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Fall 1977, $2.50
Vol. 2, No. 2

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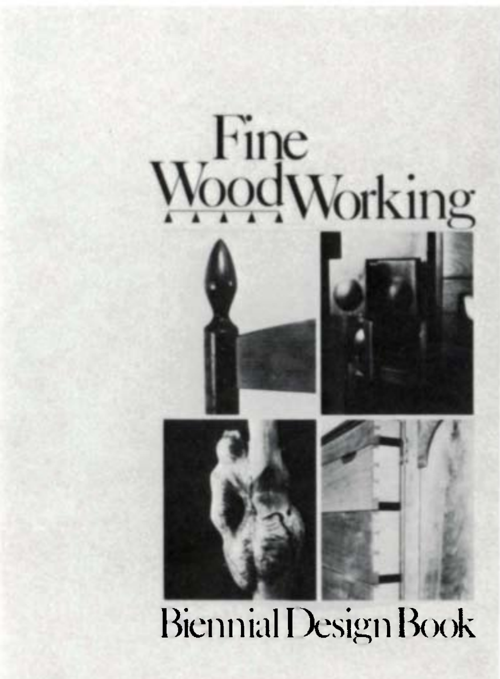

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Fine WoodWorking

Fall 1977, Volume 2, Number 2

Cover: Walnut crotch sawn into 6/4 boards with 36-in. chain-saw mill by Robert Sperber where the tree was felled. The flame-patterned figure results from cutting both branches through the center, a cut virtually unobtainable with conventional circular sawmills. Sperber discusses chain-saw lumbering on page 50.

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I was delighted to read "Cooperative Woodshop" (Summer '77). I am a member of a similar shop, called Heartwood, in Berkeley, Calif. We have 10 members in a 2,400-sq.-ft. space. We each pay a fixed amount, currently $80, to cover rent, utilities, basic supplies such as glue and sandpaper, maintenance and repair, and some major improvements. Some tools are collectively owned, though most are owned individually. All are shared freely. For the most part we each do our own jobs and handle our finances separately. The exchange of skills and knowledge is crucial and beneficial to all of us. I am a successful custom cabinetmaker, and I feel the setup of this shop has been essential to my being able to establish myself on limited finances and experience. The more shops like this, the better.

—Liz Brown, Berkeley, Calif.

Peter Child's article (Summer '77) states that scraping tools scrape, not cut. I suggest that scraping is a form of cutting. Other forms are shredding, shearing and slicing.

To suggest that scrapers do not cut is a falsehood that should be corrected. The difference between shearing and scraping is arbitrary, being no more than the angle at which the edge of the tool is inserted into the wood while it is rotating to produce a "scraping" cut (negative rake angle) or a shearing cut (positive rake angle), regardless of the tool used. The distinction should be based solely on the rake of the tool, e.g., the angle that the upper face of the tool makes with the work. This rake with regular skew chisels and spindle gouges might be as high as 70° positive. But with faceplate scrapers it might be 10° negative. If properly sharpened, both tools produce shavings of similar appearance: with scrapers, a little thinner; with cutters, thicker and more curled.

From a standpoint of sharpening, contrary to what the author implies, scrapers need a higher degree of skill than do gouges. In order for a scraper to cut efficiently, the top (broad side of the cutting edge) must be polished to dissipate the heat generated from the edge's contact with the wood at a negative angle.

—Lyle Terrell, New Orleans, La.

In reply to Blake Emerson's letter (Summer '77) about articles on women woodworkers, I do not now feel, nor have I ever felt, that woodworking has political implications. When I enter my workshop, I leave the world behind and enter into my own little world, where I design and build what I please and how I please. And somehow in this act of pleasing myself, I leave my woodshop enriched by the experience, and in the process, make the world a better place not only for myself, but for everyone who comes in contact with me. And the work I create makes life a little more pleasant for all who see and use the things I make.

When I read your magazine, I am interested in expanding my knowledge of woodworking and finding solutions to problems I have in my woodshop. It has never entered my mind...to realize or determine whether the woodworkers you write about are men or women...

I think most of us share the concerns and work for the political and social rights of women...If we suffer guilt from


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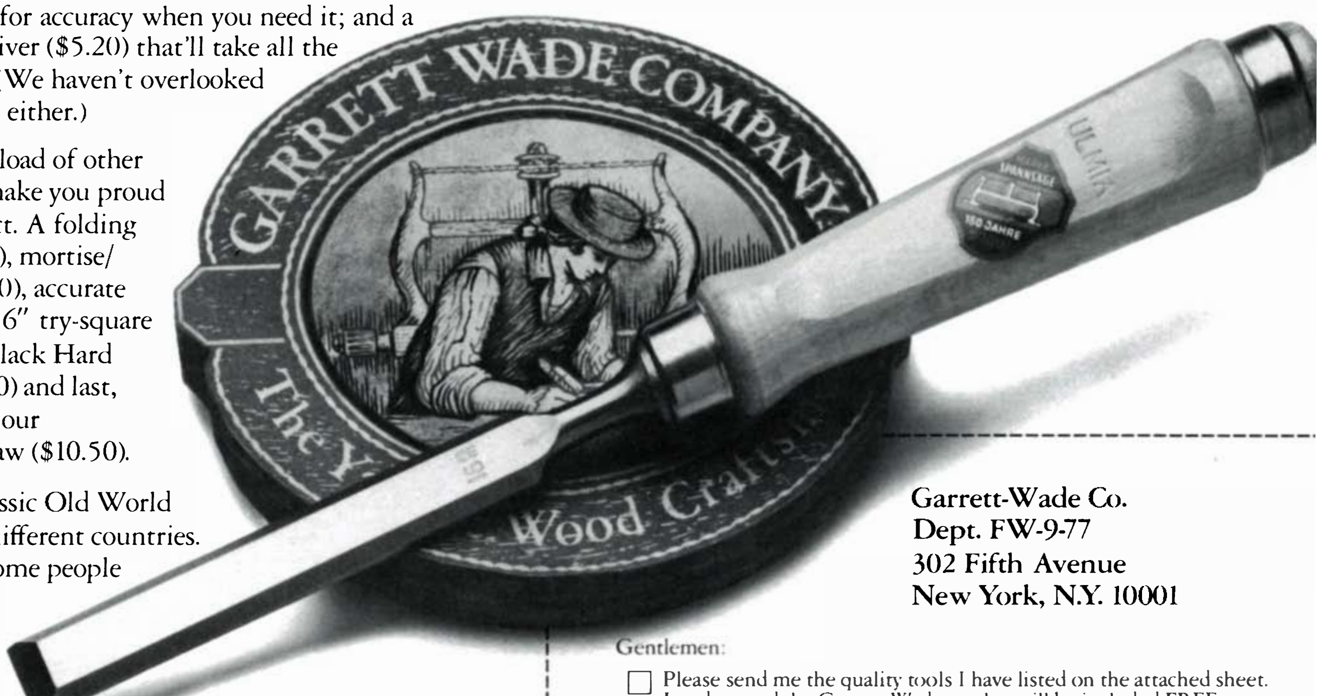

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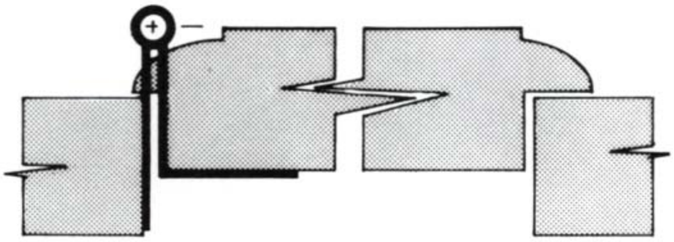
LETTERS (continued)

the past, let's not take it out on the advancement of our craft, but deal with it in constructive and productive ways, not in ways that pander to our guilt.

—Joseph R. Palsa, San Francisco, Calif.

Over the years we have noticed a trend toward "kitchen cabinet fitting" of tall-case clock waists. More and more plans are available, as well as kits, to build an "authentic" grandfather clock. Most of them show an equal-sized lip on both sides of the door. This makes it difficult, and sometimes impossible, to fit the proper hinges for this door.

Most waist doors were originally fitted with what is essentially an offset butt hinge, with a finial on either end of the hinge pin. These were cut through the lip of the door, per-



pendicular to the face of the frame, with the pin extending out beyond the molded lip and the pin center in line with the face of the door.

On the original clocks this does not create any problem as the lip on the hinge side extends over the frame only by a fraction of an inch, in some cases as little as 1/16 in. The kits and plans usually show a 3/8-in. wide lip on both sides of the door and, when made in this manner and fitted with the proper hinge, the back of the lip will rub on the frame as the door is opened. The lip on both sides was originally designed to cover any shrinkage in the wood. Naturally, since the hinge side is attached firmly, all the shrinkage will draw to that side, not away from it; therefore a wide lip is not needed at that point.

—W. Whitman Ball, Exton, Pa.

Re deep-drilling large holes ("Q&A," Summer '77): Mr. Hawkins might try using multi-spur machine bits (made by Greenlee) for his hole problem. I have used them and found them excellent.

—Bowen Sterling, Peekskill, N. Y.

You may wish to advise Mr. Kramer, who furnishes information on repairing dents ("Methods of Work," Spring '77), that another piece of equipment to employ is the thermo pad, made by Wen, which holds just the proper heat level. It is an electric soldering iron accessory that is a flat surface with a heating element having a work surface of about 1 in. square. It can be guided onto the intended spot and also is used with a damp cloth or paper.

—Sam J. Shaw, Ligonier, Pa.

"Pricing Work" and "Going to Craft Fairs" (Spring '77) are quite thought-provoking. I have found that it takes me one to three hours to turn a bowl once it is mounted on the lathe. This time is based more on the shape of the bowl than the size. If I needed $9 per hour (not counting the cost of materials), a two-hour bowl would have to bring me $18—even if it were a small one. Few people will pay that

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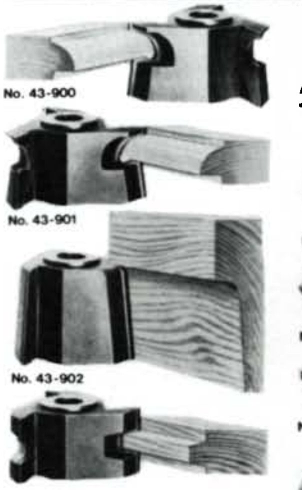

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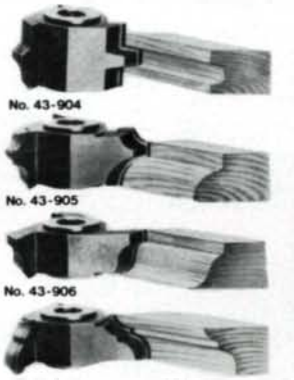

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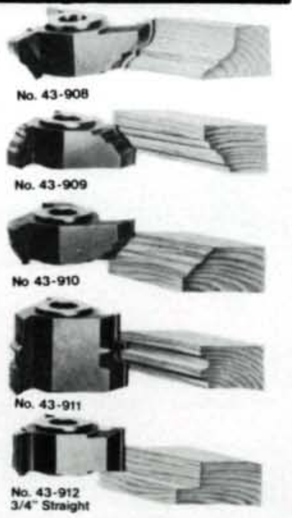

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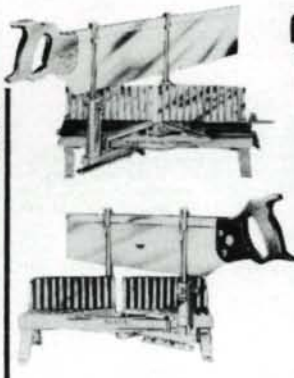

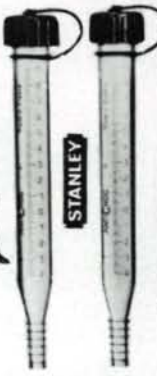

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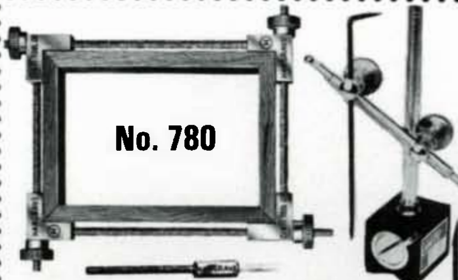

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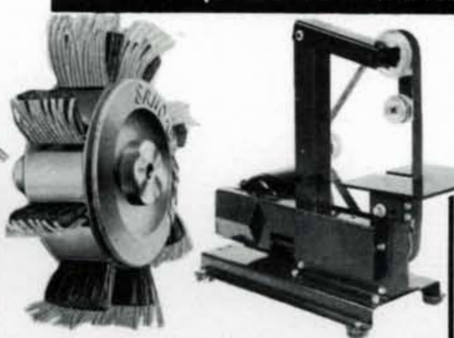

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Complete unit illustrated. **Contains:** sanding belt, Vee belt, pulleys, Belt guard and Base that has rubber feet. This unit is portable and does not require mounting to bench.
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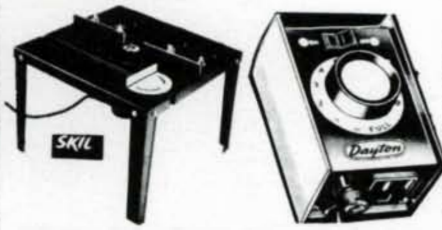

