail across the end of the table is dropped 1½ in. from the top and does not directly support it. Again, the rectangular tenon is through and wedged. The mortise is also rectangular, with a straight 45° chamfer cut back from the surface.

It is easiest to get the correct spread on the tenons by first making the wedge and then marking its size on the tenon. Using a fine-toothed saw, cut a slightly smaller triangular opening into which the wedge will be driven. The spread of the tenon is determined by the amount the opening has been made smaller than the wedge. The end cleats are attached to the top with a dovetail tenon pinned in the center and made very tight with Chair Loc, a chemical that permanently swells the wood. □

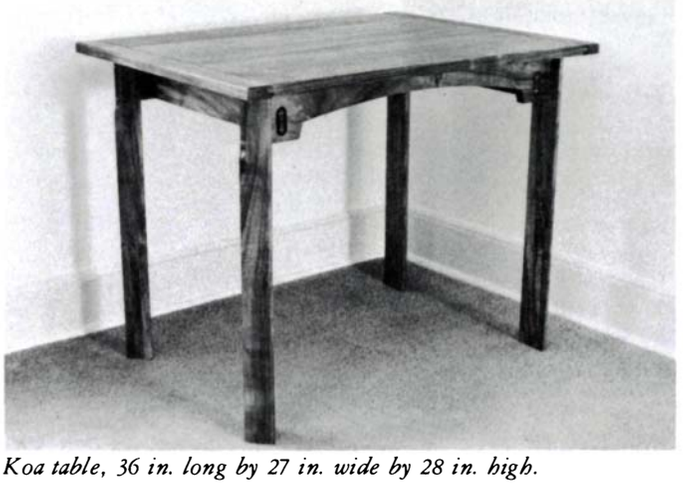
Ben Davies builds furniture and entry doors at Muntin Woodworks in Chattanooga, Tenn.





Photos: Ben Davies; Christopher Clapp

Table has wedged and chamfered tenons set in coves, non-supporting end rails, triangular legs, dovetail-tenoned tabletop.



Koa table, 36 in. long by 27 in. wide by 28 in. high.

Incised Lettering

Speed and boldness are better than puttering

by Sam Bush

Carving incised lettering is a valuable skill in the repertoire of a professional woodworker and also an instructive practice for the beginner. Its decorative effect has many applications, and its visual appeal is universal. Incised letters are the opposite of relief and are cut directly into the wood without using a router—it's actually a form of chip carving.

Those wishing to take up the work need only a small collection of chisels, a mallet, a pencil and a good piece of wood. The tools used on the sign shown here were a ½-in. and 1-in. #1 firmer chisel; a ¾-in. #3; a ¾-in. #4; a ¾-in. #5 and a ½-in. #5 fishtail; a ½-in. #6; a ⅜-in. #10; and a *V*-tool. Starting out, you'll need a *V*-tool and several sizes of flats (firmers). From there, you will want two sizes each of #3, 4, 5 and 6, say ⅜ in. or ¾ in., and one each of #7, 8, 9 and 10, in various widths. The quicker gouges are not much called for in incised lettering, yet the occasion will come along when they are just what is needed.

It is difficult to propose a truly all-purpose set. I favor buying tools individually right from the start. Quality rather than quantity is essential; nothing is worse than the poor steel and awful handles that come in cheap sets. Learning to carve with a few tools stretches the carver's imagination and ability. A great collection of chisels is usually built up gradually.

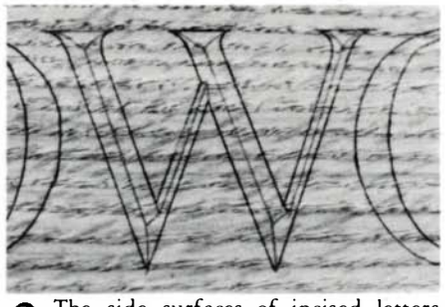
Letter design can vary widely, but almost always has to be drawn out for each job. Therefore, good models should be studied. As reference books, I particularly recommend *Writing and Illuminating and Lettering* by Edward Johnson (Pitman Publishers Ltd., 39 Parker St., London WC2 B-5Pb, England), *Italic Calligraphy and Handwriting* by Lloyd Reynolds, $3.95 (Pentalic Corp., 132 W. 22 St., New York, N.Y. 10011) and *History and Technique of Lettering* by Alexander Nesbitt, $4.50 (Dover Publications, Inc., 180 Varick St., New York, N.Y. 10014). These authors are well-known designers and teachers; their information is helpful for relief carving as well as incised carving projects. Frequently, popular graphics can be imitated, and draftsman's transfer letters are often good.

Sharp, accurate work all the way through will ensure success in incised carving, even on the first try. Speed and boldness are actually an advantage—one sure hit produces a better surface than lots of puttering. The letters in the sign shown took me about ten minutes each to carve.

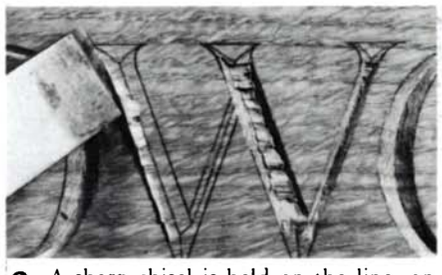
Photos: James K. Taylor

1 For this sign I used roman capitals and italics. It looks both formal and informal, the proper accent. I started with the board sized up, and sketched in with a broad pencil. This was traced for a better outline, and then in several copies on the drafting board, worked up into a well-proportioned drawing. This was a process of constant, gradual correction. In these tracings, as well as laying out on the wood, sharp, accurate lines are essential.

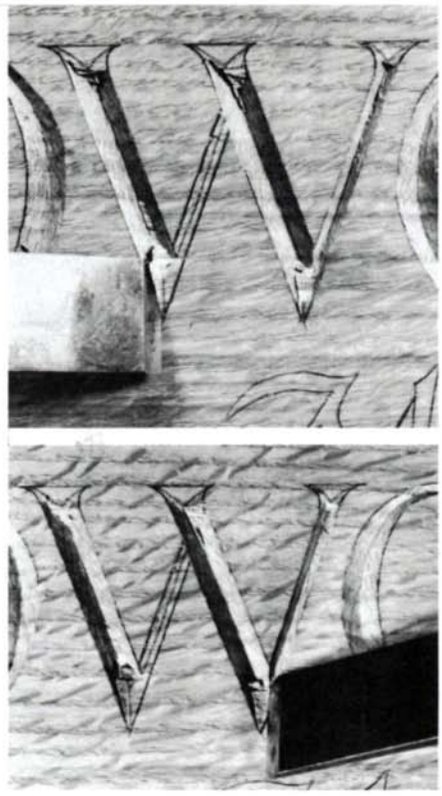
The wood to be carved should be as straight-grained as possible, so as to be predictable. Radial grain is excellent (this is quartersawn red oak) and can be relied upon not to warp outdoors. The board should be fully planed and scraped before carving; it should not be sanded, however, because the abrasive left in the pores of the wood will dull the tools.



2 The side surfaces of incised letters slant down at a uniform angle to meet in the middle of the letter width. A center line drawn on the wood may give the idea.



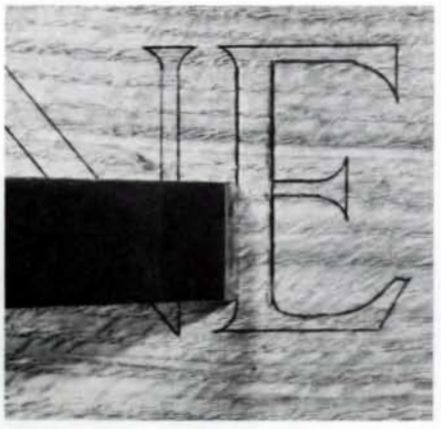
3 A sharp chisel is held on the line, on an angle, and hit with the mallet. Cut alternate sides, at a constant angle, until they meet cleanly at the center. One or two taps with the mallet will be sufficient. The cut chips should fall out; prying with the chisel destroys the top edge of the letter.



4 At the corners the chisel must be held out to avoid damaging the intersecting wall. All sides slant in. Misjudging this is a common difficulty.

5 It is important to master the stop cut. The breakout from the wedging chisel must be anticipated by a cut on the other side to avoid losing something you want. The center arrow shows where the tip of the wood inside the letter has broken off. This time it was moved by the back of the chisel, because it was weaker than the ground I was lifting. The other arrows show other danger points. Glue is indeed the woodcarver's best friend.

6 The serifs are dramatic, being curved, and relatively easy to carve. Here, a medium #5 tool is used upside-down, one corner on the center of the existing *V* and the other near the desired point of the letter. A similar cut is made on the other side using a #6, as dictated by the design. A cut across the end with a small flat, and most of the work is done.

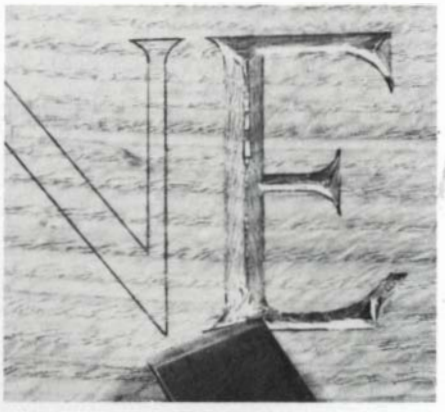


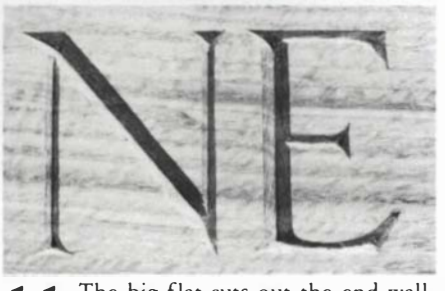
7 An *E* is carved in the same way. The slant of the letter sides remains constant throughout the alphabet. I invariably establish this angle by eye alone, but here measured it for the reader's reference: 38° off horizontal. Using the largest chisel practical promotes straight surfaces.

8 I find carving parallel to the grain much harder than across. The chisel quickly runs into the wood, so it is especially important to watch grain direction and pressure.

9 Taking the letter down all around reveals that the narrow areas are not as deep as the wide areas. Therefore the horizontals of this *E* intersect only the upper side wall of the vertical. The center lines of the two parts do not meet. This makes for some conceptual difficulty, but is quickly learned.

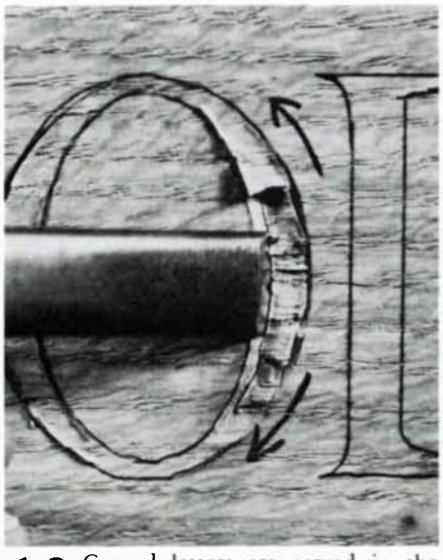
10 Carving the bottom serif requires the #5, as before. I carve the serif curve against the grain, from the main shaft of the letter out. This is easier to control and generally leaves an excellent surface. I carve the other way as well in difficult grain, but it's harder to see where I'm going.



