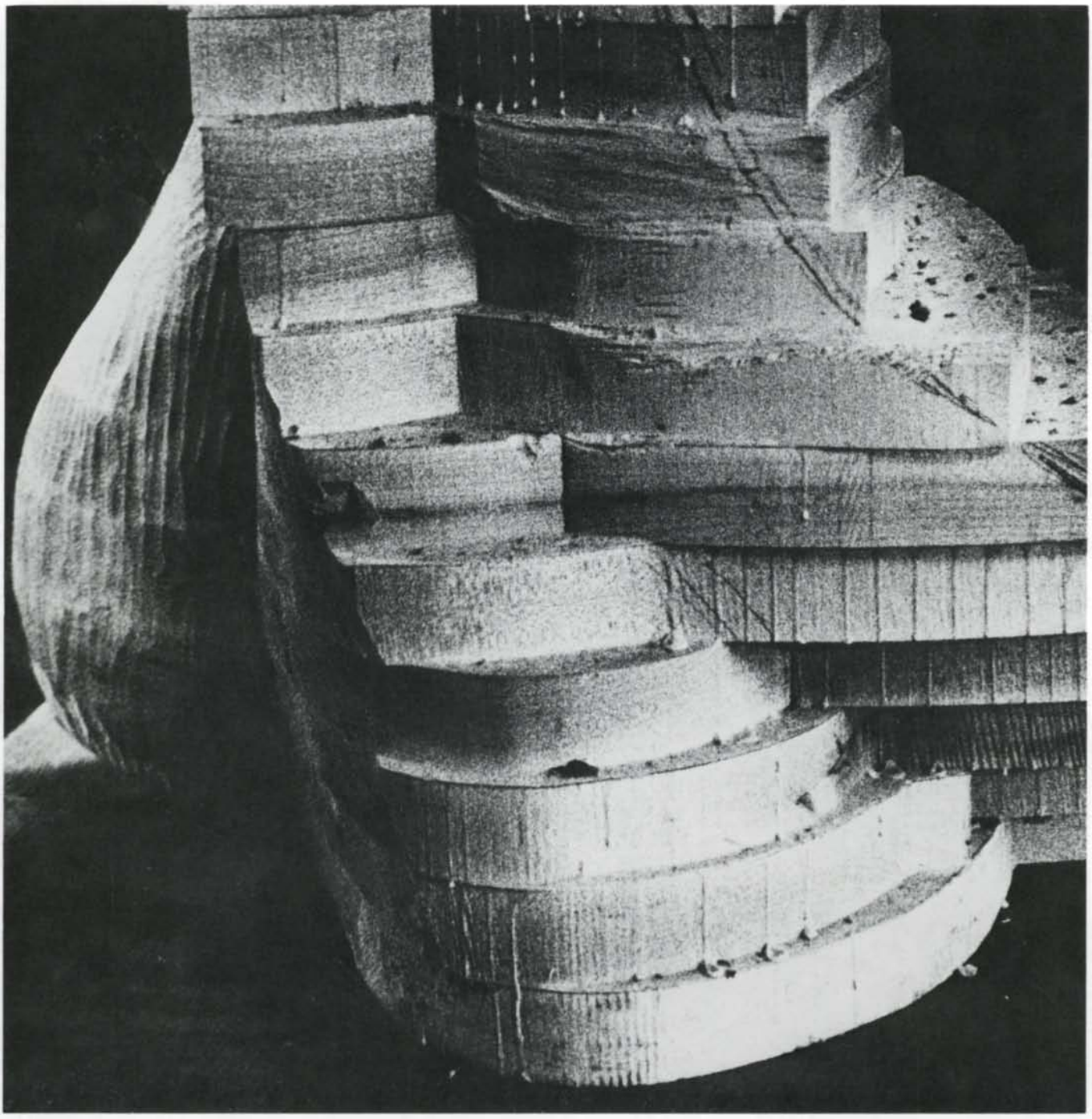
Fine WoodWorking



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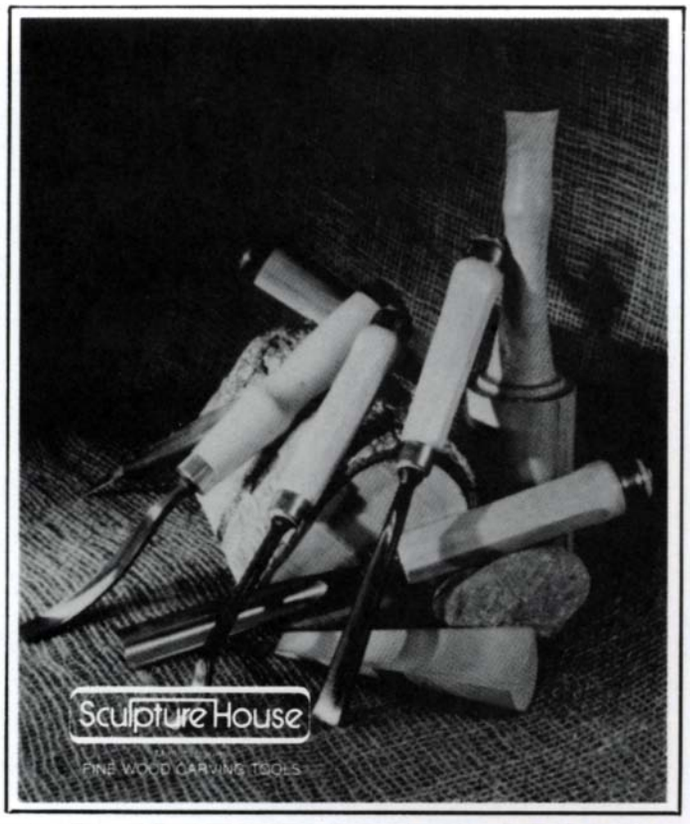

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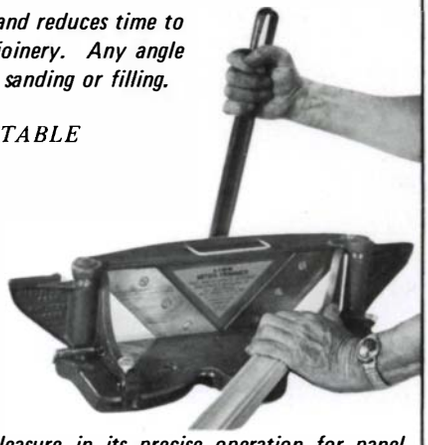

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Fine WoodWorking

Winter 1976, Volume 1, Number 5

CONTENTS

Cover: A stack of 1-5/8-inch thick maple is glued and ready for carving into a pedestal for a table. Pencil line gives indication of the final shape. Section at rear left already shows carving marks.

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Kansan Wins Design Competition

Merle Brown of Kansas State University was awarded the grand prize of $1000 in the fourth annual Student Design Competition at the International Woodworking Machinery and Furniture Supply Fair held in Louisville, Ky., in September.

His entry was a tambour extension dining table. The two ends of the table are solid. When they are pulled out (photo), the hidden tamboured sections roll out from the center and the top extends. The piece is designed so that it is difficult to discern where the solid top becomes a series of tambours.

Of seven other winners, Lawrence E. Hamilton, University of Illinois, was awarded the second-place prize of $500 for his compact folding desk. Judges included furniture manufacturers and designers. Fifteen schools were represented.

Second Turning Conference Scheduled

The people who organized last year's wood turning conference in Newtown, Pa., (*Fine Woodworking*, Summer 1976) plan another one March 25-27, 1977.

Symposium leaders will be Bob Stocksdale, the master bowl turner from California; Stephen Hogbin of Toronto, an innovator in the forefront of contemporary turnery; Frank Knox, a rare artisan of ornamental turnery; the Rev. Jacob E. Brubaker, an old-time master turner from Pennsylvania; and Paul Eshelman, who was the star of last year's show.

Each day will consist of demonstrations and on-the-lathe instruction, with time for everyone to turn in the afternoons and evenings. The fee will be less than $50, and does not include accommodations. Registration is limited to 45.

The conference is being organized by Palmer M. Sharpless of the George School who again will lend his workshop, and by Albert and Alan LeCoff of Ameranth Gallery and Workshop. If too many people enroll, they plan another session in the summer. For further information, write to Sharpless at the George School, Newtown, Pa. 18940.

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LETTERS

Mr. John S. Carroll's letter in the Fall 1976 issue makes a valid point for the consideration of esthetics in the design of objects of wood, a point that is equally valid in the creation of objects of any material. His rejection of wood as a proper material for constructing pieces that will not conform to the natural grain and structure of the wood is a bit severe however. I would agree that the appearance of a lamination in a wooden object intuitively raises the question of delamination and thus adversely affects the esthetic view of the object, but this is a prejudicial viewpoint based on experience with poor adhesives and the tendency of wood to split along the grain. Most modern glues are stronger and more durable than the wood they hold, so if the appearance of laminations becomes esthetically objectionable, the solution would be the use of an opaque finish rather than choosing a heavier or more expensive material.

—D. Conner, Beaverton, Ore.

I disagree in all points with the letter from John Carroll. Design, art, taste, it is all so much a part of one's heritage, education or circumstance that to criticize so vehemently the designs shown in the magazine is entirely out of line. Mr. Carroll misses the point of the whole thing, and that is to acquaint readers of varying talents with different techniques and bring to them information not available anywhere else. He is so completely wrong regarding the spiral steps. . . . The piece was exquisitely designed and executed, and to condemn glue as a monster in the woodpile is like saying we should never weld steel. The piece could certainly be cast in almost any material, but a very clever, experienced patternmaker

STATEMENT OF OWNERSHIP, MANAGEMENT AND CIRCULATION
(Required by 39 U.S.C. 3685)

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B. Paid circulation		
1. Sales through dealers and carriers, street vendors and counter sales	555	576
2. Mail Subscriptions	42,841	49,716
C. Total paid circulation (sum of 10B1 and 10B2)	43,396	50,292
D. Free distribution by mail, carrier or other means samples, complimentary, and other free copies	566	475
E. Total Distribution (Sum of C and D)	43,962	50,767
F. Copies not distributed		
1. Office use, left over, unaccounted, spoiled after printing	2,906	18,599
2. Returns from news agents		
G. Total (Sum of E, F1 and 2—should equal net press run shown in A)	46,868	69,366

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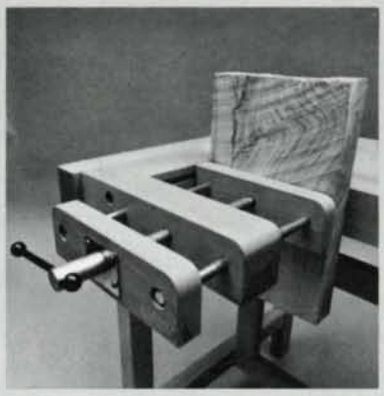

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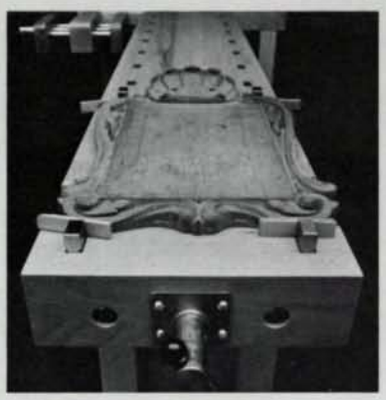

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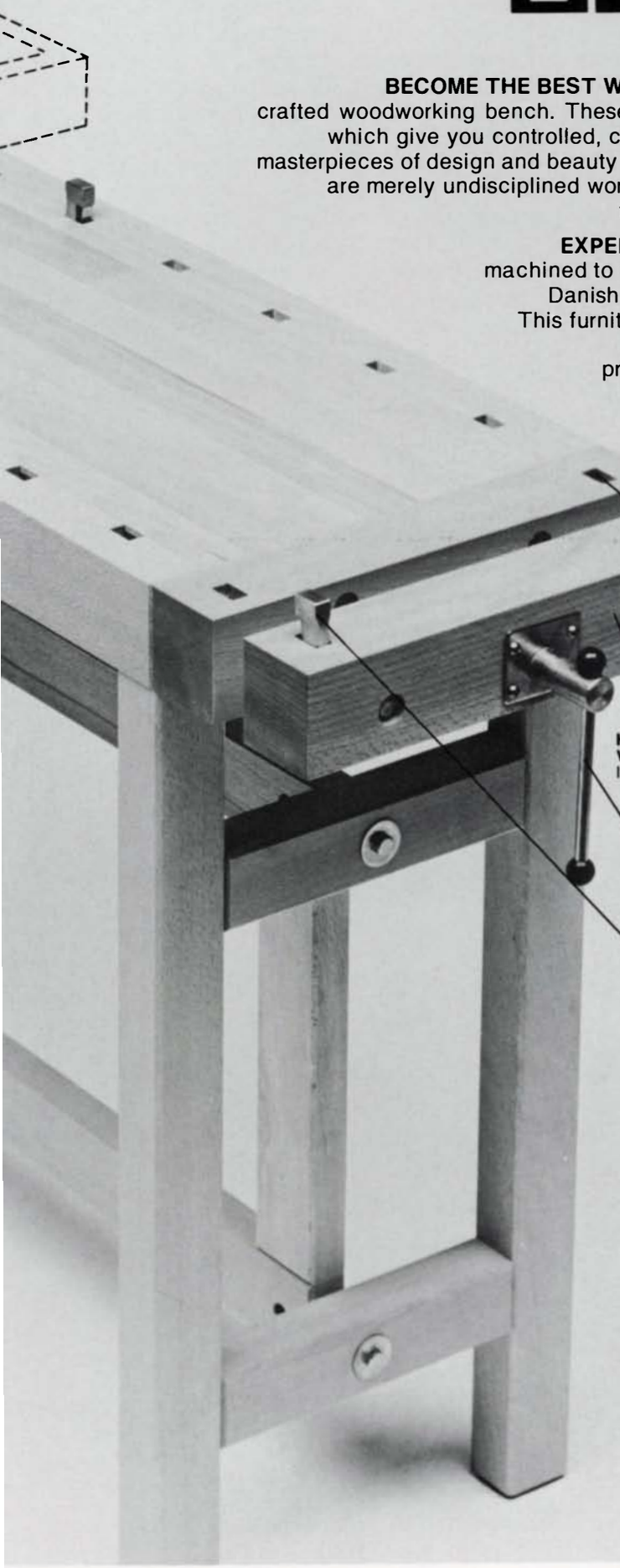

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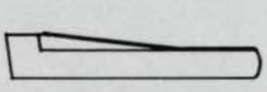

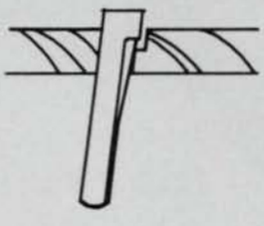

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would be involved and he would use a lot more glue, that awful stuff, than the finished wooden product used.

—John Romary, Littleton, Colo.

Perhaps other readers might join me in seeking information on a particular joint found on old drawers. What is this called? It appears too precise to have been made by hand. What tool was used to make the round tenons and their equivalent mortises? Does this method predate or postdate the conventional mortise and tenon and the dovetail joint? Examples of this joint that I have found seem to indicate that it may have been of one standard size used only for cabinet drawers.

—Clarence S. Hill, Minburn, Iowa

Regarding Mr. Selock's letter (Fall 1976), the natural color of cherry as it ages over the years, even under a clear finish, is certainly more red than brown. However, under certain circumstances a brown finish may be desirable and can be obtained on properly sanded wood as follows. After sponging with lukewarm water, resand with 6/0 (or well-worn 4/0) garnet paper, and apply an even coat of potassium bichromate in a very dilute water solution, say about the color of very weak tea. This of course oxidizes the tannic acid in the wood; when quite dry, the cherry will have a brownish, rather rusty appearance. For a deeper shade repeat the process or use a stronger solution the first time. The wood may again need a light sanding with very fine or worn garnet paper when dry. Prepare a finely-ground paste wood filler just as one would do for an open-grained wood (even cherry has pores that should be filled for a first-class finish) and add burnt umber or burnt sienna in oil, not enough to try to stain the wood which would result in a muddy appearance, but just enough to tone the cherry on the brown side; the real color is already in the wood from the bichromate, and more burnt umber than sienna will bring out the brown shades. Over the completely dry coat of filler, none of which will remain on the surface when properly rubbed off across the grain, an even coat of one of the new 'satin or low-lustre polyurethane varnishes brushed on with a fine-hair sable brush of 1-1/2-in. size should give him the results he desires. The modern satin varnishes can be applied very easily and do not have the tendency to lap, but flatten out beautifully in an hour or so in a dust-free room. Of course, a gloss varnish can be used and rubbed with pumice and oil if one wishes. I note that Mr. Selock prefers the non-grain-raising stains which do not require the additional work of sponging and sanding, but neither do they seem to produce the clear and non-fading results of some of the older methods.

—Edward L. DePuy, Black Mountain, N.C.

Some years ago I was trying to match a finish called "sable mahogany" by Drexel. None of the brown mahogany finish schedules called it by that name, and no stain or blend seemed to produce it. Finally I looked up sable in the dictionary, and it gave the key word: black. Black stain (I prefer the Constantine water soluble No. 505, but their black

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Until recently, such procedures were beyond the capabilities of small workshops where neither space nor budget could accommodate the large, expensive, heavy machinery required.

It is now possible for a craftsman with even the most restricted shop space to purchase a single machine to accurately dimension lumber up to 10" wide and 6" thick. The INCA 410 Jointer when used with the optional thicknessing attachment or the 510 Combination Jointer/Automatic Feed Planer are high quality, moderately priced power tools which occupy very little space in the shop and can be easily moved out of the way when not in use.

Buy Lumber in the Rough

The first step in obtaining clean, smooth, flat lumber is to purchase your material in the rough—in other words, as it comes from the saw. Wood is somewhat cheaper this way since one does not pay for mill time to plane the boards. Rough lumber is graded according to quality (freedom from knots, pitch pockets, etc.) and dimensioned in 1/4's starting at 1" (4/4, 5/4, 6/4, etc.). Always allow about ½" more in rough sawn thickness than finished size to account for variations in sawing at the mill. This varies from mill to mill and species to species, so select your lumber carefully to get stock as clean and flat and even as possible.

Joint Out Cup and Warp

The first step in sizing stock is to joint one side on the Jointer surface of either machine. Place the hollowest side down on the Jointer bed and cut until you have a uniform flat smooth surface on that side. You may find that working with shorter pieces of stock will eliminate a lot of cutting on warped planks by segmenting the arc of the warp. You'll work a little harder but save wood.

Plane to Dimension

Using the Model 510 or the Model 410 with thicknessing attachment, you can now proceed to dimension your stock for the project at hand.

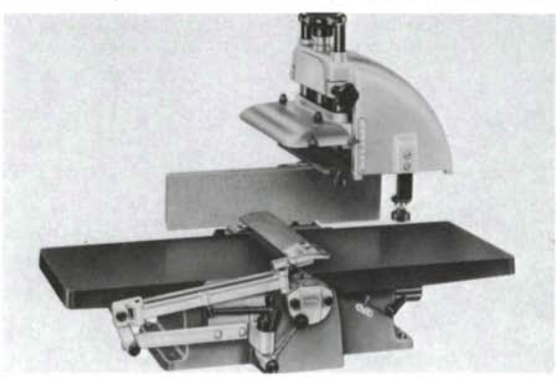
The flat smooth side you got by jointing one surface can now be used as a reference for accurate thicknessing. Place that side either (depending on which machine you are using) up or down on the table and feed through, cutting off little by little the remaining rough side until you have the dimension you require. Check the thickness of stock carefully before beginning to plane since mills often saw cockeyed, producing variations. Flattening one side of warped stock on the Jointer surface may also leave a "hump" on the opposite side. In either event, make sure you start planing from the maximum thickness to avoid jamming.

Always plane with the grain (grain towards the operator) and try to reserve the last cut for a very light finishing pass. Using the INCA equipment you'll find these simple procedures the key to creating square, well fitting projects.

PROVIDE YOURSELF WITH ENOUGH STOCK

You will always need to prepare stock for a project before you begin to put the project together. Get into the following routine.

1. Prepare a stock list: how many pieces of what size of which wood you will need and what they are for.
2. Select rough stock for size, color, grain, etc.
3. Joint out warp, cup, twist, etc.
4. Plane to dimension.
5. Rip to width.
6. Cut to length (sometimes it is wise to cut oversize and take a second trim later when the project is further along.)
7. Joint the edges straight, fit dry and assemble.
8. Sand and finish. Sand inside surfaces before assembling, being careful to preserve fit in joints. Wipe up excess glue as you go. Sand outside last. Remember a scraper will remove saw marks and tears faster than sandpaper.



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NGR might work as well) gives me the "right" color for brown mahogany. As Mr. Selock describes, a deep brown with all but a hint of the red wiped out. To me, cherry and mahogany have always seemed to have similar color. I have not tried black stain on cherry, but offer the hint to Mr. Selock for any help it may be. A mahogany that is really on the pink side needs bleaching as a preparatory step. I use full-strength Clorox, and a weak solution of white vinegar to neutralize it after it has dried. This thoroughly fuzzes up the surface, but sanding and a glue-size put it down again. The water stain raises it again slightly, but I find it is worthwhile to put up with the slight nuisance and extra work for the beautiful clarity of the final result. Filler muddies the finish slightly, another reason to start with a clear stain. This shouldn't be a problem with cherry, however. For schedules, try the *Complete Book Of Wood Finishing* by Robert Scharff. Not many trade secrets, but the basics are given. A. Constantine & Son sells it.

—William L. Flumerfelt, South Hamilton, Mass.

The best way to finish wild cherry that I have found is to let the air do it. When freshly cut, cherry is completely unattractive. Exposure to the air, however, colors the surface a beautiful medium brown. Covering the wood with sealer or varnish will not prevent this. Let the air do it.

—William E. Quinn, N. Fond du Lac, Wis.

In regard to Mr. Babula's query on wood fillers not taking stains, (Spring 1976) why not inlay a defect in wood rather than filling it? I am talking about a form of intarsia (or cut-in work). I have gotten around defects by using intarsia and it does work! Most good books on inlay include information on intarsia.

—Andrew J. Montgomery, Denver, Colo.

I have found that the use of a wood filler called Famowood, manufactured by the Beverly Manufacturing Company (9118 S. Main St., Los Angeles, Cal. 90003) is an excellent filler for the acceptance of stain. It takes the stain freely and will blend in very, very well with the rest of the wood surface.

—H. De Covnick, Alamo, Calif.

I would like to pass on a beeswax and linseed oil finish that was given to me by a friend. This finish is excellent for walnut and cherry by enhancing the natural grain and coloring without "hiding" the wood. I begin by flowing a heated solution of 2/3 boiled linseed oil and 1/3 turpentine on the wood. I work this into the wood with a buffing pad on my electric drill, pressing hard to build heat from friction. After letting this dry for a day I seal and fill the grain with a coat of orange shellac, allow to dry and rub off with 000 steel wool. At this point, I make a mixture of beeswax and boiled linseed oil in a can on my wife's candlemaking stove. I apply this mixture hot to the wood and rub it with a rag. After wiping off the excess and letting it set for a few days, I take any smeariness off with a little Johnson's Pledge. This finish is easy to do and gives me a deep lustrous sheen that resists marking. In the event of damage, I have found that it patches very easily by simply sanding an area through to the wood and applying the process again.

—Myron J. Zwizanski, West Chester, Pa.

Finish Samples

Every woodworker and wood finisher has experienced the frustration of trying to describe the peculiar merits of a particular finish to his customers or to his fellow craftsmen. Words fail because the essence of a fine finish is sensory—one appreciates it through the fingertips and the eyes. My answer is a collection of finish samples, which I have been developing and refining for the past three years. Constant questions from my refinishing students and patrons forced me to develop it as a tangible answer; my system should work equally well for the amateur craftsman or the professional.

Start with 40 or more pieces of wood about 1/2 by 4-1/2 by 9 inches, a convenient size for handling and storage, yet large enough to display the finish. Mahogany is a suitable wood because it is so often encountered in old furniture that needs refinishing. My collection includes both plain-sawed and quarter-sawed wood, and I keep a piece of raw wood as a control. It's a good idea to bleach a couple of pieces too; they will come in handy later on.

All the pieces should be carefully sanded at the same time, following your usual techniques, to ensure uniformity. I use

garnet paper and start with 100 grit until all the milling marks are gone, then I sand with 150 grit before filling. I apply paste wood filler to one face, edge and end of the sample to illustrate the contrasts that will appear in the finished piece, and then sand to 280 grit. When all the wood is prepared, it is ready to receive the finishes you most often work with. The samples can be set aside and worked up one at a time, or you can do intensive work to build up a nucleus of the more common finishes and add more, or play with variables, later on.

The possible variables include finishes on raw woods, finishes over various sealers, stains, fillers and finishes over other finishes. Additives in finish materials, such as driers and stains, produce interesting results. Several blocks of wood, all finished with the same material and then rubbed out with abrasive flours to show the development of a polished surface, say more than words ever could. Finally, finish samples can be subjected to stresses such as alcohol, chemicals, water and burns to test your efforts.

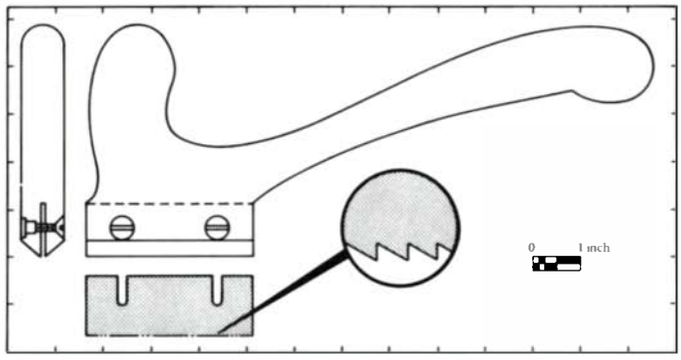
It takes many hours to produce a fine set of finished specimens, but the extended exercise is worth the effort. It

leads to conformity in each finished product and makes the finisher familiar with a wide range of materials and their application. The result is a unique educational tool that can be shared with others and always expanded. It will last forever, and it saves a lot of talking.

—David Adamusko, Alexandria, Va.

Sliding Dovetail Saw

To make a sliding dovetail saw you will need a piece of hardwood (maple, beech or fruitwood) 1 x 5-1/2 x 13 in. and two flat-head 3/16 x 1-in. bolts with tee-nuts. The blade can

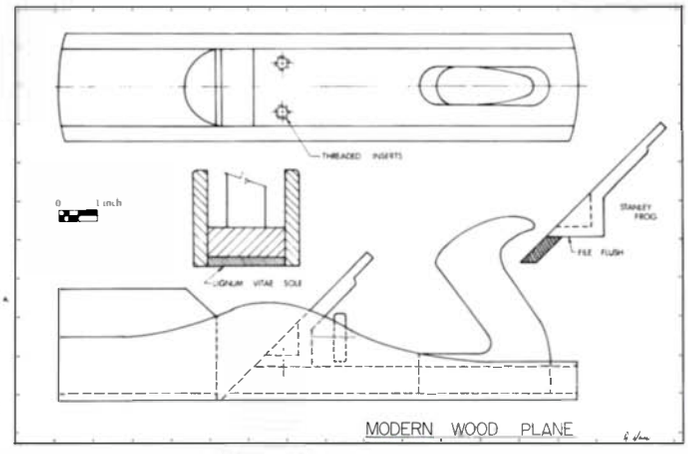


be an old band saw or bow saw blade. It should have 10 points to the inch, although 8 will do. I use a ripsaw blade, which I find cuts better and faster than a crosscut. The slots allow the blade to be set to the desired depth.

—Tage Frid

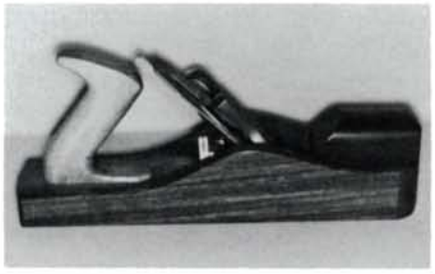
English Plane

There are thousands of old Stanley wood-bottom planes to be had at antique shows, flea markets and garage sales—usually for under $10. With a little work, most of these can be put back into service. I usually cut 1/4 in. from the bottom of the plane, then epoxy a new sole of lignum vitae or rosewood in place, and then recut the mouth.



Last year I saw a beautiful English plane that was not available here, so I made one like it. The heart of the plane is a modified Bailey frog mechanism, which provides the standard metal plane adjusting features. The frog could be removed from an old metal plane or purchased as a replacement part. It was modified by filing away the two

tongues at the base, then mounted in the wooden body (*Fine Woodworking*, Winter 1975) by setting two threaded inserts for bolts.

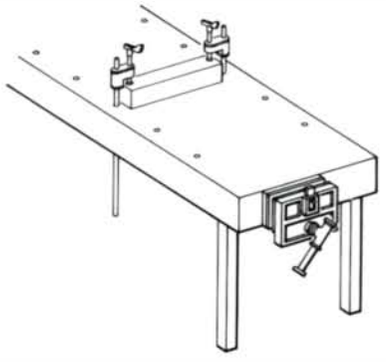


Depending on the thickness of the sole, it might be necessary to modify the cap iron by retapping the screw hole and adding a second square hole for the depth-adjusting lever. I wanted the plane to be as colorful as possible so I used lignum vitae and walnut for the sole, purple heart for the sides, rosewood for the front and beech for the handle.

—Allen Weiss, Queens, N.Y.

Bench-Top Clamps

My bench has two rows of holes along the front and back edges. These accommodate lengths of 3/4-in. pipe, standing vertically, each fitted with extension clamps of the Sears variety. Two or more clamps may thus be mounted in conjunction with cross members for clamping frames, boxes, chests or chairs in gluing position. Four or more clamps form a light-duty veneer press against the bench top.



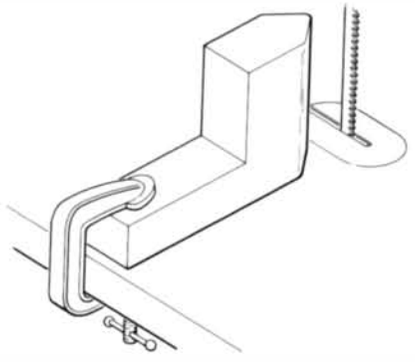
The advantage of this gluing method is that the work is always held true and square because the bench is a flat reference surface.

The holes for the pipe clamps are spaced about 8 in. apart. A crosspiece between two clamps may be used as a bench stop in conjunction with the stop on the tail vise, thereby holding long pieces of wood on the bench.

—Harold F. Lathrop, Milan, Ill.

Vee-Block for Resawing

I have had only mixed results using a rip fence on a band saw for resawing wood. Unless the blade teeth are perfectly set and sharpened, the blade tends to drift even though the board is firmly held against the fence. This drifting can cause the wood to bind and will leave a wavy surface.



The blade's tendency to drift can be sidestepped by using a vee-edged block

attached to the band saw table, as in the drawing. The block is located so that its rounded point is even with the toothed edge of the blade, and at the desired thickness of board from the blade. The block must be carefully made so that the radius at the vee is square to the face of the blade.

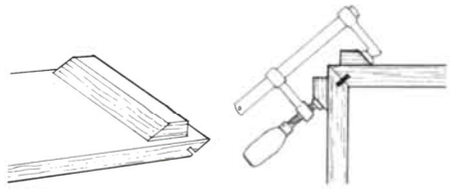
To use this approach the board to be resawed is scribed along its edge at the desired thickness. The vee-block provides a guide to hold the side of the board parallel to the blade. The board is fed into the blade with the operator free to swing the unsawed end to counter the drift. The surface will still need to be planed before it is of furniture quality, but this setup is much easier, faster and more accurate than using a rip fence.

—M.G. Rekoff Jr., Minneapolis, Minn.

Clamping Splined Miters

The splined miter, an excellent joint for plywood carcases, can be difficult to glue up. One way is to save the scrap when the miters are sawed, and use it for clamping blocks. Cut the mitered scrap into strips and glue it directly to the carcase on the outside of each joint. Spread glue lightly on the scrap strips, not on the carcase itself. Try to use scrap with the grain running crosswise as it will be easier to remove.

This creates two parallel surfaces to apply clamping pressure directly across



the joint. No large bar clamps, which usually bow the carcase and distort the joint, will be needed. The joints may be assembled one at a time or all at once, depending on the size and geometry of the work.

After assembly the scrap can be chiseled and planed away and any glue residue scraped and sanded off. Most plies are so weak when cut into narrow strips that a sharp hammer blow will break the waste, leaving only a few shreds of face veneer to clean away from the work.

—John Kelsey

Ball Plane

I was recently asked to make a double-curved "ball plane" with which to smooth a laminated cherry sphere five feet in diameter.

The wooden sole of the plane is curved throughout its length and width, combining the traditional sole design of the wheelwright's compass plane and the joiner's hollow molding plane. I followed the plane-making methods set out in your first issue to make the basic plane, which is 10 in. long, by 2-7/8 in. wide and high. The blade angle is 47 degrees and the iron is a 51-mm (2-in.) "Record" tungsten-vanadium iron and cap set.