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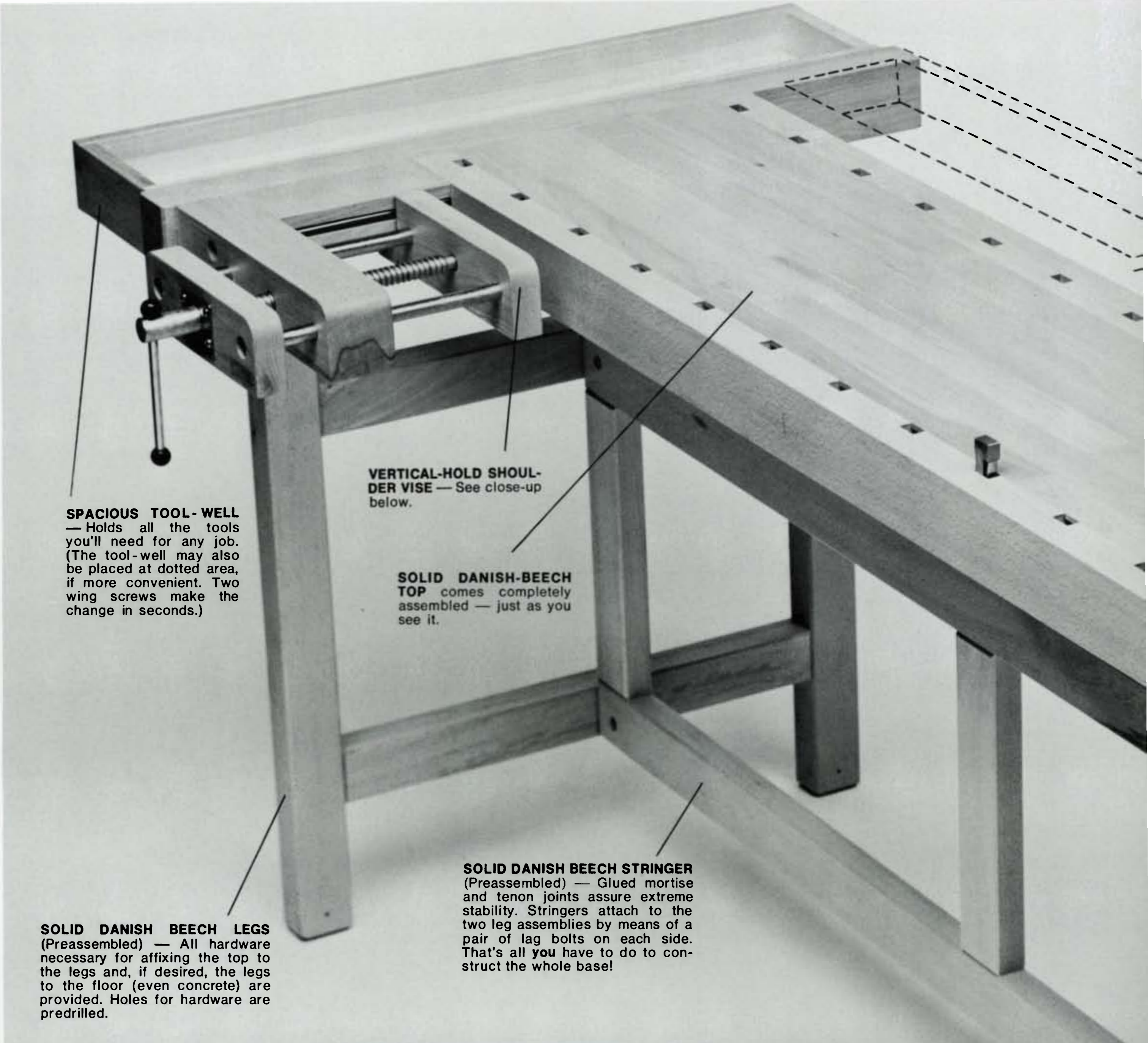

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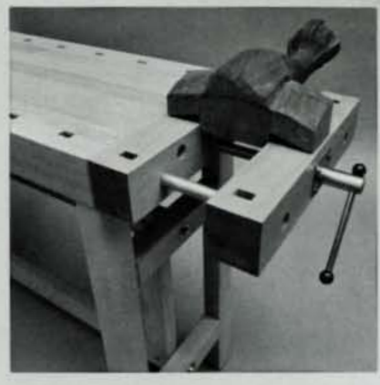

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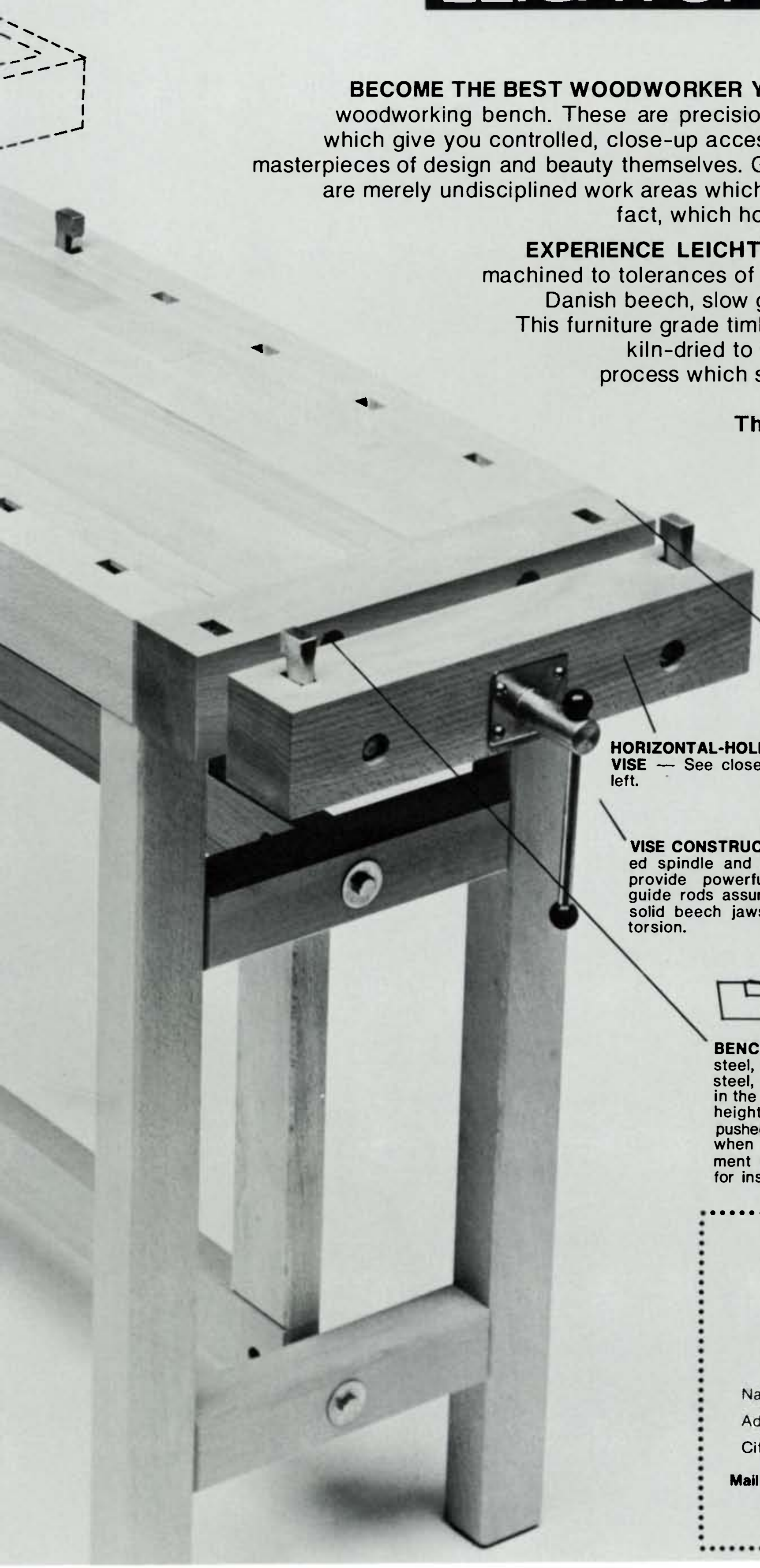

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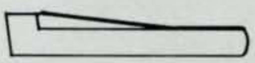

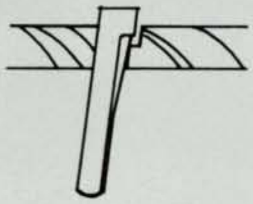

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amount of money for a bowl; this is not even a store price. What I am leading up to is that there is a "correct" price for each item, in terms of what the purchaser will pay. If this price is high enough to give the craftsman a profit then everything is fine, but if the price must be low, then...

Incidentally, I have seen imported bowls from the Orient being sold at retail for approximately the same amount of money that I would have to pay for the raw wood!

—Henry Fisher, Columbus, Ohio

"Stacked Plywood" by Ellen Swartz (Spring '77) raises my ire. It can hardly be considered to be *fine* woodworking, can it? I realize that design is to some degree a matter of taste, but really—an ugly rocking chair with a political message is going too far. The main article was perhaps worthy of *Popular Mechanics* and the rocking-chair piece—well, was it really necessary? The possibility of teak and walnut becoming "political" makes me see red! With so much ugliness in our department stores, surely you shouldn't publicize custom-made ugliness.

—John M. Montgomery, Victoria, B. C.

I must disagree with David W. Cumming's letter (Summer '77) in reference to your articles on plywood and lamination. I built a pipe organ 10 years ago using 3/4-in. cherry plywood for the console. In working the plywood (which was not cheap) I did not run into any internal pockets. I ended up with a finished piece of furniture that looked as if made from solid wood throughout. I did not experience any warping.

—John P. Wikswo, Amherst, Va.

In "Lute Roses" (Summer '77), the author derives the word "lute" from the Arabic *al-'ud*, meaning "the wood." It may interest your readers that the word is also Biblical Hebrew. In the three passages where it appears (Jes. VII 4, Zach. III 2 and Am. IV 11), it signifies "a long piece of wood" (firebrand).

Now I want to join in the scrap around the artistic qualities of plywood work. As manufacturers of fine accessories to the fashion trades (handbags, belts, etc.) specializing in wood, we have used solid birch plywood for at least a decade. Contrary to the statements of reader David W. Cumming, the material shows none of the drawbacks he claims. Split and break-off on edges of outer layers, uneven gluing, poor color, absorption and warping of edges are not prevalent; in fact, they are rarer than in the hardwoods we use.

—Arnold A. Jacobs, New York, N. Y.

Re finishing salad bowls ("Q&A," Summer '77), you printed an answer from Paul Boucher recommending mineral oil. You should warn your readers that mineral oil can't be digested by humans. It absorbs vitamins from the body and can cause a vitamin deficiency. It is far better to use an edible oil such as salad oil.

—John R. Howland, Phoenix, Ariz.

Although I am a great admirer of James Krenov's work, I don't think that doweling (Summer '77) is either the best or the easiest method of joining edges, particularly if they are long. Alignment and drilling are time-consuming, and if there is any warp, assembly can be difficult. Moreover, I sus-

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pect much of the glue often gets squeezed away from the dowel.

I have found spline joints to be preferable, simpler and faster. . .probably stronger, too. For 1-in. or 5/4 stock, I use 1-in. by 2-in. splines cut from 1/4-in. plywood at 6-in. to 8-in. intervals. Mortises are cut with a router, a bit longer than the splines, which simplifies alignment. Before cutting the splines, I sand down the thickness of the plywood slightly to allow for the glue.

Incidentally, the surface area of one 2-in. spline is more than 10 times that of six 1/4-in. dowels 1 in. long, and about six times greater than as many 3/8-in. dowels.

—Joseph T. Ponessa, Moorestown, N.J.

A few days ago I was in a local bicycle shop and noted that a sample wheel/tire assembly carried a sign indicating they would very shortly have available solid bicycle tires. I suspected it was urethane and inquired and found it to be urethane.

This, combined with some ideas I've had for making my own sander/grinder, led me to the idea of a band saw with these firm urethane tires on used bike wheels. Such wheels are very cheap at garage sales. The tire could be ground to suitable contour with the slight crown needed for blade tracking.

I may use modern urethane skate (or skateboard) wheels with precision ball-bearing assemblies for idlers. Crowning these should be easy with the router or grinder.

—Charles P. Haber, Huntington Beach, Calif.

Angelo Pallaria wanted an oil finish to repel water ("Q&A," Spring '77). None of the answers mentioned tung oil. I put this on a table several years ago. The table has been used daily and has had a variety of drinks and food spilled on it without affecting the finish. The finish does seem to repel water. I used an oil-based stain and then rubbed in several coats of tung oil with at least overnight drying until the wood seemed saturated.

I'm wondering why some of your many readers didn't come up with what I thought was a commonly used finish?

—Charles E. Holcomb, Hendersonville, N. C.