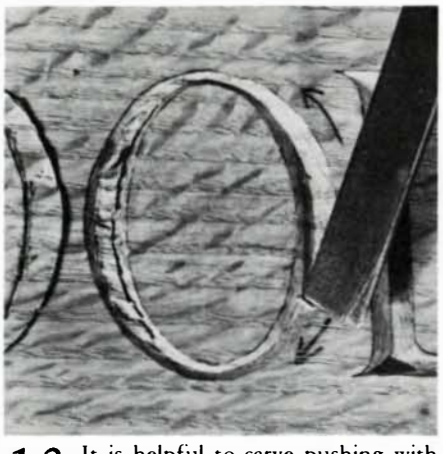


11 The big flat cuts out the end wall. Take care to be out of the wood on the left while on the same angle as the existing bottom of the letter. The rest of the cleanup is done by hand. Cutting with the mallet has worked the letter almost to the bottom, so that only a few bits and shavings remain. These can be cut out without the mallet, with a smooth push on the chisel or an occasional tap with the open palm. Generally, the hand holding the chisel grasps low on the steel, in an overhand position, leaving the handle exposed. There is more control this way, because the guide is closer to the cutting edge. This holds true while malleting as well. The wrist and perhaps the forearm of the hand holding the tool should rest firmly on the wood.

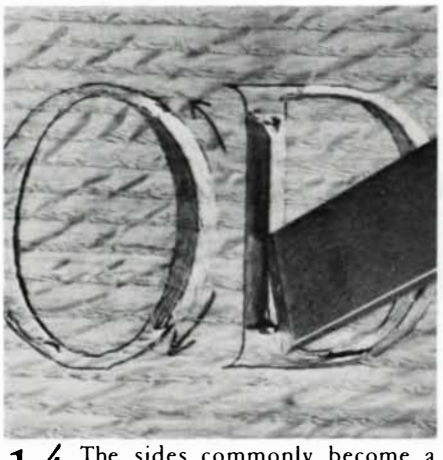
Another technique that is useful in cleaning up, especially on long, straight sections, is tipping the chisel up onto one corner and pulling it toward you like a knife. In any event, take care to keep the back of the chisel lying tightly on the side of the letter already carved. *(please turn page)*



12 Curved letters are carved in the same way, using curved tools. Holding the chisel upside-down on the inside takes some getting used to, and on the outside your chisel angle has to take into account the sharpening bevel.



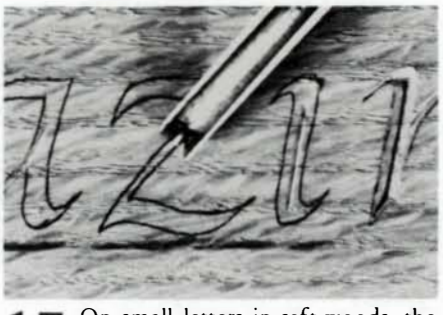
13 It is helpful to carve pushing with the grain, as indicated by the arrows, particularly when cleaning up the inevitable gouge ridges. The letter sides should be flat, or slightly concave.



14 The sides commonly become a series of chisel cuts, or rounded over, rather than a flat plane. This problem is avoided by keeping the back of the chisel tightly against the work and overlapping the cuts. This way, the chisel is self-jigging.

15 It takes four cuts to shape and clean the serif area. The delicate point can be accentuated, because there will be a little loss in sanding. The letters themselves should never be sanded, because sandpaper would destroy the crispness and fill the grain. Surface sanding of the finished sign sharpens up the letter outlines considerably. Sometimes a cabinet scraper can be used as well. I do not recommend planing, however, because I think it takes off too much of the wood and the letters.

16 Difficult areas like the centers of these two letters are merely complex intersections of flat planes. Much imagination is required, but if the constant angle is maintained, everything gradually falls into place.



17 On small letters in soft woods, the *V*-tool can be used exclusively. In this job I used it just for hairlines, as in this *Z*. I don't favor its use in cleaning up big letters because it leaves a slightly rounded bottom that detracts from the crisp look. In any event, it should be kept very sharp, because one side of the tool is always cutting against the grain.

18 The chisels for the italics are selected carefully to closely match the tracing lines. The sides are worked down in the conventional way until they meet in the middle.

19 I find this #5 fishtail very handy on little letters. A brass brush with fine wires is also helpful in removing the last shavings that hang in the carving. □

Sam Bush, of Pottstown, Pa., teaches woodworking at The Hill School, a private college preparatory school.

Bolection Turning

How to inlay around a bowl

by Thomas J. Duffy

Bolection turning is the inlaying of a narrow wooden strip into a groove around a turned object. The word bolection means a fillet or molding with part of its section set into a groove and part proud. I extrapolated the notion from John Jacob Holtzappfel's *Hand or Simple Turning* (Dover Publications), whose process of inlaying a column economized on material and did not structurally interfere with the turning. Bolection turning has advantages over built-up work: Because the band does not support an adjacent section, it skirts the problem of different coefficients of expansion. The banding is not seen on the inside of the bowl, thus creating subtleties which can not be achieved in built-up work. And it is not difficult to do.

To begin, mount the bowl stock on a faceplate and rough-turn both the inside and outside to shape. Measure the outside diameter of the area where the band is to be located. For the band, mount a square of stock plankways on the faceplate. Once the stock is round, the band can be cut from the face and edge using a parting tool. The critical dimension on the band is its inside diameter, which should be about 3/16 in. less than the outside diameter of the bowl.

In order to remove the band in one piece, I've found that it is necessary to make the face cut first, and then tape the band area on the face to the material that will remain after the parting (1,2). I make the edge cut next. The stock that remains on the faceplate can be made into rings and saved for future work.

With plankways turning, the finished piece will have the quality of chatoyance, or changeable lustre and color. The end grain will pick up finishing materials differently than the cross grain. If uniform color and light reflection are desired, it would be better to cut the banding from stock mounted with the grain running parallel to the lathe bed.

Remount the faceplate carrying the bowl, and cut a groove the width of the band to a depth of 1/8 in. It is relatively easy to arrive at an accurate fit, but be careful to make it a "light feel" fit (3). A press fit swollen with glue will make installation of the band quite difficult.

Next, secure one half of the band on a workbench—use a bench-top clamp for large work and a vise for smaller work. Plankways rings must have the grain running parallel to the holding surface. The other half of the ring is held firmly at its axis and carefully snapped (4).

Bring the two sections together in the bowl groove (5). This should first be done dry. If the band fits, this should then be done with glue. Hold the band in place with a belt clamp positioned to allow a good view of the split areas, in order to be sure of proper reunion (6). After the glue has set, continue turning to finish off the bowl and shape the molding of the band. Take care not to break through the groove when dressing the interior.

If closed-grain wood is used throughout, finishing presents no particular difficulty. Problems arise when the main body of the bowl needs to be filled and the band shouldn't be (i.e., a mahogany bowl and a whitewood band). The dark filler will stain the whitewood, especially on the end grain. I haven't refined a method for diminishing this, but I've had pretty good luck carefully painting the band with the clear finish to be used and then proceeding with the filling. After the filler has set up, been wiped off and allowed to dry, the entire piece can be lightly sanded on the lathe, and finishing can continue in the desired manner. □

Thomas J. Duffy, 29, of Ogdensburg, N.Y., is a self-employed cabinetmaker.

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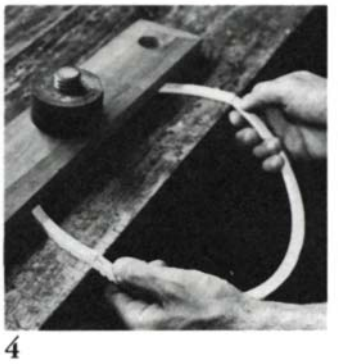

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Photos: David B. Greenberger

Air-Powered Tools

What's available and where to get it

by Lyle Laske

In the past 15 years, quite a few independent furniture-makers, sculptors and college woodworking shops have adopted pneumatic (air-driven) tools. They have done so for the same reasons these tools dominate the furniture industry: few moving parts and therefore low maintenance, lightweight handpieces (compared to electric tools) and therefore reduced fatigue and fewer mistakes, and safety. Yet pneumatic tools are largely unknown in general woodworking. They have not entered the consumer market, mainly because of the high initial cost of a suitable compressor.

In a pneumatic system, air compressed by machine flows under pressure through a pipe or hose to activate the tool. Most tools rotate by the force of compressed air against a vaned rotor. Some reciprocate, by means of a valve-and-piston arrangement. Because they have no heavy, copper wire armatures, pneumatic tools are light and compact. They do not overheat, and they can be repeatedly stalled in the work without damage. They start quickly, have variable-speed control, and stop immediately when caught or dropped—all important for safety. Also, there is no danger from electric shock or sparks. Slip-ring couplers permit quick changes from one tool to another at the work station. And since the tools are useless without an air supply, pilferage from school shops and studios is almost eliminated.

There are pneumatic equivalents for nearly every electrically powered tool, from sanders to saws, drills, grinders and routers. Furthermore, there are some pneumatic tools with no electrical equivalent, in particular, the rolling-pin contour sander, power adze and jackhammer-style carving gouge. These three, along with big, high-speed cutting burrs (ball mills) powered by heavy-duty grinders, are tremendously valuable to sculptors and carvers who work with green logs and large stacked forms. They save hours of gouge-tapping, filing and hand-sanding.

Besides the tools shown and described in this article, industry uses a large variety of special-purpose routers and laminate trimmers, which could be most useful in general woodworking and small production shops. There is also a huge variety of pneumatic clamping and positioning machinery, for gluing sub-assemblies and for holding parts in position on the assembly line.

Another factor to consider in evaluating pneumatic tools is the finishing room—the same compressor will of course run spray equipment. If you do convert, don't ignore pneumatic staplers and nailers. Although industry uses them to put the furniture together, they are more suitable for making packing crates, thus saving time for more creative work.

Although these tools are designed and manufactured for industry, there is nothing to stop an individual or a small woodworking enterprise from converting to air power—the suppliers can be tracked down. I've surveyed the industry in the course of preparing this article. The accompanying charts and lists should provide enough clues to find what you need in your particular situation. The prices of the tools listed may seem high when compared to electrical tools made for the consumer market. This is because industrial tools are manufactured to withstand long hours of constant, daily use. And it must be noted that using electricity to compress air is less efficient than using it to power a tool directly.

Stationary compressor with horizontal air receiver.

Compressors The important factor in designing a pneumatic system is air flow, measured by the pressure of the air delivered, and by the volume of air delivered in a given time. Air pressure is measured in pounds per square inch (psi); most pneumatic tools operate at 90 psi. Flow rate is measured in cubic feet per minute (cfm). Air consumption varies from tool to tool and is also affected by pipe and hose diameter. Most tools demand between 20 cfm and 50 cfm. It is essential to match the compressor to the tools to be used.

From the multitude of compressors on the market, there is basically only one type suitable for furniture-makers, sculptors and school shops: the positive-displacement, reciprocating (cylinder piston) unit type. Industry classifies unit-type compressors as those driven by ¼-hp motors to 25-hp motors, which at 90 psi deliver air volumes ranging from less than one cfm up to 90 cfm. Single-acting or single-stage pistons produce pressure when moving in one direction, and double-acting or two-stage pistons generate pressure when moving in both directions. The reciprocating compressors discussed in this article are all cooled by air and powered by an electric motor.

A large-capacity compressor is always attached to an air receiver or storage tank, which absorbs the pulses of air produced by the piston and provides a constant flow. It also acts as a reservoir to handle air demands that may for a short time exceed the capacity of the compressor. The reservoir of air re-

Lyle Laske, a sculptor, is associate professor of art at Moorhead State University, Moorhead, Minn.

duces the operating time of the compressor, thus decreasing wear and maintenance. With a suitable air receiver, a compressor in the 5-hp to 10-hp range (costing $1,200 to $4,000) will be more than adequate for a small shop. A larger compressor, up to 25 hp, will be necessary when more than one or two people are likely to be working at once.

The air receiver is usually a cylindrical tank, and the compressor motor is usually mounted on top of it. Receivers may be purchased with either horizontal or vertical stationary mountings, or may be mounted horizontally on wheels.