After making the block, a template was used to trace a section of a five-foot diameter circle on the sole. The sole was then chiseled to within 1/16 in. of true, and a flat scraper was used to finally reach the true line. This operation formed the curve throughout the sole's length. The plane bottom was scraped slightly hollow so it would function like a Japanese smoothing plane, hitting the work at three points only: front,

back and cutting iron. This helped level the ball in every direction. A spokeshave and another scraper, ground and shaped to the same 5-ft. arc, were used to curve the sole across its width.

The iron was then roughly ground to the same curved line and finally brought to the exact curve with a sequence of increasingly fine sharpening slips.

I used white beech for the sole and the main part of the block, oak for the top plate and wedge, walnut for the front horn and cherry for the rear palm handle. The handles were shaped to fit the hand whether pulling or pushing. The entire plane weighs only two pounds, an important consideration since many days were spent bringing the sphere to within 1/4 in. of a five-foot diameter.

Eduardo A. Rumayor, Bronx, N.Y.

ADDENDA, ERRATA, ETC.

On the **workbench drawings** in the fall issue, in Piece 11 (p. 45) the hole for the bench screw should be 1-3/4 inches up from the bottom, not the 2 inches indicated. And the missing type on Piece 10 (p. 43) should read 1-3/4 inches. . . . The reversing third drum for the **stroke sander** in the summer issue is no longer available as a stock item. George Mooradian says he'll make some up if he gets enough orders. Otherwise, he recommends his off-the-shelf Model 1000 special extended shaft mandrel as a substitute. . . . **We invite our readers to submit items** for our new Methods of Work section, as well as articles and book reviews. But on the articles, try the idea out on us first. Our payment upon publication is $100 per magazine page, prorated, with a minimum of $25 per item. . . . **Art Credits:** Drawings by Image Area. . . . **Picture credits:** 28, 29, Bruce Mervine; 60, 61 Charles Hall, Rodney Vowell.

BOOKS

Greene and Greene—Architects in the Residential Style by Karen and William R. Current. *Amon Carter Museum of Western Art, P.O. Box 2365, Fort Worth, Texas, 76101, 1974. $15.00 plus $.50 postage, hardcover.*

The Greene brothers were architects in California at the turn of the century. They produced a hybrid style of architecture that was widely acclaimed by their comtemporaries. Designing with an emphasis on craftsmanship, they created homes that are as masterfully constructed as they are detailed. This fine volume thoughtfully explores their inventive designs.

Of particular interest to woodworkers is that the Greene brothers employed cabinetmaking techniques taken to the scale of architecture in the homes they designed. Each structure is as well crafted and painstakingly detailed as a piece of superior cabinetry. Their interiors are predominantly wood, carefully joined and shaped. Structural elements are sculpturally considered.

The Greenes selected a design motif and reflected it in every fixture, panel, walkway, and piece of furniture. Often they participated in the carving and inlaying of finer pieces. They used a host of woods—imported and domestic—carefully chosen for their structural and visual qualities.

If one is unfamiliar with the work of the Greenes, he will probably be amazed at the unusual nature of their designs. Through a study of their philosophy and of what influenced them, the text begins to unravel the mystery of how these men created such remarkable works.

This is not a book of techniques. The woodworker may wish the authors had dealt more specifically with construction methods, but evidently this was not their intention. Instead, they investigate the design philosophy that enabled the Greenes to create such detailed masterpieces on such a large scale. The many and beautiful photographs are enough to justify any woodworker owning the book. And the text highlights the work that much more fully.

—Rosanne Somerson

Woodcraft: Basic Concepts and Skills by Thelma R. Newman. *Chilton Book Co., Radnor, Pa. 19089, 1976. $13.95 hardcover, $7.95 paper.*

For her latest craft book, Thelma R. Newman enlists a number of leading woodworkers who demonstrate their exacting arts in photographic sequences. Then she betrays them with a shoddy, inaccurate and inadequate text.

She introduces the book as one that "should provide a solid foundation for the beginner and intermediate-level woodworker." But her teaching method amounts to sympathetic magic: to name a thing is to master it. Technical discussion throughout is confined to lists of names and definitions; for example, "Mortise and tenon joints are often found in the joining of furniture legs for tables and chairs." That's all for mortise and tenon, and similarly for everything else.

Succeeding chapters show some intriguing and imaginative work. Bob Sperber makes a beautiful little jewelry box, and later a delicate and intricate wall cabinet. Edwin Spencer laminates multicolored veneers and cuts pretty jewelry, using novel techniques. Peter Child and Ron Roszkiewicz demonstrate turning, and Neville Neal makes a ladder-back chair with a rush seat. He has a canny way of bending back slats en masse. But the more deeply into the craft Newman goes, the more errors she makes; the more complicated the work, the more simplistic the text.

The treatment of Sperber's cabinetry is perhaps the most disappointing because the faultless work shown in the photos is so tantalizing.

The endpapers give Newman away. This is at least her 14th book; the others are on plastics, decoupage,

BOOKS (continued)

quilting, candlemaking, leatherworking, African crafts, papercraft, lamps and frames. The author's blurb at the back says she has studied woodworking "virtually all over the world." But I bet she only watched.

—John Kelsey

The American Shakers and Their Furniture by John G. Shea. *Van Nostrand Reinhold Co., 450 W. 33rd. St., New York, N. Y., 10001, 1971. $15.95 hardcover.*

With its fine sense of proportion, simplicity of detail and exquisite craftsmanship, Shaker furniture has probably influenced more contemporary furniture makers than any other single source. Since most of us do not have access to the pieces themselves and, from photographs alone, can only guess at the techniques and details of construction which make the originals so unique, a book like Shea's, with its photographs accompanied by measured drawings, is a welcome and valuable source of information.

Thus it is unfortunate that Shea has limited himself to a "how-they-did-it" book that seems to gloss over some difficult or poorly understood construction and design details, rather than having presented a "how-to-do-it" book with precise processes explained clearly. It is also unfortunate that, having had the inspiration to provide measured drawings "prepared to expose the organs and arteries of Shaker construction," Shea has not bothered to check them for misrepresentation and inaccuracies. For example, the drawing of the turned trestle table (p. 149) shows two beads at either end of the center portion of the cylinder, while a detail photograph of apparently the same table earlier in the book (p. 83) reveals a different treatment; the drawer measurements of the chest (p. 203) are inaccurate, and so on throughout the book.

Of course the errors in measurement can be corrected with a little common sense, and the occasional obscurity in the drawings illuminated by consulting other books of photographs. This extra trouble for the reader, even though it should be unnecessary, is worthwhile because the book is indispensable to anyone interested in Shaker furniture.

—David Landen

Biennial Design Book

A national media for showing your best work

AN INVITATION TO WOODWORKERS to show photographs of anything made of wood, the very best work that you have done during the past two years.

EVERYTHING MADE OF WOOD—cabinets, chairs, tables, sculpture, carving veneer, marquetry, inlay, turning, toys, musical instruments, tools, boats, airplanes, architecture. Any wood, any finish, any technique.

300 TO 500 OF THE BEST PIECES will be selected by the editors of Fine Woodworking for publication in our Biennial Design Book, to reach the bookstores in late Spring 1977. The emphasis will be on excellence of design and craftsmanship. The book will represent the state of the woodworker's art—a source of inspiration for today, a record for tomorrow.

RULES

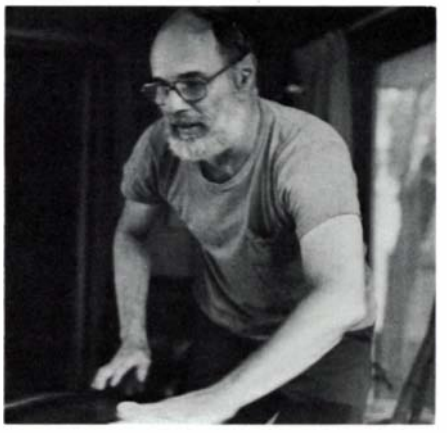
- Each piece must be of original design and the primary material must be of wood. A designer and a craftsman may enter jointly. Period furniture may be "after the style of" or may be derived from antiques; exact reproductions from museum drawings or books of plans are not eligible.
- Send an 8 x 10 black-and-white photograph of each entry, along with as many supplementary photos, drawings and notes as you feel necessary to convey what you have made. Photographic technique will not be judged. However, we must have a photograph of excellent reproducible quality for the piece to be published. The background must be featureless—plain white, grass, sand, etc., in order to emphasize the work itself. Color slides are acceptable for judging purposes, but entrants must be prepared to provide black and white photographs upon request, should your piece be selected.
- Include your name and address, the title or function of the piece, the woods used, overall dimensions, and price if it is for sale. This information will be published.
- Be sure to put your name on every photo, slide, and note that you send. If you want your material returned, include a stamped self-addressed envelope.
- Deadline is January 31, 1977. Send your entry to: Biennial Design Book Editor, Fine Woodworking, Box 355, Newtown, CT 06470.
- To order a copy of the Biennial Design Book, send $4.00 to The Taunton Press, Box 355, Newtown, CT 06470. Or place your order for later billing when the book is available in late spring 1977.

Fine WoodWorking

Life Begins at . . .

Turning to woodworking for a living

By John Kelsey



The wood comes in through the garage door at Howard Joffe's house in suburban Rochester, N.Y., to the 12-inch thickness planer on one side of the woodpile and to the 6-inch jointer on the other side. When it is planed, Joffe, a short, muscular man of 52, totes each board through the door into the house, swings it around in the kitchen, and down the stairs to the basement. The family room down there has become his assembly room and through it, in a tiny space shared with the laundry machinery, is Joffe's workbench. A well-tuned Sears table saw squats in the center of the room, an old drill press is across from the washer, and the walls are festooned with tools.

Joffe makes his living here, with just that much machinery and in such awkward space. He turns out fine, custom-designed furniture, mostly dining room tables and chairs. He set out to change careers five years ago, to become a woodworker, after spending his life in business. He had worked up to production manager of a large factory, and then went broke as partner in a precision machine tool shop. Now, he says he's never been happier.

When the machine shop's orders dried up during a recession, Joffe sold out for settlement of his debts, and there he was, he says, "47 years old and you might as well be 147, there just were no jobs. I understood then I was finished in business.

"I'd been a woodworking hobbyist for years but then I didn't know what to do, so I just whacked around for a year. One evening I was sitting in my living room talking with my wife and kids and wood came up and I said, 'That's what I would like to do, make wooden furniture.' My daughter Carol —she's 25 now—said why didn't I, dragged me out to Rochester Institute of Technology and I enrolled the following September."

The difficult thing about returning to school wasn't the youthful environment or the long absence from academic work, "but my image of myself as a woodworker and the fact I was going to 'art' school. I'd never done art and it was all so mysterious.

"But then I discovered, mostly through figure drawing, that I have a certain level of ability and I could learn to draw. That forced me to examine the question of esthetics and what I discovered is that it is totally subjective, there is no objective standard for 'pretty.' From there it was downhill."

While he was cracking the mysteries of art school, Joffe also decided he had to confront his own tentativeness, the fear of lousing up what is, after all, only a piece of wood. He resolved to tackle anything wooden that came his way, and one afternoon his first commission wandered into the RIT shop, asking if anyone wanted a small job.

"He was clutching a little piece of paper—he'd designed a set of shelves for his hi-fi. It was a terrible design and he had only $150 to spend. I did it for what amounted to nothing, solid wood construction with dovetails and pin tenons, the works.

"Then a year later he came back wanting a coffee table, only he wanted me to design it. Of course I did and got $250. Now another year later I've just finished a console table with one drop leaf for the same guy, and I'm sure he'll be back for a dining set."

That's how it's been ever since for Joffe, who, you might have guessed, loves to talk and argue. But he never sells. He just figures the public is abysmally ignorant about wood and furniture, and he has a responsibility to educate.

"I spend enormous amounts of time explaining joinery, the differences between commerical furniture and handmade. What will they get from me that they won't get from Macy's? I have to establish that it's a whole different world. So I show them the cheap veneer on chipboard in their expensive sofa. I pick up their own furniture and take it apart and show them. I lift their tables and explain the difference between a cheap metal cleat and a mortise and tenon. Every customer I have really understands it. So when I deliver the piece, I get them down on the floor and show them where the joints are, how the top is held on and why. They'll show all their friends. My salesmen are my pieces and I want each piece to say what it can. And, a person who understands fine furniture enjoys it more."

Joffe also teaches night school one evening a week at a local high school. Those students who want to use only the machinery are checked out for safety and then left to their own devices. Some students want a little advice for their own projects; others want to learn to use hand tools and cut joints. "I tell them that no matter what they do, even if they never again touch a tool, they'll never go into a store and look at furniture the same way. They'll be spoiled. The commissions start from there—they try to make a dining room table, discover what demands woodworking makes on you, and ask me how much I'd charge. Maybe a year later, they want me to make the table."

Joffe's children are grown and gone now, and his wife Helen is a social worker. When she leaves at 8:30 he starts to work, plugging away until 3:30 when he stops to cook dinner. Some evenings and weekend hours bring the weekly total to 50 hours or so. A table takes about three weeks to make, a set of six chairs about five.

Joffe's goal, when he finished at RIT,

was to work up to an income of $10,000 to $12,000 from his furniture alone. He figured if he made $5,000 in his first year and $8,000 in the second, he'd be well on the way—and he's right on target. But with all those years of business experience, he never stops to figure an hourly rate or an overhead percentage. He says business methods are meaningless on a one-man scale. With orders for six months ahead he flatly refuses to consider hiring help, and make a business of it.

"I knew when I started I had to get the stuff out, I had to give people a bargain to break in, to get exposure and experience, and now I'm working faster and also raising my prices a little. I started making a set of six dining chairs for $175 a chair, now I get $200. My dining tables used to be $500, now they're $600."

He's sure he couldn't have done it without returning to school, not only to learn how to design furniture, but also to learn the technology. "I know how wood goes together now, and what standards I have to work to.

"I always go to the customers' home to see what they're comfortable with: geometric forms, organic shapes, traditional furniture. I'd never do a piece I thought was repulsive—my challenge is to design furniture they'll be comfortable with and I'll be comfortable with too."

WOOD AND TOOL EXCHANGE

WANTED TO BUY

Deltagram/Flying Chips magazines, 1966-issues 1&3, 1967-issues 1,2&3. Will buy or swap for duplicates that I have. Don Thibault, RFD 3, Fuller Drive, Hudson, NH 03051.

Stanley Scraper Plane #112, shown in Summer 1967 issue. Carl W. Kempf, 2023 Gober Ave., S.E., Smyrna, GA 30080.

Plans and/or information for building a regulation size pool or snooker table. Write Frank Stillson, P.O. Box 172, Collbran, CO 81624.

Woodworker needs parts to complete Stanley "55" plane. Need #'s 50, 51, 52, 53, 54, 73, 80, 81, 85 & 86. Please write R. John Donsky, 1129 Kenmore Ave., Kenmore, NY 14217.

Thickness planer, 12 to 18 in., Rockwell or equivalent. C. Rannefeld, 2302 Fleetwood Dr. S.E., Decatur, AL 35601.

Shaper Table, Rockwell #5056A. Stephen Jones, Box 31, McKinley Park, Alaska 99755.

Need a duplicator to copy wood drawer pulls. Price & Describe. G.H. Collins, 303 West Main, Morris, IL 60450.

Speed changer, parts, access. for Shopsmith model 10ER. Write Wes Lockwood, 522 N. San Francisco, Flagstaff, AZ 86001.

FOR SALE

To highest bidders Jan. 1, 1977. Basic Stanley #45 plane with 16 straight and 7 round blades. Also #45 with carpenter's set of 44 assorted blades. Ind. Arts Dept., Central Senior H.S., Box 876, Devils Lake, ND 58301.

CLASSIFIED

POLYETHYLENE GLYCOL - 1000. Wood stabilizing chemical treatment of green wood prevents cracking and checking by controlling shrinkage. For Brochure send $.25 to: Earthwood Co., Box 252, Excelsior, MN 55331.

SOLID CHERRY, POPLAR, MAHOGANY, WALNUT blocks 3 x 3 x 6 in. and up. "Whittle Awhile" $.35. Animal, bird blanks $1.75. AC(F3), Cherokee, NC 28719.

Premium quality stainless screws, nuts, etc. Small quantities. Catalog $.25, Caltronic, Box 36356, Los Angeles, CA 90036.

ANTIQUE STANLEY TOOLS. Send want list. Tools for Craftsmen, Box 3145, New Haven, CT 06515.

THE TOOL BOX, Antique Woodworking Tools, Catalog $.50, J.A. Moody, 5005 Jasmine Drive Rockville, MD 20853.

FRENCH AND CIRCISSIAN GUN BLANKS, 2 x 2-1/2 x 5/8-in. maple, bowl wood. Roy Vail, Warwick, NY 10990.

Immediate residency opening for qualified Woodworker. Also, openings in Winter and Spring Internship. Weekend & Summer workshops. Write: Peters Valley Craftsmen, Layton, NJ 07851.

THERMOVATS, engineered for Polyethylene Glycol. Thermostatically controlled, stainless heaters, double walled vats; Brochure $.25. Booklet: Spielman's PEG PROJECTS, Ideas & Designs, $4.00. THE WOODWORKS, Gibraltar Rd., Fish Creek, WI 54212.

For Sale: Berg's Shark Brand Swedish tang butt chisels. Unused old stock. Other tools, etc. Stamped addressed envelope for list. R. H. Coleman, 404 Glendale Avenue, Decatur, GA 30030.

WOODTURNING INSTRUCTION. Be our guest in Westminster West. Two days comprehensive instruction in woodturning techniques, particularly as described by Peter Child, with adaptations made to your interests. Fully equipped shop in which to learn and practice, and use the MYFORD WOODTURNING LATHE which I import and stock. Russ Zimmerman, RFD 3, Box 57A, Putney, VT 05346.

U—BUILD ENGRAVING MACHINE, Power Tools, Profitable Projects! New Carving Methods! $.50 Poor Man's Catalog Box 23-FW, Highland, MD 20777.

LARGE DOVETAIL TEMPLATES, with carbide router bits, for rapid, accurate joinery. David Keller, Star Route, Bolinas, CA 94924.

Low Cost Thickness Planer Sander Plans $2.00. Woodworking Bargains. Catalog $1.00. Rego, Downing, Fall River, MA 02723.

HARDWOODS. $.13 stamp brings description, reasonable prices. Delmar, Box 850, Buckingham, PA 18912.

FULL SIZE HARPSICHORD PLANS from $25.00 for paper prints of French, Flemish, and Italian keyboard instruments. Send $2.00 for brochure to R.K. Lee, 353FW School Street, Watertown, MA 02172.

Stacking

The technique of building up wood forms for carving

by John Kelsey

The technique of stacking, by which layers of boards are glued together and carved to make furniture, was virtually unknown 15 years ago. Today it is part of the vocabulary of many professional furniture makers. Stacking makes possible the most arresting of contemporary designs. It is high-technology work, depending upon modern adhesives, clamps and power machinery.

Methods similar to stacking were used as early as medieval times, when sculptors occasionally glued baulks of wood together to build a block large enough to carve. Since the last century, carousel horses have been carved from laminated blocks of wood, with the legs and head attached by traditional joinery. Modern stacked furniture, however, relies on carefully preplanning the cross sections of the form at each elevation, and cutting the wood very near to the finished cross section before gluing it together. Wendell Castle of Scottsville, N.Y., believes he was the first to apply this technique to furniture, early in the 1960's. He has been doing it ever since, producing several dozen pieces a year, refining and developing his methods and forms.

Castle is trained as a sculptor and designer, but his interest in cross section goes back to his boyhood in Emporia, Kansas, during the 1930's. In the model airplane kits then popular, the fuselage was stacked balsa wood. The kit included a sheet of patterns and just enough 1/8-in. balsa to cut them all out. Then one would glue them together and sand smooth.

Most people, when first encountering Castles's work, conclude that he must glue together a rectangular block and slowly carve away the excess wood, like a sculptor with a block of stone. In fact, he tries to bandsaw each piece of wood to within 1/8 in. of the finished surface before gluing it. He works one layer at a time: cut, glue and clamp; cut, glue and clamp. The form is blocked out, more than half revealed, before it has been touched by a single carving tool.

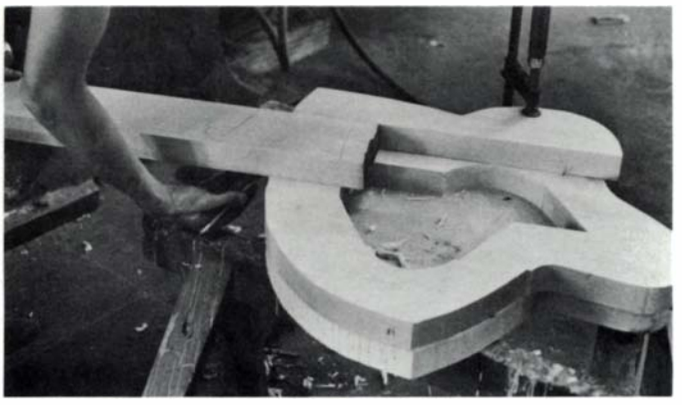
Besides being esthetically satisfying, working this way is economical of time and material. Castle estimates his waste to be somewhat higher than that of a one-man cabinet shop, but lower than that of a furniture factory. In carving, he doesn't have to bash away pounds of material; he merely removes the stair steps of the stacked boards and refines the surface. This is the result of accurately visualizing cross sections from the start.

I followed the development of a stack dining-room table from a small clay model. Says Castle, "This form started from a conch shell, although it has gone through about 50 variations over the past five years. Some of them looked much more like a conch shell than this. Bones are also nice sources of design. It's a mistake to try to interpret really literally, to make a big conch out of wood—you could have taken a photo. I use the conch as inspiration of form, to reinterpret and derive a new form. It ends up as a table base."

As an aid to visualization, Castle often draws contour lines around his models. Throughout the work, the model is close at hand and he studies it frequently.

From the model, the first step is to draw a full-size plan of the bottom layer. He glues up a flat slab of wood, traces the

In photo sequence starting at left and going counter-clockwise—The clay model sits on the first two stacked layers. The shape for the next layer is traced. Castle applies glue and scrapes off the excess. He clamps across the work to prevent sliding. Clamps are placed about every three inches for even pressure and tight glue joints. The completed stack already resembles the model even before carving.



pattern onto it and bandsaws. With a new design such as this one, he usually makes the bottom an inch larger than the desired size. This gives an inch of material to play around with while carving, and if he doesn't need the inch, the base is just that much larger. No matter.

The wood for this table is 8/4 maple, planed to a uniform 1-5/8 in. thickness. While it might seem logical to work with wide boards, Castle finds random widths ranging from 6 to 10 in. to be least wasteful. Kiln-dried lumber and careful moisture control are essential to avoid unequal stresses and consequent delamination.

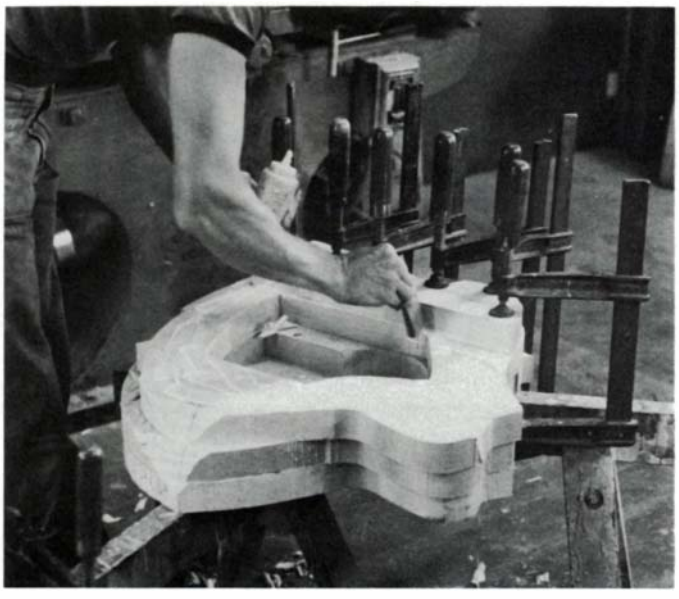
The base and first stack are glued together, with the process the same for every layer. First, Castle scrapes off the excess glue and planes the top of the form to remove irregularities in thickness and ensure a flat surface. The first board need only have one true edge—the other edge will be sawed away. With one eye on the model, Castle traces the outline of the stack on the underside of the board and then modifies the pencil line to account for the changes in the form at the new elevation. The more accurate the shape now, the less time it will take to carve the form later on. He goes to the bandsaw, cuts the board and tacks it in place with a clamp.

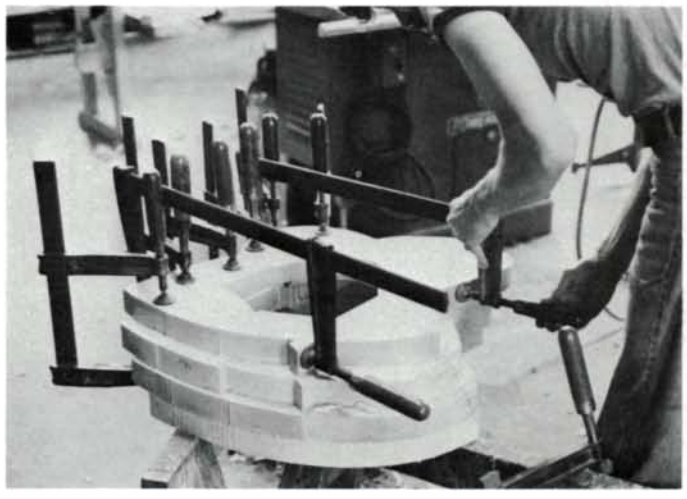
Now he selects a board with square, parallel edges, holds it in place, draws the inside cut on its top surface and traces against the previous layer on its underside. Again, he adjusts this line in tune with the evolution of the form, and bandsaws. At this stage every piece looks alike and one bump would scramble them irretrievably, if each weren't keyed to its correct location with pencil lines on its face.

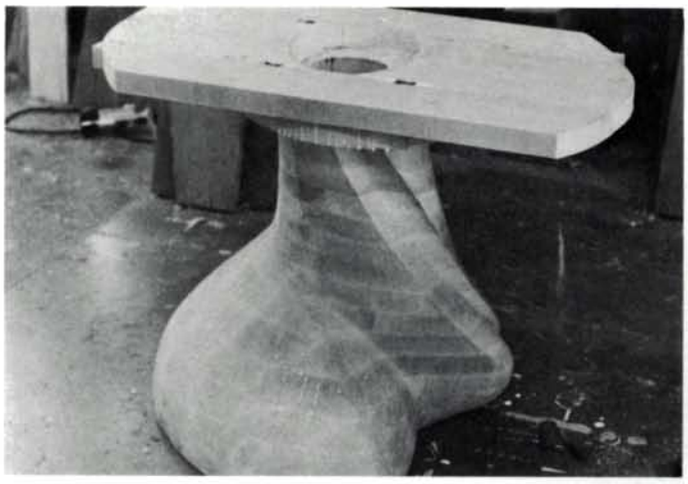
As he works, Castle varies randomly the cup of the end grain both from layer to layer and from board to board and makes sure the glue lines don't coincide. This tends to equalize stresses throughout the mass as the wood expands and contracts. And it avoids the regularity of a brick wall, which would introduce visual confusion—the predictability of the pattern would conflict with the perception of the form.

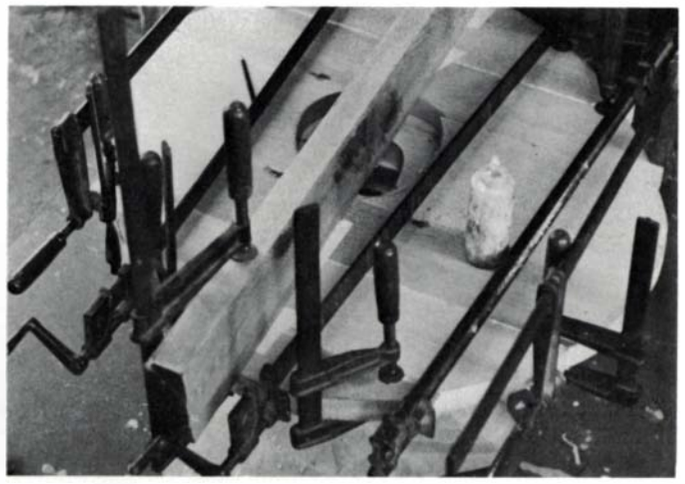
At this point, there are six pieces of wood in each layer. The table base is hollow to save weight and allow the moisture content to equalize. The bottom plate is solid now, but a hole will be drilled in it later on. And the underside will be routed out so the table rests on an edge, more stable than a slab.

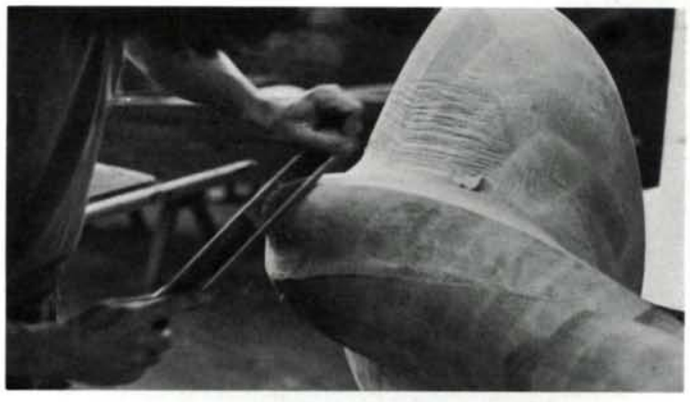
A small ear left on the last board in the layer provides a

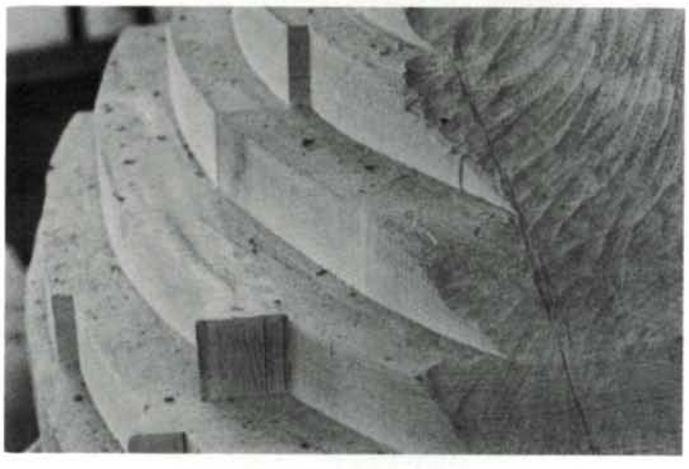


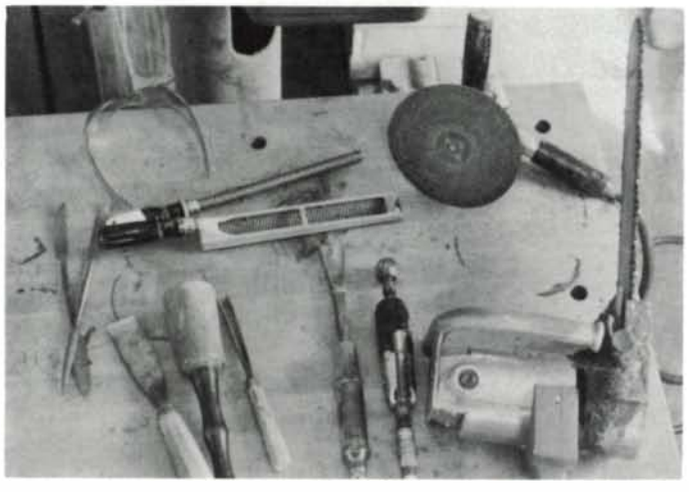












Chain saw, Surforms, pneumatic gouge and ball mill, gouges, rifflers and sanding disc are used for shaping. Then the top transition pieces are assembled and aligned.

parallel surface for a clamp to bite in, drawing the edges of the boards together. Now is the time to check back with the model and make sure there is enough wood for the changes in the form; occasionally, Castle discards a piece of wood and saws another.

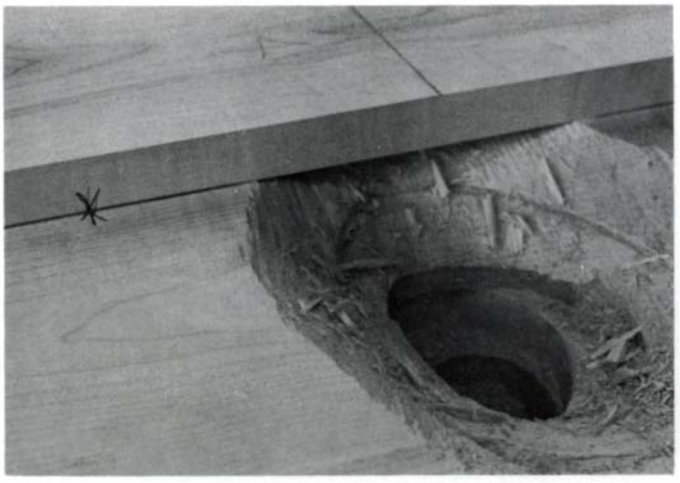
As the stack climbs, each layer twists with respect to the one below. In each, the grain remains at right angles to the long, curved edge. Castle explains that in this case the grain twists about 2 degrees per layer, to follow the twisting form and to allow carving downhill, with the grain, where there are grooves. The grain could twist as much as 5 degrees from layer to layer without danger of delamination—in a board, the fibers vary that much from parallel as the grain curves. Without such preplanning, one would be left trying to carve uphill, against the grain, from the bottom of a groove to the top. And that wouldn't be possible.