In Summer '77 you mention difficulty in locating a source of left-hand taps and dies. I have found them listed in the catalog of Manhattan Supply Co., Plainview, N. Y. 11803, as follows: 5/16-in.—18 x 1 L.H. carbon-steel die, $3.25; 5/16-in.—18 x 1 L.H. carbon-steel tap, $1.30.

They are also listed in the catalog of the Wholesale Tool Co., 12155 Stevens Drive, Warren, Mich. 48090, at $5.90 for the die and $2.20 for the tap.

—Roger W. Curtis, Bethesda, Md.

Perhaps you have already received many letters on the problem of finishing such woods as rosewood, cocobolo, etc. The main question is, of course, how to preserve the light colors, especially yellows, pinks and purples, and also the grain contrast. I really don't have a good answer yet and I have done many experiments. I have used all the traditional sealers and finishes, gunstock treatments, epoxies, bleaches, resin-removing acetones and even various photochemicals and ultra-violet light absorbers. My best results have been with many coats of lacquer sanding-sealer, wet-sanded with 600 grit and then waxed—not a very acceptable finish by any means. So I am hoping that there are people with far greater experience than my own and that an answer does exist.

—*Sander Heilig, Micanopy, Fla.*

A woodcarver friend introduced me to an excellent honing method that eliminates flat stones, a lot of time, and the need for a very steady hand or jig. It's a rubber abrasive wheel made by Cratex Mfg. Co., Burlingame, Calif. It's a fast, smooth wheel that matches the hollow of the grinding wheel and hones everything from plane blades to the most tedious gouges. The wheel glazes after a few uses, but it can be dressed in a few seconds with 220-grit sandpaper.

It's available in various diameters, shaft sizes and widths. The grit I use for honing is extra-fine, XF. Distribution seems to be limited: I ordered through an abrasives supplier. A metalsmith supplier might have them, since metalsmiths are the only craftsmen I know who have ever heard of it.

—*Ira Redner, Dillon, Colo.*

In 1932, when I lived in Boston, I made two end tables out of bird's-eye maple. I wanted an early American, soft Salem finish. I went to the Boston Public Library and read some old books on finishing as done by the Colonial cabinetmakers. I found the answer. I went to an old cigarmaker. He gave me a bag full of center stems of tobacco leaves. I cut them into small pieces and put them in a gallon container of water and cooked it to a boil. Then when it cooled I had a dark (almost black) water stain. I put it in pint bottles and used it for years afterwards. This tobacco-stem stain, applied to the maple, produced a soft tan or Salem color. A second coat of stain would make the wood a little darker. Then I rubbed wax over the stain finish and thus had a finish equal to a piece 100 years old. I am now over 80 and still working every day in my woodworking studio.

—*Sam Lancet, Los Angeles, Calif.*

I purposely neglected to mention the butted and epoxied neck/body joint in "Guitar Joinery" (Winter '76) for it is, in my estimation, an inferior joint, notwithstanding its popularity in the guitarmaking texts. Its integrity depends on the glue seam, and differing expansion coefficients of end grain and face grain may cause glue seam failure.

—*Bill Cumpiano, North Adams, Mass.*

Lookalikes:

Tage Frid's 1948 workbench at $100 (Fall '76) and Sears, Roebuck & Co.'s 1902 cabinetmaker's bench, price $8.55 tax-free (1902 catalog, p. 524).

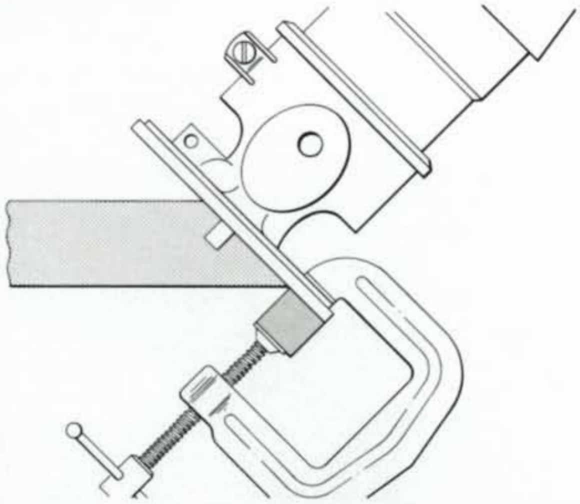
Paul Buckley's contemporary gate-leg table (Summer '76) and Sidney Barnsley's 1894 gate-leg table. Interestingly enough, the latter was itself a lookalike for an earlier design called the "Sutherland table."

Shakespeare said that comparisons are odious, but I think furniture lookalikes are fun to find, especially in the light of all that is being written on design origins and originality.

—*Carlos H. Ball, Lebanon, Conn.*

Routing slots

Slots for the splines in miter joints can be cut neatly and quickly with a router and a straight bit (carbide-tipped works best). With the depth of cut set to one-half the width of the spline plus 1/32 in. for excess glue, rest the base of the router on the face of the miter. Adjust the router fence (a block clamped to the router base will probably work better) so the

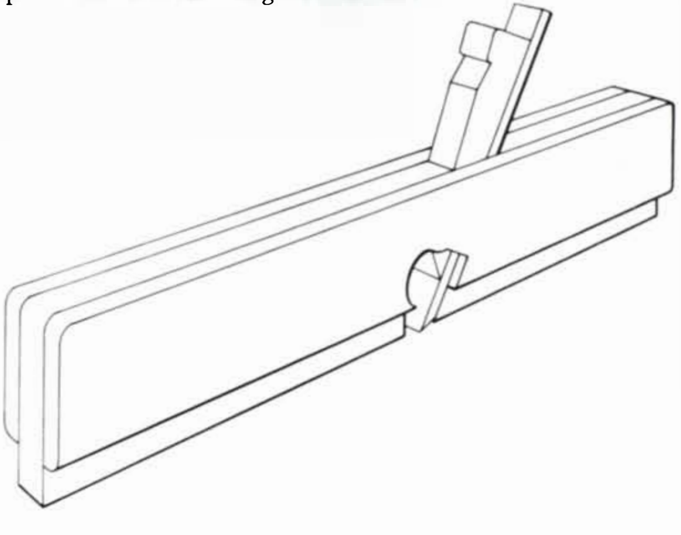


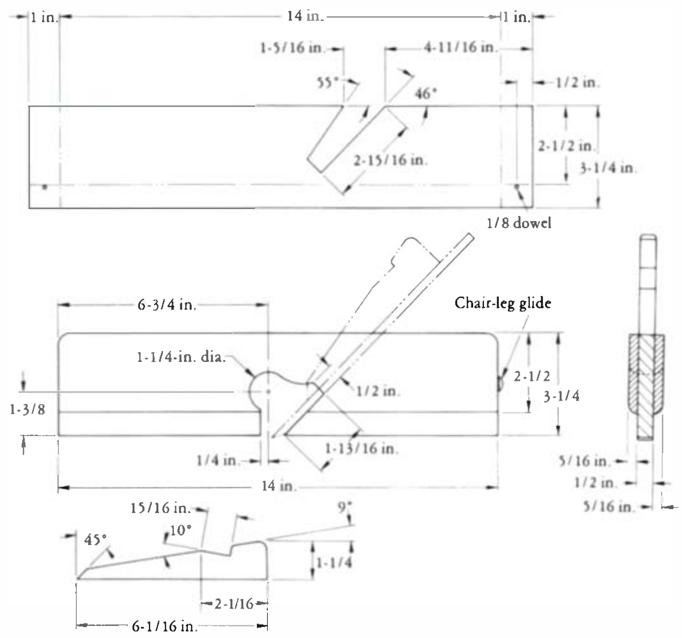
outside edge of the miter will guide the bit as it cuts the slot. Using as a pivot the point where the outside miter edge meets the corner formed by the router base and the fence, lower the bit into the face of the miter and cut the slot. This method cuts the slot parallel to the edge of the miter, which helps the spline compensate for cup in the board, and the cut can be started and stopped without exposing the spline at either end of the joint.

—*David Landen, Chapel Hill, N. C.*

Mortising plane

Here is a very old design for a plane to cut the mortises when inlaying hardware. It works like a router plane, but is more flexible as it can reach places the router cannot go, such as when inlaying hinges in door jambs. Because the two side pieces are raised from the sole, the corners of the blade can cut right up to shoulders and moldings. I have found the 14-in. plane most useful because it gives a sure surface for any hardware up to 7 in. long. Of course for a special job the plane can be made longer or shorter.





You need one piece 5/8 in. x 3-1/2 in. x 16 in. of maple or some other dense wood; two pieces 3/8 in. x 3 in. x 16 in. that may be in a contrasting wood if you like; one piece 5/8 in. x 1-1/2 in. x 6-1/2 in. for the wedge; and one piece of steel 1/4 in. x 1/2 in. x 9 in. Oil-hardening steel, which comes in 18-in. lengths, is well-suited and that is why the iron is 9 in. long. After the steel is cut and ground, send it out to be hardened or do it yourself (*Fine Woodworking*, Fall '76).

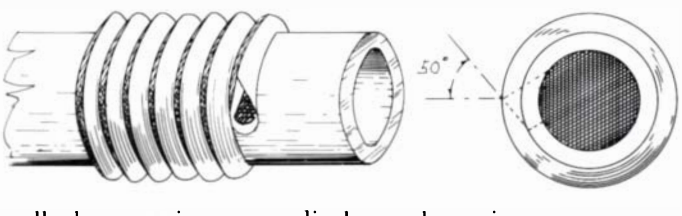
First make the centerpiece, which is notched and finished to 1/2 in. thick. Drill two 1/8-in. holes as shown in the drawing and insert two dowels, to locate the side pieces during glue-up. Plane the side pieces to 5/16 in. thick and clamp the assembly together, using cauls for straightness because the sides are so thin. Be sure to clean out the glue where the wedge and iron will fit, and clean it off the bottoms of the side pieces. When the glue has set, cut the plane to length, locate and drill the 1-1/4-in. hole and complete the cut-out shape. Round the edges of the upper part of the cut-out, so the shavings will slide off easily.

Now make the wedge and fit the iron. Move the iron back a quarter inch from the bottom and tap the wedge home, and then correct the sole for straightness. If you true the plane without the iron and wedge in place, it may change when they are pressing against the wood. To lower the iron, tap it at the top. To move it up, tap on the back of the plane. To protect the wood, you might want to hammer in a chair glide, or inset a hardwood striking button. If you wish to remove the iron completely, tap against the notch in the wedge.

—Tage Frid, Foster, R. I.

Threads in end grain

When tapping wooden threads with a homemade or commercial steel tap (*Fine Woodworking*, Spring '77), good clean threads can be gotten only when tapping perpendicular to the grain of the wood. It sometimes is necessary in the design of a certain project to tap directly into end grain, as in a turning, in which case the threads will be torn out. However, the tap can be sharpened so that the wood fibers on the inside surface of the pilot hole are cut before the root of the thread, thus not tearing out the whole thread. The tap will also work just as



well when tapping perpendicular to the grain.

Looking at the end view of the tap, it is filed so that the angle of the two cutting edges is sloped back from the radial position. This could be anywhere from 40° to 50°. A 45° file can be used to rough-form the inside bevel of the cutter. The edge can then be finished with a small slip stone.

—William Stockhausen, Northville, Mich.

Orbital sander

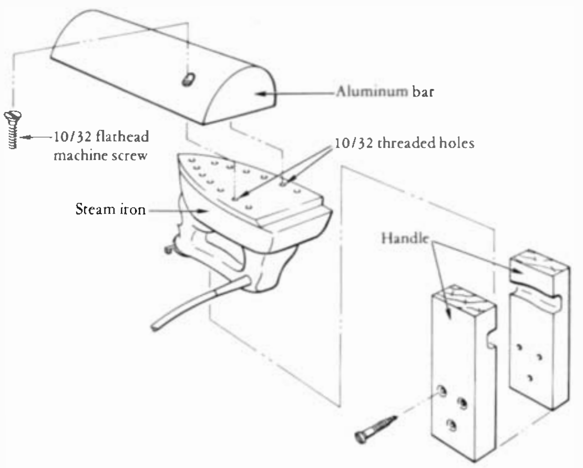
I use three orbital sanders in my shop. They have a lengthy "coasting" time and it is time-consuming to hold a sander until it stops. I have found that a coasting (or running) orbital sander may be safely placed (with the sanding surface down) on a piece of shag carpeting set on the sanding bench.

—B. D. Bittinger, Shelbyville, Tenn.

Bending iron

I teach high-school woodworking and for the past two years have had the students design projects that require bent wood. I have tried soaking and steaming with limited results, so I designed and built a simple bending iron from an aluminum bar and an old steam iron. The wood is wet with a sponge only where it is to be bent. This eliminates the staining and raised grain caused by soaking or steaming, and it can be glued immediately if it is not wet too much. My students have used the iron to bend wood up to 1/8 in. thick for projects ranging from guitar and dulcimer sides to fishing nets.