Operating costs can be reduced if the compressor is located in a clean, cool, well-lit room, large enough to accommodate machine servicing. If the compressor must be in a dusty studio/shop, an outside filtered-air intake protected from rain and debris is recommended. The sound of a large compressor can be reduced by a baffle wall or walls. Mounting the compressor/receiver on special rubber pads reduces vibration stress and noise.

Small, portable reciprocating unit compressors in the 1/10-hp to 3/4-hp range without receivers are called diaphragm compressors. The air is compressed by a durable membrane that flexes back and forth to force air through the hose. This type of compressor is usually used for spraying paint, although a 1/3-hp model that produces 2.5 cfm at 40 psi is sufficient to power a dental handpiece or a small grinder.

Reports of exploding air receivers are rare, but the potential is as real as the possibility of shock with electricity. The American Society for Mechanical Engineers (ASME) has safety standards for compressors used in schools and in places of business and general public assembly. In most states, compressors located in the public sector are inspected annually for safety. In Minnesota this inspection is done by the state boiler inspector or by an insurance inspector.

The single most important safety factor is the lifting lever safety valve, which opens before air pressure in the receiver can reach a dangerous level. This safety valve usually has an attached finger ring to pull for inspection.

Smaller single-stage compressors (frequently portable) for farm and residential use need not comply with ASME standards because they are not in constant use. These compressors are well suited to the needs of many woodworkers. However, some of these compressors are equipped with a preset safety valve, which can corrode and become inoperable. The preset valve should be replaced with a lifting lever safety valve.

Portable compressors manufactured for consumer use do not have large cfm capacities. As an economy measure, two consumer compressors might be hooked together with a tee to deliver a cfm flow rate comparable to a heavy-duty stationary compressor. Two consumer compressors cost about two-thirds as much as a heavy-duty industrial compressor. But for extensive use, the heavy-duty compressor will be more durable, thus more economical. Good used compressors can be found at liquidation sales, such as the closing of an auto service station. Ask to see the safety inspector's certificate and look for signs of deterioration. Check the seams and the junction of the legs (vibration stress) to the cylinder for cracks and corrosion. Be sure the lifting lever safety valve works.

Moisture control When air is compressed it becomes hot, and with the increase in temperature comes a proportional increase in the amount of water vapor the air can hold. This water vapor condenses in the receiver or in the main air line

Compressors

hp	Free Air Delivered (cfm)	Receiver Size (gal.)	Price Range (approx.) Compressor only	Mounted After-Cooler
1/2	1.5 - 2.9*	7 1/2 - 8	$120 - $155	
3/4	1.8* 3.5	30	$200 - $900	
1	4.2* 3.1 - 6.4	30 - 60	$250 - $1,100	$300 - $400
1 1/2	5.8 - 6.2* 4.3 - 7.1	30 - 80	$300 - $1,300	$300 - $400
2	5.0 - 7.0* 4.2 - 9.1	60 - 80	$400 - $1,695	$300 - $400
3	4.0* 9.6 - 14.7	60 - 120	$400 - $1,810	$300 - 400
5	17.2 - 20.2	60 - 120	$1,540 - $2,400	$300 - $400
7 1/2	26.8 - 33.6	80 - 120	$2,000 - $3,500	$500 - $600
10	34.0 - 37.4	80 - 120	$3,000 - $4,000	$600
15	52.7 - 60	120 - 240	$4,000 - $5,500	$600
20	71.0	120 - 240	$4,500 - $6,000	$600
25	90	240	$5,000 - $6,500	$600

* Some consumer models rate cfm at 40 psi. At 90 psi, cfm is less.

Manufacturers of Air Compressors and Dryers

Binks Manufacturing
9205 W. Belmont Ave.
Franklin Park, IL 60131
(1/3-30 hp)

Campbell-Hausfeld
100 Production Drive
Harrison, OH 45030
(1/10-30 hp)

Curtis Toledo
1905 Kienlen Ave.
St. Louis, MO 63133
(1/2-125 hp)

The DeVilbiss Co.
P.O. Box 913
Toledo, OH 43692
(1-25 hp), dryers

Dresser Ind., Inc.
N. Main & Russell Rd.
Sidney, OH 45365
(1-300 hp)

Emglo Prod. Corp.
Route 403 South
Johnstown, PA 15905
(1/2-25 hp)

Fliteway Sales, Inc.
Box 39
Horicon, WI 53032
(1/2-30 hp)

Gardner-Denver Co.
1800 S.Gardner Expwy.
Quincy, IL 62301
(1/2-500 hp)

Ingersoll-Rand
Box 636
Woodcliff Lake
NJ 07675
(1/2-4,000 hp)

Kellogg-American,Inc.
565 Cedar Way
Oakmont, Pa 15139
(3/4-200 hp)

Montgomery Ward
(1/2 and 3/4 hp)

Quincy Compressor
Colt Industries
217 Maine Street
Quincy, IL 62301
(1/3-300 hp)

Richland Industries
1140 Sextonville Road
Richland Center
WI 53581
(1/2-5 hp)

Sanborn Mfg. Co.
118 W. Rock Street
P.O. Box 129
Springfield, MN 56087
(3 and 5 hp)

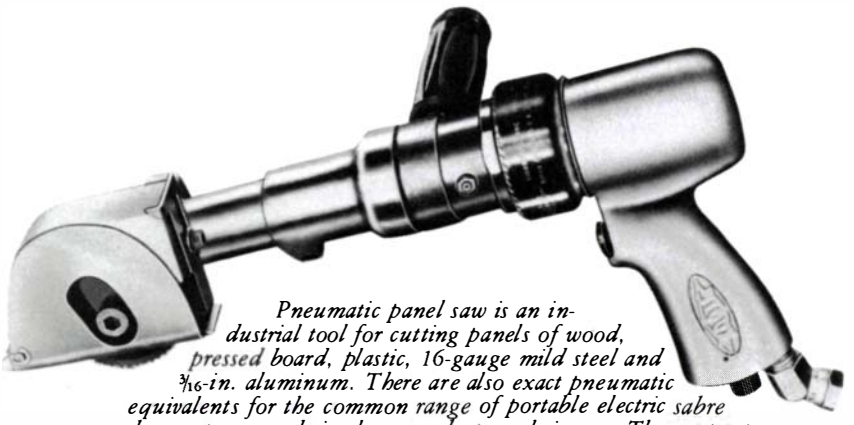
Schramm Inc.
800 E. Virginia Ave.
West Chester, PA 19380
(1/3-200 hp)

Sears, Roebuck & Co.
(1/2-5 hp)

Superior Pneumatic
Box 9667
Cleveland, OH 44101
(3/4-3 hp)

Thomas Ind., Inc.
1419 Illinois Ave.
Sheboygan, WI 53081
(1/4-5 hp)

Dental laboratory handpiece, at 25,000 rpm, does the same job as the more common flexible-shaft grinder but is less tiring to control. A slightly larger tool, the industrial pencil grinder, runs at 50,000 rpm. Users of flexible-shaft tools know that small high-speed steel burrs aren't very durable. Dental supply firms sell carbide burrs, which last much longer, for about $3 each.



Pneumatic panel saw is an industrial tool for cutting panels of wood, pressed board, plastic, 16-gauge mild steel and 3/16-in. aluminum. There are also exact pneumatic equivalents for the common range of portable electric sabre saws, bayonet saws and circular saws, but no chain saw. The contractor-style circular saw consumes 25 cfm at free speed and may draw 70 cfm at full load, although a smaller compressor with a suitable air receiver should handle it, since saws are used in short bursts.

Bill Snyder Films, Inc.

The pneumatic carving gouge is a stonecarver's reciprocating air hammer (center) that accepts a standard ½-in. shank. Right, ¾-in. #11 sweep has been cut down at the handle flange so a length of ½-in. steel rod could be welded on. The steep-sided #11 enters and leaves the wood easily, without becoming buried, but carvers' preferences vary. The large gouge at left has an added T-bar for better control. Top photo: the author demonstrates the use of the pneumatic gouge to an audience of sculptors.

(header) when the compressed air cools to its dew point. The water can corrode the receiver or the tools, and it may contaminate the work as the air escapes from the tool.

Small and medium-sized compressors carrying light loads can get by if the water is periodically drained by hand from the receiver. A regular check for moisture may be unnecessary if the tank is fitted with an automatic dump trap or automatic tank drain; these attachments usually cost from $50 to $100.

As air consumption increases, so does moisture. Accordingly, more complicated devices become necessary to control it. Extractors with filters very effectively remove condensed water, stray oil and airborne debris from the main line. Most extractors use either baffle plates or an absorbent filter to deflect or trap contaminants from the air stream into a holding chamber for removal. This type of extractor does not expel water or oil in the gaseous state, and the filter system requires periodic maintenance. Extractors cost from $30 to $200.

Woodworking production shops and school studios that consume large volumes of compressed air can eliminate water condensation with one or a combination of air dryer systems. An after-cooler connected between the compressor and the receiver will eliminate the bulk of the water, oil and residues. The after-cooler uses a water-circulation system to eliminate two-thirds of the water from the air before it reaches the receiver. The remaining moisture is in a vapor state. The cost of an after-cooler for a 5-hp unit is about $300, but be sure to check city codes before installing one.

An after-cooler will satisfy the needs of most studio/shops. But, if the air system requires numerous traps and extractors, a refrigerated or chemical air dryer can reduce the cost of the traps plus eliminate their maintenance. A studio/shop would probably use a low-maintenance refrigerated dryer, which will remove 95% of the moisture. A 5-hp compressor with a 19-cfm capacity will need one costing about $1,200. This cost is considerable, yet industry uses refrigerated dryers as it is believed that the dryer will pay for itself in the long run through low maintenance.

The most effective dryer is the chemical dryer, which produces nontoxic air that is safe for use in the food industry. There are two types: deliquescent and desiccant. Deliquescent dryers cost about $500 for a 5-hp model, and desiccant driers cost about $1,600. Both require frequent maintenance plus the cost of regularly adding fresh chemicals.

Air lines It is important to use the proper size pipe or hose to deliver the air from the compressor to the tools. When compressed air must travel long distances, its pressure begins to drop. The chart below matches compressor size and pipe length with pipe diameter.

The simplest piping arrangement, of course, is a hose directly connecting the receiver to a single tool. Where the main line is permanent or stationary for a distance of more than 10 ft., the line is usually made of pipe. Copper is the first choice, though galvanized pipe is probably used most often. Black iron pipe is also acceptable. The main line should slope slightly toward the receiver or toward moisture traps in the line. Stationary piping facilitates connection of extractors and *T*-joints for take-off stations. The take-off station or tool station, is where a

Main Air Lines

hp	Lengths	Pipe dia.
⅓ & ½	All	¼"
¾ & 1	All	½"
1½ & 2	All	¾"
3 & 5	Up to 200'	¾"
3 & 5	Over 200'	1"
7½ & 10	Up to 100'	¾"
7½ & 10	100' to 200'	1"
7½ & 10	Over 200'	1¼"
15 & 20	Up to 100'	1"
15 & 20	100' to 200'	1¼"
15 & 20	Over 200'	1½"
25	Up to 200'	1¼"
25	Over 200'	1½"

Courtesy: Binks Mfg. Co.