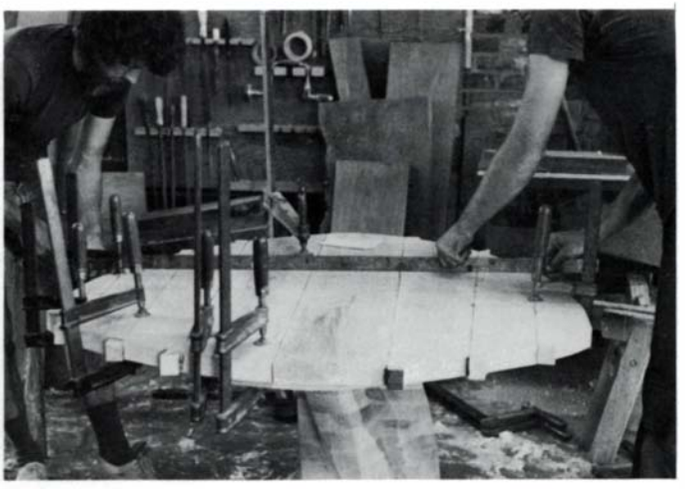
Castle uses both Titebond yellow glue and powdered plastic resin glue. The yellow glue comes ready-mixed and is convenient; powdered glue, while stronger, must be mixed anew for each job.

When the entire layer is cut, he carefully brushes the sawdust and chips from all the surfaces, lugs over a couple of dozen clamps from the rack in the middle of the shop, and begins to spread the glue. He uses a wooden shim for a spreader, starting on the stack and initially covering only the area of the first board. Then he coats the face and edge of that board and tacks it down with clamps, making sure it is in exactly the right place. Some of the clamps reach to the bottom of the form, and some go only to the next layer down; it doesn't matter. Then he quickly spreads glue across the rest of the stack and the other five boards in the layer, and plants them in place.

Quickly now, before the glue can set, two horizontal clamps pull the edges together. Without that little ear on the outside board, the clamp would have nowhere to bite. Another pair of horizontal clamps, reaching across at various angles, draws the joints tightly together and the glue oozes out. One glue line is recalcitrant, and a vertical clamp, set to bite at an angle, draws it snug. Castle calls this "applying a little East Indian."

Now more vertical clamps. A clamp every three inches all around the form, a clamp directly on every glue line, clamps alternately at the outer edge and near the center. Each clamp is twisted one-hand tight. When he is done, and it doesn't take long, there are 28 clamps. Any glue-squeeze wiped off





The cavity of the first top layer is carved to remove weight, as it adds no useful glue surface. The top is clamped across to help keep the pieces level, and then laden with clamps until the glue sets.

now won't have to be scraped off later.

On a good day, Castle will stack a layer first thing in the morning, another at lunch time and a third at quitting time. The clamps stay on at least two hours with yellow glue, and overnight with powdered resin glue. Thus it will take about a week to build up the table base, although the total time each day isn't more than two hours.

A large piece of furniture, festooned with clamps holding 30 or more pieces of wood in a layer, may weigh 600 pounds. The weight of the clamps may cause it to tip. Get quickly out of the way; it's far too heavy to catch.

Some workers use a veneer press to stack. But while the press applies enormous pressure, it is uniform pressure and that's not what is needed. Hand clamps follow the irregularities in the wood, the tiny differences in thickness, the vagaries of warp, twist and cup, and still squeeze hard enough to produce a good joint. They also can be adjusted to apply pressure at an angle, and ganged to apply extra pressure when necessary—in general, they're a lot more flexible for this kind of work.

Wood coated with glue, especially yellow glue, is slippery. A combination of horizontal and vertical hand clamps controls slippage and keeps everything where it ought to be, but in a veneer press you'd have to use locating dowels. And then when you decided to change the form later on, to carve a little deeper, the dowel would surface.

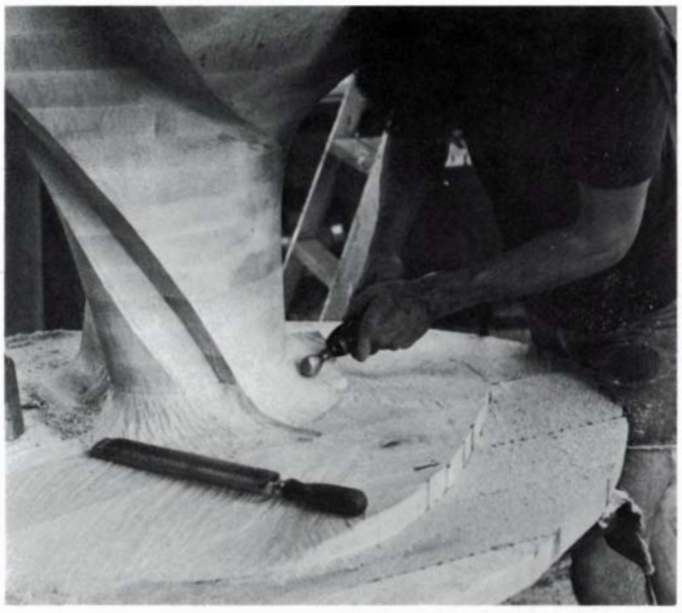
When the entire base is stacked, it resembles a free-form staircase. If the pieces have been sawed accurately, what remains is to carve away the stair steps. Ideally, the desired surface lies just below the vee of each step. In practice, this is more true in some places than in others. A piece that has been made before can be stacked even more closely than a new one like this.

While it is possible to build a table from the top down, this one has to be done from the bottom up—otherwise, you'd need clamps with a three-foot throat. In general, Castle stacks as far as he can without impairing the carving, then carves as far as he can without making the rest of the clamping impossible. In this case, it is much easier to carve the base before adding the top. There is more room to work, more directions from which to work, and less mass to shift around.

The whole form could be carved by hand, with mallet and gouge, and smoothed with Surform, riffler and sandpaper. Castle, however, uses an array of power tools, most of them air driven, to save time. He begins with the chain saw, paring away the stair steps, moves to the ball mill and pneumatic chisel to refine the main forms and block out details, and the body grinder to remove tool marks from large surfaces. The details are worked with mallet and gouge, and refined with Surform and riffler. He keeps Surform tools in sets, some to cut on the push stroke and some reversed in the handles to cut pulling.

Throughout the carving, he keeps the whole piece at the same stage; when one area is about right he moves to another. Thus the whole piece is brought at once from stepped layers to the general rough form, then each plane and hollow is defined, the sweeps of line adjusted and their starting and stopping points feathered imperceptibly to nothing. What makes a line is the intersection of two curved surfaces; what makes this form "read" is the lines. That means the surfaces have to be just right, so the lines will be just right. To change the curvature of a line, he has to change the surfaces that make it—he can't just whack a corner off. Finally, Surform and scraper remove the minute hollows and bumps and the piece is ready to sand.

The base of the table nears completion. It is remarkably like the model. Says Castle, "It's freeing for me to work in clay, and then figure out whether it's possible to make the form in wood. But in fact I find I make decisions early on, from my experience, and shy away from forms that would be too difficult to make, or too heavy to be practical. The forms I



A ball mill helps shape the graceful transition from top to base. After six coats of Watco the table is finished.

draw and model fall into patterns that lend themselves to the things I know about doing; I don't do radical experiments that risk disaster. That experience, those patterns become my vocabulary and I work within it."

The base was made without a definite top in mind, with the idea that it might fit a round top left over from an earlier project. "I've never made a table this way before, with the top abruptly planted on the base. I've always said that was dumb. Tables should have an organic transition from base to top," Castle remarks. Then he plops the round top onto the base and it's clear he was right—it doesn't work. So he makes a cardboard pattern, a three-sided lozenge, and trims it to shape. Much better.

From the base as it was, it will take three layers to make the vertical-to-horizontal transition and complete the table top. And at that height, the table would be too high. So he chain-saws off a couple of laminations and glues on a slightly larger layer to create a clamping surface. Then he cuts and clamps the center three boards of the layer that is just under the top.

This layer has to be done in two stages because the boards at the perimeter are edge-glued to those at the center. The center three boards glue to the table base, but there isn't anything under the boards at the edge. In the end most of this layer will be carved away in the transition from vertical to horizontal, but there must be enough wood to feather out so it is made nearly as large as the top itself. Since most of it will disappear, it is a good place to use up low-grade wood.

When the glue has set on the center three boards, Castle removes the clamps and begins to work out to the edge. He holds each board in position to lay out the cuts, marking them carefully for repositioning. As each is bandsawed, he tacks it in place with a couple of clamps atop the joint. An ear must be left on every board for the horizontal clamps that draw them together. A thick, straight plank, plus clamps directly on each glue line, keep the boards aligned. He puts paper under the plank to keep from gluing it to the table.

When the clamps come off, the surface is scraped to remove glue-squeeze and planed. The hole at the center is widened with gouge and chain saw to remove weight and because no useful clamping gluing surface is available there—no way to clamp. He vacuums the cavity to remove chips.

From the template, the wood for the top is cut and indexed. These boards are slightly thinner, about 1-1/4 in., to save a little weight and to achieve the correct table height. The long, tapered transition from base to top and the thin, rounded edge he plans make it impossible to detect the difference in thickness.

Castle next adjusts the placement of the top with reference to where the base provides support at the floor. The contour can still be changed later on, by chain saw and saber saw. He traces the previous layer on the underside to show where to spread glue and draws a line along the edge of a center board, keying it for precise relocation.

He changes to plastic resin glue to fix the top, at first brushing it only where the center board goes. This type of glue, mixed from powder each time, is more resistant to heat and moisture than yellow glue. Tabletop conditions won't cause yellow glue to fail, but may raise the glue lines or cause the boards to creep a little. And powdered glue gives a longer open time to work.

The dust is carefully brushed from all the surfaces, the center board positioned and clamped at each end. Then he spreads glue on one side of it and on those boards, positions them, and continues on the other side. The outer boards on each side aren't supported from underneath, so they wait on top until the horizontal clamps are applied. The first horizontal clamp goes from ear to ear across the whole top. A few vertical clamps go directly on the glue lines to tack the boards in place, with paper to prevent staining. They will be supplemented and tightened later. The deepest clamps in the shop reach in a foot from the edge. Castle and an assistant put clamps everywhere they will fit, in the end about 60 of them.

The clamps come off, the excess glue is scraped away, and the edge saber-sawed close to size. Castle carves the transition between base and top the same way he carved the base itself, with chain saw and ball mill, body grinder, Surform and gouge. The piece is ready for sanding.

The usual sanding sequence in Castle's shop begins with 32-grit rotary discs, then 80-grit discs, to remove digs and tears and bring the whole surface to the same degree of fineness. Then the whole form is carefully gone over with a sharp scraper to level the surfaces, remove bumps and hollows and minute irregularities. Then the wood is dampened to raise the grain, hand sanded at 150-grit, and finished off with 220-grit followed by six coats of Watco.

Design Considerations

Thoughts on forms, materials and techniques

by Wendell Castle

I sometimes feel it may be a mistake for an artist to speak or write too much about his own work or the work of others. By trying to express his aims with rounded-off logical exactness, he can easily become a theorist whose actual work may never come up to the conceptions evolved by logic and word. The nonlogical, instinctive, subconscious part of the mind does play an important part in the work.

I'm certain that far too often work is done for its own sake, design for design's sake. All things must lead somewhere: there must be a conscious effort to take the work in some logical direction.

The gamut that furniture may span is as wide as architecture—from simple folk pieces, showing honesty and directness of means, to pieces of great sophistication, expressing a conscious reforming of nature. When a work of art also serves a utilitarian purpose, as in furniture, its form is affected by its function. The fundamental purpose does set limits on the creative freedom of the artist or designer. Art has an ideological function but the function of furniture is not ideological, it is utilitarian. It is true that utility does not require more than a practical solution. But that solution will be in conflict with other essential instincts if it does not show an esthetic concern as well as various practical concerns. Unless this need for form is satisfied along with the functional need, the product will be incomplete.

Like many conscious acts of man, design is achieved almost simultaneously on several different levels: esthetic, mechanical, psychological, ethical and so on. I try for a fusion of these basic considerations, to give the design unity. I arrange these considerations consciously or subconsciously, adhering to the requirements of the problem without losing sight of my personal inclinations. My work deals mostly with organic form. Organic form as an entity does not let itself be clearly grasped, in the sense that a box-like form is comprehended and measured at first glance. There is a certain mystery derived from its kinship with nature. My forms are hybrids—they may be plant-like, animal-like, shell-like, etc. I make no attempt to reconstruct or stylize natural forms, but rather I try to produce a synthesis or metamorphosis of natural forms.

The quality of a plastic or organic form in nature can be reconstructed only as an illusion, an approximation. Furniture or any other man-made object, even in its wildest form, remains something created and set in order by human hands, ruled by laws quite different from those of nature. In spite of this, it is possible to make objects in which certain aspects rival nature, but which otherwise are governed by different principles. From these very contradictory principles a fascinating form evolves.

Too great a respect for material seems to be a special hang-up for craftsmen. There is a great tradition of working in certain ways with certain materials. Craftsmen are taught that some forms are more honest than others. But the more we think of the nature of a material the more ambiguous it becomes. Materials are wiggling under our fingertips, there are new materials being invented every day, there are old materials being used in new ways. The form-material relationship that was once acceptable is by no means sufficient in our day.

Form is the reason for laminating furniture. Forms can be realized that with other methods of joinery would not be possible. It is not just a matter of building up large volume, but the volume can be shaped as it is being built, thereby realizing a great saving in time and materials. A skillful person can understand forms so accurately that he knows the precise shape of every cross section. With each cross section accurately cut only a minimum of work is left to be done when the lamination is complete.

I feel I am free to use my material as I wish, but I do not allow this freedom from the restrictions of the material to go entirely unchecked. My forms are not completely free form. They are designed and constructed within strict boundaries. These are boundaries of human scale, of function as furniture: tables need tops at the right height, chairs have to comfortably fit the people sitting in them. There are boundaries imposed by the nature of the material; for example, you wouldn't stack a wasp-waisted Saarinen pedestal—it would break. Laminated wood is heavy, more suited to large, massive pieces than to lightweight movables. Many forms that I might dream up would simply require too much time to stack and carve. This is economics, perhaps a crass consideration, but necessary for one who makes his living doing this.

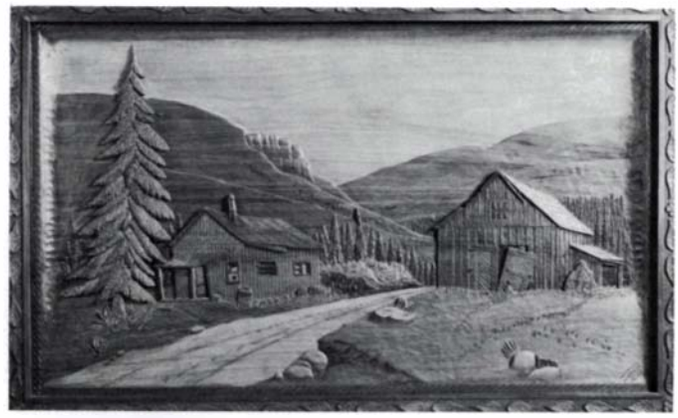
The technique itself imposes limits because it lends itself so well to subtle, slow changes in grain direction—as opposed to the abrupt changes of the traditional, right-angled mortise and tenon. And it has built-in pitfalls: it takes a stronger sense of sculptural form than does working in the vocabulary normally associated with furniture, where the results are more predictable. There is more chance of getting into clumsy, heavy and awkward pieces, and that's where many people often go wrong, by not understanding how stacking can best be used.

Wendell Castle produces 75 major pieces of furniture a year, with the help of three full-time employees. He is professor of sculpture at the State University of New York, Brockport.

Keystone Carvings

'Yorkarvers' hold second annual show

by A. W. Marlow



It all started when a group of enthusiastic whittlers numbering a lucky 13 got together a few years ago, talked over a name, and came up with a quaint word "Yorkarvers." Success was assured, intentionally or not, by seeking for membership some of the best-known carvers in the country. Members are of all ages, one or two a ripe 87 years old, and the youngest only eight.

I was cordially invited to review their second annual Woodcarving and Decoy Show held in early October. I was amazed at the profusion of talent displayed there—figures, from a full-size cigar store Indian down to a few inches; animals, birds and an infinite variety of creative art, all attractively displayed. A real problem was choosing which pieces to photograph.

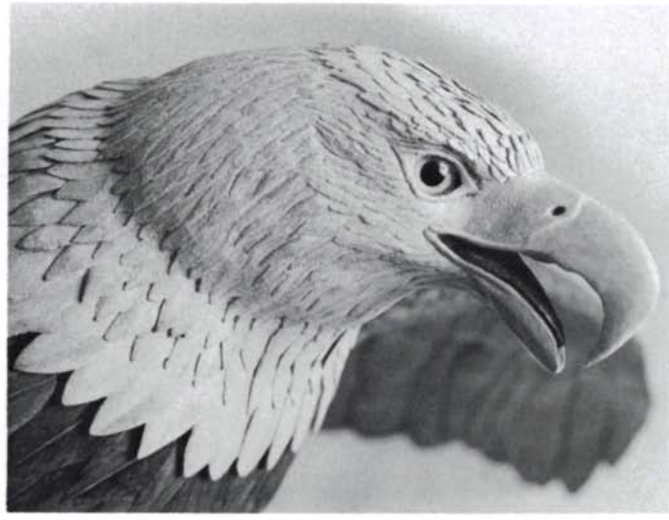
The "best-in-show" award went to Donald C. Bridell, whose decoy masterpieces have already been shown in *Fine Woodworking* (Winter 1975).

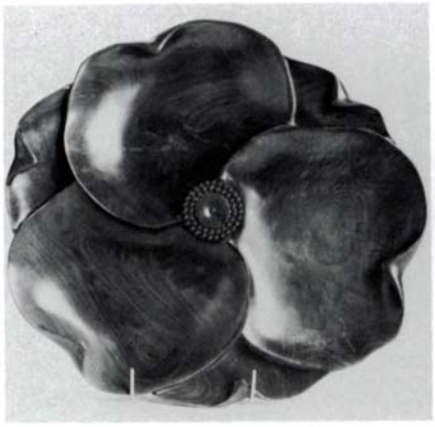
Harry E. Carpenter's 36 x 28-inch bas-relief must have had a natural setting for inspiration. The real-life details, broken door hinges, sagging roofs, broken windows and loose boards could not have come out of the imagination.

Eleanor Bruegel's delightful shepherd-like figure was really well done. It reminded me somewhat of Rip Van Winkle or better yet, Robinson Crusoe.

A green wing Teal by Harold R.

A. W. Marlow is a cabinetmaker from York, Pa. and the author of several books on Early American furniture. Much of the work he does involves graceful and intricate carving.





Bruckwalter was really something to look at. For a carver to visualize the setting he would like to produce, make working drawings, and anticipate the in-flight mounting problems requires a man knowledgeable in many fields. The bird seems to be in full flight with the left wing just brushing a driftwood post. That brief contact point is the bird's only support and considering its weight (and wing span of about 30 in.) a sturdy metal pin was needed. Even the tail feathers are in a braking position.

Huber King's character study of General Custer shows a lovable good nature, bravery without question, and loyalty right down to the last whisker of his goatee. The 36-inch figure is laminated basswood on a pine base.

The tool work detail is so exacting in H. W. Bubb's bald eagle that it would not be a surprise if he counted out the proper number of feathers which, by the way, are individually cut and fastened in position on the wing tops. With a wing span of about six feet and a weight of 30 or more pounds, transportation is a problem. So each wing is fitted with dowels for easy removal. The price is $5000.

I fell in love with Kenneth E. Carl's 18-inch tray. The design is pleasing and the tool work is as perfect as handwork can be. Most interesting is the slab of walnut from which it is made. Grain configuration borders the burl and when hand cutting must be done on that crazy pattern, whew! Also what I liked was the care he exercised in sanding out every little tool mark, then applying a finish inferior to none.

Carl E. Myers' wild turkey is a regal bird, 30 inches long, and made of pine laminate. The beard and head hairs came from a horse. They were individually pin-holed and fastened. The carving is priced at $1000.

Carcase Construction

Choosing and making the right joints

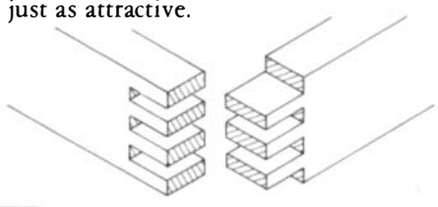
by Tage Frid

Furniture construction is broken down into two main categories: frame and carcase. In frame construction, relatively narrow boards are joined—usually with a mortise and tenon joint—as in a chair or table base, or in a frame and panel door. (See *Fine Woodworking*, Summer 1976.) In carcase construction, boards are joined end to end using dovetails, tongue-and-groove joints and the like, as in a drawer or hutch. When designing a carcase, the beginner may find it difficult to know which joint to choose. Some joints are excellent in plywood but weak in solid wood, and vice-versa. Many beginners are so concerned with the "craft" aspect that they design in the most complicated techniques. They use a complex joint where a joint easier to make would work just as well. I always choose the strongest but easiest joint to construct. I cannot see spending time over-constructing a piece. And I expect my furniture to last long after I do.

Most carcase joints can be made by hand, but are usually more easily and precisely made on a circular saw. I would advise people who don't own a circular saw to buy a table saw and not a radial arm saw. The latter is limited in function and not as accurate or flexible. It was designed for cross-cutting rough lumber to lengths, and even then is limited to a certain width. Many of the joints described here would be dangerous and impractical to make on a radial arm saw. I prefer at least a ten-inch table saw, and it does not cost that much more than an eight-inch. Buy one with at least a 1-hp motor, as an underpowered machine is much more dangerous to work with.

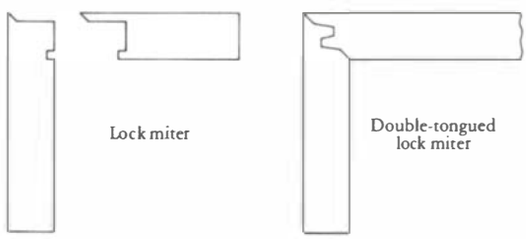
Joints at corners

In the article on dovetails, (*Fine Woodworking*, Spring 1976), it is stated that dovetailing is one of the strongest and most attractive methods of joining the ends of boards together. This is true if you are going to make joints by hand. But most carcase joints lend themselves to machine fabrication. The closest machine joint to a dovetail is a finger or box joint. Because of the greater number of pins and the resulting total glue surface, it is stronger than a dovetail, far easier to make, and just as attractive.



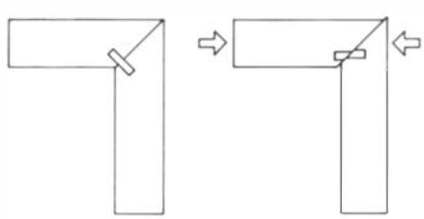
Tage Frid teaches furniture design and construction at the Rhode Island School of Design, and has been a professional woodworker for close to 50 years.

The lock miter is used for either solid wood or plywood. Its advantages are that it is hidden to the outside, and that it requires clamping in only one direction, because of the built-in locking action. The "double-tongued" lock miter is the best and fastest production joint for plywood but it requires a shaper with special knives, (available from Woodworkers Tool Works in Chicago; see page 62). Only one shaper setting is required—the first piece is run through vertically, the second horizontally. The same clamping benefit holds true here. I use this joint only in plywood. In production work, the time saved pays for the relatively high cost of the cutter.



The spline miter really lends itself to plywood, but can be used in solid wood on smaller pieces such as boxes. The grain direction of the spline must follow that of the pieces being joined. The spline should be placed 1/5 to 1/6 of the way in from the inside corner so as not to weaken the corner. Because of the 45-degree angle, all pieces must be glued up simultaneously, a real disadvantage in a piece with many parts. Also, a lot of clamps (in all directions) are required to ensure tight glue lines.

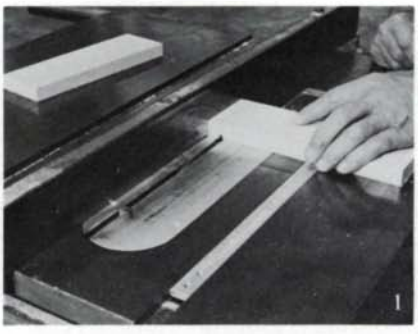
A lesser-used spline miter with a parallel spline has several advantages but can be used only in plywood. This spline is just as strong as the diagonal one. The spline slots are minutely offset (about 1/32 in.). Clamps are needed only parallel to the spline, and the offset pulls the pieces tightly together. The ease of clamping this joint is a real advantage. You can glue the inside members and sides first, and when they dry, glue on the top and bottom.

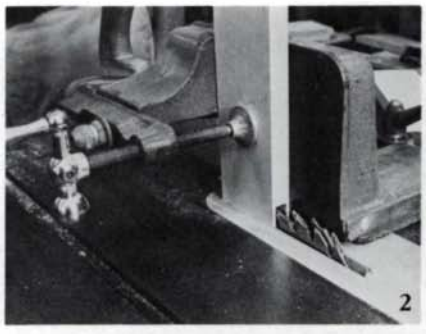


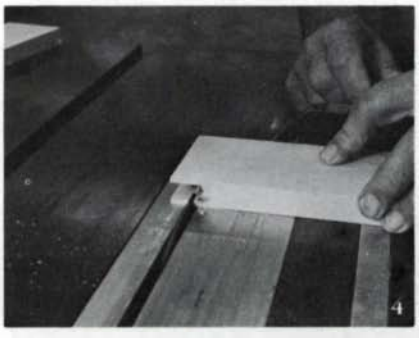
A corner tongue and groove, rounded or square, is good for either type of wood. In plywood the grain of the corner piece must run lengthwise along the edging. However, in solid woods, the grain must run in the same direction as the grain

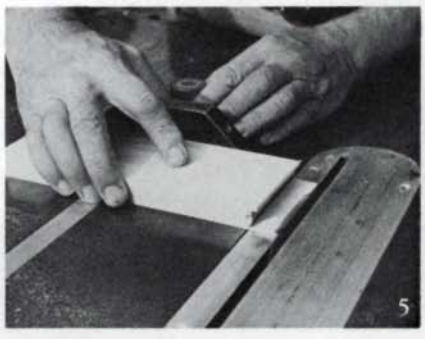
Making a Lock Miter

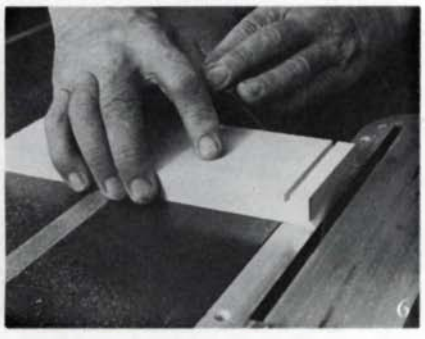
Set the table saw fence to just inside the board thickness. Set a single blade to a height 1/5 to 1/6 of the thickness. Make the first cut using a miter gauge (*1*). Set the dado blades to the desired width (about 2/3 the thickness). Mark off the blade height from the other board and cut the dado. A tenoning jig is much safer here than using the fence (*2*). Scribe the other dado side to the first piece. Set a single blade to the height of the top edge of the dado. Saw to make the second tongue (*3*). Cut off the tongue on the dadoed piece to the right length (*4*). Tilt the blade to 45 degrees and miter the mating tongues (*5* & *6*). Keep checking back and forth between pieces as you make each cut to test for a good fit, or make a scrap set as you go along.

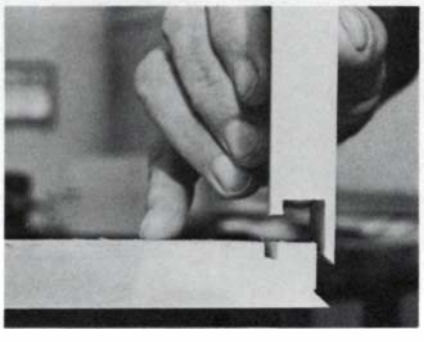


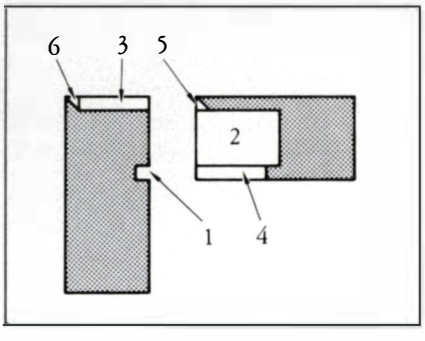






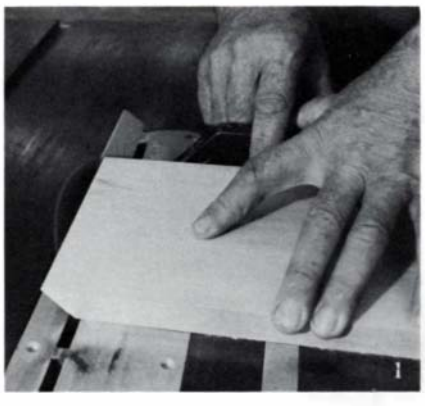






Making a Spline Miter

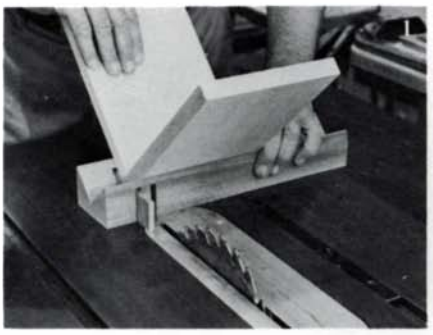
To make a spline miter set the blade at 45 degrees and cut the pieces using the miter gauge (*1*). Lower the blades, move the fence to the opposite side of the blade and cut the two spline slots (*2*). This method keeps the cuts parallel to the edge and prevents the pieces from skewing.

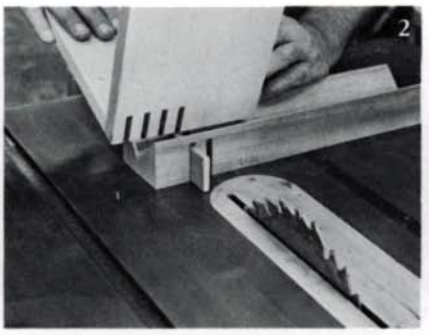


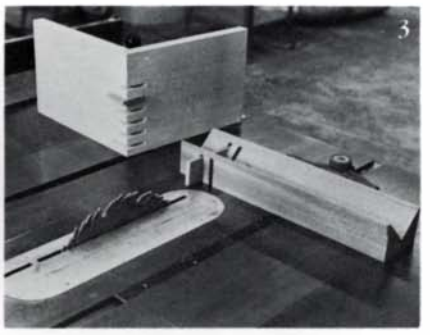
Making Multiple-Spline Joints

Mock Finger Joints

The mock finger joint is made using a simple jig on the table saw. The carcase pieces are first mitered and glued. A jig with a 45-degree vee cut out of it is made and a dado cut is sawed into the jig. A spline is fitted into the cut. The jig is screwed to the miter gauge. A cut is made at the desired arbitrary distance from the spline (*1*). The pieces are set in up against the spline and the first cut is made. The first cut slips onto the spline and the next slot is made (*2*). The process is continued down the length (*3*).

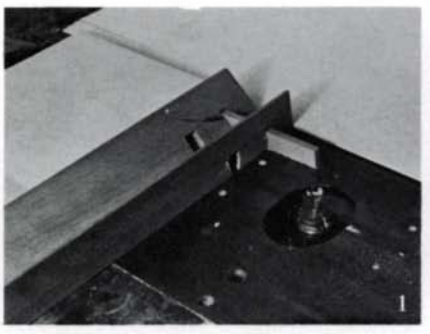


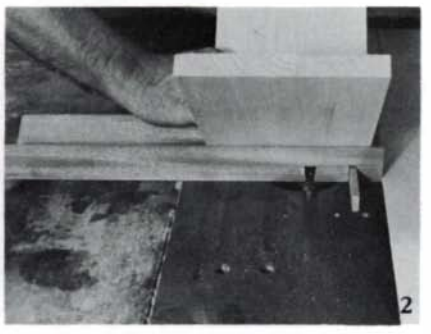


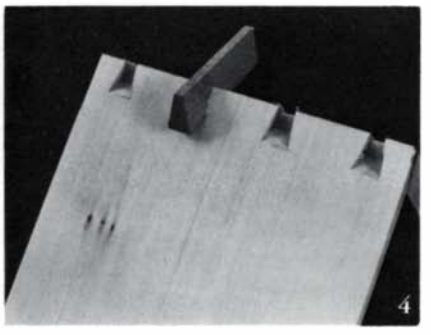


Mock Dovetails

For a mock dovetail the jig is exactly the same as in the mock finger joint. A fence is set up on the router table that is no higher than the bottom of the vee on the jig. A board is attached to the back of the jig to provide a greater surface running against the fence (*1*). The process is exactly the same as the mock finger joint (*2,3*). The length of spline is angled on both sides to fit into the dovetail slots (*4*).