Start with a 6-in. length of round aluminum bar, and hacksaw it in half lengthwise. Sand the cut surface smooth on an aluminum oxide belt, and file all the edges smooth. Pick two steam holes in the sole of the iron, drill them out and thread them to accept #10-32 machine screws. Drilling elsewhere on the sole risks breaking into the heating element. Thread only as deep as the original steam holes, else the tap may bottom out and break off. Now locate these holes on the bottom of the aluminum block, drill through with a 1/4-in.-diameter bit for clearance, and countersink the top of the holes for the flathead screws. The screwheads may need to be



filed flush after assembly. I started with 1-1/2-in. screws and ground them to length so they would tighten in the threaded holes without bottoming. Finally, groove two chunks of 2x4 to fit around the handle of the iron, so it may be clamped upright in the vise.

—David G. Johnson, Hanover, N. H.

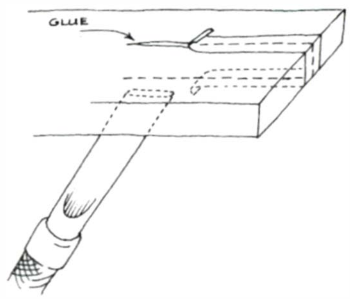
Dip for screws

When you purchase a box of wood screws (brass or steel), dip them in a solution made of two tablespoons of bowling-alley wax dissolved in a pint of mineral spirits. Spread the screws out on a piece of kraft paper to dry before returning them to the box for storage. It will keep the brass bright, the steel from rusting and will make them go into the wood with half the effort, thus reducing breakage.

—Charles F. Riordan, Dansville, N. Y.

Repairing cracks

In the process of repairing furniture or using seasoned lumber we occasionally encounter a split board. Depending on the severity of the crack and the value of the lumber, it is sometimes desirable to repair the crack. A vacuum cleaner, masking tape, clamps and glue can accomplish this. Tape over the crack, down the end of the board and on the underside of the crack. The object is to create a vacuum.

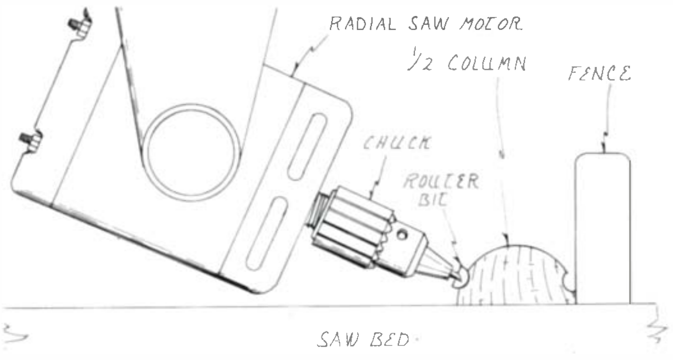


With a crevice tool on the vacuum cleaner, suck the glue into the crack while slowly peeling back the masking tape. Add glue while sliding the crevice tool out to the end of the board. Once the crack is filled with glue, clamp the split closed. The viscosity of glue is usually sufficient to prevent it from being sucked into the vacuum-cleaner hose. To be safe, remove the hose as soon as glue is visible on the underside. A little experimentation will show you how much time, glue and tape to use.

—Ray Schwenn, Jamesville, N. Y.

Fluting columns

On the clock I am building now are four fluted half-round columns, each 1 in. high and 1-3/4 in. wide, two of them 41 in. long and two of them 16 in. long. Each has five flutes. To make these columns I took pieces of walnut 1-1/16 in. x 1-3/4 in. and marked the ends to the half-round I wanted. I



then took off some of the waste on the jointer and the rest with a hand plane. To get them perfectly half-round I took a 6-in. length of tubing with an inside diameter of 1-3/4 in. and cut it in half lengthwise. Inside of this I put a piece of 60-grit sandpaper to shape the wood, followed by finer grits until it was smooth. To make the flutes I put a drill chuck with a router bit on my radial arm saw. I set the saw to the proper angle for the first flute, with the wood against the rip fence, and ran both edges of all four pieces through. I adjusted the saw setting for the succeeding flutes.

—George Eckhart, Kenosha, Wis.

A square square

To work accurately, the most basic necessity is a really accurate try square. While standing in the store you can't very well flop the square and scribe lines, but you can test one square against another, both inside and outside. Keep testing until you find two that will test inside and outside without any error—then buy either one since they are both square. While

trying to find a square try square, I also discovered that a good many framing squares aren't really square either.

—Duane Waskow, Marion, Iowa

BOOKS

The Design and Practice of Joinery by John Eastwick-Field and John Stillman. *Published in the United States by Herman Publishing, 45 Newbury St., Boston, Mass. 02116. $17.50 hardcover, 237 pp.*

The practice of opening furniture up, making its structure visible and pleasing to the eye as well as strong, is beginning to catch on in contemporary American design. But this is no new wave in furniture making, nor is it the work of a few individuals. The Shakers made cabinets and furniture with exposed joints in the mid-19th century, and what they knew about woodworking they had learned from a British tradition that was then centuries old.

Joinery is a collection of techniques for fastening pieces of wood together so that they remain in place without distortion. ''Joyners'' first organized as a craft guild in London in 1309, and now Britain has produced *The Design and Practice of Joinery*, a treasury of the tradition from timber yard to finished fixture. Its nine parts begin with sections on the physical properties of wood and theories of joinery before discussing design. The authors list the principles of each joint and discuss the uses, advantages and drawbacks of specific applications, leaving the choice to the reader and his particular circumstances. They are thorough enough to include an analysis of factors governing movement in timber, an important discussion nowhere else as complete as in this volume.

The book is illustrated with over 200 photographs and perspective drawings of the highest quality. The reader can easily compare the strengths of different joints in different situations and also can visualize the most esthetically pleasing proportions.

The following is excerpted from a discussion of no less than 12 variations of the mortise and tenon, ranging from a simple pinned mortise and tenon to the more specialized twin double tenon.

> In principle all mortise and tenon joints are the same. Each consists of one or more tongues known as tenons on one member and slots or mortises in the other. The tenons are inserted into the mortises and fixed with wedges and glue. The thickness of the tenon should preferably be one-third the width of the section, and

the depth of the tenon restricted to five times its thickness. For most mortise and tenon joints the mortise is cut right through the member and, when inserted, the tenon shows on the outer edge. When the main purpose of the joint is to locate one member relative to another and when the joint will not be subjected to tension, a short tenon, known as a 'stub' tenon, can be inserted into a shallow mortise and be fixed by gluing and possibly also by pinning, but without wedges.

The British origin of this book offers Americans some interesting contrasts and few shortcomings. There are British building codes and specifications and the odd colloquialism, but they are too few and too minor to be troublesome. The latest edition uses metric measure, but this need only be a gentle reminder that 1980, when the U. S. also goes metric, is not far off.

For the American furniture designer, *The Design and Practice of Joinery* offers more than solutions to a list of problems. The authors never directly mention the venerable origins of joinery, but they repeatedly express a high regard for craftsmanship and "the best traditions of the trade." Along with its definitive and comprehensive treatment of the techniques of joinery, it is this tie with a tradition that goes back seven centuries that makes this book so valuable and delightful for contemporary craftsmen.

—*Tim Mackaness*

The Woodworker's Bible by Percy Blandford. *TAB Books, Blue Ridge Summit, Pa. 17214, 1976. $9.95 hardcover, $5.95 paper, 416 pp.*

How to Make Your Own Built-In Furniture by Percy Blandford. *TAB Books, 1976. $9.95 hardcover, $5.95 paper, 336 pp.*

Neither book has any biographical information about Percy Blandford, but his background is obvious: he is English, nervous with machine tools, and in love with dovetail joints.

The Woodworker's Bible is more like a notebook than a bible. It is an excellent summary of information about hand tools and how to use them, and of lathe work. No remarkable new ground is broken here, but the material is complete and written from a depth of experience. The book is so English it has a section on marine borers. No Englishman ever wrote a book about woodworking without a short discussion of the problem of marine borers, a prime concern in a country of sailors. You'll have to remember that a rabbet is called a "rebate" and "stopping" is either plastic wood or putty.

When the author turns to machine tools, he runs into problems. The words "shaper" and "drill press" occur only once. There is very little about adjusting a band saw and nothing on the truly desperate problem of keeping a jointer cutting true.

His second book, *How to Build Your Own Built-In Furniture*, is an elementary version of *The Woodworker's Bible*. Over half of it is devoted to explaining the use of hand tools, glues, making joints, the application of materials, and a little section on upholstery. Then it plunges into the business of building in bookshelves, cabinets, and something called a "simple fire surround"—a conglomeration of shelves that "surrounds" an electric log and provides all sorts of convenient storage. Blandford is great on using dovetail joints and sturdy mortise and tenon connections on his built-in furniture.

Blandford is obviously a skilled woodworker with much experience with hand tools. He tries very hard to give the rest of us the benefit of his knowledge and strikes a blow for good workmanship. And we should be grateful. Unfortunately, many things are a bit out of date. He is not quite up on glues and varnishes, and not really up to reference standards on the range of tools that woodworkers in this country use.

—Cary Hall

Instant Furniture by Peter S. Stamberg. *Van Nostrand Reinhold, 450 W. 33rd St., New York, N.Y. 10001, 1976. $7.95 paper, 160 pp.*

Instant Furniture attempts to reduce the problem of making furniture to its simplest terms. It consists of step-by-step drawings and photos of 34 pieces of furniture, all built from standard lumberyard widths of No. 2 common pine. Most of the pieces are constructed from slabs with cross-rails for stiffness, or from trusses that look like stockyard gates. The joints are simple butts and laps, glued and nailed.

Such a technique makes it impossible

their trunks rising through the plane on which we live, and their branches and leaves towering above our heads, trees span the three levels of Man's experience." These words describe the symbolic importance of trees in the cultures of the world. *The International Book of Wood* successfully presents the world-wide impact of trees and their products. It's written in encyclopedic form—the contributors and advisors are mainly anthropologists, archeologists, historians and forestry experts. Only one woodworker, the popular English writer Charles Hayward, is represented.

This book is a broad survey, with sections covering architecture from grass huts to churches and temples, ships from dugouts to modern resin-wood systems, and transportation from dogsleds to airplanes. Furniture and wooden objects are also discussed. There is little detailed presentation of woodworking techniques, but facts large and small about wood nearly overflow from the pages. For example, we learn that Chinese ships had water-tight bulkheads 2,000 years before they appeared in the West and that this may be related to the internal walls of the material they used—bamboo.

The book is illustrated with hundreds of drawings and excellent photographs in two and four colors. The detailed exploded views of musical instruments, wooden ships and houses have a life of their own, and often show important construction details, though with little explanation. An experienced woodworker can pick up many useful hints from them. The density of the material is astonishing. A single page might have five or six examples of furniture, plus drawings showing details and related material on the woods used, with text that discusses the history of the particular use of wood. Much of this may not appear directly useful to the woodworker. But the book skillfully shows how wood has shaped our cultures, history and politics.

The first section of the book covers the chemistry, biology, ecology and harvesting of wood, mostly from the viewpoint of the paper-products industry. The final section, "World Timbers," is the most pertinent for woodworkers. Nearly 150 woods of the world are presented with color samples of the grain, microphotographs of the end grain, drawings of the trees them-to excuse bad design on grounds of elegant materials or rarefied workmanship. When the material, finish and detailing have been stripped away, little remains but design.

Most of the designs in this overpriced book are fully as ugly as you would imagine, despite the ingenuity of trusswork by Stamberg and Enzo Mari, and of an L-shaped shelving module by Kazuhide Takahama. But three designs, all from the legacy of Gerrit Rietveld, are sparkling gems of economy and ingenuity.

Rietveld belonged to the De Stijl movement of artists active in Germany and Holland between 1919 and 1931, and worked at the Bauhaus school. His furniture flowed from the same ideas as the geometric paintings of Mondrian, with whom he was closely associated. He is best known for his red-blue chair and zig-zag chair, classics often found in museums and art furniture books.

From Rietveld, Stamberg selects two small tables and a bookcase and puts them near the back of the book, where they are a welcome relief. The designs are of the deceptively simple, "I could have thought of that," sort—but try and improve upon them. It may not

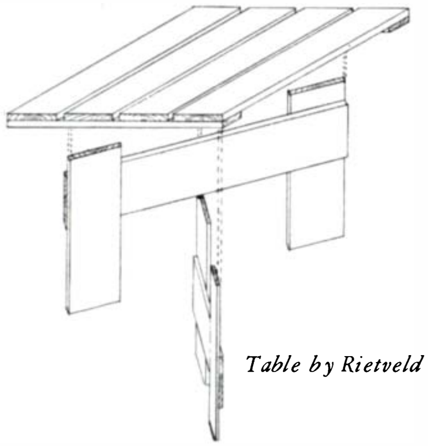


Table by Rietveld

have been Stamberg's intention, but the contrast between Rietveld's three simple pieces and the rest of the designs in the book is a powerful lesson. The good stuff stands alone.

—*John Kelsey*

The International Book of Wood, designed and edited by Mitchell Beazley Publishers Ltd., London, England. *Published in the United States by Simon and Schuster, 630 Fifth Ave., New York, N. Y. 10020, 1976. $29.95 hardcover, 276 pp.*

"With their roots in the ground,

selves, and descriptions of the tree, wood, technical properties and uses, all in a compact and accessible format.