Manufacturers of Portable Air Tools

Aro Corp.
One Aro Center
Bryan, OH 43506
(routers, sanders, grinders, drills, hoses, reels, screwdrivers)

Chicago Pneumatic Tool Co.
Six East 44th Street
New York, NY 10017
(drills, grinders, sanders, saws, files)

Creative Engineering
216 Tosca Drive
Stoughton, MA 02072
(Tool-trax, Uni-crane, riveting tools, drills, screwdrivers, grinders, sanders)

Danair, Inc.
P.O. Drawer 3898
Visalia, CA 93277
(nail hammers)

Dynabrade Inc.
72 E. Niagara Street
Tonawanda, NY 14150
(small belt sanders, grinding sticks)

Ekstrom, Carlson & Co.
1400 Railroad Ave.
Rockford, IL 61110
(drum sanders)

Granite City Tool Co.
Box 368
St. Cloud, MN 56301
(carving hammers)

International Staple & Machine
1000 East Butler Road
Butler, PA 16001
(nailers, staplers, tackers)

Merit Abrasive Products, Inc.
201 West Manville
Compton, CA 90224
(sanders, die grinders)

National-Detroit, Inc.
1590 Northrock Court
P.O. Box 2285
Rockford, IL 61131
(orbital, straight-line sanders)

Nicholson File Co.
Box 728
Apex, NC 27502
(rotary burrs)

Nitto Kohki USA, Inc.
111 Charlotte Place
Englewood Cliffs, NJ 07632
(sanders, files, die grinders, chisels, drills)

Rockwell International
662 N. Lexington Ave.
Pittsburgh, PA 15219
(drills, grinders, orbital and straight-line sanders, saws, routers, laminate trimmers)

Rotor Tool Co.
26300 Lakeland Blvd.
Cleveland, OH 44132
(drills, die grinders, screwdrivers)

Sand-Rite Mfg. Co.
1611 N. Sheffield Ave.
Chicago, IL 60614
(drum sanders)

Sculpture Associates Ltd., Inc.
114 East 25th Street
New York, NY 10010
(woodcarving tools, hammers, grinders)

Severance Tool Industries, Inc.
3790 Orange Street
P.O. Box 1866
Saginaw, MI 48605
(rotary burrs, files)

Sioux Tools, Inc.
2901 Floyd Blvd.
Sioux City, IA 51102
(drills, grinders, laminate trimmers, routers, sanders, saws)

SME Corp.
P.O. Box 126
Fairfield, NJ 07006
(convex rotary planer heads)

Stanley Air Tools
700 Beta Drive
Cleveland, OH 44143
(drills, grinders, routers, screwdrivers)

Star Dental Mfg. Co., Inc.
Ford Bridge Road
Conshohocken, PA 19428
(dental lab handpieces)

Starlite Industries, Inc.
11 11 Lancaster Ave.
Rosemont, PA 19010
(die grinders)

Stuhr Manufacturing Co.
5005 27th Ave.
Rockford, IL 61109
(sanders)

Superior Pneumatic & Mfg.
P.O. Box 9667
Cleveland, OH 44101
(drills, die grinders, sanders)

Thor Power Tool Co.
175 North State Street
Aurora, IL 60507
(drills, grinders, sanders)

Trow and Holden Co.
45 S. Main Street
Barre, VT 05641
(carving hammers)

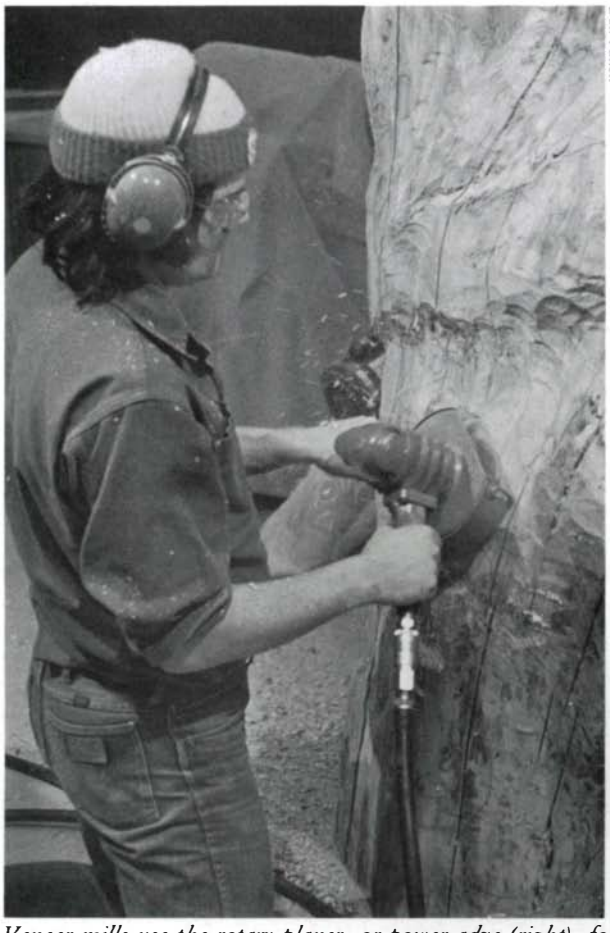
Willson Division, E.S.B. Corp.
P.O. Box 622
Reading, PA 19603
(safety glasses, respirators)

Bill Snyder Films, Inc.

The die grinder is extremely valuable for woodcarving and sculpture. This one weighs only a pound, yet the burr twists at 22,000 rpm, saving hours of gouge-tapping. The burr shown was specially designed by Severance Tool Industries for sculptor Wendell Castle. It is No. NNB ball mill, ¼-in. shank, 1¼-in. diameter, 5½ teeth per inch double cut. It costs $22 in high-speed steel, $143 in carbide; both can be resharpened. The tree-shaped burr, right, is a standard pattern. Merit Power-Lock flexible sanding pads, left, snap on and off the shaft, which remains chucked in the grinder.

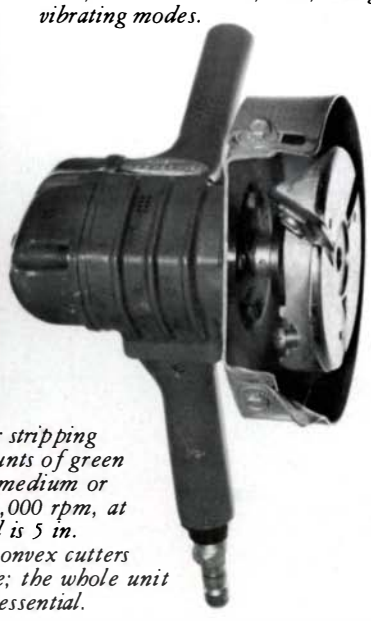
Pneumatic Tools

Tool	Weight (lb.)	cfm	psi	hose dia. (in.)	free speed (rpm)	Price (approx.)
Carving hammer	1⅞ - 3½	4 - 6	90 -100	⅜	5,200 -6,200	$220
Dental handpiece	3/16	2.5	36 -60	⅛	25,000	$250
Drills	1½ - 3¼	4	90 -100	¼ - ⅜	330 - 5,200	$40 -$120
Grinders, die	¾ - 2⅜	14 - 18	90 -100	¼	20,000 -25,000	$70 -$140
Grinders, pencil	5/16	7	90 -100	⅛	50,000	$115
Grinders, vertical	10	15 - 20	90 - 100	½	6,000	$400
Laminate trimmer	2 - 3¼	22 - 54	90 - 100	¼	22,000 - 28,000	$150 - $210
Routers	3 - 8	22 - 54	90 - 100	¼ - ⅜	6,000 - 22,000	$270 - $370
Sanders, belt	15	22 - 54	90 - 100	⅜	1,120 - 1,900 ft./sec.	$550
Sanders, disc	4½ - 5	24	90 - 100	⅜	5,000	$120
Sanders, drum	¾ - 3½	14	90 - 100	¼	2,400 - 2,600	$200
Sanders, orbital	3⅜ - 6¼	5.3 - 15	75 - 90	¼ - ⅜	8,000 - 15,000	$70 - $120
Sanders, random orbital	4	15	90 - 100	¼ - ⅜	9,000 - 10,000	$64 - $135
Sanders, straight line	5½ - 30	8 - 15	75 - 90	¼ - ⅜	1,100 - 3,000	$70 - $780
Saws, circular	16 - 24½	25 - 70	90 - 100	½	3,000 - 6,000	$810 - $870
Saws, jig	5¾	22	90 - 100	¼	4,000	$230
Saws, panel	3½ - 3¾	22	90 - 100	¼	1,400	$325 - $410
Saws, reciprocating	5 - 8½	24	90 - 100	¼ - ⅜	1,500 - 1,600	$535 - $600

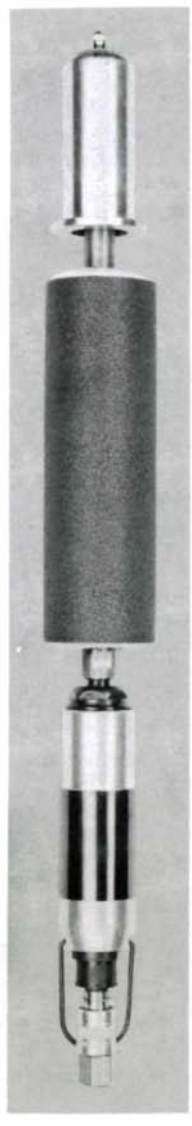


Dan Pullen

The rolling pin sander (right) has no electrical equivalent. It consists of an in-line pneumatic drill (the more common gun drill, above, can be substituted) fitted with an inflated drum and a ball-bearing handle. The drum conforms to convex shapes, although the sanding sleeves must have J-weight cloth backing for flexibility. The sander is made in several diameters from 1 in. to 3 in., and in lengths from 6 in. to 10 in. Pneumatic sanders are also made in the usual orbital, random orbital, disc, straight-line, belt and vibrating modes.



Bill Snyder Films, Inc.



Veneer mills use the rotary planer, or power adze (right), for stripping bark. Sculptors find it especially good for wasting large amounts of green wood (above) and stacked glued forms. The power unit is a medium or heavy-duty vertical grinder, which produces almost 2 hp at 6,000 rpm, at a cost of 20 cfm of air at 90 psi. The three-knife planer head is 5 in. across. Straight cutters (Indiana Manufacturers Supply) and convex cutters (SME Corp.) are available. The depth of the cut is adjustable; the whole unit weighs about 10 lb. Blade guard, goggles and ear protectors are essential.

T-joint is placed in the main line to gain access to the compressed air. If the air system does not include an after cooler or air dryer, then some form of drain or extractor should be located at the take-off staion and at low points in the line.

The tool station may require accessories for special situations. Where a spraying operation may be affected by water or oil in the air, a water and oil coalescer (filter) must be used to remove oil aerosols, water droplets and suspended particles. To reduce air pressure, say, from 90 psi to 35 psi, a regulator, also called a diaphragm or transformer, is included in the take-off station. Regulators are also manufactured in combination with coalescers and extractors.

Tools that need small amounts of oil for lubrication and to prevent rust can be serviced with an automatic lubricator attached to the tool station or the air intake of the tool. Some manufacturers build automatic oilers into the tool, although the expense of an automatic lubricator can be bypassed by putting a drop or two of pneumatic oil into the tool's air intake every 15 or 20 minutes.

Flexible hoses are easily connected and detached with couplers, also called quick couplers. Couplers are attached to the work station, to the ends of hoses and extension hoses, and to the air tool. The female coupler and male fitting engage and disengage quickly by sliding the locking sleeve on the female coupler. The work station is always fitted with a female coupler; hoses and extension hoses have a female and male fitting at their ends, and the air tool is always equipped with a male fitting.

Air hoses from the main line to the tools should not be any longer than necessary, to keep the pressure up. Some tools require hoses of specified inside diameters, which the manufacturer will provide, although general requirements are given in the chart on page 72. There are several types of hose: non-oil resistant, oil resistant and nylon Re-Trak. If oil can enter the line via a lubricator at the work station, oil-resistant hose must be used. Nylon Re-Trak, available in ¼-in. and ⅜-in. diameters, is formed in a spring-like coil and will wind itself up when left to its own devices.