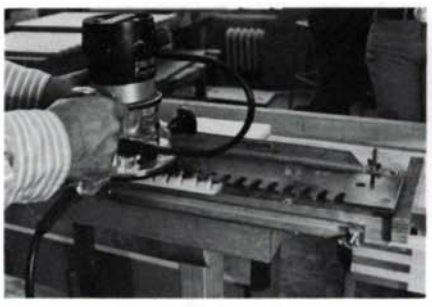


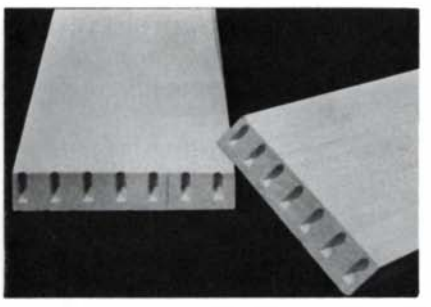




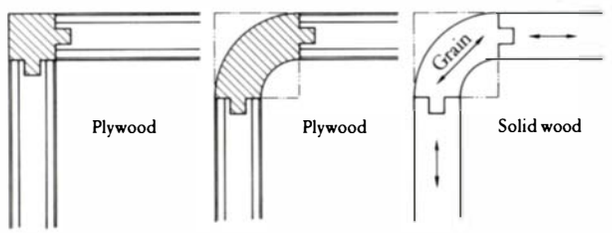
Full-Blind Splines

The first piece is lined up with the left side of the jig and the second with the right so that the two align properly. Or a piece of plywood can be made to serve as a guide. If the joint is made with a dovetail jig the splines will have to be rounded on two edges. Or the splines can be made smaller and left square since there is plenty of glue surface. The joint can also be made on a mortiser, using a jig just as in the mock spline joints.



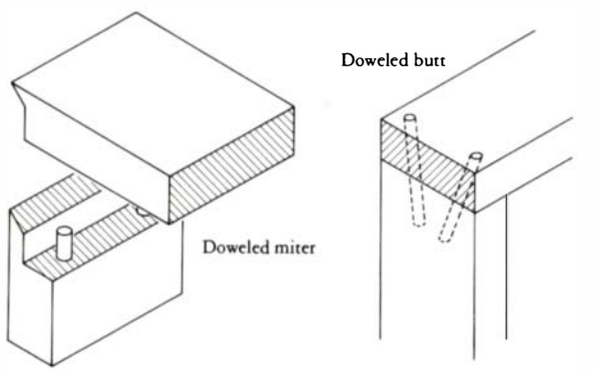


of the sides so that expansion is constant. The grain should run diagonally from tongue to tongue. Any shaped corner molding can be used. The inside is shaped first, the pieces are glued together, and then the outside is shaped.

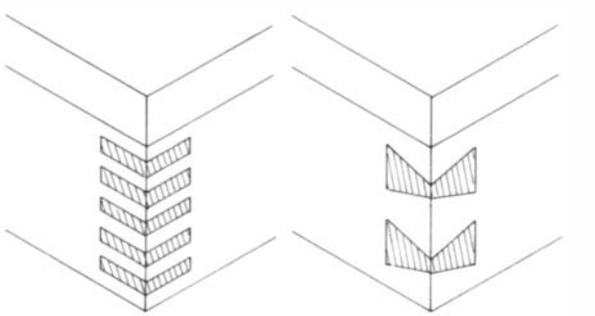


The doweled miter is used where structure is not crucial—in small boxes, knickknack cabinets, spice racks, etc. It is easy to make, and aligns itself correctly for gluing because of the dowels. A dowel center is useful for transferring the position of one hole to its corresponding hole. This joint works in solid wood or plywood.

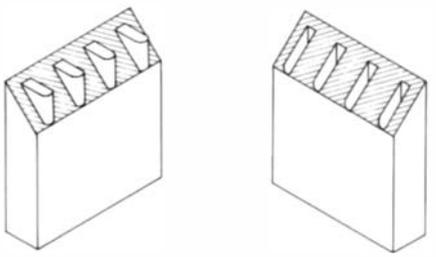
I generally do not use a butt joint with dowels, but when I do, I find it advantageous to angle the dowels. This adds needed strength to the joint.



Several joints are made by cutting a miter, gluing the corners together, and then cutting slots to receive splines. Water-based animal glue in an electric glue pot is perfect for gluing the miters since the glue is strong and dries in just a few minutes so you can then finish cutting the joint. These joints have great strength and pleasing decorative qualities. With jigs, they can be made extremely fast. The first is a mock finger joint—it resembles a finger joint without the alternating fingers. For the same effect in a small piece, thin, handsaw kerfs are spaced down the joint. Pieces of veneer are hammered to make them thinner, and glue is squeezed into the saw cut. When the veneer splines go into the slots they swell from the moisture of the glue. (A loose through dovetail can be repaired in the same way, by evening out the gap with a saw cut and diagonally inserting a veneer strip.) A mock dovetail is made similarly, but using a router mounted in a table. If desired, a contrasting wood can be used for splines as a decorative detail.

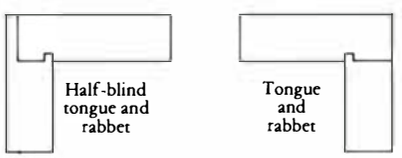


If the splines are to be hidden, the spline slots can be cut using a router with a machine dovetail jig. This joint is considerably stronger than a full-blind dovetail because of the greater glue surface.



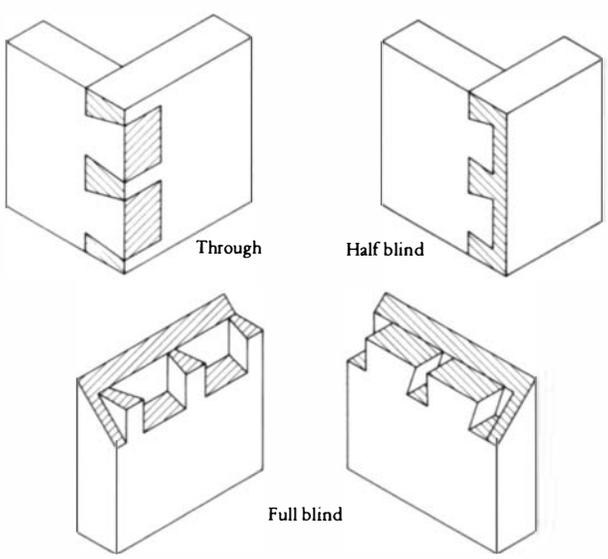
The tongue and rabbet is not the strongest joint but is good enough for the back of a drawer (although not as strong as a dovetail). It is very easy to make. The proportions must be strictly adhered to, as they are determined by factors of strength. The groove should be no deeper than 1/4 to 1/5 of the board's thickness.

The half-blind tongue and rabbet is made like a lock miter but without the miter. It is particularly good for drawer fronts, but in that case be sure to put the drawer stop somewhere other than in the front because of the limited joint strength. This joint can also be made with a router.



Machine-cut dovetails made with a router and dovetail jig are useful where great quantities must be cut, or where the extra strength of a hand-cut dovetail is not needed. I use them when I have stacks of drawers to do for kitchens. Otherwise, I prefer hand-cut dovetails for their strength and looks. Besides, when you've made them for many years you'll find them easier to do than setting up the router.

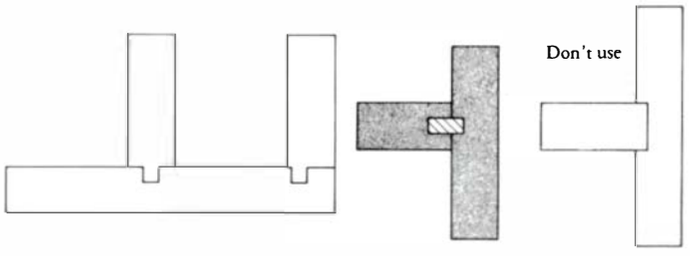
The through and half-blind hand dovetails are explained in the dovetail article in the Spring 1976 issue of *Fine Woodworking*. The full-blind dovetail (and similarly the machine-made, full-blind spline joint) is not used to be "crafty," but is used where strength is important, as in a freestanding cabinet without a back, or in a cabinet with glass doors.



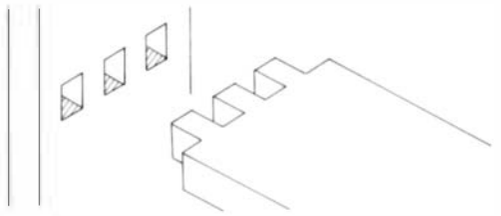
Joints not at corners

A simple tongue and groove can be used for any type of wood except composition boards. At the ends of boards the tongue is set off center so that the outside shoulder isn't too weak. Fiberboard and particle board are made of waste materials and so there is no grain strength. Since a tongue would break, a spline must be used with these materials. The spline should go into the carcase side about 1/4 of the side's thickness, and twice that amount into the perpendicular piece. Setting the spline further into the side will weaken it, and keeping it shorter in the perpendicular piece will not add enough strength.

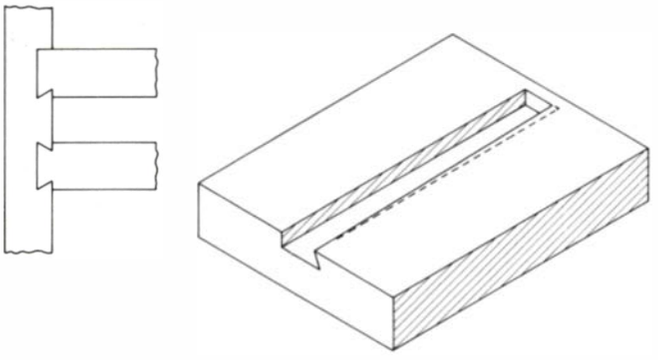
I would never use a fully-housed dado joint. There are no shoulders to lock the wood and help resist sideway stresses. Also, if the wood is sanded after the joint is cut, the piece becomes too loose. If there are imperfections in the wood, the piece will not fit tightly.



Another strong joint is a series of small mortise and tenons. For extra strength, the tenons should run through the sides and be wedged from the outside at assembly.

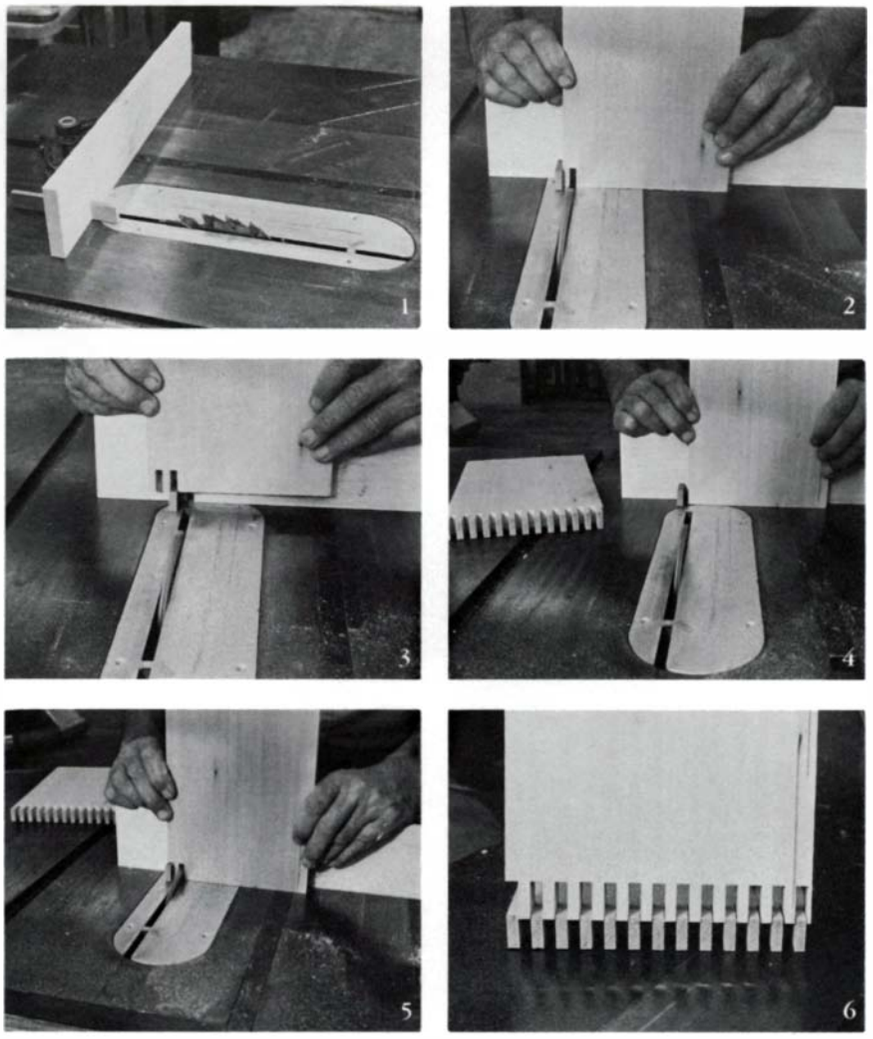


The sliding dovetail is an excellent joint for perpendiculars. The double-shoulder version is machine cut with a router and a dovetail bit. The single-shoulder joint is cut by hand with a dovetail plane and its corresponding saw, and with a router plane. The machine version is excellent for production. If



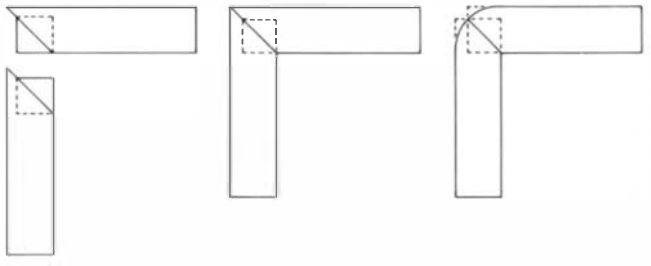
Making a Finger Joint

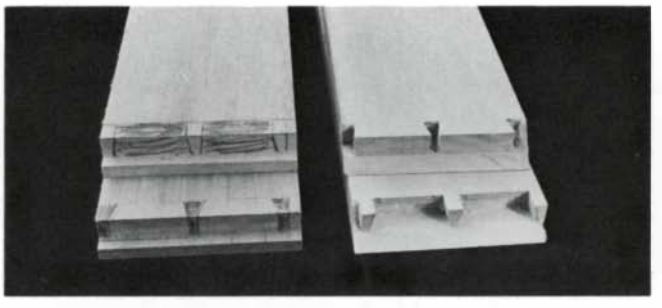
A simple jig on a miter gauge makes cutting this joint very simple. A correct fit is solely dependent on how accurate the jig is. Raise the blade a hair higher than the thickness of the boards: It is easier to sand a little off the ends of the joint than to plane the whole side. Make a cut in the board with the dado blades. Then make a spline that is exactly the same size as the slot and fits into it snugly (*1*). Line up the blade to a position precisely one spline thickness over from the first cut. Screw the jig to the miter gauge. With the spline in the slot, cut the first finger with the board edge up against the spline (*2*). Slip the finger slot onto the spline and continue down the board, moving over one each time (*3*). Start the second piece lined up to the open sawcut so the first cut makes a slot (*4*). Continue down the board (*5*) and the two should fit together perfectly (*6*). I recommend you do a small test to check the accuracy of your jig before cutting the final pieces.



Making a Full-Blind Dovetail

The pieces are marked and the excess above the pins and tails is removed. The remainder that will form the top miter must be a square. A 45-degree angle is cut at the edge (or at both edges). The pins are marked, cut and chiseled out. The tails are marked from the pins, sawed and chiseled out. With a little luck, they might fit. If for some reason the corner is slightly open, hit it lightly with a hammer when the piece is being glued. This will bend the fibers over and close the imperfection. For a round corner the dovetail is made exactly the same but without the upper miter.





Making Hand-Cut Sliding Dovetails

Hand-cut sliding dovetails require the special dovetail plane and saw (*1*). The position for the groove is marked with a framing square and scribed. The angle of the taper is drawn in. For lumber 3/4 in. or thicker I use about a 1/8-in. taper. If the groove is to be stopped in the front I mark off where the joint ends. All lines are scribed and scored deeper with a chisel. This is important since the cutting is across the grain. A slight vee is pared off of each line the whole way down (*2*). If the joint is to be hidden the end is chiseled out. This stops the groove and provides an opening to start the saw in. The straight side is sawed at 90 degrees and the tapered side is sawed at an angle using the saw shoulder as the guide (*3*). The router plane cuts out the mass of material and the groove is finished (*4*). The depth of the dovetail is marked onto the edge of the other board with the arrow-shaped blade in the dovetail plane which is available from Woodcraft Supply (*5*). I make the dovetail 1/32 in. shorter than the depth of the groove. The planing is continued until the piece appears to be the right size (*6*). It should slide in easily at first and become very tight in the last fifth of the groove. One or two more passes with the plane with testing in between should result in the desired fit. If the joint is hidden, the front of the dovetail is pared off.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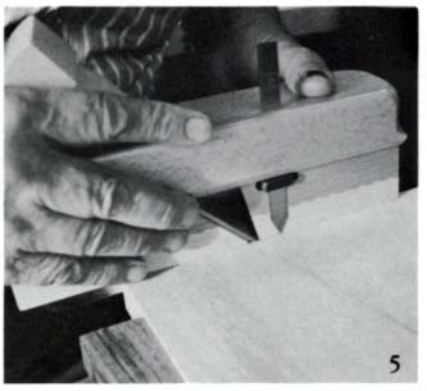
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6

only a few sliding dovetails are required, the hand method is preferred. It is extremely simple and much faster than one would expect. In the hand version the track is tapered so that the dovetail slides in easily at first and locks at the end as it is hammered into place. Consequently, as the dovetail is forced in tight, a small shoulder is pressed into the straight side and increases at the narrow end. In the machine version, the pieces should mate exactly and thus will require a lot of force to assemble. This is especially true if glue is used on a long dovetail, because the glue will swell the grain, making the piece increasingly difficult to slide in.

With both types of sliding dovetails, glue is not necessary, although a spot can be put at the front to fix it in position, or the whole length can be glued. If two different materials are used (e.g., plywood shelves into solid sides), only the front should be glued so that as movement occurs, the front will remain flush.

In a chest of drawers or similar carcase higher or wider than two feet, some sort of strengthening brace will be required. I use a sliding dovetail in the center brace, and if additional bracing is needed, a tongue and groove out to the sides. The sliding dovetail holds the center in tight.

If you wish to keep joints from showing through in front, you can stop the joints before the front or else cover them. In solid wood I sometimes cut a half-inch strip off the cabinet, run the joints through, and reglue the strip. In plywood I run the joints through and add a facing for the same result.

Backs for carcases

The back of a carcase is an important strength-determining factor. Various methods for inserting backs will require differing assembly sequences, which must correspond to that of the particular carcase joint used. This is an important relationship that must be decided at the design stage.

The easiest and most common way to insert a back is to make a rabbet around the four sides and screw on a piece of plywood after the carcase is glued. This method gives you a second chance to square a cabinet that has been glued slightly out of square. The plywood can be made square or slightly out-of-square the opposite way and this will counteract the mistake. This type of back is fine if the cabinet is designed to go against a wall. Most antique furniture was designed to be placed against a wall, and so the backs were usually crudely made and left rough. Today furniture is used much more flexibly, e.g., as room dividers, so it is advisable to design a piece with the back as nice as the rest of the cabinet. The cost and effort of sanding and finishing the back are minimal in light of the time spent designing and executing the piece. Of course, if the piece is designed to be fastened to the wall, the back must still be finished, but not to the same perfection.

A good method for a freestanding piece is to make a groove for a piece of plywood or solid wood which is inserted at the same time the cabinet is glued up. If solid wood is used, be sure the back is free-floating to allow for movement. You may pin or glue the back just at the center points, which will allow the wood to expand equally out to both sides. Leave a little space in the groove on each side to allow for expansion.

If the sides of the cabinet are frame and panels, a set-in flat back would look out of place. To keep your design consistent you can make a frame and panel back that is inserted using either of the assembly sequences described for a plywood back.

Dealing with Plywood

by Karl Seemuller

Plywood is a much overlooked and often abused material for building furniture, largely because of the horrible production furniture pumped into the market by short-sighted designers. But plywood has a lot to offer and is relatively easy to work with. The key to using it successfully lies in understanding its strengths and weaknesses, and in designing work specifically for the material. It does not help to think of plywood as a substitute for solid wood or as its poor cousin. Such an approach can result only in a finished piece that is a substitute for the real thing. If you are going to use plywood make the full commitment and design for it.

Why bother to use plywood when you have the technical skill to use solid woods? Cost is a major consideration. The cost in time and material of a plywood piece is a fraction of that of a solid wood piece. I am speaking in terms of a small shop that produces furniture many people can afford. If you design one-of-a-kind pieces for yourself or for museums, plywood is probably not the material for you.

Plywood offers quite a few advantages to the designer. It is available with just about any veneer. It comes in nice flat finished sheets ready to be cut into components. It is designed to resist seasonal changes in dimension. And plywood joinery tends to be very simple, though exacting. The cost is about the same per square foot as the board foot cost for solid wood in the rough. But solid wood needs to be rough dressed, edged, glued up, surfaced and sanded to bring it to an equivalent stage.

On the other hand, the very flatness of plywood dictates planes or simple curves. Solid wood offers much more versatility. Adding solid wood edgings to plywood softens some of its harsh quality. Solid wood also provides better colors and grain variation in the finish. The finish surface of plywood is veneer only about 1/32 inch thick, so there is not enough depth for the colors to develop fully. And the wetting or steaming process tends to bleed or leach colors out of finished veneer. However, a careful selection of veneered plywood can often bypass this problem.

Hardwood plywood is available with either a veneer core or a lumber core. In the veneer core, the core has a plywood construction. In lumber core, the core is solid wood, usually mahogany, poplar or basswood. The staves are glued side by side, and covered on both sides by layers of crossbanding and a face veneer. Veneer core is suitable for most applications; it is stable, uniform, and cheaper than lumber core. Lumber

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Karl Seemuller has taught at Philadelphia College of Art. When he isn't busy using plywood he works with sculptural form in solid woods.

core is used where additional strength is required. There is also hardwood plywood with a core of particle board, with all of the latter's advantages and disadvantages.

Several machines are used for working plywood. In addition to a table saw, either a shaper or a router is necessary. Carbide blades and bits are a must as the glue in plywood quickly dulls steel. Either a set of tongue-and-groove shaper cutters or a slotting bit for the router is helpful. If you do more than an occasional piece, a shaper and a good set of tongue-and-groove cutters are indispensable. An invaluable asset of these cutters is that they joint the edge of the plywood at the same time that the tongue is cut, thereby ensuring a perfect fit.

It is in the realm of joinery that plywood is most abused. You can cut and join plywood in almost any way you desire and it will go together. Unfortunately, this is precisely what many people do. The result is a product that deteriorates quickly. In solid wood, no one considers cutting dovetails out of short grain, but plywood is often equally misused.

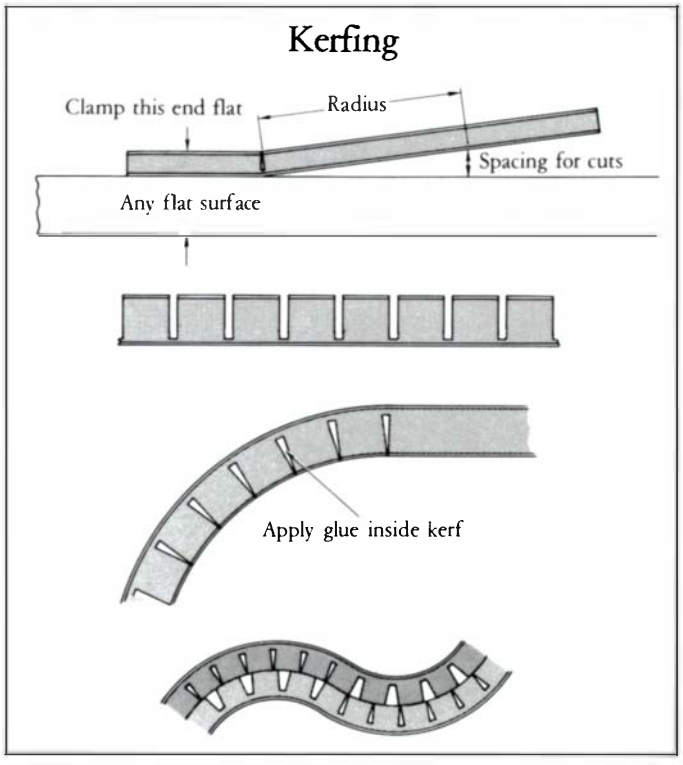
A major problem is how to cover the ugly raw edges that pop up everywhere. The most common solution is simply to glue a strip of veneer over it. Ouch! You are just asking for trouble. We are working with wood, not plastic laminate. One basic design consideration is to avoid any sharp veneered edges or corners. The veneer must be protected from sharp blows or knocks that could easily chip or crack it. Veneer is not fragile, but it does need some help if it is going to give proper service. This problem is solved by using a piece of solid wood edging. It can simply be glued in place, but it is better to attach it with a sturdy joint. I prefer the simple tongue and groove.

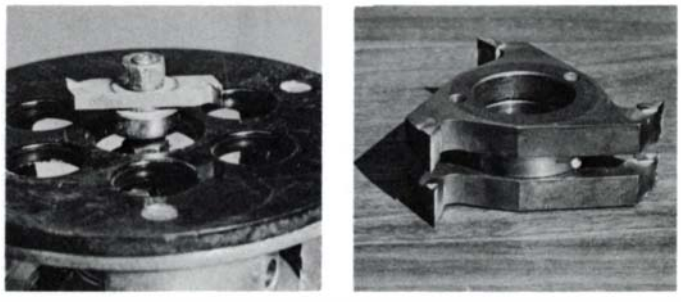
This creates another problem. We now have an obvious strip applied to the edge. I take the easy way out. I cannot hide the edging, so I make it an important part of the design. Now, the fact that it is hiding the core and protecting the veneer becomes secondary to its visual importance.

The next problem is joining the plywood at the corners. While the standard solutions are variations of a mitered corner, either spline or locked (never plain), a better solution is to use solid wood in the corners, joined to the plywood with tongue and groove joints, and left square or rounded off. Or you can use a spline miter and inset a small square "wear" strip along the outer edge to give the protection needed. Interior partitions of plywood are best joined by a tongue and groove, so that inevitable variations in the thickness of the plywood don't affect the fit.

Precise joinery is crucial to successful plywood construction. An error might result in cutting through the thin veneer. If you should cut through, do not get into a sweat figuring how to fix it; you cannot. Avoid the error. Work carefully and precisely so there is no need to fudge the joints. Proper use of the router and shaper will prevent these errors. Always keep the important surface of the work against the shaper table or router base to ensure a uniform dimension from the veneer to the tongue. Always use hold-downs on the shaper to keep the work in firm contact with the table. When cutting solid wood edging, keep it slightly fuller than the plywood. In this way you can sand the solid wood to meet the veneer rather than the reverse. When using a one-shouldered tongue and groove in a partition, sand the member before cutting the tongue. This will prevent a sloppy fit later.

Plywood can easily be bent into simple curves. If the curve is shallow it can be made by laminating several 1/4 or 1/8-in. pieces together over a form. As you might expect the springback will be quite large, but the resulting piece will be very strong and stable.





Tongue-and-groove joints can be made with a carbide-tipped slotting cutter in a router, left. At right, shaper cutters shown in the tongue-cutting configuration. Groove cutter is not shown.

Another method is to run a series of kerf cuts in the plywood. In this way a 3/4-in. piece of plywood can be made into a curve with less than a 5-in. radius. For this operation I prefer a lumber core. Use a carbide blade, preferably one with a thin kerf—the thinner the better. The procedure is simple and economical. Large jigs or forms are often unnecessary. The kerf cuts must be spaced properly so that once the curve is made, the cuts all close up tight, restoring strength to the plywood.

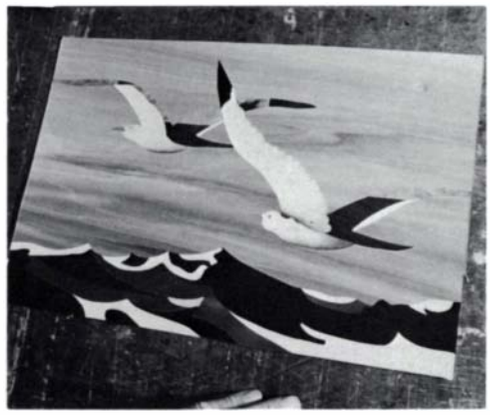
If the inner surface is important visually, two thin kerfed pieces can be used instead of a single thick one. This is particularly helpful with an "S" curve. For example, instead of a single 3/4-in. kerfed piece, use two 1/2-in. or 3/8-in. pieces. Kerf them in the same manner as before, and bend them into shape with the kerfs facing each other. The result is a very strong form, finished both inside and out.

Plywood is limited and cannot offer the same potential as solid wood. But remember, it is not a substitute but a distinct material. Design for it specifically and you will have come more than half the way to a successful piece.

Patch-Pad Cutting

A basic method for cutting marquetry

by John N. Beck



The patch-pad method is one of several ways to cut and assemble wood veneers to form geometrical, floral or pictorial designs. The veneers are stacked between cardboard or plywood, and taped or tacked closed to form a "pad," which is then cut up with a jigsaw. This method has certain advantages. All the pieces are cut at once; and a single sawcut cuts the line between two adjacent pieces. (In some other methods each line is sawed twice.) Also, by using the cut pieces in different combinations, several pictures can be assembled from the same pad. In addition, by stacking sets of veneers, one can cut several identical pictures simultaneously. For the craftsman interested in selling his products the time saved by this method is considerable. For the occasional marquetarian there is no other method by which multiple cutting can be done.

The main problem of making wood inlay pictures is fitting the pieces. The patch-pad method accomplishes this to within the thickness of the saw blade used. No trimming of oversize pieces is necessary. Layers in the pad are made by taping choice veneers selected for specific picture pieces into cheaper veneer seconds called "wasters," to keep the layers even in thickness. The pad is sawed in a horizontal position with a vertical blade. Consequently, all edges are square and join precisely when butted together.

Cutting is the same with a hand or power jigsaw. I use a Rockwell Delta 24-in. throat, 1/3-horsepower jigsaw. If the picture is larger than the depth of the throat, the pad can be sawed into several smaller pads. An electric foot switch which turns the machine on and off leaves my hands free. Blade size is not determined by pad thickness, but by the size of the pieces to be cut. I usually choose a 4-0 jewelers' saw blade because the pieces in my pictures are generally small; for larger pieces a 2-0 is sufficient. I buy my blades from H. L. Wild, 510 E. 11 St., New York, NY 10009, saw list $.25. The blades are of high quality and break less than others.

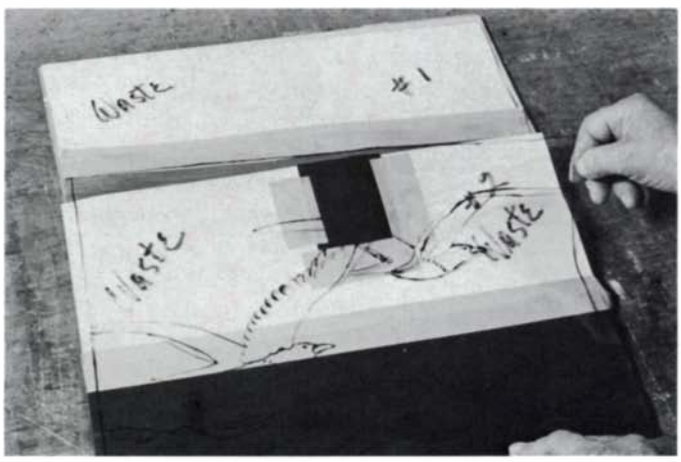
The first requirement is a paper tracing of the desired picture. Two copies are needed: one is used as a master tracing upon which the names of the desired woods are indicated; the other is used for the assembly of the cutout pieces. A piece of acetate is cut to the exact size of the paper tracing, laid over the tracing, and the lines copied exactly with India ink to form a third picture template. This is called a "finder," helpful in choosing and orienting the grain patterns. All tracings should have 1/2-inch margins.