—*Irving Fischman*

The Pine Furniture of Early New England by Russell Hawes Kettell. *Dover Publications, Inc., 180 Varick St., New York, N.Y. 10014, 1949. $12.50 hardcover, 480 pp.*

Country Furniture by Aldren A. Watson. *Thomas Y. Crowell Co., 10 E. 53rd St., New York, N. Y. 10022, 1974. $10.95 hardcover, 263 pp.*

Early American Furniture by James M. O'Neill. *McNight Publishing Co., Box 2854, Bloomington, Ill. 61701, 1963. $11.96 hardcover, 163 pp.*

Colonial Furniture Making for Everybody by John Gerald Shea. *Van Nostrand Reinhold Co., Inc., 7625 Empire Dr., Florence, Ky. 41042, 1964. $14.95 hardcover, $7.95 paper; 214 pp.*

Furniture of Pine, Poplar, and Maple by Franklin H. Gottshall. *Bonanza Books, 419 Park Ave. South, New York, N. Y. 10016, 1966. $3.98 hardcover, 111 pp.*

Country Furniture of Early America by H. Lionel Williams. *A. S. Barnes and Co., Inc., Box 421, Cranbury, N. J. 08512, 1963. $7.95 hardcover, $4.95 paper; 135 pp.*

These six books represent the range of information available to woodworkers who wish to make country-style antiqued pine furniture. I'll discuss them in the order that I would buy them, my favorite first. In sum, I'd recommend Kettell's book, *The Pine Furniture of Early New England*, as an invaluable reference for the experienced craftsman who wishes to work out his own designs. The beginner who needs detailed project plans should start with O'Neill's *Early American Furniture*. And any serious woodworker will enjoy Aldren Watson's excellent *Country Furniture*.

Kettell's book was first published in 1929; my copy is a 1956 reprint that is still in print. It contains 229 black and white photographs, many full-page, of early American pine furniture and 55 working drawings. The pieces are arranged in chapters or groups such as "wall boxes," "chests" and "mirrors." Within each group, the photographs are arranged to show the evolution through time of each type of furniture. Kettell's photographic records of weathervanes and shop signs are especially unusual and interesting.

In the opening chapters, Kettell describes the wood, construction techniques and hardware. Each grouping of furniture is preceded by a well-written introductory chapter, and each photograph is accompanied by a paragraph including overall dimensions. Kettell writes with obvious interest and knowledge of his subject. His style is simple and straightforward. The only thing this book lacks is the approximate or actual date of the furniture shown.

Watson's *Country Furniture* covers many aspects of the country furniture maker's life-style, workplace, tools and techniques. It is beautifully illustrated with over 300 realistic pencil drawings. The chapters "Sawmill to Bench," "Bench Tools and Equipment" and "Woodworking Methods" are at the same time humbling and fascinating to me, a late-20th-century woodworker surrounded by power tools and with easy access to kiln-dried lumber.

There are no furniture plans in *Country Furniture*, but many types of furniture joinery and woodworking techniques are clearly drawn and explained. An illustrated glossary of techniques and tools includes many little-used but interesting terms—annulet, bobbin turning, gunstock stile, cockshead hinge, quirk bead, etc.

Early American Furniture is a furniture project book, with chapters on material, construction techniques and finishing. The author's instructions for a distressed antiqued finish are especially practical and easy to follow. Each of the 24 project layouts includes a full-page photograph, a page of general construction notes, an exploded drawing and a bill of materials keyed to the drawing. The drawings are accurate and easy to read. Several of the pieces appear overly heavy, due to the thickness of the material, and some, such as the fake butter-churn table, seem out of place. But overall, this is the best project book I've seen on antiqued pine furniture.

Colonial Furniture Making is another well-developed project book touching on many aspects of furniture construction. The first section covers Colonial furniture design, with photographs of original antiques and also of modern commercial furniture in the early American style. Altogether Shea provides drawings for about 100 projects, ranging from small stools and boxes to chests, chairs and beds. The drawings are complete and show authentic joinery and solid lumber construction. But this would be a much better book if each plan were accompanied by a clear photograph. Sketches rather than photos leave one wondering if the plan has been tested, and photos are useful to those who want to adapt the piece rather than copy.

Furniture of Pine, Poplar, and Maple contains detailed plans for 34 projects. Gottshall's pine case pieces are designed for 3/4-in. or 13/16-in. thick material and are shown finished without stain or antiquing. These pieces do not have the antiqued appearance I prefer, but the plans are useful for design reference. Many do not include photographs of the completed project, and Gottshall's instructions lack details that would be helpful to a beginner.

Country Furniture of Early America contains 121 photographs of various types of Colonial furniture, plus numerous illustrations, but few are dimensioned. A short descriptive paragraph gives overall dimensions, comments on methods of construction and an approximate date.

—*B. D. Bittinger*

Old Furniture by Nancy A. Smith. *The Bobbs Merrill Co., Inc., 4 W. 58th St., New York, N. Y. 10019, 1975. $12.95 hardcover, 191 pp.*

Nancy Smith has written *Old Furniture* as a lay person's orientation to the history and preservation of old and antique furniture. Her perspective is valuable to woodworkers as an introduction to traditional design and construction details of 17th and 18th-century furniture making.

Old Furniture explains how to gauge the age of furniture through a study of original construction details, such as joinery, fasteners, hardware and finishes. It familiarizes the reader with the effects of time, with examples of warpage and structural changes, finish deterioration and restoration efforts. A furniture collector's perspective on restoration techniques provides basic criteria for determining the quality and craftsmanship of restoration.

Old Furniture is intended as an academic study of antique furniture, so the interested observer may develop a background and appreciation. Detailed information on woodworking, finishing and restoration is best learned from texts dealing with these specific subjects. But Nancy Smith's book is invaluable as the basis for further study.

—*Stephen Smith*

Tim Mackaness of Portland, Ore., is a professional furniture maker and a sculptor; Irv Fischman teaches woodworking in Boston and is about to open his own cabinet shop and school; Cary Hall of Hampton, Ga., and Bill Bittinger of Shelbyville, Tenn., are professional engineers and long-time amateur woodworkers. Cabinetmaker Stephen Smith owns Timberworks Studio in Kansas City, Mo.

Q & A

Questions

How do I prevent warp in a tabletop 4 ft. x 6 ft. x 2 in., composed of boards 6 in. to 8 in. wide running crosswise? The planer will not take out all of the warp and when several are joined, won't the warp be a problem?

—L. M. Hursh, Urbana, Ill.

All the rolltop desks and plans I have seen use canvas-backed slats or wire stringers to fasten the rolltop together. My father insists that in the old days, the wood slats were made to interlock. Is there a method of doing this that would allow the rolltop to follow a complex curve rather than a simple arc?

—Neal L. Burstein, Stanford, Calif.

When resawing 1-in. stock to 1/2 in., it frequently bows quite badly, the resawn surface becoming concave. Why does this happen and how can it be prevented or corrected?

—Dennis S. Kinnel, Seaford, Del.

I am building a French country sideboard from a photograph, and I note the use of what are called *fiche* hinges, which seem to be set in slots vertical to the body of the case, and horizontally into the doors. How do I form these slots and install this type of hinge?

—Daniel Milano, Northport, N. Y.

I plan to install a pine or similar softwood floor and need a finish that does not darken the wood appreciably and has proven durable.

—Richard Haward, Diablo, Calif.

I buy clock movements and install them in cases that I make from Western pine shelving. I finish them with a dark-walnut oil stain and two or three coats of low-lustre varnish. Lately small round specks and short narrow streaks of pitch keep breaking through the varnish, sometimes within a day and sometimes several weeks later. I tried to seal in the pitch with shellac and with clear lacquer but I can't see any improvement.

—Harold Kauffman, Houghton, N. Y.

I carve birds in various hardwoods and finish them to match the natural color of the bird. I would like to find a natural finish for vermilion wood that prevents the original color from darkening.

—Kenneth Carl, Williamsport, Pa.

How do I finish a butcher-block kitchen countertop? I desire something to seal and protect the wood yet be nontoxic. The top is birch, glued with plastic resin.

—Van Wagner, Trenton, Mich.

I have several old hand-carved chairs that have about half of the rounds loose at one end only. How can the tight end be loosened without damaging the round? I want to reassemble the chairs with quick-setting epoxy, hoping to produce a strong joint.

—P. F. Ulmer, Indianapolis, Ind.

Answers

To *Roy Ashe*, who had trouble inlaying brass strips into walnut: James Bamborough of Holland, Mich., says a furniture company where he worked tested a variety of adhesives and settled on a modified white glue called "Adhesive AB," made by Franklin Glue Co., 2020 Bruck St., Columbus, Ohio. Make sure the brass is clean and free of oil, he advises. John Burns of Washington, D. C., suggests "Weldbond" glue, made by Frank Ross Co. of Cleveland, Ohio. Finally, William Bader of Asheville, N. C., a master marquetarian, writes that the old-timers roughened the surface of the brass and rubbed it with the juice squeezed from a fresh clove of garlic. Says Bader, "Great care must be taken not to touch the surfaces with your fingers. Then hide glue will hold it."

To *Roland Norton*, who finds that a linseed-oil finish isn't durable enough for a dining-room table: Several readers argue that since varnishes contain linseed oil, Norton can simply wash the table with turpentine and apply the varnish of his choice, directly on top of the oil. For a linseed-like glow, gunstock finisher Bob Powelson of Dorena, Ore., recommends Fletco brand "Varathane Plastic Oil;" buff the top coat with 4/0 steel wool.

Furniture finisher George Frank of New York City disagrees, advising that the linseed should be removed completely before refinishing with a modern polyurethane varnish. To remove linseed oil, Frank says, "soak the wood with lacquer thinner and wipe off with a clean rag. Repeat several times, until the thinner has nothing more to dissolve, using a small, stiff brush to reach into corners."

Frank continues, "The success of your refinishing depends on how clean the wood is. Scrub it down thoroughly with water and brown soap or laundry detergent. This may leave the grain slightly raised, so use 80 or 100-grit sandpaper to make it smooth again, and brush off the dust.

"The pores of the wood are still sheltering minute particles of the old finish. I wouldn't attempt any further cleaning; I would rather seal them in there. For sealer, use a well-diluted solution of your new finish, or use commercial shellac, orange for dark wood and white for light, diluted one part to four of alcohol. Let dry 24 hours or more, sand through 120 and 150, and you are ready to apply new stain and finish—the wash coat of shellac won't interfere with either."

Labels on polyurethane varnish usually warn against applying over shellac, but manufacturers advise that this is because a thick coat of shellac under varnish is liable to chip readily, taking the varnish away with it. There will be no problem with most varnishes if the shellac coat is thin and sanded well.

However, some professional finishers report varnish peeling off in sheets when applied over shellac. This problem is most common with the "moisture curing" variety of polyurethane, which sets by chemical reaction with water vapor in the air and is very sensitive to impurities. The answer is to use a dilute solution of the varnish itself as a wash coat.

To *W. Dalton*, who needs a finish for cups and mugs: Alan L. Sweet of Shelbyville, Ky., recommends pure tung oil. He says, "It is extremely resistant to alcohol, citric acid, soap and plain old water. . . It's pure to food and has been used for years by commercial canners as the coating inside tin cans."

To *Charles Alger*, on repairing fancy old picture frames: Elwin T. Hirte of St. Paul, Minn., writes that he presses modeling clay or warm paraffin over the existing decorative molding, and allows it to cool in position. "After cooling it releases well and produces a very good mold that retains all the detail of the decoration. I then use a wood putty such as "Durham Rock Hard," mix it into a stiff paste and spread it into the clay mold using an artist's palette knife. Peel off the mold and you should have a perfect duplication of the missing part, which can be fitted and glued in place and finished to match."

To *A. R. Zigan*, who is struggling to strip casein-base paint from poplar baseboards: John Greenwalt Lee of Annapolis, Md., cites a research paper delivered in 1972 by Prof. Seymour Z. Lewin: "A combination of the enzyme trypsin (available from biochemical supply houses and relatively inexpensive) and monosodium dihydrogen phosphate, dissolved in water, softens casein paints and allows them to be brushed away, no matter how old the paints may be." E. A. Franks of Silver Lake, Ind., says he has successfully used "Bix" furniture-stripping solution (Bix Manufacturing, Plumtrees Rd., Bethel, Conn. 06801).

To *James B. Patrick*, who is searching for alkanet root, an old-time orange-red stain: Furniture finisher George Frank says you can get the color you want with oil-soluble aniline dyes, which can be dissolved in oil, lacquer thinner or turpentine. "However, if you insist on alkanet root, your best bet would be to shop in herb stores. Specify the Latin name of the plant, which is *Alcanna tinctoria*. You may be able to get the root or the dye extracted from it."

To *D. K. LeCount*, on gluing oily woods like lignum vitae and cocobolo: Joseph Ponessa of Moorestown, Pa., says, "Try various solvents to see which is best at cleaning each wood, judged by the residue left on the rag. Ethyl alcohol, for example, cleans teak better than methyl or isopropyl alcohol do. Then use white glue." William Bader of Asheville, N. C., says the old-timers used a thin lye wash and rinsed the wood with water before gluing.