A useful accessory in a busy shop would be an overhead track system that pivots in a full circle, to prevent a clutter of hose on the floor. Industry uses retractable cable balancers to support tools at work stations for long operations. Auto service stations usually store hose in a self-winding reel, very handy. If you are installing an air system, don't neglect a small blowgun, invaluable for cleaning up and blasting chips out of holes and awkward recesses. □

Further reading

The Compressed Air and Gas Institute, 122 E. 42nd St., New York, N.Y. 10017 publishes a handbook (4th edition, edited by John P. Rollins) that I have found useful. In addition, Binks and many other manufacturers publish pamphlets on compressed air, pneumatic tools, hoses and fittings.

Polyhedral Puzzles in Wood

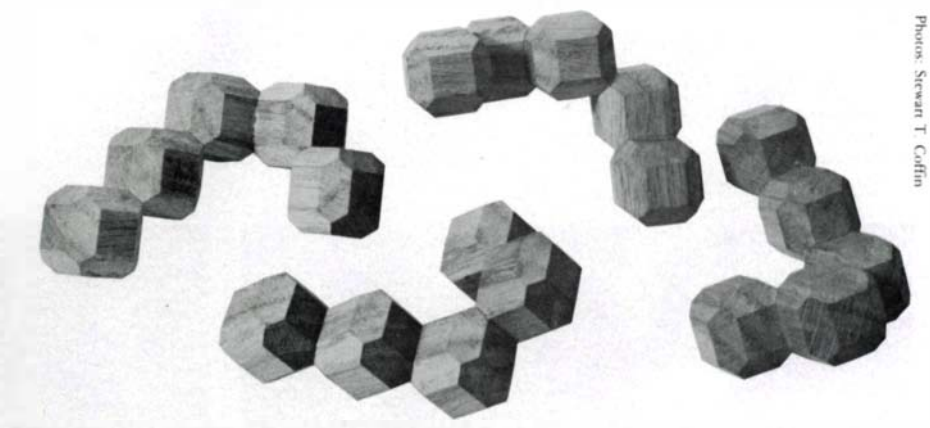
Sculptural art that comes apart

by Stewart T. Coffin

Geometrical and mechanical puzzles have always fascinated me, especially those made in three dimensions with notched sticks. Curiosity led me to wonder if there might be interesting configurations other than the usual orthogonally notched square sticks, and I came up with a set of new arrangements with interlocking triangular or hexagonal rods. This discovery inspired me to begin a systematic investigation of the subject of interlocking polyhedral dissections which, surprisingly, seems to have been almost entirely overlooked by puzzle designers of the past. Concurrently, I devised tools and techniques to produce the puzzles in my shop, and soon they were being marketed under the slogan "AP-ART—the sculptural art that comes apart." Some were molded or cast in resin, but wood soon proved to be most practical for producing small runs of unusual shapes, as well as most pleasing esthetically.

Introducing different-colored pieces added a new dimension to the puzzle designs. A few years ago, a set of four colored cubes marketed under various names suggested to me the possibility of introducing color matching problems in interlocking solids. I used different-colored exotic woods—ebony, rosewood, tulipwood, satinwood, purpleheart, padauk and many others—all highly polished.

Recently I've been investigating the combinatorial possibilities of various interlocking solids. A combinatorial puzzle is one in which all or nearly all of the individual pieces are

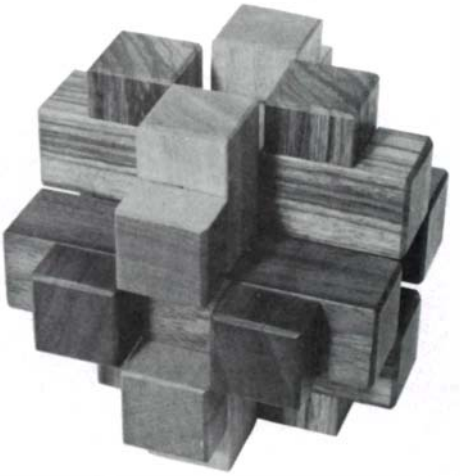


Photos: Stewart T. Coffin

This 20-block pyramid, left, consists of four pieces, each made up of five truncated rhombic dodecahedra joined in different ways. They assemble one way and in one order only to form a tetrahedral cluster. The individual units are made by taking cubes and sawing off the edges at 45°. Joints are doweled and glued. Model shown here is white oak.

The triangular prism puzzle, so named because it has the appearance of four mutually intersecting triangular prisms, is one of the most difficult to fabricate because of the odd angles of the six dissimilar puzzle pieces. Only a few were made. This one is African mahogany.

The convoluted cube, made up of 12 pieces, is one of Coffin's early designs. This one is made of rosewood and satinwood. The six outside faces are sanded after assembly, the puzzle is disassembled for lacquer impregnation, then assembled again for final waxing and buffing with lamb's wool.

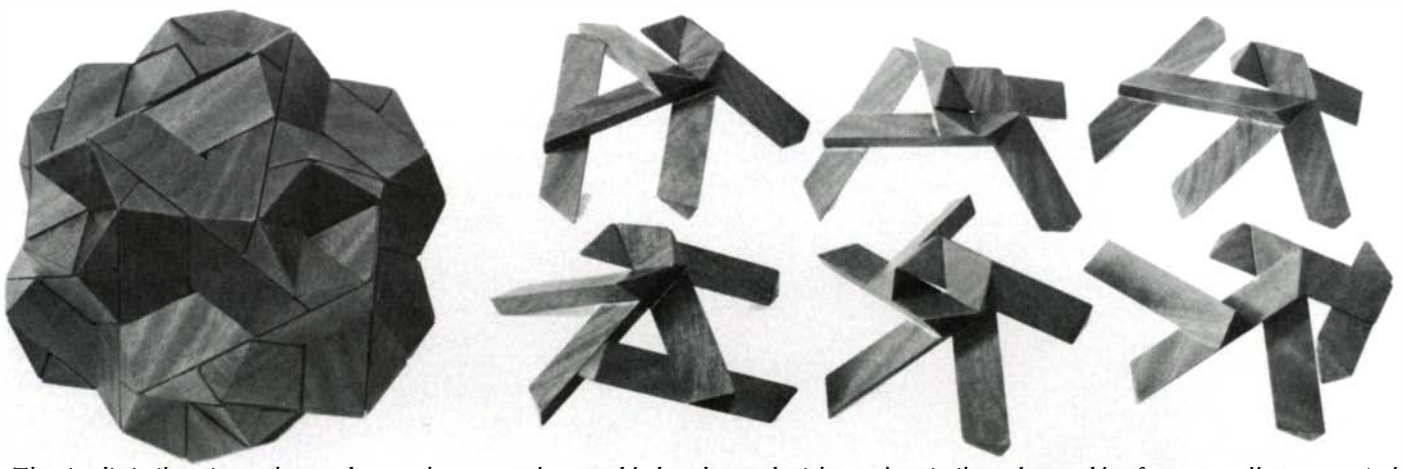


This ingenious 12-piece burr puzzle is not an original design—the basic principle was patented by W. Altekruse in 1890. Coffin's version has the appearance of three interlocked squares, each of a different kind of wood—here in zebrawood, satinwood and padauk.

dissimilar and nonsymmetrical, and the object is to discover the one correct method and order of assembly from among a great many incorrect ones.

My woodworking shop would be considered modestly equipped by professional standards. I buy my lumber planed to exact thickness, or I send it out to be planed. I do my ripping with a 20-in. band saw. All crosscutting is done on a little 8-in. table saw, using a Simonds 150-tooth hollow-ground blade. My other power tools are a belt sander and a drill press. The "trick" is that all sawing, sanding, drilling and gluing are done using carefully designed and extremely accurate jigs. Even the band saw is capable of very accurate cuts if set up properly, meaning a sharp, high-quality ¾-in. blade (I use only Olympia), maximum tension and tight guides, and sometimes auxiliary guides as well. No measurements or markings are made at any stage of fabrication, for they would certainly be less accurate than the jigs, to say nothing of the time they would consume. Fortunately, most of the designs call for identical sub-pieces, and the same few basic angles come up again and again in the calculations, so that relatively few jigs are required to produce all the puzzles shown.

I use aliphatic-resin glue. Other types, such as urea resin, may form a stronger bond with certain difficult oily woods such as teak or cocobolo, but the aliphatic has the elasticity



The six dissimilar pieces shown above, when correctly assembled and mated with another similar subassembly, form a totally symmetrical hollow shell having a shape that might be described as a dissected castellated triacontahedron, left. Coffin's patent D-232-571 defines it as a "spheral polyhedral interlocking puzzle."

John T. Urban

The 60 individual sticks that make up the puzzle shown above are assembled on a set of 12 precise gluing jigs. The original pentahedral base for the jigs was made on a milling machine, then duplicated by

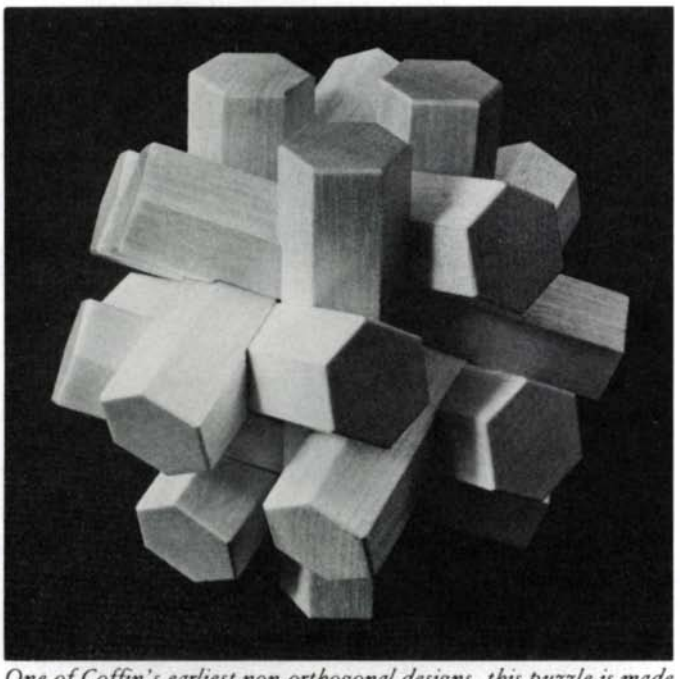
John T. Urban

casting in Hydrastone. After the yellow glue has set, the puzzle is assembled, and the ends of the sticks are trimmed flush on the table saw, using a jig that slides in the miter-gauge slot.

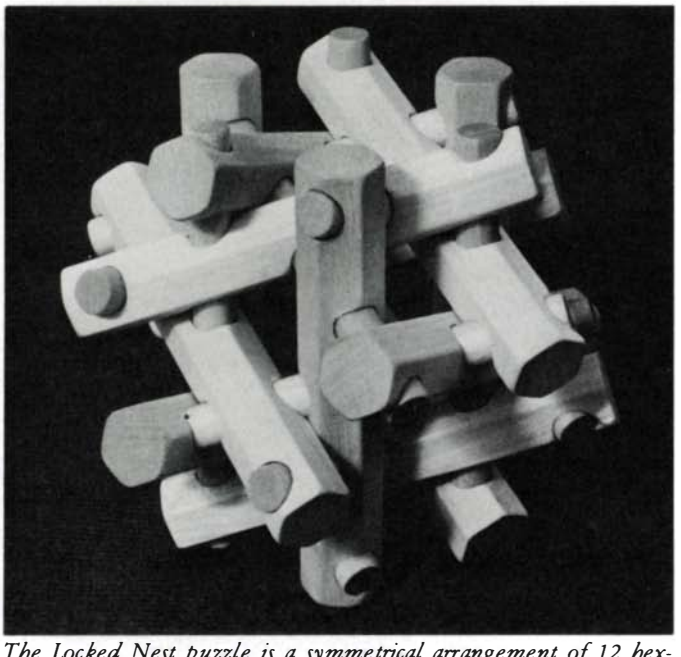
necessary for my side-grain to end-grain joints, where a harder glue might fail from seasonal stresses.