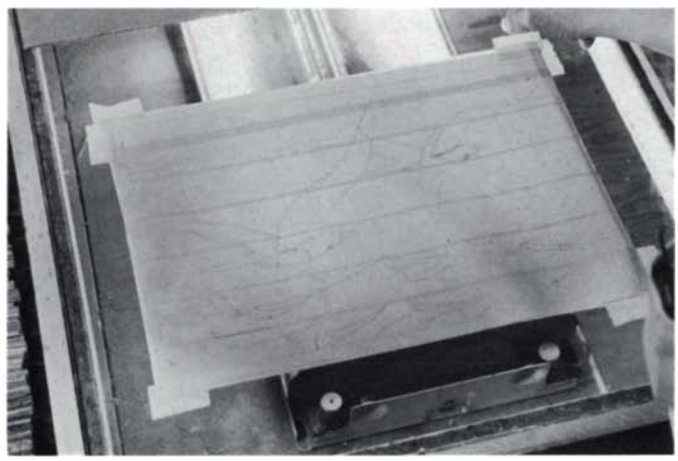
Two pieces of corrugated cardboard are cut to the exact size of the tracing. These form the top and bottom of the pad. On one cardboard the design is duplicated by tracing it over carbon or graphite paper with a ballpoint pen. This serves as the top of the pad.

In the picture shown here, I used a poor grade of maple for wasters. Any waste veneer will do providing it is the same thickness. The first piece in the pad is a poplar veneer chosen for its grain design which makes a perfect sky. I laid the finder (with the design tracing on it) over the poplar to select the most fitting grain pattern, and marked the finder edges (including the margins) on the desired poplar, which I cut to the exact pad size. I then layed it on the corrugated cardboard that forms the bottom of the pad.

For the white in the waves and the seagulls, I used holly veneer. I didn't have any holly the full size of the picture, so I

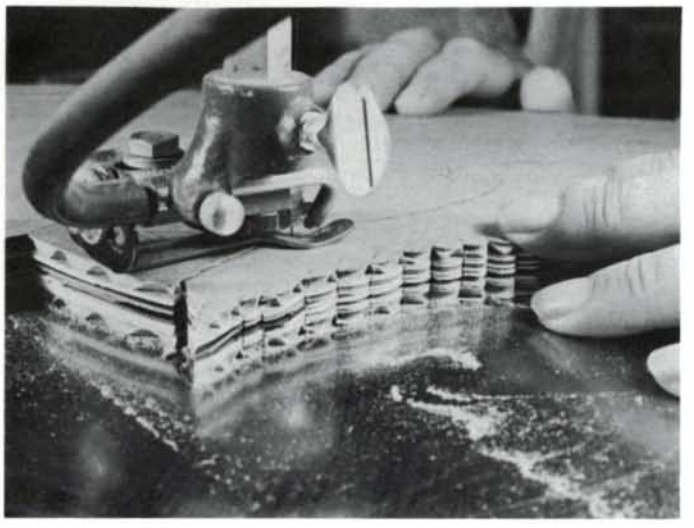
John N. Beck started marquetry shortly after coming to this country from Austria 38 years ago. He sells many pieces which are displayed in his Littleton, N. H. bakery.



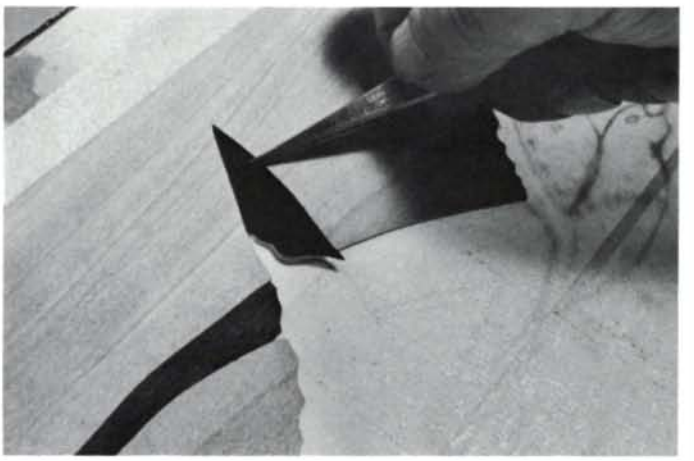


In photograph opposite below, the pad is being made up of good veneers and "wasters," using an acetate finder to help orient the grain. Next to it is the back-lit assembly table, with a sheet of masking tape ready to take the cut pieces. In the sequence of photos on this page starting at right, the author cuts the pad on his jigsaw, places the pieces on the masking tape, and uses sand heated on a hot plate to put shading on the veneer. The finished picture is shown opposite, with reverse side up, ready for gluing and mounting.

cut two pieces, one overlapping the waves and the other covering the birds. Since the birds reached from one end of the sky to the other, wasters would have been impractical, so I used another piece of holly, again overlapping the bottom piece. This formed the second sheet in the pad. The third veneer was a sheet of oak dyed with ferrous sulfate to a dark bluish-gray. This formed the wings. Since the seagulls occupied only about two-thirds of the picture, the veneer was cut to that size and a waster taped to it. The fourth sheet contained black-dyed veneer for parts of the waves and the water, and to it I attached a waster of maple veneer, into which I patched another piece of black veneer for the wing tip of one bird. The last sheet contained a green-dyed ash veneer, also for the waves, with a waster for the balance of the picture. All of the joined pieces in the pad were taped together with gummed craft tape to form one sheet. The pad was then ready to be taped at the edges and sawed. (The orange beaks of the birds were so small that I cut them separately and then fitted them into their proper places. The same was true of the eyes. I drilled two holes through the pad, and after the birds were assembled, inserted small pieces of black-dyed veneer.



To assemble the cutout pieces a sheet of masking tape is made, the same size as the picture plus a margin. To do this, lay the design on a clean wooden surface, with the bottom of the design at the edge of the table. Fit a 2-foot carpenter's square around the design on the top and left side. Mark the size of the picture on the right with a pencil and remove the design. Place a piece of 2-inch masking tape, sticky side down, from the inside corner of the top of the square to the pencil mark on the right. This tape is as long as the picture, including a margin for a reinforced edge. Remove the framing square and lay down strips of masking tape below the



first one. Cut them off on the right in line with the pencil mark. Continue down to the table edge. You will have a complete sheet of tape the size of the picture. It is important to reinforce both sides with a narrow strip of masking tape to facilitate removing the sheet from the table. Starting with the upper left-hand corner, the whole sheet can be peeled up slowly. The masking tape should not overlap more than 1/8 in. between strips, to ensure visibility of the design when placed on the assembly bench, which is a square pine frame, topped with a piece of plate glass of the same size. Underneath the plate glass is a fluorescent light.

Place the second tracing of the picture onto the glass and fasten it with tape at the corners. Place the sheet of masking tape over it; it should conform exactly to the size of the tracing. It is fastened sticky side up with tape in each corner. When you turn on the light the lines of the design will show through the masking tape, which is now ready to accommodate the cutout veneer pieces.

As you cut the pieces out of the pad, lay them down on the illuminated masking tape until the complete picture is formed. Since the pieces are removable, they can be corrected if improperly placed. Throughout the assembly process you have a clear view of the picture.

Next, remove the corner tapes and lift the picture off the design. Tape 1-1/2-in. gummed craft tape over the whole picture with a minimum of overlap. Turn over the picture and pull off the masking tape strip by strip until you see the completed picture in reverse.

Prepare a glue-size of half water and half white glue and brush the exposed side of the picture with the solution just enough to dampen it. Cover the brushed side with a piece of waxed or silicone paper and lay the whole picture between several sheets of newpaper to absorb the excess moisture. If you don't have a veneer press, lay the picture between newspapers and then between two boards, and weigh them down with something heavy. At room temperature the picture will dry in about two days. Inspect the picture for open sawcuts. The glue-size should have filled most of them, but if not, any open spaces should now be filled with wood filler. I use Duratite with a little black acrylic added. I mix it with water to a paste, and apply it to the open sawcuts. Press again to ensure a flat surface; it will take only a few hours to set and dry. Then sand with a fine garnet paper to make it absolutely smooth and even. The picture is now ready to mount on a panel, frame and finish.

If you intend to sign the picture, do it after the first or second coat. Rub the spot with 000 steel wool and it will then take your signature with India ink. Or if you have a pyroelectric pen you may use that before the finish is applied.

Some of the dyed veneers I use may be made from a solution of one or two ounces of ferrous sulfate (which may be obtained in most drugstores) in a gallon of water. Maple immersed into this solution will turn various shades of gray. Philippine mahogany will turn a near black and some types of oak a deep blue. One might experiment with other types of wood. Make sure that the veneers have been immersed long enough for the solution to penetrate completely through the wood. One can check that by taking a small strip off the edge of the veneer. Wet veneers coming out of the dyeing vat must be packed between sheets of newspaper to absorb the moisture. When they are only slightly damp they should be pressed between pieces of dry paper.

Drying Wood

The fundamental considerations

by R. Bruce Hoadley

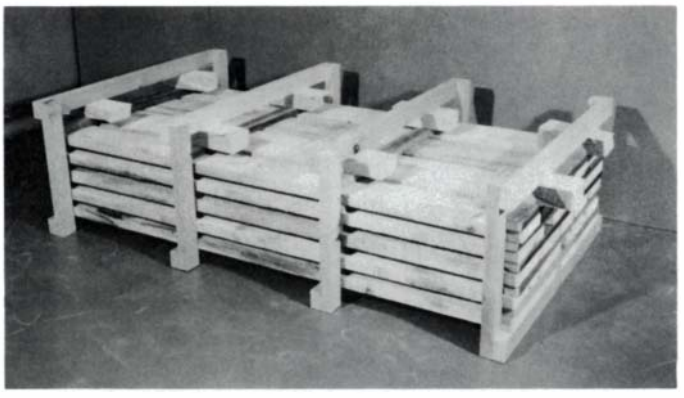
It is ironic that our environment has us surrounded by trees—yet wood seems so inaccessible and expensive for the woodworker. Actually, abundant tree material is available to those who seek it out from such sources as storm damage cleanup, construction site clearance, firewood cuttings and even direct purchase from local loggers. With chain saws, wedges, band saws and a measure of ingenuity, chunks and flitches for carving or even lumber can be worked out. Also, it is usually possible to buy green lumber, either hardwood or softwood, at an attractive price from small local sawmills.

But what to do next? Many an eager woodworker has produced a supply of wood to the green board stage, but has been unable to dry it to usable moisture levels without serious "degrade" or even total loss. Certainly, the most consistent and efficient procedure would be to have the material kiln dried. Unfortunately, however, kilns may simply not be available. The cost of custom drying may be prohibitive, or the quantity of material too meager to justify kiln operation. But by understanding some of the basic principles of drying requirements and techniques, the woodworker can dry small quantities of wood quite successfully.

The so-called "seasoning" of wood is basically a water-removal process. Wood in the living tree has its cell walls water saturated and fully swollen with "bound" water and has additional "free" water in the cell cavities. The target in drying is to get the wood moisture content down to the equilibrium level of dryness consistent with the atmosphere in which the finished product will be used (*Fine Woodworking*, Fall 1976). In the Northeast, for example, a moisture content of about seven percent is appropriate for interior cabinetwork and furniture; in the more humid Southern states, it would be higher; in the arid Southwest, lower. Since removal of bound water is accompanied by shrinkage of the wood, the object is to have the wood do its shrinking *before*, rather than *after*, the woodworking.

Wood dries first at the outside surface, creating a moisture imbalance. This moisture gradient of wetter interior and drier surface zone is necessary to cause moisture in the interior to migrate to the surface for eventual evaporation. On the other hand, if a piece of wood is dried too quickly, causing a "steep" moisture gradient (i.e., extreme range between interior and surface moisture content), excessive surface shrinkage will precede internal shrinkage; the resulting stress may cause surface checking or internal defects (collapse or

R. Bruce Hoadley is a wood technologist at the University of Massachusetts and a carver who is never without a pile or two of drying wood.



Small quantity of lumber piled for indoor drying is shown at left. Double wedges are tapped in tighter to maintain restraint as lumber shrinks. Above, an assortment of log sections and blocks for carving is arranged for indoor drying.

later honeycomb). Gradual drying with a moderate moisture gradient allows moisture from the interior to migrate outward, replacing moisture as it evaporates from the surface, thus maintaining gradual and more uniform shrinkage. Shrinkage in wood per se is a natural and normal part of drying which should be expected and accommodated; *uneven* shrinkage due to uncontrolled drying, however, is the culprit which we must deal with. On the other hand, drying cannot be too slow or unnecessarily delayed, lest fungi causing decay, stain, or mold have a chance to develop. In other words, the key to drying is manipulating conditions of humidity, temperature and air circulation to attain a compromise drying rate fast enough to prevent fungal development, but slow enough to prevent severe uneven shrinkage.

The practice of drying includes (1) proper cutting and preparation of the pieces, (2) appropriate stacking and location to allow regulated drying (and in lumber, restraint of warp), and (3) systematic monitoring of the drying progress. Let's review the application of these basic concepts to typical situations of drying small quantities of wood. We will consider the drying of short log segments or short thick stock, commonly used for wood carvings or stout turnings, as well as regular lumber or boards. We will also assume that fairly small quantities such as several log chunks or up to a few hundred board feet are involved—as occurs when one suddenly falls heir to a storm-damaged tree or purchases enough lumber for a single piece of furniture.

First let's look at proper preparation of the material. Selection of pieces should favor those with normal structure and straight grain. If possible, avoid pieces with large obvious defects. Lumber from trees with special grain will invariably twist upon drying. Irregularities such as crotch grain or burls are esthetically interesting but chancy to dry, since their cell structure usually has unpredictable shrinkage. Knots are troublesome if they are large enough to involve grain distortion. Logs with sweep or from leaning trees having an eccentric cross-sectional shape probably contain reaction wood and will almost surely develop warp and stress due to abnormal shrinkage.

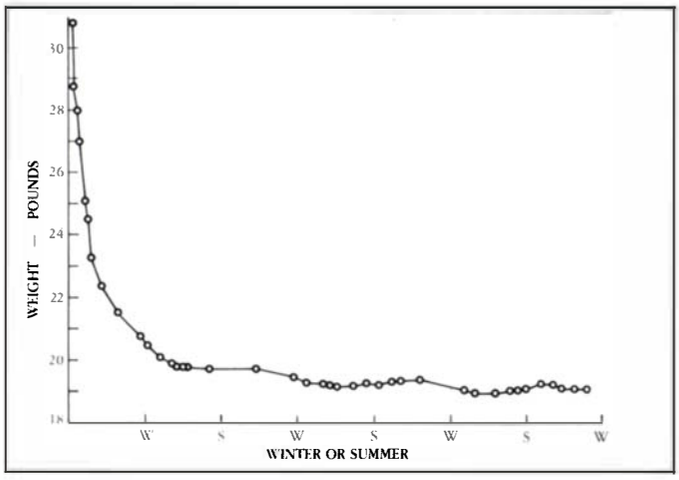
Whether preparing lumber or carving blocks, remember that normal shrinkage is about double tangentially as radially. My initial rule in splitting carving chunks from logs is to avoid pieces containing the pith. A half log or less which does not contain the pith can dry with a normal distortion of its cross-sectional shape (like slightly closing an oriental fan).

Another advantage of not boxing in the pith is being able to see if any overgrown knots are present which may not have been apparent from the bark side. Every knot-causing branch developed from the pith, so it is important to examine pieces from the pith side to discover hidden branch stubs, especially if they have decay. Additionally, the pith area is often abnormal juvenile wood that might best be eliminated.

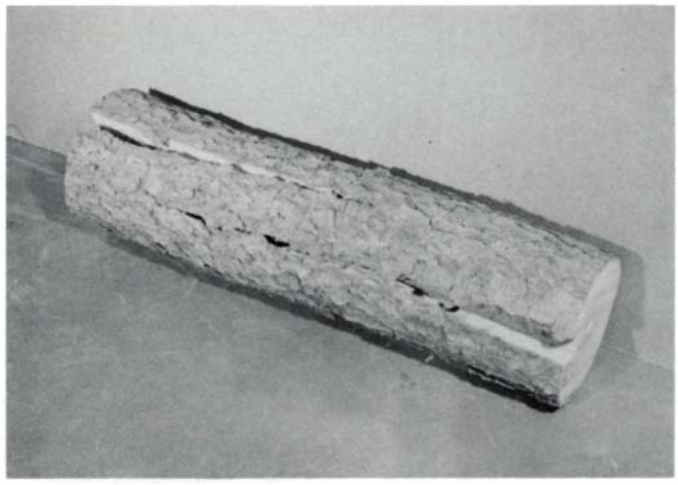
In sawing lumber, cup will be minimized by favoring quartersawed boards, which have no tendency to cup, or flatsawed boards taken furthest from the pith. Boards sawed through the center of the log, containing the pith or passing very close to it, will usually cup severely (or split open if restrained) along the center and might as well be ripped into two narrower boards before drying.

End drying is about 12 times as fast as drying through side-grain surfaces. Consequently, the regions near the ends of pieces drop below the fiber saturation point first. As the ends begin to shrink while the rest of the piece is still fully swollen, end checking usually results. In boards that are relatively long compared to their thickness, most moisture will leave slowly via the side surfaces; the influence of the end-checking problem is confined to a zone near each end of the board (about 6 inches from the ends of 1-in. boards). With relatively thick material, e.g., an 8 x 8-in. chunk 20 in. long, the end checking under uncontrolled drying can extend inward so far from each end that it riddles the entire piece.

To prevent the rapid end drying which will ruin carving chunks and the ends of lumber, the end-grain surface should be coated. Any relatively impervious material (such as paraffin, aluminum paint or urethane varnish) in ample thickness will do nicely. End coating can be applied to relatively wet surfaces by giving a primer coat of latex material first. It is important to end coat as soon as possible after sawing, before even the tiniest checks can begin to develop. Once a check develops, the cell structure failure will always be there even if it later appears to have closed. Also, when normal drying stress develops, a small check can provide the stress concentration point for further failures which otherwise might not have even begun in check-free wood. The purpose



Periodic weights of drying wood plotted on a graph show equilibrium moisture content has been reached.



As shown in this cherry log, the greater tangential than radial shrinkage is relieved by radial cracking.

of end coating is to force all moisture loss to take place from lateral surfaces.

In some species, radial drying may be significantly faster than tangential drying. Therefore, if the bark on larger carving blocks is tight (as with winter-cut wood), it may best be left on to slow the radial drying. If the bark has been removed from a heavy slab, it should be watched carefully during the early drying stages for signs of surface checking. Another reason for prompt end coating is to prevent ever present airborne fungal spores from inoculating the surface. If the bark is loose, it should be removed; otherwise the layer of separation will become a fungal culture chamber with undesirable results.

Don't forget to mark a number and date on each piece. It is amazing how easily your memory can fail once you have several batches of wood in process.

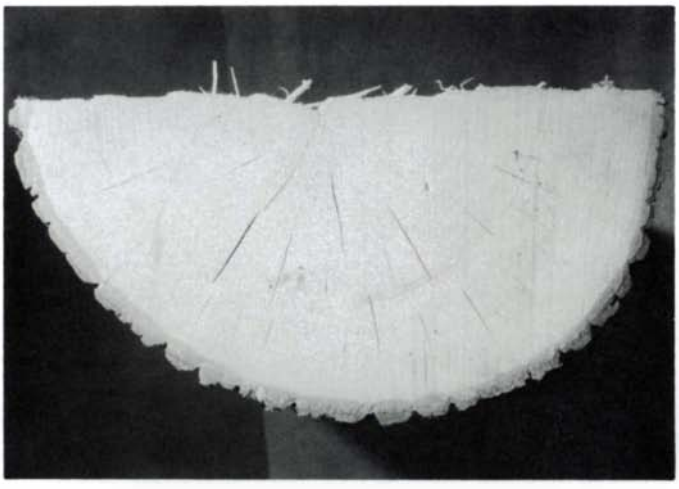
Next, consideration must be given to the correct piling and location of the material so proper drying will result. Piling must ensure maximum air circulation around virtually every surface of the material. Some means of elevating the bottom of the stacks should be provided and some sort of sticker strips are usually recommended to separate adjacent pieces. With irregular carving blocks, merely piling them loosely may suffice, as long as flat surfaces do not lie against one another. No attempt should be made to restrain distortion of large chunks. With lumber, however, carefully designed systematic piling is best.

The usual piling method is to arrange boards in regular layers or courses separated by narrow strips or stickers. This permits the free movement of air around the lumber, uniformity of exposure of the surfaces, and restraint to minimize warp. The stickers should be dry and free of fungi and at least as long as the intended width of the pile. In planning the pile, stickers should be placed at the very ends of each course and at least every 18 inches along the length of the boards, since loose ends hanging out of the pile lack restraint and dry too rapidly (resulting in excessive warp). It is best to have lumber uniform in length, but if random lengths are unavoidable, they should be arranged in a pile as long as the longest boards; within each course, stagger the position of alternate boards so their alternate ends are lined up with the end of the pile. This "boxed pile" system prevents excessive drying of overhanging ends. To prevent excessive drying degrade to the top and bottom courses or layers, extra outer courses of low-grade lumber or even plywood might be added to the pile. Stickers should be lined up in straight vertical rows. To ensure uniform restraint in a course, lumber and stickers should be as uniform in thickness as possible.

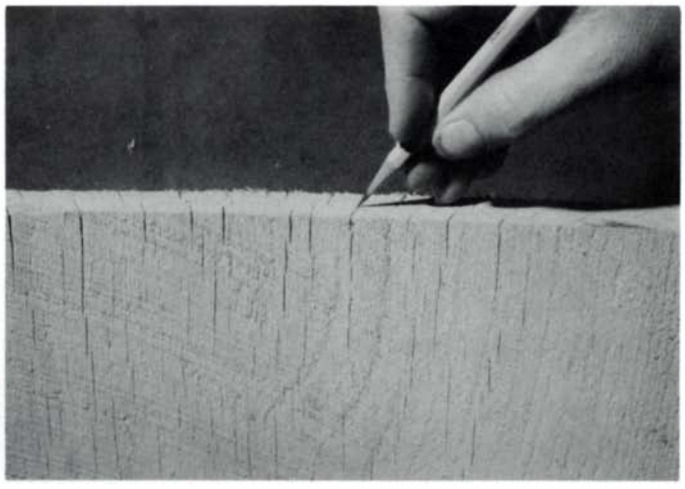
In large piles, the majority of the boards are restrained by the weight of others above. In small piles, extra weight (old lumber, bricks, cinder blocks, etc.) should be placed atop the pile. An alternate method of applying restraint is to assemble rectangular frames to surround the pile. The pile can be wedged against the frames and the wedges tapped further in to maintain restraint as the pile shrinks. Obviously the weighting or wedging should not be so extreme as to prevent shrinkage of the boards across their width.

In a commercial dry kiln, the operator can manipulate air circulation, temperature and humidity to dry the lumber gradually. He begins with a moderately low temperature and high relative humidity until the lumber (based on monitored samples) drops to a certain moisture content, say, near the fiber saturation point. He then establishes a slightly higher temperature and drier condition which he holds until the next lower prescribed moisture content is reached. Then he again establishes another warmer, drier level and so on until the lumber is dried. The so-called "kiln schedule" is a sequence of successively drier conditions which are regulated according to the moisture content of the lumber.

In home drying of wood, we must therefore try to choose locations or regulate conditions to allow only moderate drying at first, followed by more drastic conditions once the lumber has reached a lower moisture level. One logical starting place is out-of-doors. Except for especially arid regions, the relative humidity is usually moderately high. For example, in the New England area the humidity averages around 75 to 80 percent, which would give an equilibrium moisture content of 12 to 14 percent. Piles of blocks or stacks of lumber should be kept well up off the ground to avoid dampness, and should be protected from direct rainfall and sun rays as well. Any unheated building which has good ventilation, such as a shed lacking doors and windows, is ideal. Most garages serve well and even unheated basements are suitable if plenty of air space around the pile is provided. In air drying out-of-doors, some rather obvious seasonal variations will be encountered. In many Eastern areas, slightly lower humidity and more prevalent winds favor drying in spring months. In winter, if temperatures drop to near or below freezing, drying may be



End grain surface of a basswood half log which was not end coated in time shows a large number of end checks.



Cross-cutting has revealed that the surface checks have penetrated deep into this white oak board.

brought to a standstill. You must therefore interpret conditions for each particular area. If wood is intended for finished items that will be used indoors, outdoor air drying will not attain a low enough equilibrium moisture content. The material must be moved indoors to a heated location before it is worked.

Surface checking should be closely watched. Minor shallow surface checking that will later dress out can be ignored. However, deeper checks should be considered unacceptable. The worst type are those which open up but later reclose. Often they go unnoticed during subsequent machining operations only to reveal themselves when staining and finishing of a completed piece is attempted. If any serious end checks develop, don't pretend they don't exist, or will ever get better or go away. For example, if a large carving block develops a serious check, this indicates fairly intensive stress; it is probably best to split the piece in half along the check, thus helping to relieve the stresses, and be satisfied with smaller pieces.

If wood must be located indoors from the very start, drying may be too rapid. Any signs of surface checks in the material suggest that some retardation may be necessary. This can be accomplished by covering the entire pile with a polyethylene film. Moisture from the lumber will soon elevate the humidity and retard the drying. However, this arrangement must be closely watched, since air circulation will likewise be stopped. Moisture condensation on the inside of the plastic covering or any mold on the wood surfaces may mean the pile has been turned into a fungi culture chamber and signals the need for speeding up the drying again. Common sense and intuition will suggest how often to check the wood and how to modify the storage location to speed up or slow down the drying. The seasonal humidity fluctuation commonly encountered in heated buildings must also be allowed for in determining the equilibrium moisture level.

Drying progress can be monitored by weight. Weights should be taken often enough to be able to plot a fairly coherent graphical record of weight against time. Weighing should be accurate to within one or two percent of the total weight of the piece. A large chunk in the 100-pound range can be weighed on a bathroom scale. Pieces in the 10 to 25-pound category can be weighed with a food or infant scale. Small stacks of boards can be monitored by simply weighing the entire pile if this is convenient. In larger piles, sample boards can be pulled and weighed periodically. Electrical moisture meters are perhaps the simplest means of keeping track of the drying progress in boards.

The last stage of drying should be done in an environment similar to the one in which the finished item will be used. The weight of the pieces will eventually level out and reach a near constant equilibrium with only faint gains and losses of weight in response to seasonal humidity fluctuations.

When material comes into equilibrium weight with the desired environment, it's ready. Don't pay attention to overly generalized rules like "one year of drying for every inch of thickness." Such rules have no way of accounting for the tremendous variation in species' characteristics or in atmospheric conditions. Basswood or pine decoy blanks four inches thick dry easily in less than a year, whereas a four-inch thick slab of rosewood may take much longer to dry without defects. In general, the lower density woods are easier to dry than higher density woods. Since the average cell wall thickness is less, moisture movement is greater and this results in faster drying. In addition, the weaker cell structure is better able to deform in response to drying stresses, rather than resisting and checking. After some experience is gained for a particular species and thickness dried in a certain location, a fairly reliable estimate can be made as to the necessary drying time. Here, the initial date you marked on the piece will serve you well.

Whether drying log sections or boards, remember that the drying must be somewhat regulated; usually at the beginning, indoor drying proceeds too quickly and needs slowing down.

In drying your own lumber or carving wood, one common problem is hesitation. You can't wait! If you do, fungi or checks will get ahead of you. Try to think out all the details *before* you get your wood supply; don't wait until you get it home to decide how you are going to end coat or where you are going to stack it.

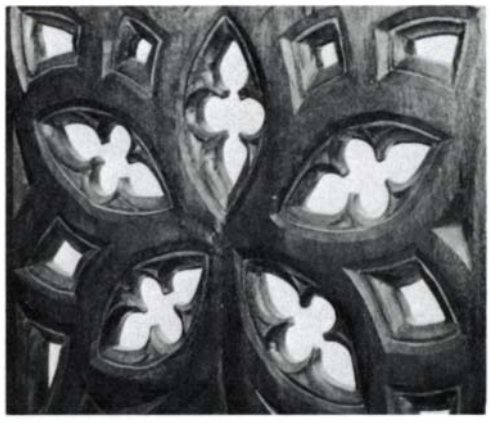
But perhaps the greatest pitfall is greed. Most woodworkers never feel they have enough material put aside and tend to overstock if the opportunity presents itself. With green wood, this can be disastrous. Don't try to handle too much. Don't even start if you can't follow through. More material is ruined by neglect than by lack of know-how.

Finally, in drying wood, nobody has ever proved that it doesn't pay to cross your fingers.

Gothic Tracery

Working with intriguing medieval designs

by Edward R. Hasbrouck



Sometime during the 12th century in Western Europe arose an architectural style which was later to be called Gothic. It developed through architects' and stonecarvers' efforts to raise their churches from squat Romanesque masses of stone to the towering, airy, light-filled cathedrals we admire today. The flowing, geometric lines and patterns which not only define but also decorate the structure were first called tracery by Sir Christopher Wren.

During the Gothic period (12th to 15th century), the Gothic style was common in most of Europe but was most fully developed in England, France and Germany. Various cultures and historical influences modified what was once an almost universal style. Ultimately the Renaissance swept over it. A brief revival in the 19th century seemed out of place and was short-lived.

The shapes used in tracery seem to derive from the sweeping structural lines of the arches and groined vaults invented by Gothic builders to open up stone walls and admit the mystical light. I get the impression that the spaces thus created were filled with lively and pleasing lines of stone or wood to support myriad tiny panes of colored glass. Craftsmen of the day were advised to study geometry, even to depict natural forms of plants and animals. Tracery on furniture mimics this architecture, and continued after the architectural style had passed.

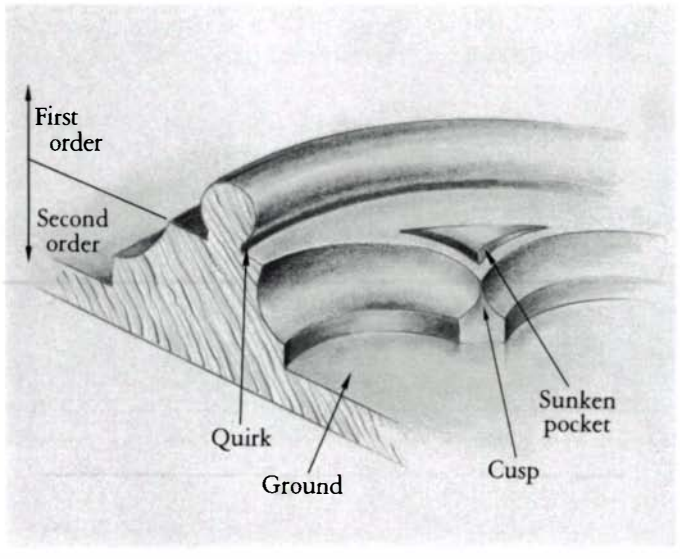
The serious student of Gothic tracery can differentiate the cultural and historical influences with terms such as early English decorated, perpendicular, or French flamboyant. But these terms were applied long after the fact and for my purposes are merely academic. The Gothic style was more a feeling or intuitive concept than anything clearly delineated. I don't think the old carvers had very many verbalized rules.

English publications and illustrations of English work have been the best sources of designs for me. The use of wood in English churches was primarily decorative, although timber roofs, porches and doors are exceptions. The early work, even woodwork, was done by masons and smiths. Once carpenters and woodcarvers got into the act, screens, pews, galleries, choirs, thrones, font covers, pulpits, bosses, carved beams and spandrels grew, blossomed and ultimately filled the church interiors until the stonework became almost secondary. The very nature of wood allowed this decorative elaboration and proliferation.

Broad spaces were considered great opportunities to fill with decoration. Many of the design elements had symbolic meanings. The common ellipse probably refers to the Christian fish. Circles can be foliated three or four times: the Trinity or the cross. A circle with a quatrefoil can be twisted

Edward R. Hasbrouck is a biologist with the California Dept. of Agriculture. He took up carving eight years ago, and now carves Gothic-style furniture as a part-time business.

A 14th-century monk's stool carved from California-grown English walnut is shown at left. The pierced top and uprights were drilled and sawed before carving. Above, one panel from a headboard carved in Eastern willow and stained. Drawing shows elements of gothic tracery.



In photo sequence at right, a template is used to lay out one quarter of the design. The template is divided diagonally, with the first order cut in one half and the second order in the other. The entire repeat is drawn by flipping the template over. When the first-order foliations are cut, the template is used to renew the outline of the second order and the lines are cut in with curve-fitting gouges. Once the stop cuts outlining the pattern have been set in, the rest of the wood is wasted away. When the ground is established, a quick sweep is used to cut the hollows outlining the second-order foils. Most of the design was carved with the tools shown at bottom right: (from left) a flat gouge, vee parting tool, skew, and two medium-curvature gouges. A 30-degree parting tool, not shown, cleaned out the junctions between hollows and the quirk, or undercut, of the first-order bead. The finished panel is 11-1/2-in. square and one-in. thick.

off-axis to make the "whirling cross," a reference to the martyrdom of St. Catherine. I think it was all to delight the eye, enthrall the hearts of generally illiterate and superstitious people, boost the prestige of the patrons who paid for the work, and give good employment to the craftsmen. Today we view the geometry, the moldings, the twining foliage, the saints and the gargoyles as symbols of a culture and life no longer our own.