Tim Schmitz of Craigmont, Idaho, has had success with cyanoacrylate "super glue." David Powell of Northampton, Mass., uses Franklin's "Multibond C," first washing the wood with acetone to remove the oils.

Medieval woodworking

Often, with muted anger, I have read statements such as, "The early work, even woodwork, was done by masons or smiths" in relation to the construction of buildings in medieval Europe (*Fine Woodworking*, Winter '76, p. 44). This type of writing shows ignorance of the guild structure of the Middle Ages and perpetuates the misguided attitude that masons were the only skilled craftsmen of the time.

The reason medieval woodworkers have remained unrecognized is twofold. First is the natural lack of durability of wood. Moisture, fire, sunlight, fungus and molds destroy wood; changing styles, personal preferences and progress lay waste to even the best and most beautiful fabrications. Second, Gothic cathedrals seem to have a group of romantic admirers who have no idea how the works were built.

The Gothic cathedrals of Europe are the product of many lifetimes of labor, structures built to glorify God and to remain forever. We see the huge masses of stone and the brilliant sunlit windows, little realizing that without wood and woodworkers these structures could not exist. Every cathedral has a wooden framework to support the watertight roof; unprotected, the stone would now be rubble. To lift and bear those great stones, scaffolds, frameworks and supports had to be made and fitted before the first stone was laid in an arch or vault. These scaffolds were built of wood by the medieval carpenters.

The tradesmen of medieval Europe were tightly organized into guilds, which received charters directly from the Crown. Each was limited in the type of work that could be performed. To say a mason would work in wood is to say a modern electrician would do plumbing. Violations of guild charters meant severe fines or even charter revocation. *The History of the King's Works*, (Her Majesty's Stationery Office, London, 1963) states, "All we know of the medieval craftsman suggests that it was very rare for a master mason, however eminent, to dictate to a master carpenter or vice versa. Each was supreme in his sphere and solved his own problems in accordance with the traditions of his own craft."

By 1400, the midpoint of the Gothic period, a woodworker in London could be a member of any of the following guilds: the carpenters, carvers, cofferers, joiners, sawyers, turners or upholders—not to mention the arkwrights, coopers, wheelwrights and shipbuilders. Compare this to the masons, the only guild to work with stone, a medium used only when permanence justified the additional labor and expense.

—*Stanley Niemiec, Pleasant Gap, Pa.*

ADDENDA, ERRATA

"Questions & Answers," page 32, is devoted to readers' questions about cabinetmaking and furniture finishing. Up to now all the answers have been provided by interested readers. In this issue, we supplement answers about finishing with the experienced views of George Frank ("Elegant Fakes," page 70). And next issue, master cabinetmaker and designer A. W. Marlow will join Frank as a consulting editor to field questions about cabinetmaking.

Frank became a furniture finisher in his native Hungary and in France, and for many years owned a cabinet and finishing shop in Manhattan. Marlow, of York, Pa., began making fine reproduction furniture during the Depression. He's written five books on cabinetmaking, and today he's recognized as one of the finest American artisans. Between them, these two have about a century of experience.

We welcome readers' questions, and we'll continue to publish readers' answers, along with expert advice from contributing editors Tage Frid and R. Bruce Hoadley. Frid, trained in Denmark and a cabinetmaker for almost 50 years, is professor of woodworking and furniture design at Rhode Island School of Design. Hoadley is professor of wood science and technology at the University of Massachusetts in Amherst, and an expert woodcarver in his own right.

Marlow joins the fray here and now by taking issue with the answer in the Summer '77 issue to the problem of finishing holly inlay so it stays white. He writes, "Assuming that the holly is 1/16-in. stringing, the only positive procedure is to finish the piece without stain. Use walnut or rosewood for the primary wood, for contrast. Another suggestion is to use plastic stringing, which is available from Constantine, or if a slight discoloration of the holly is acceptable, stain with a weak solution of sodium bichromate."

Also in this issue, we're pleased to introduce three new regional correspondents, our eyes and ears among woodworkers in their parts of the world. Stan Wellborn, a professional journalist and amateur woodworker ("Painted Furniture," page 48), will keep us posted on Washington, D. C. and environs. Jim Richey of Houston, Tex. ("Two Tools," page 77), is an avid amateur craftsman who'll represent us in the Southwest. Colin Tip-

ADDENDA (continued)

ping, who teaches woodworking and design education at Middlesex Polytechnic, will report from England. Our roster of correspondents already includes three professional woodworkers: Alan Marks in California, David Landen in the South, and Rosanne Somerson in New England.

"Methods of Work," page 18, is reserved for tips and techniques, jigs and gadgets that readers have found useful in their own shops. Send us your idea, along with a clear sketch or photograph from which our artists can draw. We pay for published methods at our regular rates of $100 per magazine page, prorated. And we are always interested in discussing ideas for major articles.

We continue to receive letters about Cary Hall's "The Wood Butcher," (Spring '77). Many readers have praised its refreshing humor, but others have mistaken it for a sneering insult to the amateur craftsman. We accept blame for allowing Hall to be misunderstood—we didn't point out that the butt of the joke was Woodbutcher Hall himself.

The Renwick Gallery's "Craft Multiples" exhibition (Winter '75) continues to travel around the country. From Oct. 1 to Oct. 30 it will be at the City Museum in Santa Cruz, Calif.; from Nov. 26 to Dec. 25, at Allied Arts Association, Richland, Wash.; from Jan. 21, 1978, to Feb. 19, at Laramie (Wyo.) Crafts Guild; and from next March 18 to April 16, at Pensacola (Fla.) Junior College.

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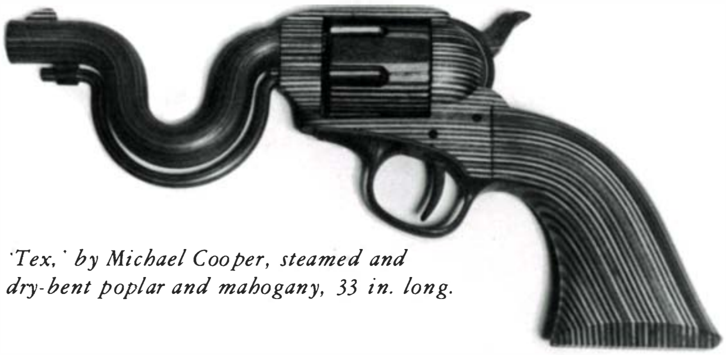
Out West

Diverse woodworking businesses

by John Kelsey



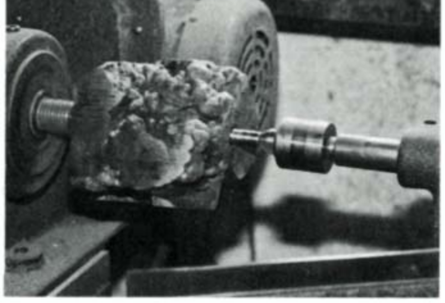
'Tex,' by Michael Cooper, steamed and dry-bent poplar and mahogany, 33 in. long.

In May I spent two weeks visiting woodworkers in California and Oregon. I stopped at 30 professional shops and a half-dozen college woodshops, from San Diego north to Portland, and talked with about 60 craftsmen. Herewith some notes and observations:

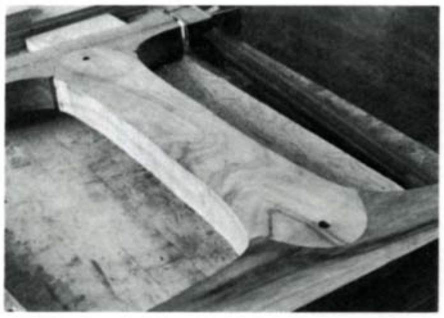
Since California was settled relatively recently, it has little of the traditional English and American Colonial cabinetmaking so common in the East. I met only one reproduction cabinetmaker. On the other hand, many colleges teach woodworking and young craftsmen from across the country have gone west to settle. The colleges I visited emphasize design, sometimes at the expense of careful craft. Students and teachers seem eager to explore sculptural solutions to furniture problems and produce exuberant and fanciful work, but many also rely exclusively on table saw and router joinery.

The only plentiful tree in southern California is eucalyptus, but nobody has found a way to work it. The wood is very hard and it twists and checks ferociously. Therefore most wood is imported, and cabinetmakers use exotic hardwoods as readily as they use woods from the eastern states.

Hap Sakwa, 26, of Santa Barbara, solves the wood problem by haunting new subdivision sites to salvage the roots and burls of the scrubby manzanita and ceanothus that grow on the hillsides. He saws the roots into blocks and turns lovely little weed pots, which he sells wholesale to gift shops.



Sakwa's steel dowel centers a burl.



Jim Sweeney makes curved closed bridle joints with precise router jigs.

Sakwa turns the wood green, lets it dry, and re-turns to finish. He accepts the inevitable checking as part of the design. His trick is to drill the hole for the neck of the pot first, in the rough-sawn block. Then a steel dowel, countersunk to receive the tailstock, goes deeply into the hole. This transfers the stresses of turning to the bulk of the block and allows him to turn a delicate neck without breakage.

John Kinsey and Gerry Morris are also production woodturners, with a thriving business in Sacramento called "The Turning Point." Their fortunes turned 18 months ago, when it became popular to restore the city's dozens of Victorian-era houses. Kinsey and Morris reproduce posts for porches, stairways and bannisters, all in clear redwood and ready to paint, priced by the running foot. One of their lathes can handle a post 18 ft. long, and they've recently bought an automatic lathe with which to manufacture stools and chairs.

Jim Sweeney, 31, is a mathematics graduate of M.I.T., a meticulous craftsman and a genius with router and shaper jigs. His curved bridle joint, above, would be almost impossible to make by hand. He got into woodworking six years ago, by entering the low bid for building office furniture for a ladies' fashion house in San Francisco. Now he rents shop space at the back of the renovated warehouse the clothier uses as corporate headquarters, and with his three employees has built most of the furniture in the place: conference tables, dress racks, filing cabinets and about 50 desks.

Sweeney figures the arrangement hasn't cost the clothing firm any more than it would have spent by having a decorator do its headquarters, and he suggests that other woodworkers could find a similar niche with a crafts-conscious corporate patron.

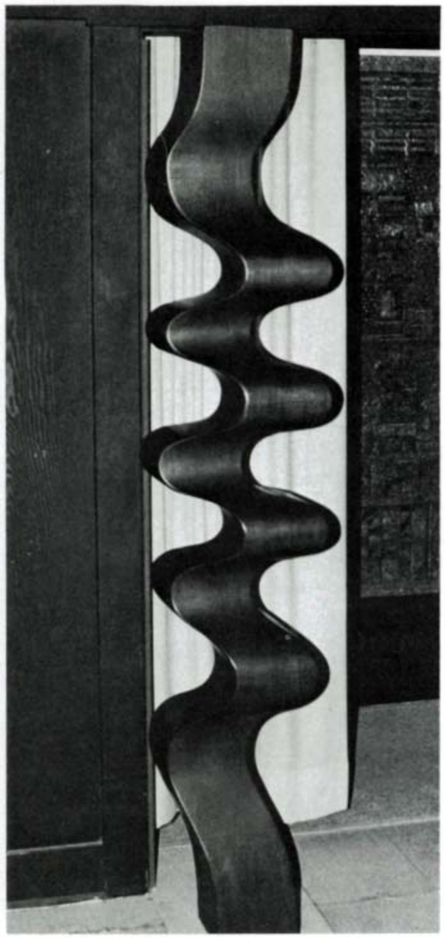
Michael Cooper, 33, teaches furniture design at De Anza College, near San Jose. This job gives him the income and time to make sculpture in the shop behind his home. His forte is bent lamination; he figures he can make in wood any shape he can conceive. He uses an amazing assortment of home-built clamps and forms, applying pressure with threaded rod, eyebolts and wing nuts, twisted rope and strips of inner tube. Cooper's shop is one of several I've seen that includes a metalworker's milling machine, which he uses for making precision parts as well as for wasting away large amounts of wood. But most of his shapes, as in

Detail of knockdown bed by Dick Cross.

''Tex,'' left, are hand-formed with rasps and files.

Dick Cross, 45, manufactures a line of modular children's furniture based on a simple knockdown joint, opposite page. He used to sell it at a Saturday crafts market in downtown Eugene, Ore. This spring he was able to open an attractive gallery called ''Made in Oregon,'' which features his beds and displays the work of 60 local craftsmen, most of them woodworkers. The summer traffic of browsers has been brisk, Cross reports, and sales have been increasing at an encouraging rate.

Jan de Swart, 72, of Los Angeles, is a furniture maker and sculptor who works mainly in wood. His favorite tool is the band saw; with it he makes wood seem like clay. He's been at it for so long that technique has become automatic, and the band saw a handy tool for sketching ideas. The photo below is of a man-high sculpture cut from a single square beam of redwood. What de Swart cut away on the right, he glued on at the left; what he cut from the back he glued at the front. Nothing but the kerf is wasted, and the beam is made to undulate.



Band-saw sculpture by Jan de Swart.

Steam Bending

Heat and moisture plasticize wood

by William A. Keyser, Jr.