The finish I use for nearly all my exotic woods is lacquer impregnation, sometimes followed by waxing and buffing. For my latest designs, in which I use mostly domestic hardwoods and mahogany, I have had good results with dipping in dilute tung oil and rubbing by hand. □

Stewart T. Coffin at one time published a newsletter, Puzzle Craft, *about the design and construction of mechanical puzzles. A 24-page reprint may be obtained by sending $2.00 to Coffin at Old Sudbury Rd., RD 1, Lincoln, Mass., 01773.*



One of Coffin's earliest non-orthogonal designs, this puzzle is made up of 12 essentially identical notched hexagonal rods (U.S. Patent 3,721,448). The original model was cast in epoxy and later manufactured by injection molding. This one is a new wooden version.



The Locked Nest puzzle is a symmetrical arrangement of 12 hexagonal rods pinned together by 12 dowels. Some of the dowels are free to slide. The hexagonal birch stock is milled to Coffin's specifications, then the holes are made with a spur bit, using a jig that positions them very precisely.

Design Sources

Conventions stand in for genius

by Cary Hall

The amateur cabinetmaker usually stumbles into the fascinating world of wood by trying to make something his wife sketched on the bottom of her shopping list. Hooked, he buys some tools, maybe a book, and learns about the voluptuous delights of successfully mating two pieces of recalcitrant wood. Further seduced by the beauty of freshly worked wood, he finally approaches a level of competence that enables him, with some trepidation, to take on a real woodworking project. He makes the joints tight and the finish smooth only to find, once it's complete, that it's a well-made mess, offensive to the eye, destined for those distant reaches of the house reserved for furniture-to-be-ashamed-of. There are also some professionals who lavish their skill on atrocities. The reason is obvious—being an expert cabinetmaker doesn't automatically make one a skilled and expert furniture designer.

So you love wood and beautiful joinery. But you lack that rare muse whispering in your ear, "Another 1/32 off and it'll be just right." Small changes in furniture dimensions, changes so small as to be imperceptible on a drawing, make astonishing differences in appearance. The compromises between appearance, strength and ease of construction require something more than training and experience. Truly original design requires inborn talent, and such talent is extremely rare.

We amateurs need some guidance. I get it from the past, in particular from the golden age of furniture design, the Chippendale era (about 1750 to 1800). During this period the Queen Anne leg blossomed, together with the ogee foot, the ball and claw foot, fluted columns, cyma curve molding and other design conventions that simplify the problem of laying out good-looking furniture. In effect, the furniture designers of this period established a large number of design choices that could be combined to make a tasteful piece. Drawers could be lipped, or the discontinuity graced by beading. Quarter-columns made corners elegant. Molding provided easy transition to curving legs. Shell carvings fitted well into furniture ornamentation.

Furniture-makers in our time, equipped with modern tools, have progressed beyond the conventions that made things easier for the Chippendale-era designers. The delightful flowing creations of today are, by all odds, the best-looking furniture the world has so far seen. But modern furniture can't easily be copied. The lines are so fine and critical that a very small deviation from the original can spoil the piece entirely. And there's just no way to combine and alter modern furniture designs to arrive at a different piece in the same style. Modern furniture is for artists and trained designers, not for cabinetmakers.

We can, however, follow in the footsteps of the Colonial cabinetmakers who took the basic designs of Chippendale, Hepplewhite and Sheraton and built pieces that still make the eyes sparkle and the hands tremble. Generally, our Colonial furniture makers were inspired copyists, and by combin-

ing the standard features—the square tapered legs, the shell carvings, the ogee legs—the amateur can also come up with furniture that from a decent distance stands some chance of comparison with the stuff in museums. Most of us, however, need some idea of sizes and actual shapes—we just aren't good enough to look at a photograph and be able to sketch up a piece that will come out of the shop looking good.

Fortunately, some authors have turned out books with dimensioned plans. Few of us will follow these plans exactly, and more to the point, shouldn't try. Many have a dimension wrong somewhere, and blindly following the plan may lead to parts that won't fit. The Summer '76 issue of *Fine Woodworking* contains a comprehensive list of books offering such dimensioned plans. My own favorites are two of Franklin Gottshall's books, *Heirloom Furniture* and *Reproducing Antique Furniture*, which give a library of attractive designs. They are not exact copies, as in Lester Margon's books, and each has some usually helpful construction tips.

As a practical example, let's take a design out of Gottshall's *Reproducing Antique Furniture* and see what happens. On p. 138 is a lovely block-front chest-on-chest, a piece that Goddard would have been pleased to claim as his own. The problem is, this chest-on-chest is too big for most bedrooms, the upper drawers are too high for daily use, and the pediment is mighty ambitious without adding too much to the basic furniture need, a chest of drawers. The lower section is just perfect for a chest of drawers, provided you adjust the overall dimensions while keeping the block fronts proportional. The need was, in my own case, for several chests, each wandering well away from Gottshall's dimensions.

Now it's time to be careful. We go over Gottshall's fine drawings. We discover that the legs cannot be made as shown on the side view in fig. 3. We puzzle over fig. 21, where the leg curves have been reversed, further confusing the issue. We note his instructions for laying out the shell carving and find that making each shell flute identical just won't work.

Because we are changing all the dimensions anyway, we don't really delve into the accuracy of the printed dimensions. We do bear in mind that the plans for the corner cabinet (p. 154) have a half-dozen inaccuracies, so we check every layout of our modified plan to make sure it can be assembled. It takes concentration to fathom the relationships of the block-front recessions and projections and of the base moldings. We are particularly impressed by the thickness of the mahogany needed for the drawer fronts and the catastrophic loss of expensive wood if a gross mistake is made.

All of us have preferences concerning the way a piece is put together. My own stubbornly held choice is to dovetail upper and lower carcase corners of a chest of drawers, to make something the professionals call a "true chest." This sturdy four-sided box then carries the drawers and sits on a removable base. This construction method is quite different from the interior design of the Gottshall piece used as a model.

The corner dovetails of the chest could perhaps be made by machine, but making them by hand is a delightful way to spend time, and the splendid feeling one gets when a corner is fitted and everything just matches and you tap the wood a bit to make it go—well, it's indecently sensual.

I mortise the drawer runners into the sides (no glue here) and tenon the rails into the sides. With my preferred construction method, the basic four-sided box, the rails, the runners, the stiles (if any) and the drawer partitions must all be assembled in one gluing session. Realization that a few minutes of delay can ruin a couple of weeks of work is a marvelous stimulant to one's attention. The stack of parts in less than an hour's time becomes a recognizable object, so put together that it can never again be taken apart. I pin all tenons and the end dovetails.

The top drawer needs carving into the Goddard shell design. Gottshall lays out the design, essential for someone not adept at interpreting a murky picture and detailing the carving barely shown. This sort of carving doesn't require the artistic sense that allows one to call oneself a woodcarver, but it is a most pleasant occupation, shaving away slices of mahogany to arrive at the stylized shell.

The block fronts and the rails have to be fitted vertically so that everything is aligned when the drawers are closed. No matter how carefully I cut the drawers to make the block fronts, and the rails to fit the upper lips of the drawers, there will be misalignment. I have become reconciled to my own inability to measure and cut several parts and then bring them together for an acceptable fit. Consequently, I allow a little excess wood and plane and carve the drawer fronts and rails into proper alignment after the drawers are assembled.

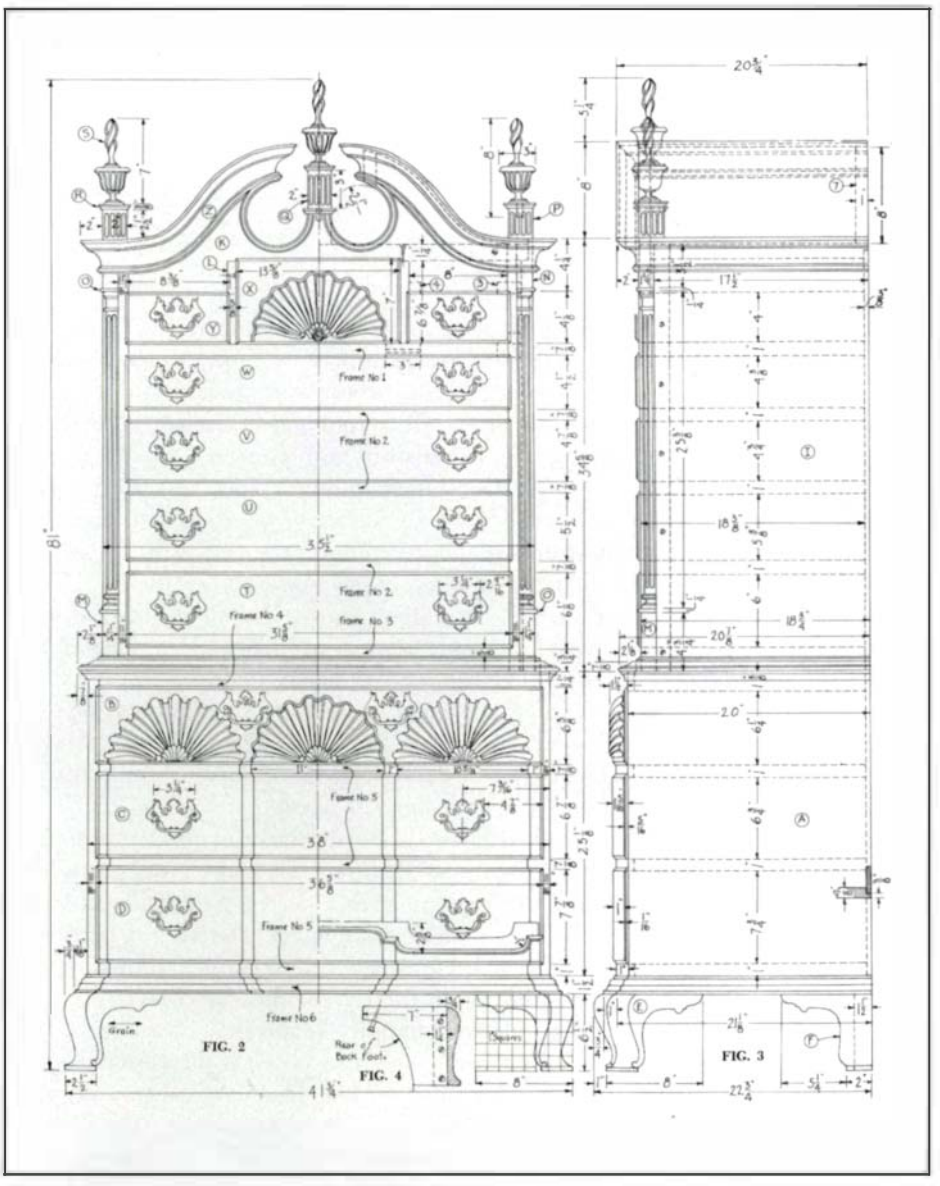
After lining up the block fronts, dovetailing and assembling the drawers, and fitting the molding (which covers the top dovetails) I make the base assembly—frame, legs and molding. I go overboard on making my bases strong with a good deal more wood than shown in the book plans, and pins where they can't be seen. I don't use dowel joints, but I do use dowels to pin tenons and to pin pieces where the strain is perpendicular to the dowel, not parallel to it. Carving the legs is pleasant; it's a joy to see the complex curves emerge. The molding can't be completed with a router or shaper because of the changes in direction, and it too must be hand-carved at the interior corners.

Close fits are essential throughout. If you trial-assemble a piece, without glue or pins, and shake it, there can be no movement—it must be steady as a rock. Any looseness in furniture means that it has a limited life, since looseness will always increase until the thing disintegrates. One test I use is to check that one leg of a completed piece is a little clear of the floor. Few floors are as accurately level as the furniture legs of closely made projects, and one leg clear means that the piece is rigid enough to resist sagging to fit a slightly uneven floor.