Nevertheless, I enjoy tracery. I enjoy the process of carving it. In the current parlance, it is an esthetic and nostalgic "trip." I have used it on boxes, headboards, tables and stools, and will continue to use it wherever I have the chance.

Tracery can be carved in several ways, but each begins with a satisfactory pattern, usually involving several repeats. One can draw the design onto the wood, repeat by repeat, with ruler and compass (a technique I use on large pieces). In the example illustrated here, I made a template of one of the repeats and traced out the major foliations, then added small details and corrections freehand.

The design I used is taken from Brandon's *Analysis of Gothick Tracery* (1860). The square is divided into four foliated sections. This design has two orders. In this context the term "order" refers to the organization of design elements both spatially and in complexity.

The first order consists of the thick, sweeping lines close to the surface of the carving, the main elements in the design.

These lines trace out the four circles within the square, and divide each circle into three parts. The first-order lines are rounded and "quirked," or undercut, to form a bead.

The second order comprises the sharper lines and planes within the curves of the first order, from the ground of the carving up to the flat surface at the bottom of the bead. In pierced work the ground would be cut out. The second order is cusped where the curves intersect, and has sunken pockets setting off the cusps.

In executing the design, whittling is kept to a minimum. The shapes of the design result directly from the shape of the tools. The concave portions, or hollows, take their form from a given sweep of gouge; the convex elements are formed by back-bents.

The pattern can be set in either with stop cuts inside the lines or by outlining with a parting tool. I use both techniques, depending on the material. Well-placed stop cuts are a must where the grain is short, or the space too small or deep for the parting tool. Each order is bosted out in turn until the ground, or deepest part of the pattern, has been established. If the carving is to be pierced, I drill and saw out the pierced areas first. I use a saber saw with the narrowest, smoothest cutting blade I can get.

Starting from ground, the cove or hollow of the second order is run first. The amount of curvature in the hollow is a matter of choice. The longer I work, the deeper I want the hollows and the narrower I want the lines. The junction of two intersecting hollows cleans out nicely at obtuse angles, but at acute angles, must be worked with a 30-degree parting tool. The depth of the ground from the bottom edge of the hollow is controlled by eye, as is the width of the ledge outlining the top of the hollow. A pencil line makes that control a lot easier, however. Ideally the hollows can be run with clean, curving sweeps of the chisel, with maybe a little careful paring to tidy up the lines. (True joy is also a rare experience.) Where the grain is contrary, I whittle and then pare with the intent of leaving as few tool marks as I can. Straight-shank tools were sufficient for much of the design, but the equivalent long-bent tools would have been easier.

In tracery, the first order is frequently flat-surfaced. In this case I chose to mold and undercut the pattern until it approximated a bead. The bead can be run with straight-shank gouges, but I used a couple of back-bent tools, which simplified the job of rounding the top and sides of the bead. To cut the quirk I used a 1/4-inch 30-degree parting tool, with a small skew at the corners.

Once the overall design has been cleaned up and the acute angles tapered in, the sunken pockets at each of the cusps can be cut. These pockets lighten up the design by thinning the outline on each of the orders. They can be cut in with three strokes if the grain is right. Technical difficulties arise when the grain is very short between the pocket and the hollow. Some woods tend to crumble readily, such as pine and deodar cedar, which I chose for this carving. Oak was traditionally used in England, walnut in France, and basswood in both. Cherry and maple carve cleanly but are harder to work.

The success of this kind of carving depends on the regularity of the lines and shapes. Although machinelike perfection usually looks quite dead, irregular and uneven lines are even less desirable. I avoid using sandpaper because I don't like to sand. I also take an atavistic pride in good clean chisel work, an achievement I can sometimes claim.

Measured Drawings

by Lester Margon

I was one of the lucky fellows to secure admission to the old Cooper Union Art School in New York City. It was a three-year evening course in various aspects of architectural design, interior decoration and related arts. The course was free except for the purchase of the necessary materials.

First-year students in the interior decoration class were required to make an original color sketch of a room of their choice. I selected a Louis XVI foyer in tones of gray with highlights of gold. The exhibition attracted considerable attention. Mr. Wilson Hungate, director of the drafting room of W & J Sloane, liked my sketch and invited me to join his staff of designers as an apprentice. I was glad of this opportunity and worked there on Fifth Avenue for seven years, advancing from apprentice to full-fledged interior designer.

As time went on, conditions changed: W & J Sloane no longer required 17 men in the drafting room. Formerly, all the work had been done to special order, but then mass production showed its ugly head and there was less work.

Several Sloane designers found good jobs at tremendous salaries in Chicago, Sheboygan and Grand Rapids. I heard of an opening at Stickley Brothers of Grand Rapids, and after some negotiations, they suggested that I submit an original sketch for a bedroom group. I made a colored rendering with stencil decorations, a new note which they liked. It was not long before I was on my way to Michigan.

The work proved rather difficult, not only doing the drafting but supervising the work in the factory. By the end of the year I was ready to resign and try my hand at freelancing for smaller factories. This proved fairly successful. I joined the Grand Rapids Designers Association and thereby met many of the leaders in the industry.

In 1924 the Exposition of Decorative Arts was planned in Paris. The club was invited to send a representative to the inaugural services, and I was selected. I was amazed. My dream of Paris was to become a reality. It entailed a three-month vacation with all expenses paid. What an opportunity!

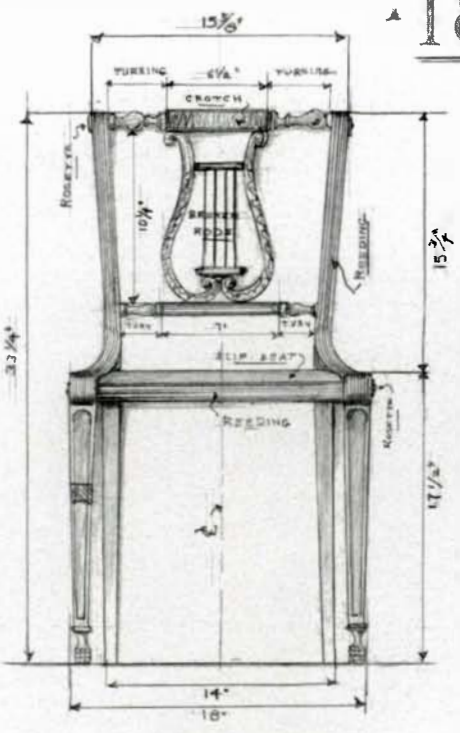
After ceremonies consisting of many introductions and long speeches in French, which I did not appreciate, we spent days visiting the exposition and the many exhibits, led by a member of the academy who spoke English. Much of this proved mighty interesting and instructive. But being in Paris for the first time, my next objective was to visit the Louvre.

This is such a huge and sprawling establishment that it

Lester Margon is an interior designer who resides in Los Angeles and is well-known for his many books of measured drawings of the finest museum pieces.

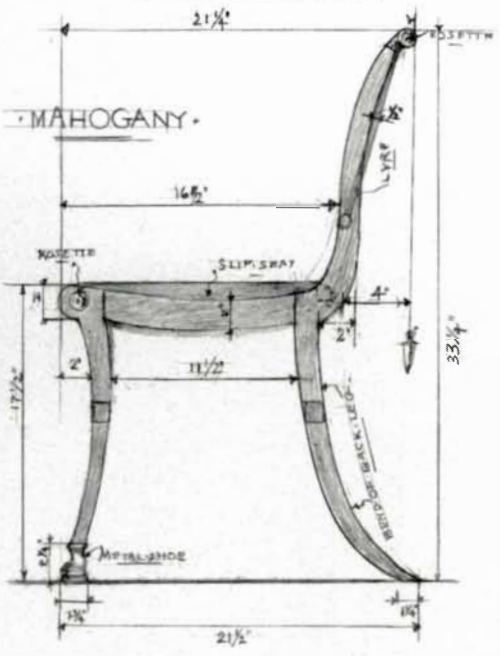
A DUNCAN PHYFE CHAIR

1810



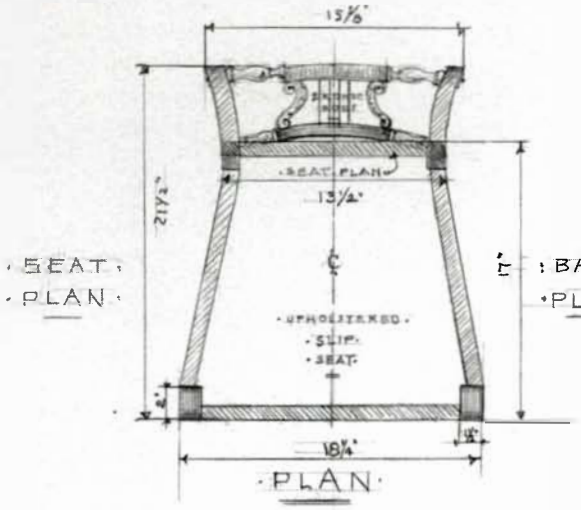
FRONT ELEVATION

SIDE VIEW.



SIDE ELEVATION

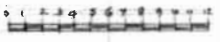
SIDE CHAIR



SEAT PLAN

BACK PLAN

PLAN



Scale in INCHES

Measured & Drawn by Lester Margon

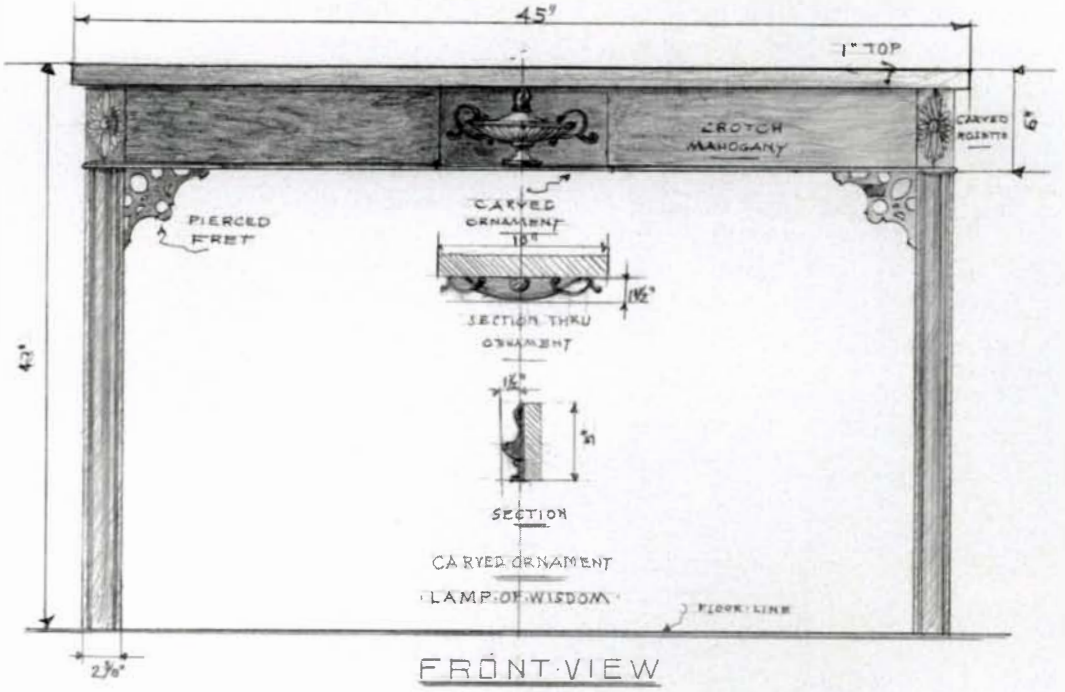
THE DETROIT INSTITUTE OF ARTS

CITY PURCHASE

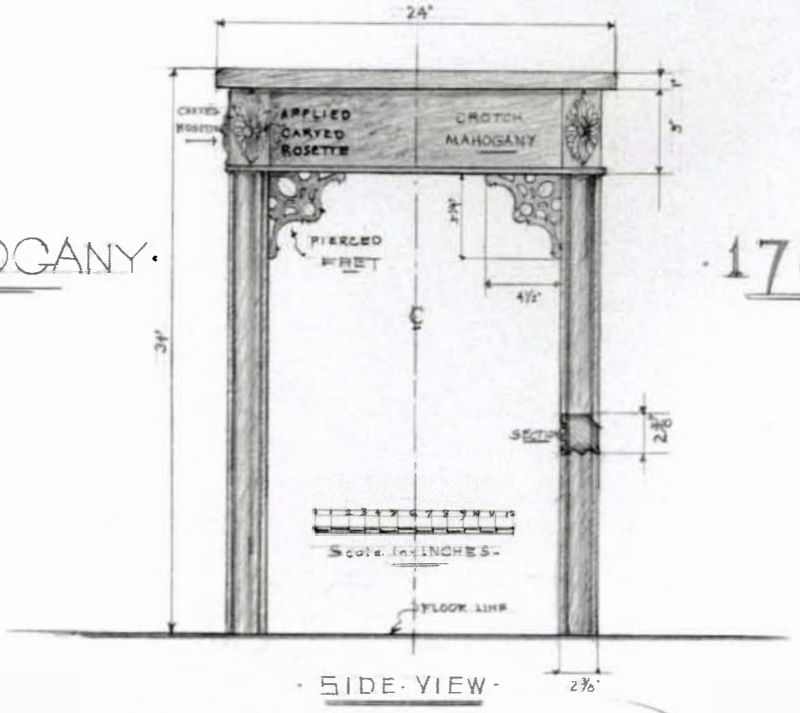
ADAM SIDE TABLE 1780

VICTORIA & ALBERT MUSEUM

LONDON ENGLAND



FRONT VIEW



MAHOGANY

1780

SIDE VIEW

Measured & Drawn by Easter Maegon

cannot be conquered readily. After several days of exploring, I gave it up as an impossible undertaking. What interested me most was the Museum of Decorative Arts in a wing of the Tuileries Palace. Here I found a decorator's happy hunting ground: there were 45,000 objects on display including furniture, tapestries and wood carvings, as well as related objects of decoration. I also toured the Cluny Museum, one of the most important collections in Paris. It is in a colorful 15th-century structure built by the abbots of Cluny of the remains of a Roman bath. Here is portrayed life as it was in the Middle Ages. Besides Gothic and Renaissance furniture, the collection includes manuscripts and even a chastity belt.

Margon

The furniture in these and other museums was so astonishingly beautiful that I was impelled to explore for some way to bring the design elements of these masterpieces of the Old World to the attention of students, designers, craftsmen, decorators and furniture manufacturers over here.

I finally secured an interview with the director of the Museum of Decorative Arts and presented my credentials. I told him what I would like to do—to make measured drawings of some of the furniture. He was interested but suggested that I make one sketch and show it to him. I was glad to do this. He was delighted with the result and gave me carte blanche to proceed as I desired. This reception was repeated in all the other museums. I was on my way to starting a collection of measured drawings of 500 pieces, possibly the largest in existence. Where photographs were available I secured them. Where photographs were not available, special ones could be taken at a moderate cost.

Then followed six European trips traveling thousands of miles in England, Italy, France, Germany, Belgium, Denmark, Norway, Sweden, Rumania, Austria and Czechoslovakia. During World War II some of the furniture in these museums was bombed out and my measured drawings remain the only authentic record of their design. I have on occasion traveled hundreds of miles just to sketch a chair.

Making a measured drawing is not quite as simple a procedure as one might expect. Some previous experience in drafting is essential. A knowledge of the use of drafting materials is taken for granted, such as the T-square, triangles, curves, dividers and the compass, and certainly the ability to use the scale rule.

One must generally know about and have some appreciation of furniture periods and design. Of course, museums have the largest variety of furniture on display, but you must decide what pieces are of interest to you and what particular pieces you wish to sketch. Be selective in your choice. After you have decided, study the piece well before starting on the sketch for the measured drawing.

Of course, permission must be secured from the curator. Find a good spot in the gallery. If necessary, the attendant will rearrange the setting to afford you good light and the necessary privacy while you are working.

You will need your box of instruments, a six-foot folding rule, a good supply of paper, pencils and erasers. Use a legal-size pad of paper. Take measurements of the piece of furniture slowly and carefully. A good scale to use is three inches to the foot. For most pieces this will give ample room. If several sheets are required, so much the better.

Generally, front and side views are required, a seat and top plan, and auxiliary views to show any special aspects of the design. Individual bits of carving can be noted separately. Put down all sizes carefully and check them before leaving. Make notes about any significant features of the design. The title, the period and the name of the designer are important. Be sure to note when the piece was bequeathed to the museum and by whom. Know the woods that have been used, the color and the grains. Don't let anything escape you. You will need all this information when making the final measured drawing. Use a plumb line when necessary and a good, large pair of dividers. Get the correct readings. Then, after all this has been done, you can leave the museum feeling satisfied that the job has been well done. If there are any doubts later, don't hesitate to return to check. It is well to let some time pass between the work at the museum and the actual making of the measured drawing.

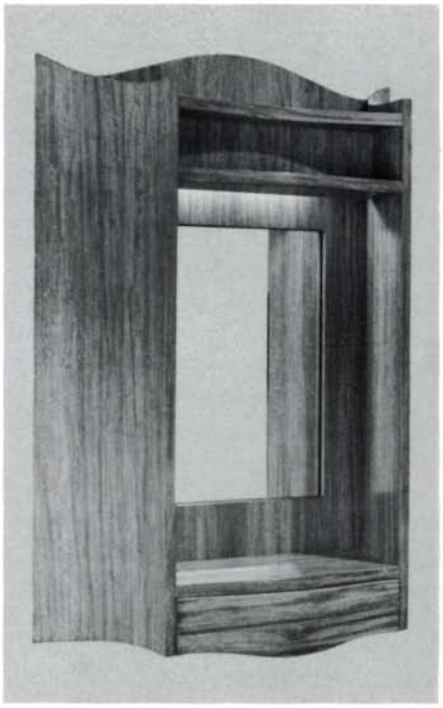
This has been the beginning. When you get back to the drawing board, secure sheets of white illustration board, 20 by 30 inches, with a smooth surface. To the scale of three inches to the foot, roughly lay out the entire project. See that it fits nicely on the illustration board. When the layout has been determined, lightly draw in the design. Then use a black pencil, possibly an HB, to make a good clear outline. This is just the beginning. Line drawings are not very attractive. Discover how the piece of furniture has been put together and indicate it on the drawing. These details can be adroitly handled so as not to deface the drawing.

It is important to indicate clearly the measurements in their proper place. Lettering requires careful consideration in its placement. The title, dates and any other relevant facts should be carefully set down. The final step is the rendering. Note the light and shade indicating the grain of the wood. Bring out the moldings and stress the carving. Then the sketch will begin to have life, structure and virility. The result will be far better than any photograph, as the design will be drawn to scale and all the features brought out in proper relationship. It will be the most accurate and complete record of the piece, supplying all the information necessary to reconstruct it.

The designer who has been permitted to make a sketch in the museum is also permitted to make the piece in reproduction, but only for his own use and purpose. Any multiple reproductions for sale or commercial purposes are not to be considered. Occasionally, a manufacturer will be able to arrange with the museum for reproduction of the piece, but this is rare.

My making measured drawings in Europe was a delightful adventure which later found its way into magazines and then into book form. But it is a sad fact that measured drawings of European furniture masterpieces are more welcome in America than in Europe. Europeans seem to dislike having their furniture sketched by an American. I have come to realize that American colonial furniture from 1750 to 1830 is the most rewarding work and finds the greatest audience; my book *Masterpieces of American Furniture* has gone through several printings and continues to be most popular.

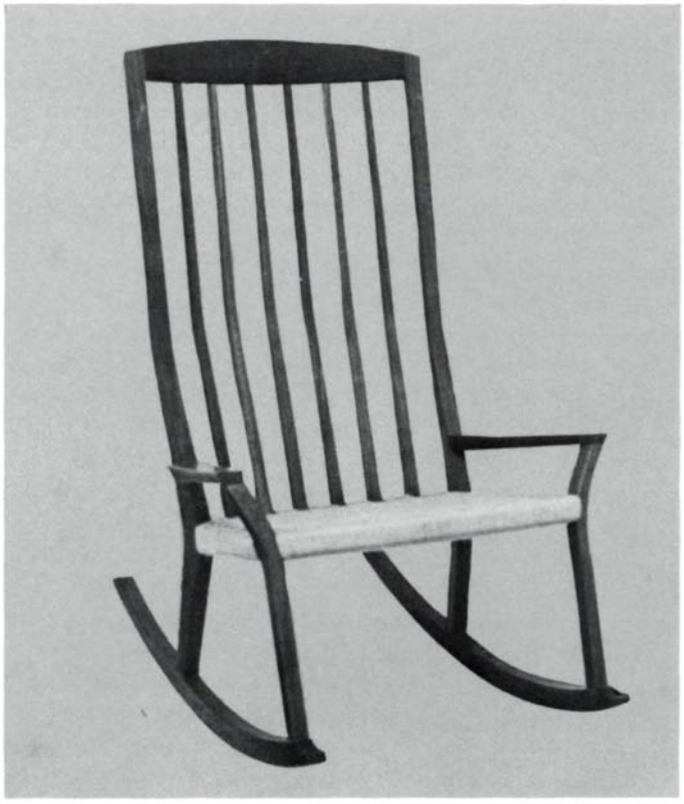
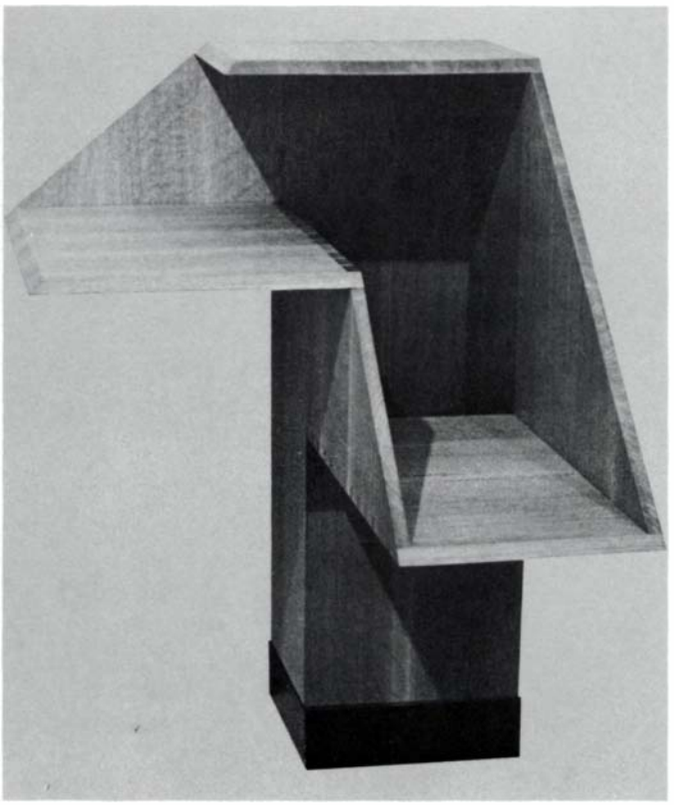
Almost every museum in the United States has some furniture on display. Surely there is one with a furniture collection near you. Good Luck!

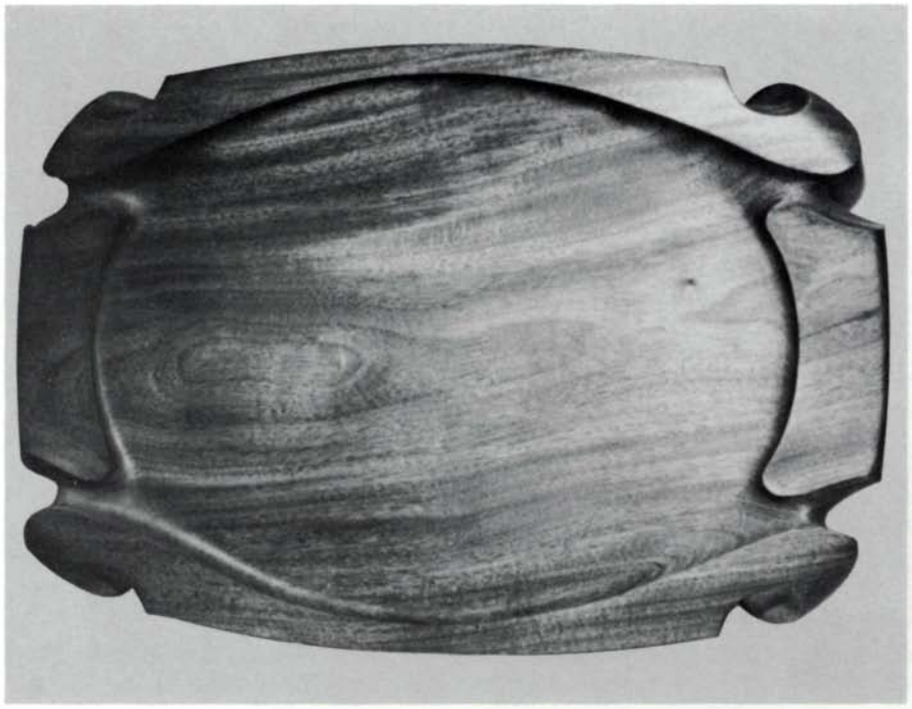


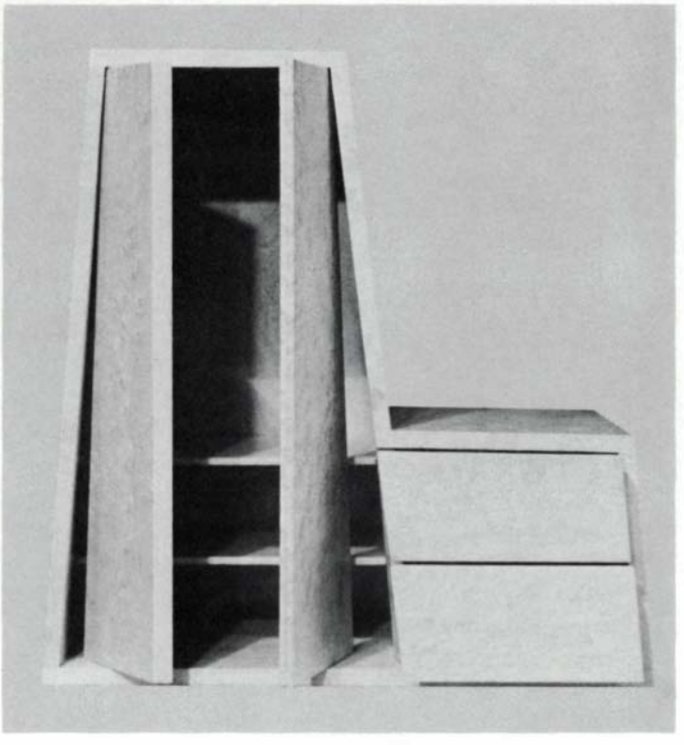

Wood Invitational

Twenty-nine craftsmen exhibited works at the Peters Valley Craftsman gallery in Layton, N. J., in their invitational show held August 21-October 3. Craftsmen from across the country were represented. About 90% of the works were for sale, one sixth of which were sold.

Peters Valley Craftsman is part of the National Park Service, and offers residencies, associateships and internships in wood and other crafts media.





On opposite page from upper left going clockwise: wall cabinet by Rosanne Somerson, with light, mirror and drawer of narra-veneered bent plywood, 31 in. high; "Travelling Stool" by Debra Deis, in walnut with handcaning, 26 in. high, $155; wall jewelry case by Robert Sperber, of doussie, hickory, and blue cottonwood with rosewood hinges, 24 in. high; corner piece by Doug Sigler, in white oak, 45 in. high; "Kathy's Rocker" by William B. Dunn, in walnut with a woven seat, 39 in. high.

On this page starting at top and going clockwise: serving tray by Mark Sfirri, in mahogany, 26 in. long, $200; mirror by Alphonse Mattia, of bubinga, rosewood, chestnut, zebra, walnut and cherry, 27 in. high; "Secret Cabinet" by Ian Calvert, in bird's eye maple, 20 in. high; low table by Konrad Richter, in white ash with cherry veneer splices in top, 42 in. long, $475; dining chair by Gary Logsted, in laminated maple with a suede seat, 30 in. high, $315.

Guitar Joinery

The balance between structure and tone

by William R. Cumpiano

The author with apprentice R. Goldberg.

The major problem confronting the guitar maker is how to counteract the structural changes that will occur in his instrument over time. These changes will alter tonal quality and affect the instrument's playability. The builder relies on joinery to counteract these changes.

A strung-up guitar is a structure undergoing constant sizable stress and requiring utmost economy of materials to render it a highly compliant, frequency-dependent vibrating object—that is, with different sections of the guitar vibrating at different but specific frequencies. A successful guitar design must correctly balance an effective structure with an optimum mass to produce an instrument that will project good strong tone for many years without destroying itself in the process. The designer will usually favor good tone and lightness at the expense of rigidity. He will build into the guitar features that anticipate distortion while allowing for repair through its hoped for 100-year life span.

Interestingly, a guitar's tone is expected to mature and decay within a relatively short time, short compared to the maturation span of several hundred years of violins and other bowed instruments. This is because the architecture is different in each case. When a guitar is played, six long strings are pulled up at the center of a wide expanse of very thin spruce of essentially even cross section. In the violin, four short strings are pushing down on a perfectly vaulted cross section of fairly thick and narrow dimension. The guitar body fatigues first, losing power and volume dramatically when its contemporary violin is just passing adolescence.

Guitar assembly methods vary according to how the builder chooses to join neck to sound box. Factors affecting this choice are: the number of instruments to be built simultaneously, the extent of the builder's facilities, his talents, time and profit margin, and his training and accumulated prejudices. Unfortunately, the sense of responsibility of the builder to his creation and his buyer is predominantly absent today, and most mass-produced instruments are designed with only profit in mind.

The selection of the neck/body joint is critical. The primary requirement is rigidity. Also, it must fit at a precise angle. The angle of neck to body determines the height of the strings off the neck and consequently the instrument's playability. Of equal significance is how easily the joint can be disassembled for later readjustment of the angle.

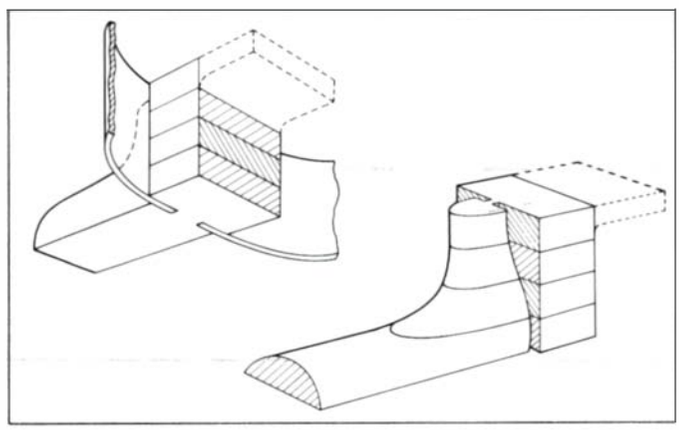
If we accelerate the effect of string tension on an instrument we see the following: As soon as the strings are strung the entire instrument flexes longitudinally away from them, like a wooden bow under a taut cord. Soon the area under the string attachment point at the sound box bellies out as if the instrument were being inflated. Consequently, the previously straight neck is forced into a curve. The fingerboard pushes down toward the sound hole in an effort to resolve the stress. The back of the instrument strains, and the stress causes tension against every inch of its seams. The sides try to flatten out and away from the face, as if the whole system were collapsing into its sound hole.

All of this movement is slowed by the stiffening braces inside the guitar box. A stiffening spline or an adjustable pre-tensioning device running through the center of the neck counteracts its tendency to curve.

The untrained eye will notice only that the strings are gradually moving away from the fingerboard, and that the instrument is becoming progressively more difficult to play. From time to time the guitar must be repaired. Depending on the extent of the distortion, the repair might entail readjusting the pre-tensioning device, filing down the string-to-body attachment, or resetting the neck. The latter involves removing the neck and reattaching it at a new angle to compensate for its distortion and the distortion of the sound box.

Neck/body joints fall into two main categories: those requiring an integral heel and neck block (such as the Spanish method), and those with separate blocks (such as the tapered dovetail and the pinned mortise and tenon). A host of other joints, uncommon in modern guitar making, rely on intricate

The three neck/body joints are, left to right, the Spanish method, the tapered dovetail and the pinned mortise and tenon. The last is shown with its pinning tool.



William Cumpiano was a furniture designer/draftsman who turned luthier seven years ago. He builds, repairs and teaches at his studio in North Adams, Mass.