Ever wonder how old bentwood furniture parts were made or how ribs for boats are formed? Probably by steam bending. This process uses steam or boiling water to plasticize the wood so that it can be bent, usually over a form or mold. Upon cooling and drying, the bent piece retains its shape. The distinct advantage of steaming is that the grain of the wood follows the curve, thus eliminating the short-grain problems associated with bandsawn curves.

Of course a lamination, i.e., several thin pieces glued together in the curved position, will also do the job. But there is something nice about one integral piece of wood making the bend, with the grain following the curve. The time required to resaw and surface all the laminations is saved, no wood is lost to saw kerfs and ugly glue lines don't surface if the bent piece is subsequently carved or shaped. Also, a lot fewer clamps are required.

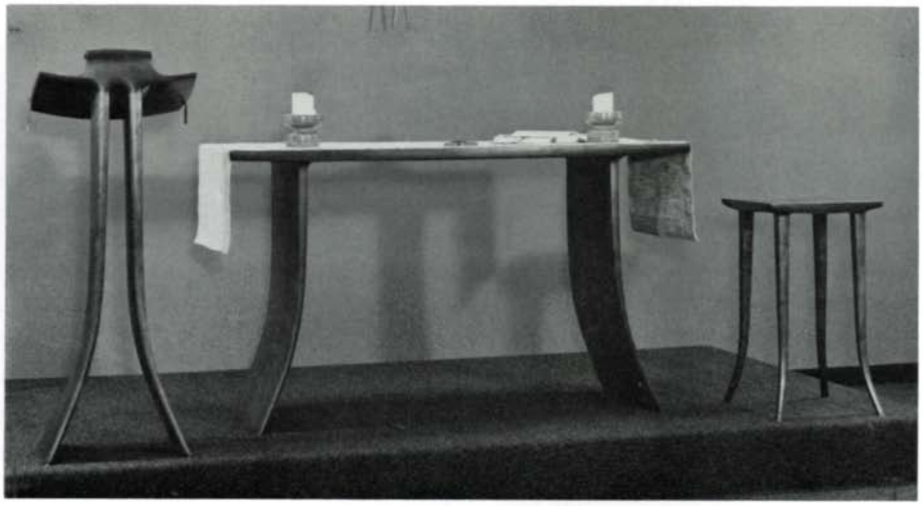
Steam bending has shortcomings. The most troublesome is accurately predicting springback. A laminated member will conform very closely to a mold; the greater the number of laminations, the less it will spring back. In steam bending the results depend upon the grain structure of each piece of wood. Local eccentricities—knots, checks and cross grain—will affect the final curve much more than in lamination, where the process itself tends to homogenize the structure of the member. This disadvantage becomes critical when exact duplicates must be made. Also, some breakage or rejects can be expected in steam bending. If ten pieces are required, bend twelve or thirteen.

When deciding whether to steam-bend or laminate, reason it out this way: If the member must start precisely at some point *A*, negotiate a specific curve and end up exactly at point *B*, and do so repeatedly, the odds are better if you laminate. If the relative positions of *A* and *B* are not critical, or if their relationship is maintained by the rest of the structure and if there is some tolerance in the path taken from *A* to *B*, then the integrity of a single piece would justify steam bending. Where either process is appropriate, the material and time saved in steam bending by not resawing settle the question.

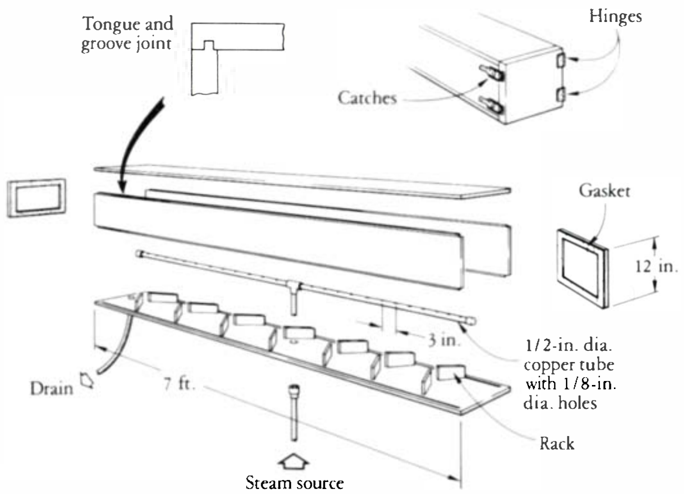
The piece of wood to be bent is placed in a closed container or steam box and bathed in steam generated by boiling water. The steam gradually softens the structure of the wood and makes it flexible. The wood is then forced around a mold and clamped in position. The outside circumference of the wood must usually be reinforced with a metal strap. The shape of the mold is determined by the curve desired, with due allowance for springback. The bent piece is either left clamped on this mold to cool and dry, or it is immediately placed on a separate jig to hold it in position during drying.

When the piece has cured and is removed from the mold or drying jig, it usually springs back slightly. With luck, it now

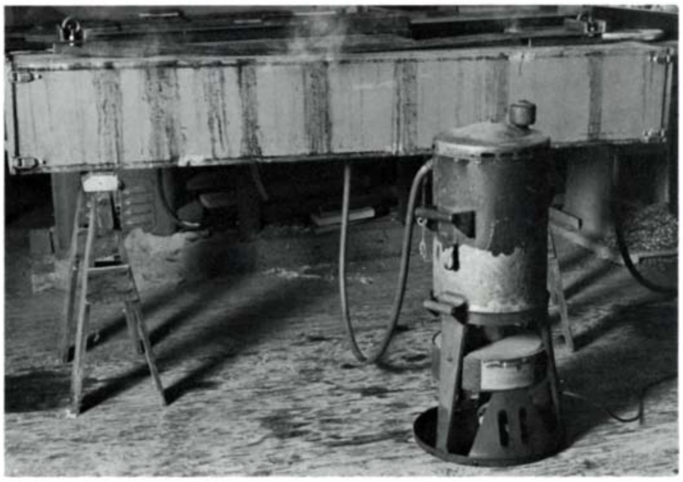
Bill Keyser, 41, is professor of woodworking and furniture design at Rochester Institute of Technology. He's currently writing a woodworking textbook.



Ark at Interfaith Chapel, University of Rochester, is 8 ft. high and made of steam-bent teak angled and then joined edge-to-edge to create the shell's compound curve. Pieces bent off-the-corner become legs of small table in chapel at Geneseo, N. Y.; plain bends joined edge-to-edge support altar and lectern.



Keyser's steam box is made from one sheet of ordinary 3/4-in. plywood and is supported on sawhorses.



Wet steam for bending can be generated in a variety of ways. Keyser uses a kerosene-fired wallpaper steamer.

coincides with the desired curve. Machining, cutting of joints and shaping can then be done on the bent piece of wood.

When wood is steamed, the heat and moisture soften its fibers and allow them to distort with respect to one another, thus permitting the piece to bend. Steam at 212° F warms the wood and whatever moisture is already in the fibers; the moisture in the steam supplements the initial moisture content of the wood, especially in those fibers near the surface. Apparently, pressurized steam doesn't help much; in fact, there is some evidence that it makes the wood brittle and is detrimental to successful bending.

It's important to make sure the steam is saturated with moisture. Bubbling the steam through a trough of water or leaving some free water lying in the bottom of the steam box will ensure this. Generally, the wood should remain in the steam for about one hour per inch of thickness. Steaming for longer periods of time doesn't increase the bendability much.

Generating steam

Steam can be generated in a variety of ways; I use a kerosene-fired wallpaper steamer. Electrically heated versions are available from Warner Manufacturing Co., 13435 Industrial Park Blvd., Minneapolis, Minn. 55541. Local paint and wallpaper stores often rent them. The steam-generating units from home sauna baths can also be used. One unit, the Hot Shot Model MB4L, is available from Automatic Steam Products Corp., 43-20 34th St., Long Island City, N.Y. 11101. A lidded 5-gal. can with a filling cap and a hose fitting brazed or soldered into the lid also works well. It can be heated on a large camp stove, plumber's furnace or open fire.

The steam box can be made from one sheet of 3/4-in. exterior fir plywood, either C-C, B-C or A-C grade, depending on how much you want to spend, with the best face toward the inside of the box. You could use marine exterior grade, but it's not necessary. Tongue and groove the corners, or butt and screw them. A manifold can be made from 1/2-in. dia. copper tubing drilled with 1/8-in. dia. holes every 3 in. Introduce the steam through a hose adapter and tee midway along the length of the manifold, to equalize distribution. A drain hole for the condensation should be provided at one end, with a hose adapter to carry the water to a floor drain or outside the shop. A rack or some other method of supporting the wood above the manifold should be provided so the wood doesn't lie in the condensate. I use blocks of wood screwed to the bottom and angled toward the drain end of the box. A coat or two of porch and deck enamel or marine paint, inside and out, will preserve the steam box for years. Assemble the bottom and two sides, install the manifold, drain and rack, and paint the interior surfaces before putting on the top. Use a good waterproof glue and brass screws at the corners. Both ends should have hinges, gaskets and catches. Thus, the box can be loaded from either end if short pieces are being steamed, or very long pieces can be run right through the open-ended box and the gaps stuffed with burlap or rags to contain the steam. When the box is supported on sawhorses or on a permanent stand, slant it slightly so the condensate runs toward the drain.

Selecting wood

Some species of wood steam-bend better than others. I've found that white and red oak, walnut, ash, hickory, pecan and beech bend well. Cherry is not quite as good, and it's just barely possible to bend teak and mahogany. Softwoods do not bend well. The tables below show the relative bendability of various species, expressed as a percentage of unbroken pieces, and the limiting radii of supported and unsupported bends in 1-in. stock. Such tables have been compiled to guide industrial users and are only approximations—the craftsman's best guide is experience.

Bendability of Domestic Hardwoods	% Unbroken Pieces
Ash	67
Beech	75
Birch	72
Elm, soft	74
Hackberry	94
Hickory	76
Magnolia	85
Maple, hard	57
Oak, red	86
Oak, white	91
Pecan	78
Sweetgum	67
Sycamore	29
Tupelo	42
Walnut, black	78

U.S. Forest Products Laboratory, *Wood Handbook: Wood as an Engineering Material*, 1974.

Limiting Radii of Curvature (in inches for 1-in. stock)	Supported By Strap	Unsupported
Afrormosia	14.0	29.0
Alder	14.0	18.0
Ash	4.5	13.0
Beech	1.5	13.0
Birch, yellow	3.0	17.0
Douglas fir	18.0	33.0
Ebony	10.0	15.0
Elm, white	1.7	13.5
Hemlock	19.0	36.0
Hickory	1.8	15.0
Mahogany	36.0	32.0
Oak, white	0.5	13.0
Oak, red	1.0	11.5
Spruce, Sitka	36.0	32.0
Teak	18.0	35.0

W.C. Stevens and N. Turner, *Wood Bending Handbook* (Princes Risborough, England: Forest Products Research Laboratory, 1970).

Industrial research has also found that air-dried wood at a moisture content of 15% to 20% is best for steaming. But I have bent some species of kiln-dried wood at 8% to 12% MC with good success. If difficulties arise and the wood seems too dry, try soaking it in water for a day before steaming. The added moisture is absorbed mainly by the fibers near the surface and will evaporate quickly when the heated wood cools.

Stock for bending should be selected for straight grain and must be free of cross grain, knots, checks and other defects. I have found that flatsawn stock bends better than quartersawn; that is, the annual rings of the board should run parallel to the mold, as closely as possible.

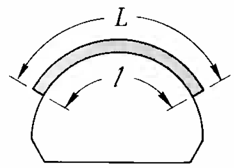
Preparing the stock

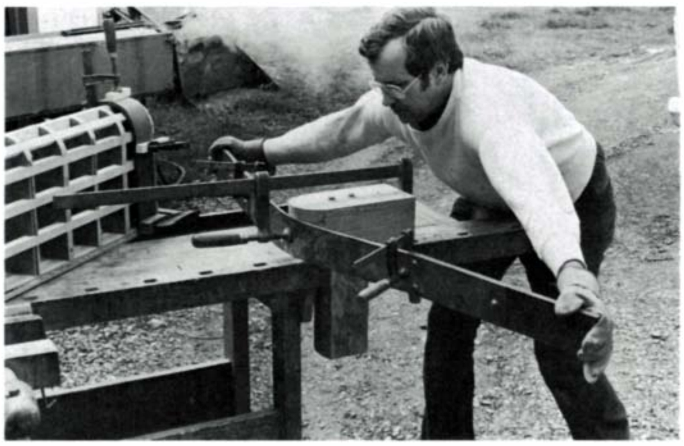
It is best to place the heartwood side of the board on the inside of the bend. The board should be jointed and thicknessed, but usually not to finished dimension, particularly if the stock is thick. With cross sections 1-1/2 in. x 4 in. and larger, it is best to leave a little extra stock so the final profile can be sawn or otherwise worked to final form after bending. But having the stock smooth on four sides before bending prevents cracks and splits from propagating from a surface irregularity such as sawmill or circular-saw marks. A small chamfer, perhaps 1/16 in., on all four edges of the stock also helps prevent splits from starting at points where the grain might be slightly crossed. On thin stock or where curvature is not great, I sometimes presand the parts before bending. Although steam raises and sometimes discolors the grain, at least the mill marks are gone and all that is required after bending is light scraping and final sanding.