I made two block-front chests from the one Gottshall drawing, one close to the original proportions of the base of the chest-on-chest, and one somewhat taller. I also got a third chest out of the same basic design. It has quarter-column corners like the upper section of the Gottshall design, but with the same legs as the first two chests.

One of the problems with this sort of work is that the dimensions of the legs should really be changed a bit to match the revised dimensions of the chests. I am just not good enough to figure out how much and where. Probably few cabinetmakers are talented enough to make such small changes during construction to gain maximum proportional appeal. I find it difficult to worry about this lack, although it may, 300 years from now, keep my work out of somebody's museum of 20th-century homecraft. □

Cary Hall, of Hampton, Ga., is an engineer who achieved a dubious notoriety for his humorous article, "The Wood Butcher," in our Spring '77 issue.



Block-front chest-on-chest, taken from Reproducing Antique Furniture *by Franklin H. Gottshall,* © *1971 by Franklin H. Gottshall. Used by permission of Crown Publishers, Inc., New York.*

Cary Hall's variations on a theme: This chest, adapted from Gottshall's design, measures 20 in. deep, 35⅛ in. wide and 47½ in. high. Material is mahogany outside and Southern pine inside.

Photos: J. O. Strickland

This chest has quarter-column corners, but the same feet as the other two. It measures 18½ in. deep, 36¼ in. wide and 49¾ in. high. The outside is mahogany, inside is Southern pine.

Block-front chest at left closely resembles the base of Gottshall's large chest-on-chest. It measures 20 in. deep, 43½ in. wide and 37⅜ in. high. Material is mahogany outside and Southern pine inside.

BRUCE HOADLEY

Wood has to breathe, doesn't it?

"But I was told I shouldn't use varnish because it really doesn't allow the wood to breathe. The wood *should* be allowed to breathe, shouldn't it?"

As I tried to answer the telephone inquiry about a routine finishing problem, I thought to myself, "Oh, oh, the old 'wood has to breathe' thing again." It took another twenty minutes of talk to untangle things. After hanging up, I opened my notebook to a list I once started, called *Common Confusion about Wood*. "Wood has to breathe" had been logged in as Item 2B. It goes with 2A, "Wood is a living substance," and 2C, "You must feed and nourish wood to keep it well." I wonder how these notions get started, or where to begin separating fact from fiction, to clarify the confusion. Wood is such a complicated material, and there is so much vital information to become familiar with, it is truly a shame that the whole subject has been made even more confusing by such wrong ideas as wood somehow being a living, breathing material. Because these misconceptions are so rampant and can be so misleading, a review of some of the more common fallacies will be worthwhile.

A tree is a living organism, which of course it must be in order to grow. It is made up of a myriad of cells, all of which were alive when they formed, some of which are still alive, but most of which (in the wood of the tree) are dead. A cell is considered alive if it contains living protoplasm and a nucleus within the cell cavity. The thin cambium layer, which is the growing interface between bark and wood, is composed of living cells. Cambium cells can divide to produce new bark and wood cells. As the newly divided cambial cells differentiate and transform into various specialized wood cells, they remain alive for several days—long enough to assume their final shape and to develop the full cell-wall thickness.

In newly matured sapwood, however, only a few cells (roughly 10%) remain alive. They are called parenchyma cells. By retaining their living contents, they are able to assimilate and store carbohydrates and perform other metabolic functions. But all the cells other than parenchyma lose their protoplasts after maturing and are therefore non-living. They may still participate in the tree's life functions by providing a means of sap conduction through their now empty cavities (vessels in hardwoods or tracheids in softwoods), or they may simply strengthen and support the tree according to their relative cell-wall thicknesses.

As sapwood eventually becomes heartwood, the parenchyma cells also die. Heartwood is all dead cells. No sap conduction takes place in heartwood either.

When a living tree is cut down, its complicated life system comes to a halt. The parenchyma cells of the sapwood gradually die too. By the time the moisture is dried out of the wood, it is absolutely dead—no more alive than a cotton shirt or a wool necktie.

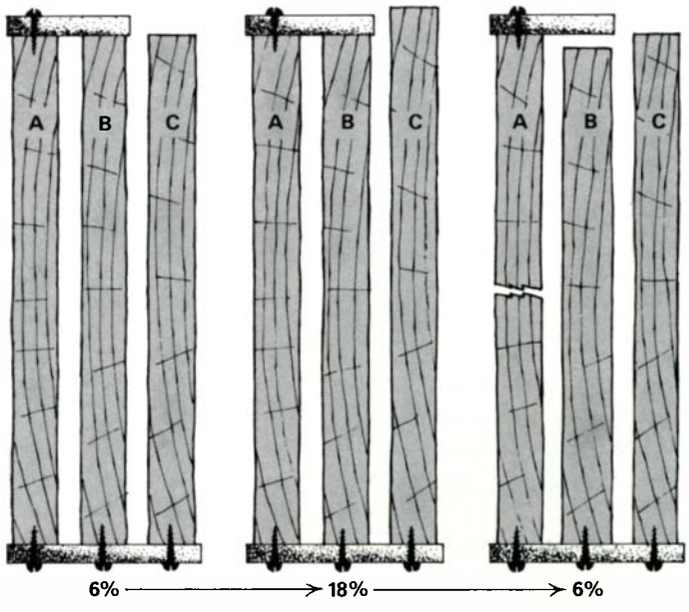
The "breathing" analogy is often applied to the shrinking and swelling of wood as moisture is gained and lost in response to variations in atmospheric humidity. It has also been applied to the fact that as atmospheric pressure and temperature change, air from cell cavities may be exchanged with the atmosphere by expansion and contraction. If this is breathing, then cellulose sponges and lava stones also breathe. By sealing off the surface of wood, some finishes can virtually eliminate moisture or air exchange, which is usually an advantage. The wood doesn't have to breathe.

Wood doesn't eat, either, so you don't have to feed it.

When a finish is used on the surface of a piece of wood, the improvement in appearance is mainly an optical effect. When a finished surface becomes ineffective, the finish may be rejuvenated without affecting the wood. The coats of finish put onto wood may enhance its appearance or protect it, but the finish in no way nourishes the wood.

Confusion exists also about agencies or mechanisms that can destroy wood. Item 3A on my list is about dry rot, a misnomer from the beginning since rot is caused by decay fungi whose activity is possible only in the presence of moisture. Item 3B is that wood somehow disintegrates if allowed to dry out. One authority on the care of museum objects declares that a 50% relative humidity (equivalent to about a 9% equilibrium moisture content in wood) is the absolute lower limit of safe humidity, on the meaningless grounds that "dehydration" will take place if the air is dryer, or that wood is susceptible to "damage by desiccation" (whatever that means). In fact, as evidenced by artifacts discovered in the arid Southwest, wood can survive for centuries in extreme dryness. The notion that wood is harmed by dryness may come from the shrinking of wood upon exposure to relatively low humidity. Certainly, the loss of dimension and the uneven shrinkage that causes warping or checks are usually undesirable. But the wood itself does not deteriorate merely by drying and shrinking. Every piece of cabinet wood has already been dried and has already shrunk in the process of getting it from the tree to the shop.

Cyclic humidity, not dryness only, is probably at the bottom of these misunderstandings. People say, "Oh, we don't have any trouble from high humidity. Low humidity causes all our problems." Most of the time, damage to wooden furniture which has been in use for a long time is due to seasonal moisture cycles, usually associated with some sort of restraint in the construction. When the humidity goes up, the wood expands. It may be restrained, for example, by a tenon that tightly fits a mortise. The fibers are compressed, but the joint remains tight with no apparent damage. Inside the joint, though, the fibers may have been compressed beyond their ability to recover. The assembly dries again, and the wood either checks or the tenon shrinks smaller than its original dimension. Although the wood has only returned to an originally low level of moisture content (at which the wood was in



This diagram summarizes an experiment Hoadley conducted to illustrate the effect of variations in moisture content when wood is prevented from shrinking and expanding. All three sections were cut across the width of the same board, whose moisture content was 6%—equivalent to a relative humidity of around 20%, normal for interiors during the Northeastern winter. Heavy screws fixed one end of each piece of wood to a metal plate. The other end of board A was also screwed down tight, equivalent to a tabletop tightly secured to an apron frame. Board B was prevented from expanding by the metal plate, but not attached to it—equivalent to a panel fitting tightly into grooves in the stiles of a frame. Board C was unrestrained. Hoadley slowly raised the humidity to 80%, typical for summer. The moisture content of the wood increased to 18%. Board C expanded, as you would expect, while the metal plates prevented boards A and B from expanding. You can't see it, but the elastic limit of the wood has been exceeded and the wood cells are permanently deformed: compression set. When he reduced the moisture content to the original 6%, the unrestrained board C returned to its original size. Board B became smaller than it had been during the previous "winter," and board A cracked because it wasn't allowed to shrink. It's neither the high humidity nor the low—it's the annual cycle, combined with restraint in construction.

good condition), people conclude that the damage occurred because the wood "dried out." The point is, the variation in moisture content, not simply drying out or dryness, caused the damage. The weathering of wood outdoors is the perfect case in point: The wood gradually breaks up due to cyclic swelling and shrinkage, although the moisture level remains fairly high all year around. This also suggests that finishing is helpful and "breathing" would actually be bad for the wood's "health." Severe dryness may also harm some finishes and adhesives. The finishes may dry out, or veneers may separate as a result of dryness, but such problems must be blamed on the degradation of the chemicals or on associated shrinkage stresses, not on deterioration of the wood itself.

Item No. 4 is listed as "Sapwood is weaker than heartwood." This frail idea collapses when we realize that every mass of wood cells was once sapwood, and the cell walls were formed when it was sapwood. Transformation into heartwood may deposit extractives which may ever-so-slightly increase the wood's density and perhaps its abrasiveness to cutting tools, or possibly its hardness, but strength differences are usually insignificant. The confusion is entangled with decay resistance. Because sapwood never has noteworthy decay resistance and heartwood may be very decay-resistant, the sapwood may be weakened in wood exposed for a period of time to conditions favoring decay. Hence the conclusion that heartwood is stronger.

Few subjects can evoke more controversy than the drying of wood. My list reads "No. 5: drying in general" with many sub-headings. It contains notions that seem strangely illogical, even though they cannot all be flatly disproven.

The lore of woodcraft seems rich in rules for when to cut trees to produce the best lumber for various purposes. The supportive reasons involve such nebulous explanations as "when the sap is up" (or down, depending on whom you ask) or "atmospheric influences." Such recommendations probably date back to the difficulties of harvesting and seasoning timber by muscle power. The tree had to be cut down, sawn into lumber, stickered and the drying initiated before it could begin to rot. Logically then, "Beech should be cut in November"—to take advantage of the cold months to get it cut and stacked, and of the dry, windy spring months to get air-drying well under way. Oak was harvested in late spring and summer because an important by-product was bark for tannin, and the bark won't come off an oak tree cut during its dormant season. These days, logs can be harvested, hauled, sawn and the drying begun in a matter of days. Lumbering goes on year round.

Controversy also exists over the comparative qualities of air-dried lumber and kiln-dried lumber, or new wood and old wood. Some people believe kiln-dried wood is permanently shrunk and stable. Not so. Others believe that very old wood becomes stabilized and loses its ability to shrink and swell. Not so. In fact, tests of wood of known ages up to several thousand years have shown that it remains quite hygroscopic and dimensionally responsive, apparently forever. Whether air-dried lumber or kiln-dried lumber is superior is another unending dispute. For such questions the answer may be in the qualification. Not all kiln-dried lumber is dried properly—lumber can easily be ruined in a dry kiln. Carelessly air-dried lumber can be equally useless. But kiln-dried lumber is pretty hard to beat when moisture content and stress are properly controlled.