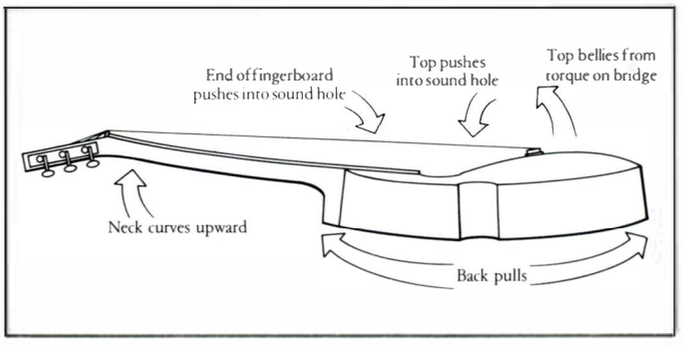
and contrived systems—threads, screws, cams, hooks, wedges and inserts—to hold the neck to the body. Some are bizarre and fascinating; most have been relegated to the dustbin of history.

Some instruments such as the early lutes, citterns and gitterns of medieval times were carved from a single billet of wood, but the oldest surviving assembly technique is the Spanish method. It has outlived all the others because it is simple and adaptable to-hand building. It is used by novice and master alike, by hand builder as well as machinist, because it requires less accuracy than the others and does the job as well. Its major shortcoming is that it cannot be undone for resetting, and so it is only used responsibly on instruments with low-tension strings, or short strings and thus short necks. A skilled person can sometimes reset Spanish-method necks, or compensate for body/neck distortion by relying on some arcane tricks of his trade.

In the Spanish method, the instrument's sides are let into slots cut into the neck. The portion of the neck inside the instrument is kept massive and rectangular for ample gluing surface to lock sides, top and back together, and the portion left outside is whittled into the graceful triangulation called the heel.

If you are an experienced hand builder or a well-tutored novice contemplating building a single instrument, you may use the Spanish method/free assembly. You will build the guitar from its face upwards, piece by piece like a Tinkertoy. Start with the guitar face upside down, with its internal bracing members looking up at you. Attach the slotted neck, also upside down. The sides, previously bent, are let into the slots, glued to the face one by one, and carefully lined up with the template outline scribed on the face. The far ends of the sides are both attached to a tail block, similar to the neck block. The back closes the sound box, completing the main. structure of the instrument—sound box and neck are locked together rigidly and permanently.

If you need to build several identical instruments, or if your skills are not up to the demanding task of aligning the sides with a template mark on the face, you might choose the variation of the Spanish method that requires an elaborate exterior mold. The mold is a clamping/centering device. You begin by gluing together the sides, slotted neck and tail block. The mold keeps these pieces in place while the glue sets. The product is a neck attached to a guitar-shaped hoop. Then affix the face, and lastly the back. The result is a closed sound box and cantilevered neck, just as in the free assembly. What remains to be done is to attach the fingerboard to the neck, and trim and finish the instrument.



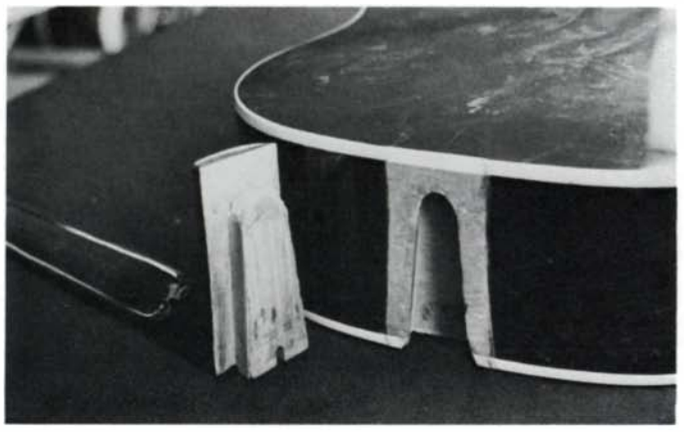
An exaggeration of structural distortions that will occur in time.

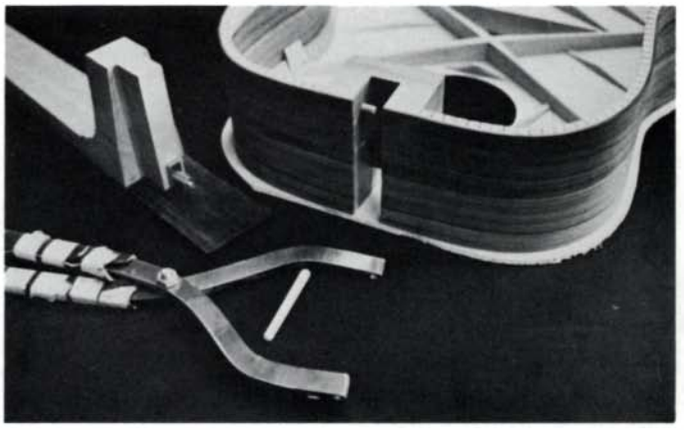
The tapered dovetail neck/body joint is the most common production joint. It is also used by many hand builders, but it requires skill with a backsaw and chisel to make the necessary angled cuts. In a factory setup, jigs and hold-downs allow the mating pieces to be cut with an overhead router and a dovetail bit.

The tapered dovetail joint consists of a separate neck block inside the body, exposing a dovetail cavity, its least width pointing down to the back of the instrument. A matching male counterpart behind the heel of the neck slips into the body and down, forming the precise body/neck angle that yields accurate string height. If you've done any woodworking you can see why this joint is more popular with machinists than with hand builders. Yet some hand builders feel it is the supreme neck/body joint.

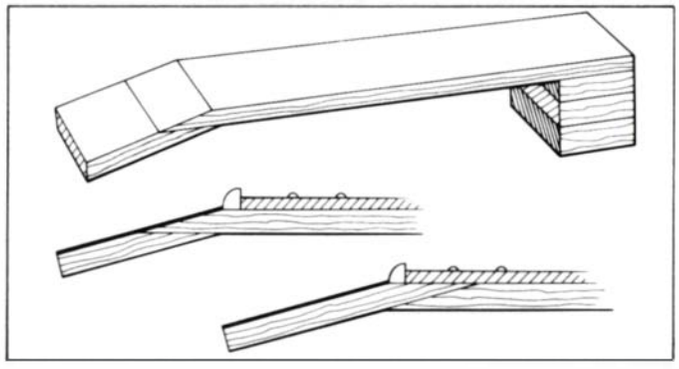
The pinned mortise and tenon has a vertical mortise exposed on the outside of the sound box. The mortise mates perfectly with a vertical tenon on the neck behind the heel. Whether machined or hand-built, it is simpler to construct than the tapered dovetail with its double-angled cavity. However, the right angles must be perfect if the instrument is to fit together properly.

Two tapered hardwood dowels just long enough to pass through the neck block pin the neck tenon to it. Pre-drilled holes in the neck block and neck tenon are taper-reamed to match the pin, so that as the pin is pushed through, it tightens. The holes in the tenon are minutely offset to those in the block, so that as the pin is forced through, it draws the neck tightly against the body. After the neck and body are completely finished and polished, the pinning is done with the aid of a homemade steel pincer called a pinning tool. It is manipulated through the sound hole, its pincers grabbing the





The guitar's braces help control structural distortion while "disciplining" flex and thereby determining tonal quality. The large, flat brace at the left counteracts the top's tendency to split from differing expansions of top and fingerboard. The thicker brace next to it supports the end of the fingerboard. The three short braces around the sound hole restore rigidity where the hole was cut out. The X-brace is the main support for the top, the fan braces above and below support the outer edges. The patch to the right of the X increases the mass for the bridge attachment. The two diagonal braces control the top's flexibility and therefore its frequency response. The small cross-grained diamonds reinforce the book-matched seam of the top. In the drawing, at the left the headstock veneer reinforces the joint; at the right the fingerboard acts as a reinforcement, commonly found on banjos.



neck block and pin, forcing one into the other when its lever arms are squeezed. A small light bulb inside the body illuminates the process. To remove the neck, the action of the pinning tool is reversed with the help of a small metal dowel inserted into the small end of the pin hole. Pressure on the tool pops the pin out. Removing the neck becomes a fifteen-minute affair, instead of the hours-long job of undoing a tapered dovetail.

With the tapered dovetail and the pinned mortise and tenon, the neck and body are constructed, trimmed, and often even finished separately. The production advantages are obvious. Parts can be conveniently stacked, and the often laborious pre-finish and post-finish sanding at the heel/body juncture in the Spanish method is no longer necessary. The result is a clean, finished joint at the end of the line.

I have often participated in lively discussion with hand builders who eschew these two-piece systems. They feel that something intangible is lost when they work long hours on an object that only at the very last moment becomes a guitar. They feel, understandably, that they can retain a subtle connection with their creation through the entire process only if it is guitar-like from a very early stage in its construction. However, the more pragmatic realize the superiority of the dovetail and pinned mortise and tenon, when it comes to building a salable product that can be guaranteed over the long run.

The pinned mortise and tenon is highly efficient and practical. Its use is not widespread and when it is found, it is on instruments coming from small shops that specialize in individually handcrafted instruments. I have found some controversy about its use. Some people are just prejudiced in favor of the other methods; others legitimately feel that in time the pins may shrink and loosen, or that its rigidity and impact resistance is inferior. And although it is easier to disassemble for resetting, very few repair people are familiar with it, let alone possess the special pinning tool necessary to dismantle and reassemble it. However, I prefer this last joint. It is neat and foolproof, and I have yet to see it come undone when it wasn't supposed to. On the other hand, I have repaired dozens of tapered-dovetail instruments whose necks had slipped due to glue failure or inaccurate fitting. I feel free to guarantee the pinned mortise and tenon on my instruments, since if worst comes to worst, repairs can be made with a minimum of fuss and time.

The rest of the joints in the instrument are simple glue joints with two exceptions: a lap joint on the X-brace found under the top, and the headstock-neck joint. The purpose of the top braces is not exclusively structural. The top braces control the amount of flex and movement in the top and determine each instrument's vibration characteristics. The guitar box is not only a sound amplifier, but more importantly a sound modulator. Nowhere on the instrument is the balance of mass and structure more finely determined than at the top braces. The size, shape, weight and placement of these braces determine the flex and vibration of the top, thus modulating the sound and giving a guitar its characteristic tone. The angle of the lap-jointed X-brace determines the size of the resonating "working area" (the circular lower portion of the guitar top, which has the bridge as its approximate center) and thus influences the tone; it must be accurately laid out and cut for the instrument to produce the desired sound. All these braces counteract the effects of string tension.

Another important joint is where the headstock meets the neck. On mass-produced instruments, this is usually not a joint at all, but a one-piece neck blank bandsawn from a single billet of hardwood, often Honduras mahogany. A one-piece blank can be made quickly, but it is wasteful of stock and relatively weak, with its short grain in the angled headstock. A better possibility is the composite neck blank. A scarf joint at the bend reinforces the headstock because the long grain follows the shape, and the built-up heel eliminates the need for thick stock.

The sheer economy of all these methods has always intrigued me. They have been refined and perfected over a period of 500 years, and may never be superceded. A musical instrument, like an airplane or a racing bicycle, owes its success to the dictum "less is more" (but not too much less!). Its components must be pared away, thinned out, made so economical that all that remains is its essence: the absolute minimum that will allow it to function properly. Anything more gets in its way. In this process you also end up with something that happens to be a thing of beauty.

The Bowl Gouge

Using long-and-strong tools to turn the outside

by Peter Child

Woodturning gouges are of three types: one designed for bowls, one for between-center coving and small rounds, and one for roughing square stock to cylinders and sweeping curves, also between centers.

The blade of a bowl gouge is always "long and strong," meaning heavy duty. A good new one measures 12 in. from cutting edge to tang. It has a deep U-shaped flute with much meatier metal at the bottom, or keel, of the flute than at its two wings. Bevel angle varies with how tall a person the turner is, but it is always less than 45 degrees, although not so small as to make the edge fragile. There is no second bevel as in a bench chisel or plane iron, and there is no point. The edge is shaped square across.

Four sizes of bowl gouges are in current production: 1/4 in., 3/8 in., 1/2 in. and 3/4 in., ranging in weight from 4 to 16 ounces. Each size has a particular function. The 3/4-inch is absolutely the largest that can be used correctly; any bigger gouge is not a bowl gouge, however long and strong it may look. The heavy-duty handles should be about a foot long, and hefty—weight and length are necessary for control. This is why bowls should be turned outboard and should not be attempted between centers, where the lathe bed restricts movement of the gouge.

Coving gouges, for between-center work, are of medium strength and have a longer bevel and a lighter handle than bowl gouges. They also have pointed, "lady fingernail" noses and a much shallower flute. Common sizes range from 1/4 in. up to 3/4 in. The roughing-down gouge serves for larger work.

Roughing-down gouges are of medium strength, deeply throated, semicircular rather than U-shaped in cross section, beveled at 45 degrees, and of even thickness. Their lack of keel makes them unsuitable for bowl work, whatever the size. They range from 3/4 in. up to 1-1/2 in.

Depending on the mood of the factory grinder, the bevel of a new tool can be any angle or length at all, and so the purchaser will have to reshape it. Any point must be removed so the edge is straight across. The bevel should be hollow ground right up to the cutting edge, without a second bevel. A skilled operator can thus provide himself, straight from the grindstone, with an edge that has a fine sawtooth cutting burr. Such an edge would horrify a cabinetmaker or carver, but it is most practical for a turner as it can be resharpened in seconds on the grindstone. An absolutely flat bevel does the same job as one hollow ground, but takes longer to obtain and maintain with a flat stone. Although the final result will be much sharper than the sawtooth edge, it may not last long enough to merit the time and care taken to obtain it. Also, with a stone it is very easy to round the bevel, exactly opposite to hollow ground. The slightest belly is intolerable since it causes the tools to lose most of their usefulness.

When cutting, the whole length of the bevel is in full contact with the wood. Take a piece of wood and hold it in the bench vise. Use the gouge to make a groove in the wood, as though starting a carving. In controlling the cut there

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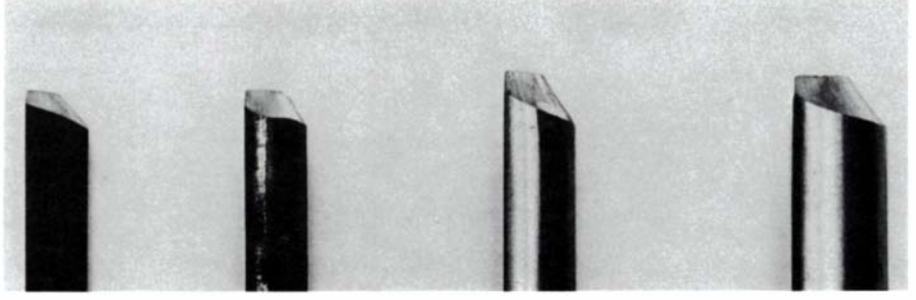
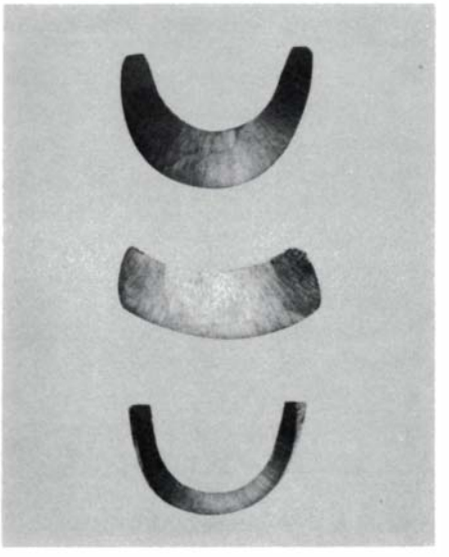
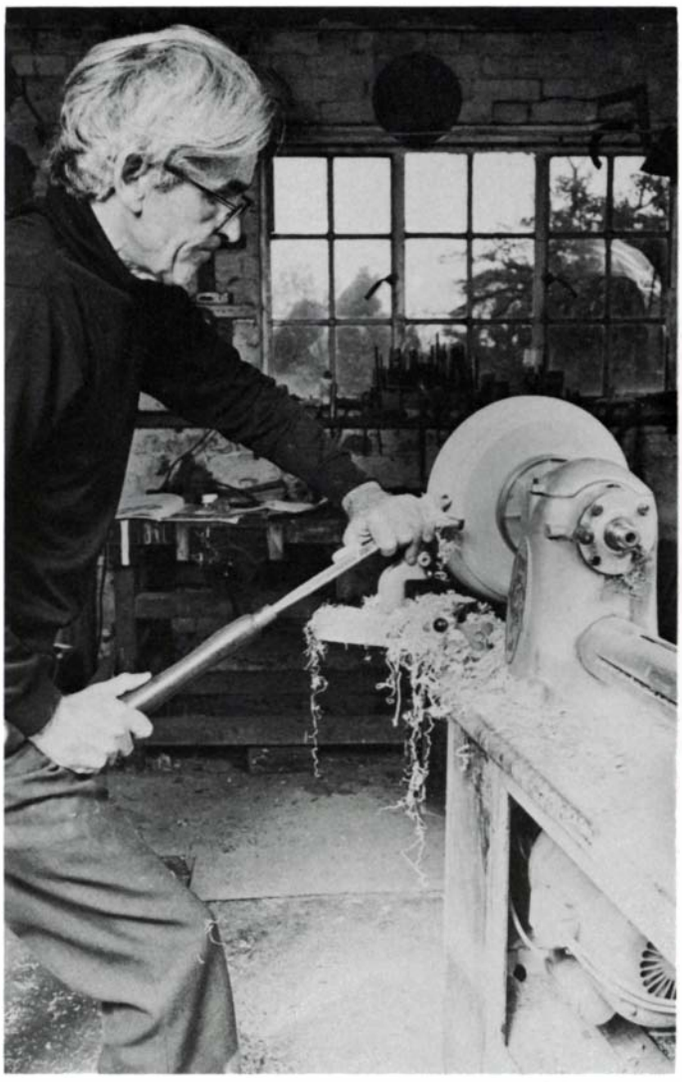
Peter Child, author of The Craftsman Woodturner, *operates a full-time turnery and for the past dozen years has taught turning at his studio in England.*

The different sizes of bowl gouges corresponding to cabinetmaker's planes are shown below. From the right, the 3/4-in. gouge is equivalent to a scrub plane, the 1/2-in. and 3/8-in. are jack and smooth planes, the 1/4-in. is a block plane for cleaning up end grain. A turner with a new set should start by grinding all the bevels to the angle of the 1/2-in. tool, second from right. To try your hand without investing in a whole set, choose the 3/8-in. or 1/2-in. gouge. At right, starting from the top, head-on views of the three kinds of turning gouges, all at 3/4 in. Bowl gouge is ground square across; spindle or coving gouge is ground to a pointed nose; roughing-down gouge at bottom is ground square across.







Child slices curls of wood from the rotating disc. Proper gouge work depends upon correct stance, hand position and coordination of eye, hand and leg. With the bevel always rubbing (bottom middle photo) the trick is to roll the tool over in the direction of the cut, while lifting the handle straight up. The cut begins at 12 o'clock high (left) and slices a downward arc to three o'clock (top and middle right). He watches the progress of the cut at the silhouette at the top of the whirling disc. His right hand rolls and slides the handle up the thigh; his right leg supports and powers the thrust of the tool, his left palm presses firmly on the rest, the thumb pushing the blade and the fingers curled around and controlling it. The shaving is narrow at the start and broad at the end, but its thickness does not change. At bottom right, the gouge digs in. The wing away from the direction of cut, here the left wing, has been allowed to touch the wood. It scores a deepening ring in the bowl, ending in a sharp tear, startling the operator out of his careless stupor.

should be no space between the bevel and the wood. Now try to make a similar groove with the bevel not in contact, holding the handle more or less upright. It will be almost impossible. A gouge can remove wood without the bevel rubbing and without conscious effort, but only because the power of an electric motor is scraping it off. Only with the full bevel rubbing is it possible to take clean cuts.

There are two main methods of turning a bowl. One is to screw the wood to the faceplate and turn the outside and base first, perhaps with a flange or lip, and then remove the wood, reverse it, and somehow reposition it on the faceplate to turn the inside. The other way, my method, is to flatten and sand the bottom of the blank first, then fix the base to the faceplate and turn the outside and inside in one operation. There is a little more cutting against the grain, but the troublesome end grain is the same in either case. And I am saved the tricky problem of getting the bowl back onto the lathe in exactly the right place, since I never take it off.

Let us move to the lathe to cut the outside of a bowl with the long-and-strong gouge. The blank is sawed to a disc, screwed to a faceplate and mounted outboard. The tool rest is parallel to the axis of rotation, set about center. The height of the rest is adjusted according to the height of the operator, so that the gouge cuts at the center of the disc or slightly above center. (We assume the operator is right-handed and cutting from left to right, from the face of the disc toward the faceplate.)

Every cut has to be fully under control from beginning to end. The operator has to stand centrally behind the gouge, with its handle upright. He cannot see the bevel. With the blade on the rest, the heel of the bevel rubs the revolving wood. The cutting edge is not yet touching the wood.

Keeping the blade on the rest, he gradually lifts the handle straight up until a thin shaving appears at the center of the U-shaped channel. This indicates that the whole bevel is rubbing, without the turner having to move to one side to look. At this stage, the blade will be in contact with the front, not the top of the tool rest.

The left hand holds the blade close to its cutting edge and on the rest, palm over the blade, first and second fingers curled around it, and thumb, if not curled around, then pushing against the side of the blade. This hand does not move for the duration of any one cut—the fingers may move slightly at the end of the cut, but the palm remains where it is. The right hand holds the long handle very close to the bottom in a tennis or hammer grip.

The shearing cut of the gouge starts at the top (12 o'clock high), coming down in an arc to finish at 3 o'clock. The first cut is started about 1/2 in. from the right-hand edge of the disc and removes wood from left to right toward the faceplate.

The shaving is removed first by the center of the blade, then, progressively, by its right-hand edge or wing, so that only half the cutting edge is occupied. To do this the turner rolls the blade over to the right and at the same time lifts the handle straight up. This coordination has to be learned and the way to do it is to start a thin shaving with the center of the gouge and keep the shaving at the same depth for the duration of the cut. If the blade is rolled too much the shaving will finish thicker than it started. If the handle is not lifted, the cut will be straight across and not in a downward shearing arc, which is the best cutting action. Do not attempt to remove too much wood with one cut—a cut that traverses a half inch at a time is ample for practice, and this should be done again and again, keeping the shavings the same thickness throughout.

Sometimes the gouge digs in, a startling and unpleasant jump that leaves an unsightly gash in the wood. All sorts of circumstances can lead up to this shock—bevel not rubbing, gouge out of control due to incorrect holding or wrong position, blade not sharp, or overcutting. What actually happens is that the unwitting operator allows the blade to roll in the wrong direction, from right to left, and the left wing of the blade comes into contact with the wood. This is what digs in.

To avoid this, I emphasize rolling and lifting the gouge and using its center and right wing only. This motion keeps the left half of the blade away from the wood and out of harm's way. This "wrong half" is the only cause of a dig-in.

Time and again I am puzzled at seeing an operator standing in one position, albeit a correct one, and endeavoring to traverse more and more wood with each cut. To keep the blade cutting he has to roll it over more, move his hand along the rest (incorrect), and lift the handle uncomfortably high. This is overcutting, an awkward motion which can easily lead to a disastrous dig-in. I now firmly believe this mistake is a result of training, probably in other crafts. Consider a cabinetmaker hand planing at his bench. He stands still. Likewise a woodcarver and a potter with his clay. But to keep constant control of a gouge, a turner seldom stands still for long.

After a disc has assumed a distinct rounding, say from half of full thickness to almost the faceplate diameter, try the following. Take an even cut from full disc thickness toward the right. The gouge will tend to come off the cut after about 1/2 in. of travel. Do not force it to cut further, but move your feet a little to the right and take up the cut from where you left off. You should find absolute control in cutting, and a comfortable action. Remember that each cut is still from 12 noon to 3 o'clock. The bowl might look a little ridged, but not much. A practiced turner can do the whole area from middle thickness to faceplate in one or two sweeping cuts, but his feet are continuously moving him sideways to the right. The majority of bowl turning is done by body and legs, not hands alone.

The normal stance of a right-handed operator is left leg in front of right, with the right hand holding and providing thrust to the gouge. To make a smooth and even cut over wood containing end grain, hard and soft areas and perhaps knots can be quite difficult. The blade may skip over a hard area, then plunge too deeply into the soft.

Try this. Stand directly behind the gouge in the correct position, but reverse your legs so that the knee or mid-thigh of the right leg touches the end of the handle. It will feel most peculiar at first. Take a cut, but with the handle not quite in contact with the leg. Next, take a cut with the handle butt touching your leg and either raise your heel to lift the handle, or slide it up your thigh. The handle is always lifted straight up, not sideways, so the leg can support the tool over the full cut. Turners use this leg action to control depth of cut, whatever the terrain, and as a third hand or power source to remove large shavings in minimum time. The 3/4-in. gouge cannot be used to full capacity with the hands alone, unless one has the mighty thews of a blacksmith.

While the left wing of the blade must be kept away from the wood to avoid dig-in, no harm will result if the gouge is rolled so far that the whole right wing is cutting. Try having the bevel rubbing, but not cutting, and rolling the tool to the right over the whole working area. Repeat the exercise, but deliberately look away from the blade—don't watch what you are doing. This should convince you that nothing untoward will happen, and will give confidence to an otherwise apprehensive and tense approach. Now start a cut, looking at the blade, and immediately transfer your gaze to the top of the disc. A suitably placed lamp will help. You will be able to see the effect of the cut without looking at the cutting edge. The coordination of roll and lift, so difficult for beginners, is automatically simplified when the eyes transfer information directly to the hands. If the gouge is rolled over too far, the cut will immediately thicken and you will see it happen at the top of the disc. Your eyes will send a correction directly to your hands. As a bonus, you can govern the shape of the bowl much more easily. By starting each cut just before the finish of the previous one, you can reduce and practically eliminate ridging. The gouge does the work almost alone.

A basic woodturning principle is that all cuts are made from large diameter to small, and never going uphill from small diameter to large. Too deep a practice cut can lead into this, so watch it.

Up to now we have assumed the turner is right-handed, and most technical writing ignores the hapless left-hander, who must mentally reverse all the directions. But when a bowl bellies out in the middle so one has to work both right to left and left to right to keep working toward the smaller diameter, then a right-hander must also learn to switch directions and hands. If he doesn't, the fingers are pulling the blade and it can easily roll back the wrong way and dig in. A gouge blade should always be pushed, never pulled, and the hand that is doing the pushing has the opposite leg supporting the handle. I always tell my right-handed pupils they will be better turners when they learn to do it left-handed and I am nearly always proved right.

English Treen

Useful objects for around the house

by Alastair A. Stair

The word "treen" is of Old English derivation and means "made of tree." It refers to various wooden domestic articles, many of them fashioned by rural folk who used the cheapest material at hand. Most outstanding among treen items are the drinking cups, standing cups and tankards for wine, ale and cider. Elaborate cups were used in private chapels or on special occasions. Less ornate goblets were made for drinking shops called "cider cellars," or passed around the domestic table and drunk out of by each person in turn. Another drinking vessel is the wassail bowl, which is a huge drinking cup for hot punch, used at ceremonial or convivial gatherings. Verses and songs relate the old English custom of the carrying of wassail on the streets by strolling carolers at Christmas and New Year's. In Devonshire it was customary to wassail the orchards on these holidays by pouring punch on the roots of trees to the accompaniment of a rhyming toast to their health.

Closely related to drinking vessels are wooden trenchers (heavy wooden plates), platters and bowls. Flat-rimmed platters were usually made of sycamore or fruitwood. English bread or fruit trenchers were generally of beechwood, flat, and with one side carved with epigrams and coated with transparent varnish. In the American colonies, the favorite wood was maple. Dishes and bowls were often made to nest, in graduated sizes. These were generally undecorated, with perhaps a few concentric rings incised. Circular spice boxes (also often made in nests) had molded lids, sometimes blackened to imitate ebony.

Various treen accessories were made for the elegant dining room from 1750 to 1800, when the increased specialization of rooms gave the dining room and its accoutrements a new importance. Today these can be found in antique shops. For the circulation of bottles on dining tables that often reached 15 feet in length, coasters or "sliders" were provided; carved mahogany coasters shaped like miniature sleighs facilitated the passing of cheese after the meal.

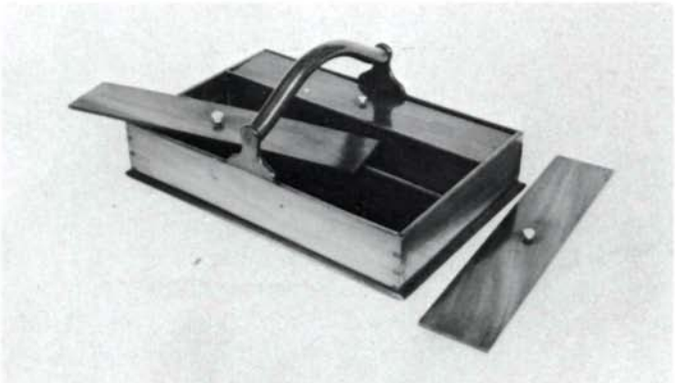
Candlesticks, candle boxes and candle stands of many types were often made of wood, but few examples survive. Simple candleholders of yew and sycamore were common, as were the more elegant "city" versions of carved mahogany, nicely polished with brass embellishments. In the provinces, square and cylindrical candle boxes were made of oak.

In the mid-seventeenth century, Tunbridge Wells in Kent became a center for the production of boxes and other small wooden articles. This "Tunbridge Ware" was decorated with simple, coarse inlay, often geometric, in different colored woods. This geometric inlay developed into more elaborate representations of pastoral landscapes surrounded by floral borders. These were built up from minute checkers made from strips of different woods. Only woods in their natural colors were used, and much ingenuity was required to procure a variety of tints from different shrubs and trees, including purplewood, partridge, tulip, zebra and ebony.

Tobacco smoking, which became widespread in England in the early 17th century, gave rise to several treen objects. Pipes, rasps (to reduce tobacco leaves to a fine powder), pipe cases and pipe stoppers (to pack tobacco tightly into the pipe) are delightful examples of treen. These were often carved out of boxwood. When taking snuff became a popular habit in the early 18th century, large boxes containing the powder were found in the bar parlors and taprooms of most English hostelries for the use of their patrons. Pocket-sized snuff

Alastair A. Stair is a transplanted Englishman and New York's leading dealer of 18th-century English antiques, quite a few of them treen.

Walnut box for holding silverware has three covers that lift out. At right, two small "string barrels" with brass fittings.



boxes were carved from burrwood, boxwood or fruitwood and sold by London streetsellers and in country stores.

Pipe racks and stands were made in various woods and in different forms. In one type the long "churchwardens" are supported vertically around a central standard; in another the long pipes are held horizontally one above the other. In a third type, pipes hang vertically on a wall fixture. Wooden racks for spoons were introduced in the Elizabethan period.

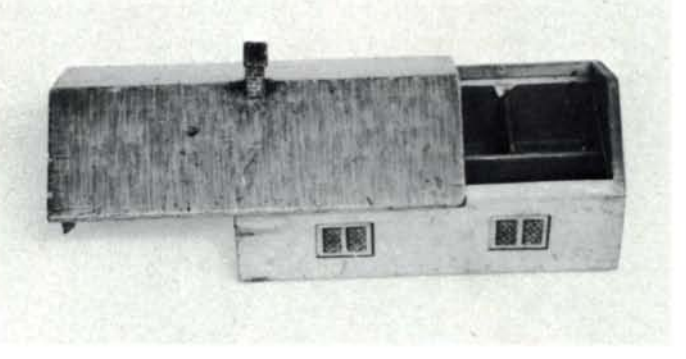
Another type of rack, for letters, was introduced about 1750. This was often found in urban homes where the custom of leaving calling cards was common. The letter rack is generally a narrow vertical strip divided into sections. It is often made of mahogany and perforated in Chinese and Gothic latticework patterns or painted with delicate flowers.

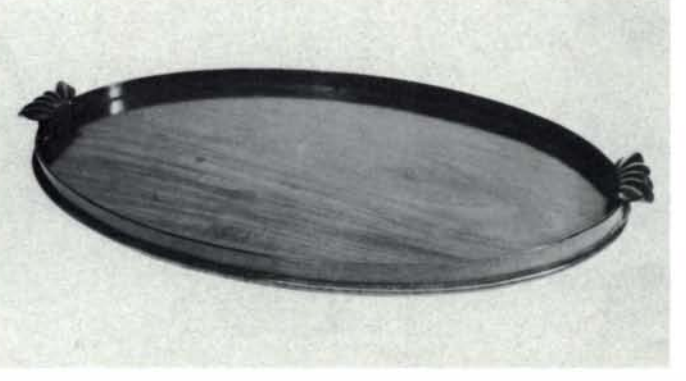
Many domestic novelties are based on the barrel and cask. I recently acquired a collection of these in London and find them among the most appealing and whimsical items of treen folk art I have seen. These are miniature barrels, the staves made of oak and held together by brass bands, often with brass hinges and locks. Many such treen objects serve as implements for needlework. One miniature cottage has a sliding roof and holds thread. Young men of earlier times often spent hours carving love tokens of wood, reminiscent of sailors' scrimshaw; many of these items are sewing tools such as knitting sheaths, lace bobbins and silk winders.