I have heard claims and counter-claims by the most reputable and accomplished woodworkers to the effect that if wood is air-dried it has better "working properties" or "richer color." I have also been told that kiln-drying, after a period of air-drying, "sets" the fibers, enhancing workability. I can neither substantiate nor disprove these opinions, and there are countless other such grey areas. This is probably what makes wood so fascinating to deal with. As hard as I strive to learn about wood, I somehow hope that all the answers are never found—and I'm sure they never will be.

This brings me back to the top of my list of misconceptions. Item No. 1 was entered when I received a letter written to me on the advice that I am an expert and know everything about wood. The writer went on to ask many questions, and I couldn't answer any of them. So the biggest misconception is that somewhere there are "experts" like me who know everything there is to know about wood. □

R. Bruce Hoadley is professor of wood science and technology at the University of Massachusetts. His book, Understanding Wood, *will bring wood science to the woodworker and will be published this summer by The Taunton Press.*

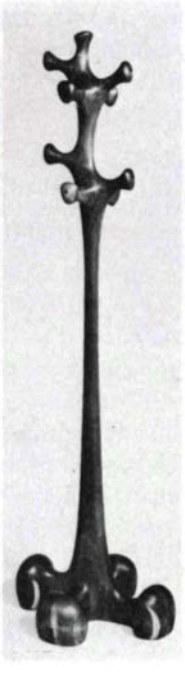
EDITOR'S NOTEBOOK

A portfolio of recent work

by John Kelsey

Just a few years ago, a gallery exhibition of contemporary woodworking was a rare event almost anywhere in America. Things have changed—you can find a gallery that displays wood—good wood—in most cities. Some of them are beginning to specialize in contemporary furniture and sculpture, in settings (and at prices) that compare with the treatment formerly reserved for top-quality antiques. The pictures on these pages are a small sample of work that was on view this past autumn.

Jim Kittle



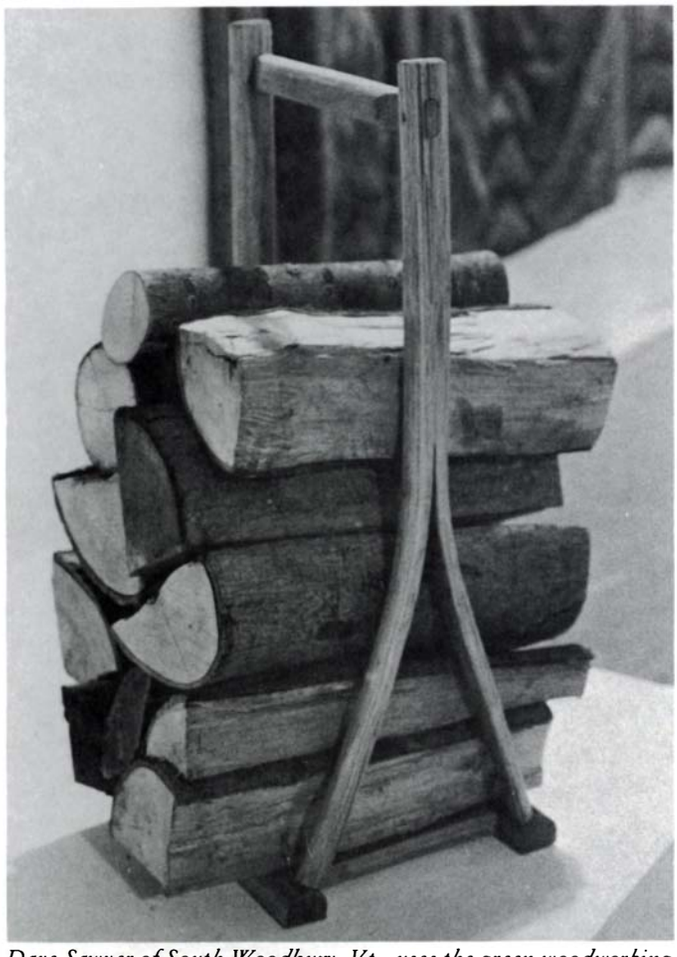
Makers Gallery in Manhattan, which opened last spring, is emphasizing contemporary furniture and this fall organized a major show of new work by 14 woodworkers. The Whitley chairs on our back cover were also photographed there. Top left, Edward Zucca's pillow table (maple, walnut and cherry with pillow of solid wood) and temple table (cherry). Top right, a coat tree in walnut by Dick Shanley. Bud vases, above, are turned from manzanita root by Hap Sakwa.

Rosanne Somerson

Tea trolley, made by Bruce Beeken of Burlington, Vt., was on display in September at the Board Feat exhibition at Exeter Academy in Exeter, N.H. It's made of hickory, laminated to form the curve of the legs and steam-bent for the wheels. The trick here, Beeken says, was a careful two-part chipboard form, cut by swinging a router with a ½-in. straight bit around a central point. Four hickory staves, each ½ in. thick and long enough for two-thirds of a wheel, were steamed and bent in the form. Then the same form, with its central core shifted off center, guided the router in cutting a long scarf at both ends of each segment. The cart is 32 in. high, 38 in. wide and 22 in. deep, and although Beeken plans to keep it as a showpiece, he'd sell it for $800.

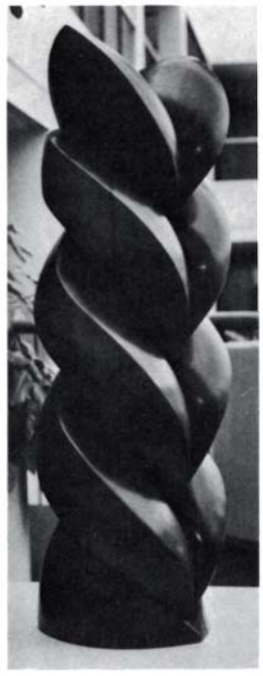
Charles Heinrich

Mindscape Gallery in Evanston, Ill., included work by eight woodworkers in a show of adult toys. The winged dragon Grendal, made of pine by Charles A. Heinrich of Chicago, is 12 in. high and 38 in. wide with wings fully extended. It sold for $180.



Richard Starr

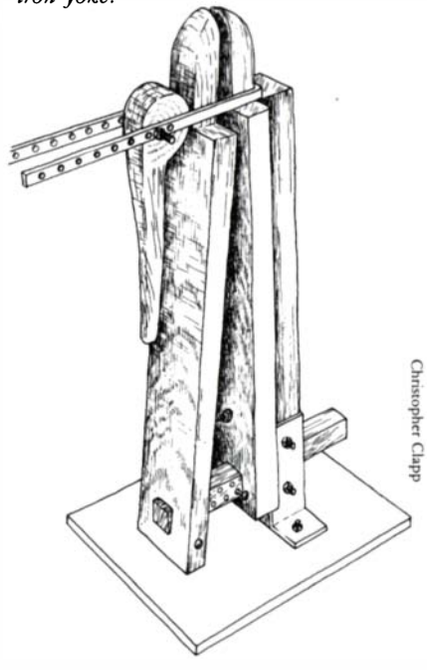
Dave Sawyer of South Woodbury, Vt., uses the green woodworking techniques of the old-time chairmaker to bend and join his firewood carrier. The part you can't see, under the wood, is an open rectangular frame joined by mortise and tenon. This photo was taken at the exhibition that accompanied the Sunapee (N.H.) craft fair last August. Sawyer put a price of $25 on the carrier, and it quickly sold.



Jimmy L. Richey

Masiru Takiguchi, 37, of Houston, Tex., usually makes a clay model before attacking whole green logs with a chain saw. He refines the surface with gouges and sandpaper, filling in the inevitable drying checks with wooden wedges, to achieve the flawless surface shown here. This piece is made of walnut and called 'Your Name Is Eros,' from his recent one-man show at the University of Houston.

Waterfowl group, above, made by Oliver Lawson of Crisfield, Md., was exhibited at the annual Wildfowl Festival in Easton, Md. At the same show, I saw William Schauber of Still Pond, Md., demonstrating his art. When he's not at work for the state forest service, Schauber carves 'counterfeit' wildfowl. He uses the clever old vise shown below to hold the work. The upright is securely bolted to a square plate, on which Schauber can plant his weight. The movable jaw adjusts at the bottom via a pin through the crosspiece, and the squeeze comes from a cam handle pinned to an iron yoke.



Christopher Clapp

Rich Baldinger

Michael Coffey of Poultney, Vt., demonstrates the lounger he stacked from mozambique wood. He showed it this fall at Westlake Gallery in White Plains, N.Y. Coffey calls it Aphrodite and is asking $8,700 for it. While it's an impressive piece of sculpture, I wasn't as comfortable, in a quick sit, as he appears to be. Westlake opened the 12-man exhibit with a lecture and slide show on the origins and methods of modern furniture-making. Several of the craftsmen also installed photos and drawings showing how their work was done, a big help to the curious but uninitiated viewer.

More about benzene

After reporting last issue that Minwax Antique Oil contains the toxic solvent benzene, I got a clarifying telephone call from a Minwax spokesman. He explained that Minwax (which has a linseed-oil base) does not contain benzene as an ingredient, although it does contain an unavoidable trace of it. He said the mixture of hydrocarbons called mineral spirits or petroleum distillates always contains traces of benzene, and all penetrating oil finishes contain mineral spirits. The spokesman added that like Watco, the Minwax company doesn't recommend using Antique Oil on food utensils or children's toys, although this warning isn't considered important enough to print on the label.

I also got a letter from General Finishes saying that their Sealacell brand of penetrating oil does not contain benzene. Like the others, however, it does contain mineral spirits.

The problem with benzene (benzol) is that when you inhale its vapor, it enters the bloodstream and attacks the bone marrow, increasing the risk of leukemia. Despite a lot of recent fuss, it's still easy to buy the stuff, by buying cheap brands of paint remover. A federal researcher told a safety conference in Washington during October that paint strippers he bought at the hardware store contained up to 50% benzene. When he peeled some paint off a chair in a two-car garage, he measured benzene levels exceeding 200 parts per million of air. Proposed federal regulations would make 1 ppm the allowable exposure. Methylene chloride strips paint just as well and it isn't lethal, but strippers containing it cost more.

Photos: Jim Kittle

Throne chair, curly and crotch walnut, bird's-eye maple, $5,800. Right, underside of seat shows pinned tenons, Whitley's signature.

Right:
Whitley rocker, figured walnut, $975.

Far right:
Continuous-line rocker, crotch walnut, $5,500.

Have a seat

For the past 25 years, Robert C. Whitley's bread and butter has been restoring and reproducing antique furniture. He's become good enough to be named master conservator at Independence Hall in Philadelphia, and to be commissioned to reproduce the Oval Office desk for the Kennedy Foundation. His specialty has been filling out sets of fine chairs—the client inherits one superb Chippendale or Queen Anne antique, and wants five more for the dining table. It would take an expert to sort the originals from the copies, were Whitley not scrupulous about signing and dating his work.

However, what's rare about Whitley is his ability to design and make contemporary furniture along with the antique, and to be happy with both. His walnut rocker, center, was designed about ten years ago and Whitley now makes several dozen a year, in batches of ten. Last fall, he showed three new chairs at the Maker's Gallery in Manhattan. The curving parts of the chariot chair and the continuous-line rocker are carved from solid wood, with mortise and tenon joints at each hairpin turn. The webbing at the inside of each bend is part of the tenon. The legs of all three chairs are notched to receive the seats, and the joints are held by tapered dowels that penetrate 7 in. into the seats. The trick is to drill a tiny hole into the dowel hole from below, so glue can be injected and air can escape as the dowel is driven home. The back pedestal of the throne chair is fastened to the seat by a complex assembly of through pinned tenons, top right.

Chariot chair, curly maple, $5,200.