Other domestic arts called for woodenware. Cheese molds, called "chessels," and cake molds, often of sycamore, were always found in country kitchens. Large mortars were used for crushing salt, mashing potatoes and pounding meat as well as by pharmacists and apothecaries and for crushing tobacco leaves in inns and coffee houses. Small mortars with flat-ended pestles, known as "washing dollies," were for mangling (after washing) fine lace. Antique coffee and spice mills, much sought after by today's collector, are highly polished and often simply carved.

Space does not permit discussion of the beautiful carved games such as cribbage, dominoes and spinning tops, the 18th-century peruke blocks, wig stands and articles for domestic convenience including wooden towel horses, nutcrackers, egg whisks, ladles, standing salts, seals, picks, bottles, funnels, or shoebuckles, carpenter's planes and various weights and measures. Treen, produced in an age when the resources of art were called upon to beautify even the smallest everyday articles, is indeed fascinating in its endless variety.

Other examples of treen include a pair of candlesticks, an 18-inch long letter holder that hangs vertically, a seven-inch long "cottage" for holding thread spools, an 18 x 30-inch oval tray with a shell motif, and two boxes in the style of "Tunbridge Ware."





Making Shaper Knives

by Tommy Bargeron

The shaper is one of the most useful machines to have in the serious workshop for machining edges, moldings and lippings. Only the router or a set of hand planes can even attempt to do the type of work the shaper can do, and they are no match for its speed, versatility and efficiency.

For most woodworkers and antique restorers, however, the shaper's usefulness is limited by the small selection of patterns available in the common three-wing cutters. Its range can be made infinite by using shaper collars to hold pairs of flat knives, which can easily be ground to almost any desired profile. The process is surprisingly simple and no elaborate grinding equipment is required.

Shaper collars are available in various diameters to fit most spindles. There are two basic types of collar, lock-edge and plain, and each comes with either solid or ball-bearing construction. I highly recommend the lock-edge collar because it is much safer. Knife steel for these collars is made with a serrated edge, which fits into grooves in the top of the collar and virtually eliminates the danger of throwing a knife. The lock-edge collar is approved by the federal Occupational Safety and Health Administration (OSHA). On light to medium-duty machines, a 2-1/2-inch diameter collar is adequate. If your shaper has a variety of spindles use the largest. An extra long spindle is helpful at times.

In a small shop where flexibility is vital, ball-bearing collars are best. They make shaping curved work safe and easy, because the stock can ride directly on the bearing. Ball-bearing collars cost about $100; plain collars are available for $60.

Knife blanks to fit the collars are made in a variety of widths and are usually sold in 24-inch bars. Shaper steel is available hardened or unhardened; I always use hardened because I do not have the knowledge and equipment for heat-treating. The depth of the cut determines bar thickness. It is advisable to make the knife at least one-third as thick as the cut is to be deep. Although this ratio can vary depending on spindle speed, wood density and so on, it is better to play it safe and not skimp. If you are trying this setup for the first time, buy several precut shaper blanks in various widths. Be sure to specify lock edge. Later, buy a 24-inch bar of the width you use the most. Note also that it is possible to grind both ends of a blank, and also to grind several narrow profiles on one wide blank.

To add this setup to your present shaper, you must adjust its spindle speed and add a spindle lock. Lock-edge cutters are designed to run about 4,000 r.p.m., but most shapers are set at the factory for about 10,000 r.p.m. Running too fast risks thrown knives. To compute your present spindle speed, use the formula:

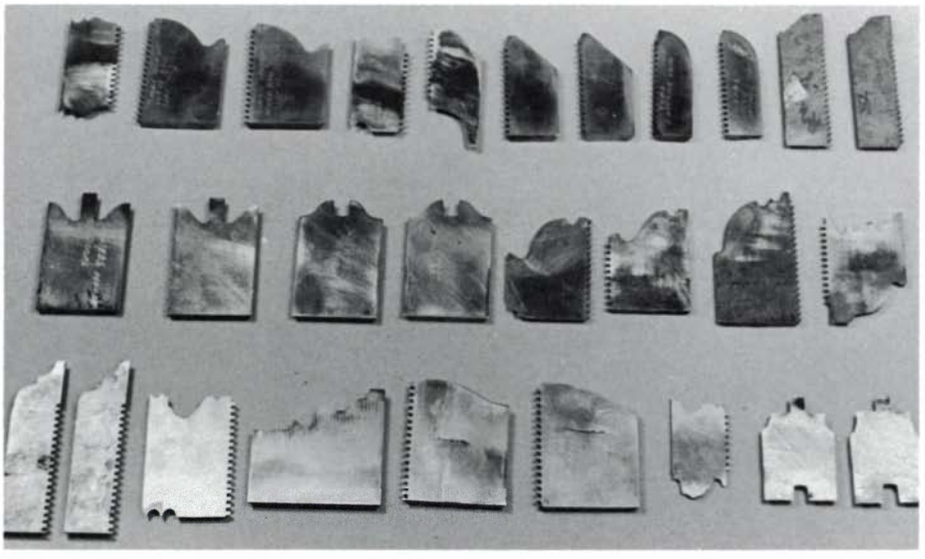
spindle speed x spindle pulley size = motor speed x motor pulley size

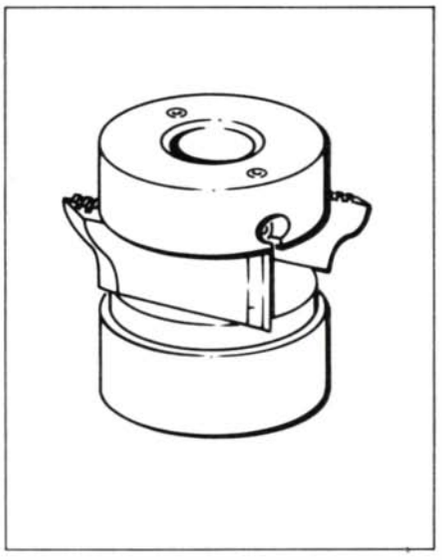
Plug in all the knowns, which can be obtained by measuring the diameters of the pulleys and from the motor specification plate. Then use the formula to determine the proper pulley for 4,000 r.p.m. On most machines the motor pulley is easiest to change, and you will have to buy new vee-belts of the proper length.

The compression of the spindle nut is all that holds the knives in the collar. Therefore the machine must have a positive spindle lock against which to tighten the nut. To make one, weld a short piece of 1-1/2-inch pipe to the bottom of the spindle pulley and drill a 1/2-inch hole through the pipe. A Phillips screwdriver slipped into this hole will catch on other parts of the machine and prevent the

Tommy Bargeron is a restoration specialist with the Georgia Agrirama Development Authority in Tifton, where part of his time is spent making knives to match existing moldings.

Knives can be ground to almost any profile. Some of these knives are ground at both ends, and some carry more than one profile on an edge. Drawing shows lock-edge knives in a ball-bearing cutter.





spindle from turning as it's being tightened.

The knives are ground to shape on a conventional bench grinder with a medium or coarse grit wheel, with delicate profiles worked on an abrasive cutoff wheel. Each profile requires two matched knives. The process is straightforward and, like anything else, becomes quicker and easier with experience.

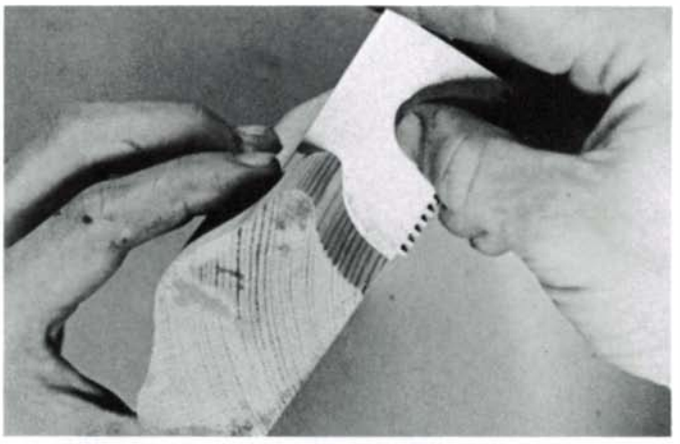
First, know exactly what profile you want to cut and make a drawing or hand shape a wooden template. Paint or spray the knife blank with the blue layout dye that machinists use. It is inexpensive, a little goes a long way, and should be available at a local machine shop or mill supply house. After the dye has dried use an awl or scriber to mark the desired pattern on the knife. The dye makes possible a very fine but highly visible line.

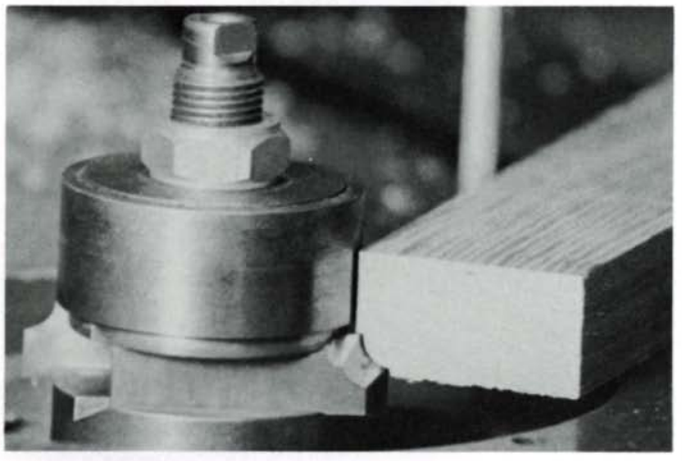
In designing knives, avoid long narrow sections and sharp points, which break easily. The cutting edge must have a side clearance of three to five degrees to prevent burning. And you should realize that the cut produced is not exactly the same as the pattern ground on the knife, because the knives are set on a chord, not radially, in the cutterhead. This affects the depth of the cut, not its width. Unless extreme accuracy is required this will not be significant. One way to overcome the problem when duplicating molding is to miter a piece of the original molding at the attack angle of the knife, and use this profile as a layout template.

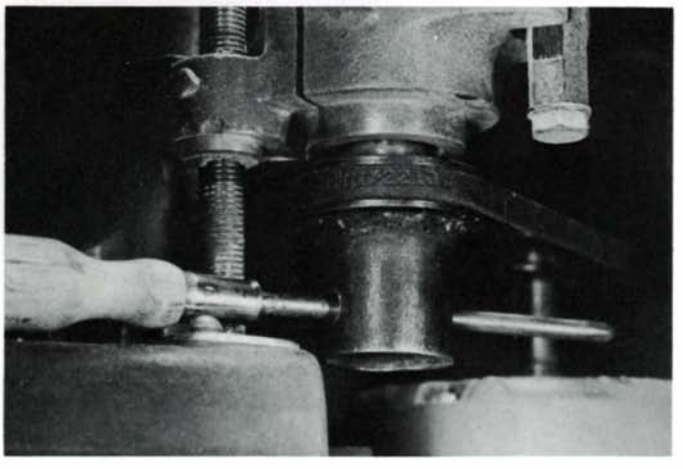
Begin rough grinding on a conventional bench grinder. The bevel depends on the size of the shaper collar, and must be steep enough to keep the heel of the cutting edge from bumping the stock. On a 2-1/2-inch collar, I use a 45 degree angle—about five degrees greater than absolutely necessary for clearance. The width of the wheel depends on the profile being ground; they are made in widths from 1/2 to 1 inch. Remember to keep the steel cool by dipping it frequently in water. When it gets uncomfortable to hold it is too hot, and overheating can ruin the temper.

After the knife is rough ground to within 1/16 inch of the desired profile, change to a fine grit wheel and finish very carefully to the line. Sometimes it is necessary to lay out the profile again as the dye may have burned away.

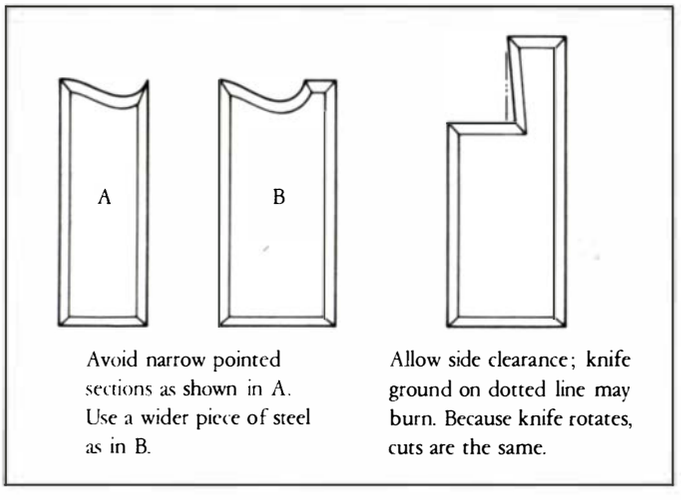
Delicate profiles and moldings with sharp corners or small





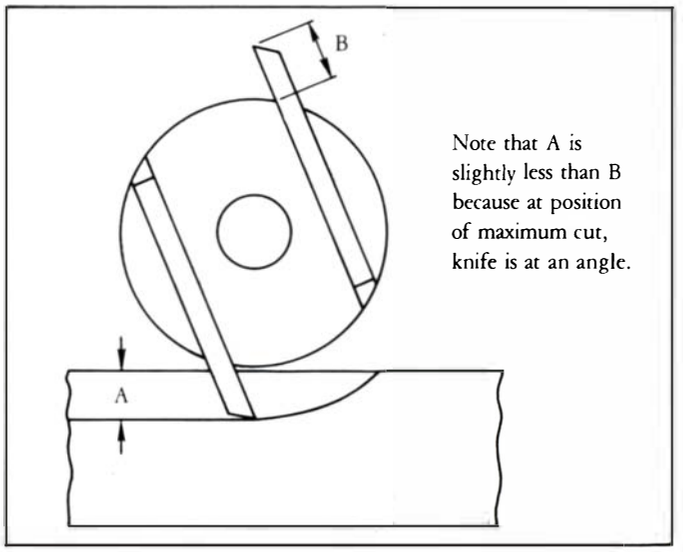


Top picture shows knife being checked for accuracy against an existing molding. At center a bead is cut using ball-bearing collars and a starting pin. At bottom a piece of pipe welded to spindle pulley provides positive lock against which to tighten spindle nut.

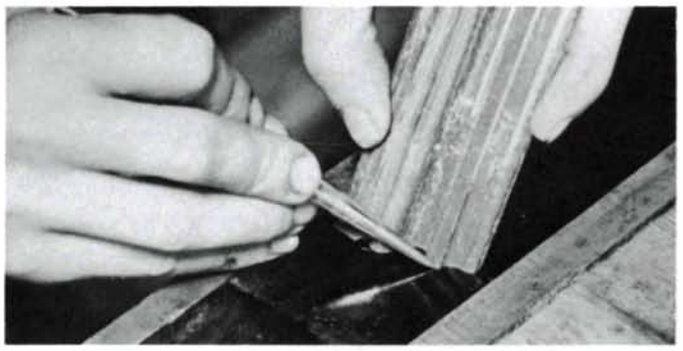


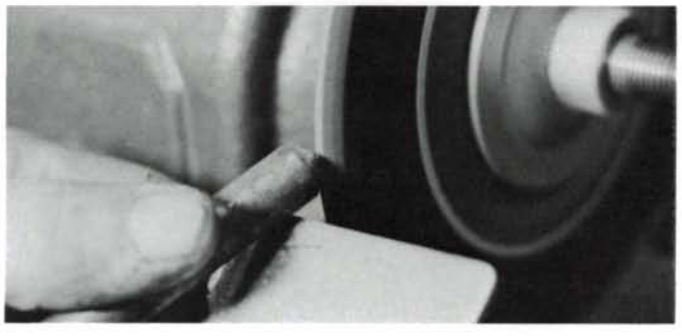
Avoid narrow pointed sections as shown in A. Use a wider piece of steel as in B.

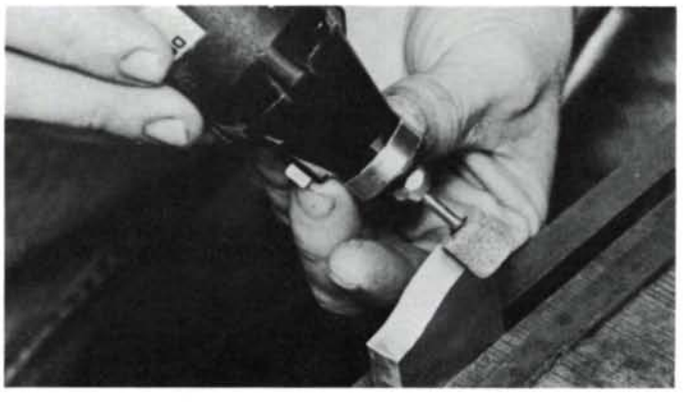
Allow side clearance; knife ground on dotted line may burn. Because knife rotates, cuts are the same.

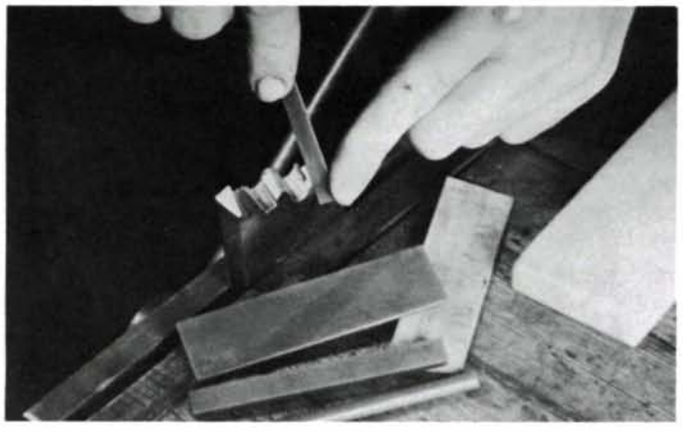


Note that A is slightly less than B because at position of maximum cut, knife is at an angle.









radii will require special grinding operations and here an abrasive cutoff wheel about 1/8 inch thick is most useful. Normally cutoff wheels are used on special industrial machinery with elaborate guards, but they do excellent work mounted on a bench grinder or on the arbor of a table saw. They cannot withstand lateral stress and you must be careful to cut directly into the wheel and avoid binding or pinching. Stay well under the maximum safe r.p.m. printed on the wheel, and guard it as much as possible, exposing only the cutting edge. On a table saw, simply raise the arbor until the wheel meets the table at the proper bevel angle, and carefully remove all sawdust to prevent a fire. I also use cutoff wheels on the table saw to cut knife blanks from 24-inch bars of shaper steel.

A jig to hold knives for grinding can be made from two pieces of scrap steel about 1/4 inch thick. Drill both pieces, tap the holes in the bottom one to accept bolts and sandwich the blank between them. A valuable aid is the diamond wheel-dressing tool. It looks like a Phillips screwdriver with diamond impregnated in the tip and can be used to shape and dress a grinding wheel to any profile.

High-speed rotary grinders, such as the Dremel, can be used with small diameter wheels to grind sharp curves. Mounted wheels for such tools can also be chucked in the drill press, with the table tilted to the correct bevel.

After the knife has been ground to the desired profile, it must be sharpened. First, remove the burrs by whetting the face of the knife on a fine stone such as hard Arkansas. Then whet the ground edge with a regular bench stone for straight or bevel cutters, and a slip stone, moon stick or Arkansas file set for curved cutters. When properly sharpened the knife should shave.

Before mounting the knives, make sure the collars are free of dirt, grease and chips. Set the bottom collar on the spindle and place the knives in its slots, allowing them to extend about the distance of the required cut. Be sure the knives are long enough to reach at least the centerline of the collar. Place the top collar over the knives, engaging the slots, and make sure the lock-edge notches fit properly. Adjust the knives to the desired cut by turning the Allen screws on the bottom collar, and hand tighten the spindle nut. Now lock the spindle and snug the nut. It is wise to place a heavy board in front of the knives when the machine is turned on, just in case.

Finally, a few cautions: Never run the spindle clockwise as this would loosen the spindle nut. Cut from the bottom whenever possible, as the knives are less exposed and there is no risk of binding. Avoid kickback by keeping the knives sharp and using hold-down fixtures. Keep the cutterhead well balanced and investigate any undue vibration.

[*Author's note:* Shaper collars and knives can be obtained from the following sources: Wisconsin Knife Works, Inc., 2710 Prairie Ave., Beloit, WI 53511; Forest City Tool Company, Box 788, Hickory, NC 28601; Charles G. G. Schmidt & Co., Inc., 301 West Grand Avenue, Montvale, NJ 07645; Woodworkers Tool Works, 222 S. Jefferson Street, Chicago, IL 60606].

At top, existing molding mitered to the attack angle of the knife can be used as layout template for an exact reproduction. Below, a cut-off wheel mounted on table saw arbor refines the contour that has been roughed out on a bench grinder. For safety, cut-off wheel should be used with a knife holder and guard. A diamond wheel dresser shapes grinding wheel to reverse profile of the desired cut. High-speed grinder sharpens difficult contour. At bottom Arkansas file set is used to hone knife.

HARDWOOD SOURCES (Continued)

Editor's note: This is the first addition to the listing of hardwood suppliers which appeared in the Fall 1976 issue. We hope readers will continue to let us know of other dealers who sell lumber in quantities of 1000 board feet or less or who deal in hardwood plywoods, or veneers in less-than-a flitch quantities.

The key to this is:
1. Dom—Domestic lumber 2. Imp—Imported lumber 3. AD/KD—Air dried/Kiln dried 4. Min—Minimum board foot quantity of lumber sold 5. Veneer—if available in less-than-a-flitch quantity 6. Planks—if available thicker than 8/4 inches 7. Logs—if available 8. Plywood—Hardwood plywood if available 9. Unusual species in stock, or specialties of the firm

California

House of Hardwood, 2143 Pontius Ave., W. Los Angeles 90025. (213) 479-4196. Dom. & imp. KD, no min. Dom. veneer; planks, plywood. Brazilian rosewood, teak, ebony, bubinga, wenge.

Spar Lumber, 1325 Harbor Ave., Long Beach 90801. (213) 436-9285. Dom. & imp. KD, no min. Planks, plywood. Marine lumber, boat materials; rosewood, teak, African shedua.

Chico Hardwoods, 565 E. Lindo Ave., Chico 95926. (916) 891-0570. Dom. AD/KD, imp. KD, no min. Dom. veneer; planks, plywood. Walnut planks, osage orange, claro walnut.

Colorado

Paul E. Killinger, 4309 Butler Circle, Boulder 80303. (303) 499-2648. Dom. & imp. Dom. & imp. veneer; planks. Rosewood, ebony, paldao, pau ferro, zebrawood, padauk, satinwood, wenge; burl panels.

Frank Paxton Lumber Co., 4837 Jackson, Denver 80216. (303) 399-6810. Dom. & imp. KD, no min. Veneer, plywood.

Connecticut

General Woodcraft, Inc., 100 Blinman St., New London 06320. (203) 442-3445. Dom. AD/KD, imp. KD, no min. Dom. & imp. veneer; planks, plywood. Kauri, mahogany, teak, walnut, maple, oak, poplar, cherry.

Florida

G. F. Weiss Industries, Inc., 12350 S. Belcher Rd., Largo 33540. (813) 536-9408. Dom. & imp. KD, no min. Plywood flooring. Teak, mahogany, bubinga, zebra.

Illinois

T. A. Foley Lumber Co., Inc., Box 336, Paris 61944. (217) 463-6180. Dom. AD/KD, no min. Dom. & imp. veneer; planks, logs, plywood. Oak, walnut, poplar, basswood, birch, hard maple.

Iowa

Frank Paxton Lumber Co., 205 SW 11th St., Des Moines 50303. (515) 283-2131. Dom. & imp. KD, no min. Veneer, plywood.

Maryland

House of Wood, Rt. 7, Box 3A, Waldorf 20601. (301) 645-1797. Dom. KD, no min. Planks. Walnut, cherry.

F. Scott Jay & Co., Inc., 8174 Ritchie Hwy., Pasadena 21122. (301) 544-1122. Dom. & imp. AD/KD, min. 100. Planks, plywood. Teak, mahogany, red & white oak, walnut, western red cedar, maple, basswood, cypress, cherry, poplar.

Massachusetts

Green River Lumber Co., Box. 329, Great Barrington 01230. (413) 528-9000. Dom. & imp. AD/KD, no min. Planks, logs, plywood. Bird's eye maple, oak, pine.

Steve Smith, Harlo Clark Rd., Huntington 01050. (413) 667-3220. Dom. (green), no min. Planks, logs.

Michigan

Red Mill Lumber Co., 115 N. Hall St., Traverse City 49684. (616) 946-5330. Dom. & imp. KD, no min. Plywood. Teak, walnut, cherry, oak.

Red Mill Lumber Co., 130 S. 3rd St., Big Rapids 49307. (616) 796-5504. (same as above).

Red Mill Lumber Co., 1220 N. Mitchell St., Cadillac 49601. (616) 775-9951. (same as above).

Red Mill Lumber Co., Thompsonville 49683. (616) 438-6191. (same as above).

Mississippi

Tradewinds, Ltda., 109 Coachmans Rd., Madison 39110. (601) 856-8543. Dom. & imp. KD, no min. Dom. & imp. veneer. Mahogany, Spanish cedar, teak, walnut, cherry lumber & veneer.

Missouri

Midland Walnut Co., Box 262, Savannah 64485. (816) 324-3612. Dom. KD walnut, no min. Planks.

Frank Paxton Lumber Co., 6311 St. John Ave., Kansas City 64123. (816) 483-7000. Dom. & imp. KD, no min. Veneer, plywood.

New Mexico

Frank Paxton Lumber Co., 1909 Bellamah Ave. NW, Albuquerque 87125. (505) 243-7891. Dom. & imp. KD, no min. Veneer, plywood.

New York

Maurice L. Condon, Inc., 250 Ferris Ave., White Plains 10603. (914) 946-4111. Dom. AD/KD, imp. KD, no min. Planks, plywood. Boat lumber; teak, ebony, rosewood, oak, maple, walnut, mahogany, cherry.

H. Herrmann Lumber Co., 2510 Park Ave., Bronx 10451. (212) 669-0828. Dom. & imp. KD, min. 200. Planks. Teak, mahogany, walnut.

Kenco Merchandisers, 507 5th Ave., New York 10017. (212) 682-4133. Imp. & dom. plywood. Lauan, mersawa, birch, oak, ash.

J. H. Monteath Co., 2500 Park Ave., Bronx 10451. (212) 292-9333. Dom. & imp. AD/KD, $200/item min. Veneer, $100 min.; planks, logs, plywood.

North Carolina

Crowe & Coulter, Box 484, Cherokee 28719. (704) 497-5588. Dom. & imp. AD, no min. Buckeye, cherry, poplar, walnut.

Tennessee

Bedford Lumber Co., PO Box 65, Shelbyville 37160. (615) 684-2825. Dom. & imp. KD, min. 10. Cherry, oak, walnut, ash, basswood.

Ross Kreamer Hardwood Veneers, 1657 Lamar Ave., Memphis 38114. (901) 276-8662. Dom. & imp. AD/KD, min. 100. Plywood. Burls, bird's eye veneer & lumber.

Texas

Alamo Hardwoods, Inc., 1 Fredricksburg Rd., San Antonio 78201. (512) 736-3137. Dom. & imp. KD, no min. Dom. & imp. veneer; planks. Custom millwork.

Virginia

Colonial Hardwoods, PO Box 552, Falls Church 22046. (703) 893-3331. Dom. & imp. KD, no min. Black locust, sassafras, white ash.

Canada

British Columbia

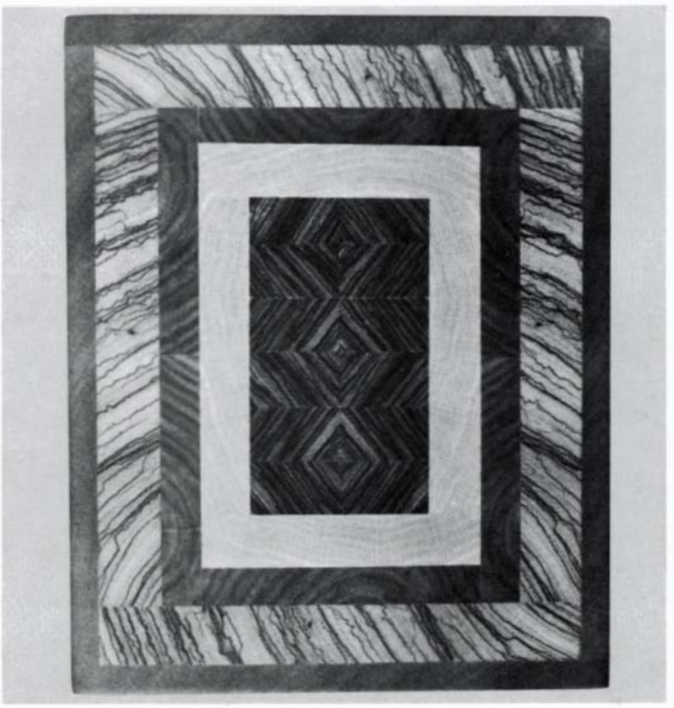
Arkwood Hardwoods, c/o Rick Bockner, Box 54, Winlaw V0G 2J0. (604) 226-7761. Dom. KD. Sitka spruce, yellow cedar, slow growth red cedar, western birch.

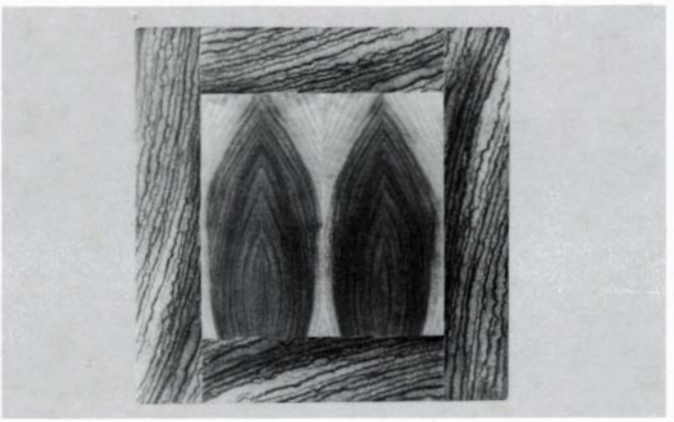
SOURCES OF SUPPLY (Continued)

Editor's note: As an editorial service to our readers, *Fine Woodworking* is periodically publishing some sources of supply. This chart expands lists of tool dealers that appeared in previous issues.

	Telephone	Catalog	Mail Order	Retail Store Sales	WOODS: Veneers	WOODS: Hardwood Lumber	WOODS: Hardwood Plywood	WOODS: Carving Blocks	WOODS: Turning Blocks	HAND TOOLS: Cabinetmaking	HAND TOOLS: Carving	HAND TOOLS: Turning	HAND TOOLS: Marquetry	POWER TOOLS: Portable	POWER TOOLS: Stationary	Cabinetmaking Hardware	Marquetry Supplies	Finishing Materials	Books	Plans
Buck Bros., Inc. Millbury, MA 01527	(617) 865-4482	free	yes	no						●	●	●	●							
Chico Hardwoods 565 E. Lindo Avenue Chico, CA 95926	(916) 891-0570	no	no	yes	●	●	●	●	●	●	●	●					●	●	●	
The Japan Woodworker 1806 Bancroft Way Berkeley, CA 94703	(415) 848-8343	50c	yes	yes						●	●									
The Princeton Co. PO Box 276 Princeton, MA 01541		free	yes	no						●	●									
H. L. Wild 510 E. 11th Street New York, NY 10009	(212) 228-2345	$1.50	yes	yes	●			●	●	●	●	●	●				●	●	●	●
Woodworkers Supply, Inc. 11200 Menaul NE Albuquerque, NM 87112	(505) 293-8080	free	yes	yes	●					●	●	●		●	●	●		●	●	●
Woodworkers Tool Works 222 S. Jefferson Street Chicago, IL 60606	(312) 726-8702	$1.00	yes	no											●					

Serving the Eye As Well





The idea of assembling end-grain pieces to form pleasing serving trays occurred to Lew Korn several years ago when he began playing with the cut-offs from ends of boards.

He now makes quite a few of them, using the natural grain patterns to their best advantage in handsome arrangements. The trays—or wall plaques for that matter—sell for about 25 dollars each, and compose only a small part of his cabinet-making business in Larchmont, N. Y.

Korn glues one section at a time, and works from the center out until the piece looks right. Because the sections are glued long grain to long grain, no joints are necessary. In the three years since he made his first tray, none of the glue lines have opened up. He uses a variety of woods—commonly walnut, cherry, oak, oriental wood, mahogany, and zebra wood, and uses an oil finish to bring out the rich pattern and color of each wood. The result is a series of beautiful trays, with subtle pattern changes from wood to wood.

Tray at upper right is 11 x 14 in. and is made of (from center out) zebra, oak, walnut, zebra and mahogany. The center tray is 9 in. square and is walnut bordered in zebra. The third tray is 7 x 8 in. and is red oak, oriental, imbuya and white oak.