The piece of wood to be bent should always be several inches longer than the desired finished length. During bending the ends frequently are distorted and these defects can be cut off later. An end coating (such as that used around kilns, or ordinary oil-base paint or roofing cement) spread on the end grain before presoaking or steam bending prevents excessive absorption of moisture and subsequent end-checking during drying.

It is usually better to cut joints after the piece is bent; however, I have cut mortises and tenons before bending where they occurred on the straight portion of a member.

In any bend, the distance *L* around the outer convex side of a curve is longer than the distance *l* around the inner concave side. Ordinarily, when stock of length *l* is bent around a curve the outer fibers stretch (or go into tension) to attain the addidional required length (*L-l*). Wood plasticized by steam will stretch only very slightly before fracturing (failing in tension), but it can be compressed to a much greater degree. The fibers in compression slip, compress, bend and distort without failing. Therefore, the objective is to begin with the plasticized stock at length *L*, prevent the outer convex fibers from stretching (going into tension), and force the inner concave fibers to compress (and therefore shorten to length *l*). This is done by fitting the outer surface of the stock with a heavy steel strap securely welded or bolted to steel end blocks. Assuming the strap does not stretch as the wood is bent, the end blocks push against the inner fibers, compressing them to length *l*.





Wood fits tightly against strap between solid steel end blocks, which extend outward from small clamps to provide leverage. Then assembly is clamped to center of mold to prevent initial buckling and quickly pulled around. After setting for 15 minutes, wood is clamped overnight to drying jig, left.

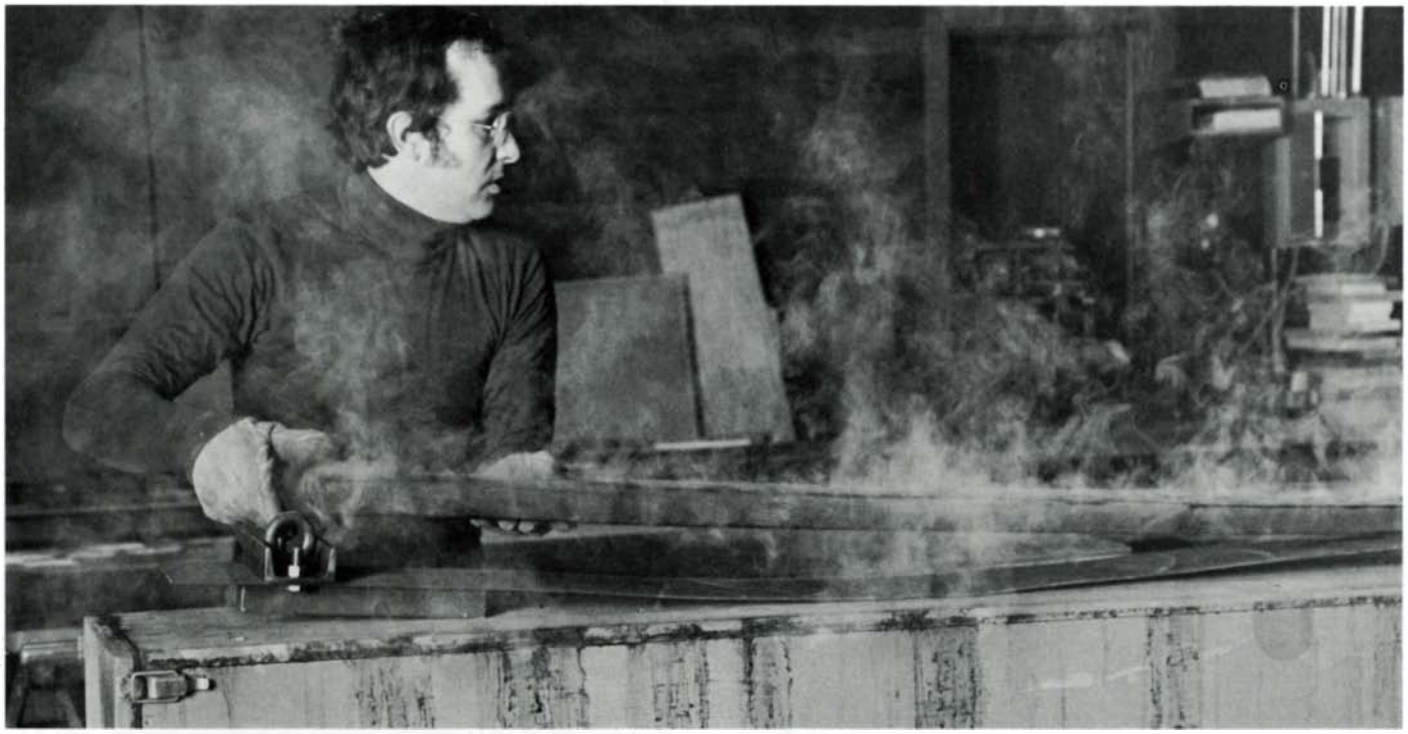
Straps and molds

I use 16-gauge cold rolled steel for straps on stock up to 1/2 in. thick, 1/16-in. hot rolled steel for stock 1/2 in. to 1 in. thick and 1/8-in. hot rolled steel for stock 1 in. to 2 in. thick. I make end blocks from angle iron or channel iron at least 1/4 in. thick, or solid steel bar stock when available. Don't underestimate the amount of force the end blocks must withstand when bending heavy stock. Frequently the force is great enough to bend the angle iron. Welding corner blocks behind the angle iron helps prevent this.

The strap must be wide enough to cover the full width of the stock being bent, and end blocks must be large enough to cover the entire end of the piece. When bending stock thicker than 1 in., I fasten each end block to the bending strap with at least three 1/2-in. dia. bolts. When I buy the strap material, I get it long enough to accommodate quite long stock. Then I can redrill the holes and rebolt the end blocks to reuse the strap for other bends. Chemical reaction with the steel strap will discolor the surface of most woods. Discoloration is usually removed in subsequent shaping and finishing, but if it is objectionable, use stainless steel straps or cover them with polyethylene sheeting.

The plasticized wood member must be bent around a mold. This mold must be very strong, must support the full width of the bent piece and must accommodate some clamping arrangement for drawing the wood around the curve. A male mold is always used, so that it will support the inner fibers of the bent wood. I make many of my molds from discarded telephone-pole crossarms (about 4 in. x 5 in.) glued into a blank and bandsawn to shape. Stacked 3/4-in. thick fir plywood or laminated 2-in. construction lumber also works well. Regardless of construction method, strength is the key word, because incredible forces can be generated in bending a piece of wood around the mold.

It is important to allow for springback when shaping the mold, so that after the bent part is released it assumes the intended shape. Only experience will teach how much to overbend in compensation for springback. Among the variables are the nature of the curve, thickness of the wood and species. Usually the more gentle the curve, the more one must compensate. It seems that the more the fibers on the concave side of the member are displaced, the less they spring back.



Keyser puts the hot wood into the strap, which has been warming atop the steam box. A clamp at each end secures it to the heavy channel-iron reverse levers, tight against the end blocks. Speed is essential; do a dry run to make sure mold, clamps, tools are handy.

When making molds, I work from the full-size drawing of the piece and guess at the amount of springback. I cut the mold, bend a trial piece and then revise the mold if necessary.

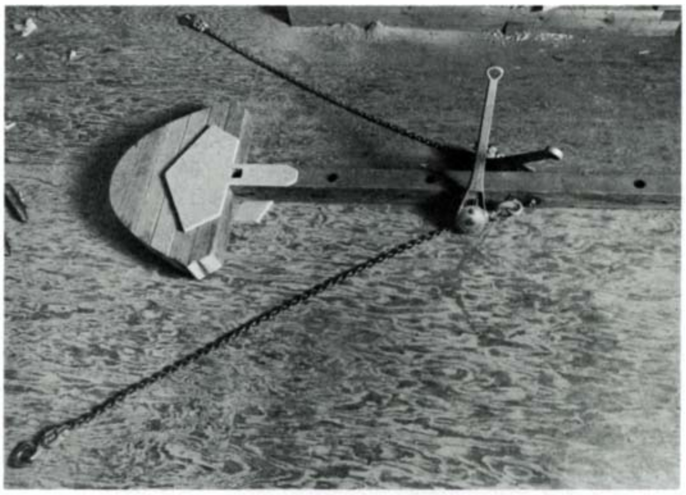
If only one piece is to be bent, the strap and wood can be left clamped to the mold for a day until the piece cools and dries thoroughly. If several pieces must be bent, it saves time to construct a drying jig. This allows you to bend, remove the clamp and strap after about 15 minutes, and clamp the wood onto the drying jig. This frees the bending strap and mold for the next piece to be bent.

I usually allow one day per inch of thickness (or fraction thereof) for the bent piece to cool, dry and set before removing it from the mold or drying jig.

Bending in one plane

The simplest bend is a single curve in one plane. In bending a 1-1/2-in. x 5-in. x 56-in. piece of walnut around a 10-in. radius mold, I've used a giant cross-bow arrangement. Be careful with this method; don't take a chance on lightweight equipment failing and recoiling. I use two 1-ton heavy-duty chain hoists for the job. The wood is removed from the steamer and placed between the end blocks of the bending strap, which has been warming on top of the steam box. The strap is secured to the wood by a clamp at each end, then the strap and wood piece are aligned and clamped to the center of the mold. This is important because as bending progresses, the wood will try to pull away from the mold at the tangent point and will immediately crack if not clamped tightly there. Continue to wind the chain hoists and pull the piece around the mold as quickly and smoothly as possible, until the bend is complete. You have only a few minutes to work, for the longer the bending operation takes, the more the piece cools and dries, and the greater the risk of failure.

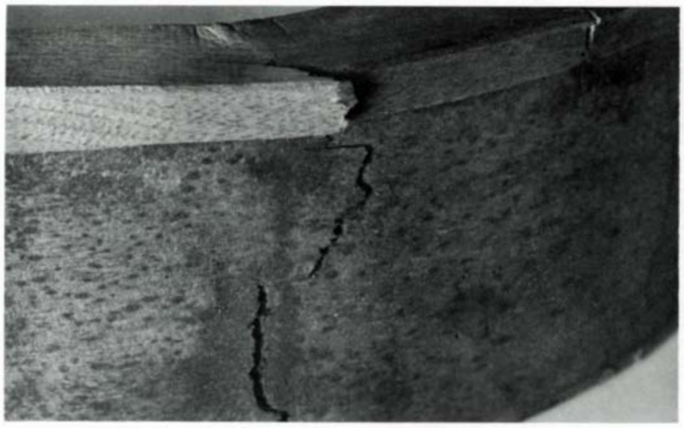
When the curve is this severe, the compressive forces against the end blocks become great enough to overturn the

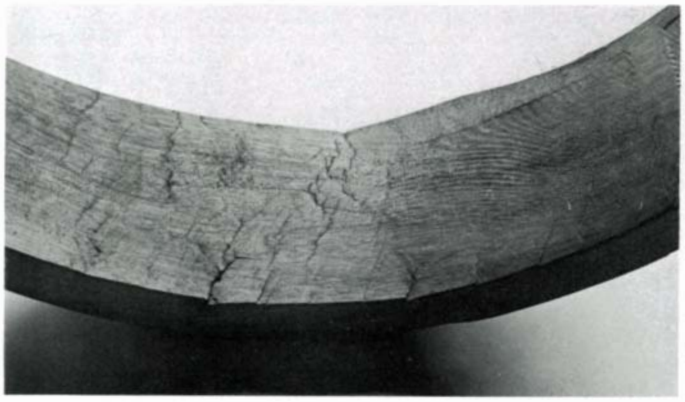


Cross-bow mold is made from telephone-pole crossarms and fitted with one-ton chain hoists. Center clamp at base of mold and two more clamps hold wood firmly in place as hoists pull it around.

Bend is complete. Enormous compressive forces are apparent in slight curve away from mold's ends, despite heavy reverse levers.

After two days on mold, wood still springs back, left. Bar clamps, right, shackle bent pieces to minimize further springback.





Catastrophes: Tension failure, top, indicates loose or overturned end blocks and too-narrow strap (discoloration); compression failure, bottom, occurs when bend is too tight or wood is too plastic.

steel blocks and allow the strap and wood to recurve away from the mold. To counteract this tendency, a reverse lever made from heavy channel iron is bolted through the strap to the end block. This lever, pushing against the back of the strap, prevents the end block from overturning.

In good weather and when a helper is available, the mold may be staked to the ground and a car or truck used to pull the bent piece around the mold. The steamed piece with the strap in place is clamped to the mold on one end of the curve, and the other end of the strap is fastened to a tow chain. The advantage is that the piece can be pulled around very quickly; the danger is that lightweight chains can snap and recoil.

A few cautions are in order; live steam is dangerous stuff. The steam box and steam generator should not seal tightly, to avoid building up pressure inside. You must be sure the generator doesn't run dry and burn up. Wear heavy gloves when handling the steamed wood, and when opening the box, beware of scalding your face in the blast of steam. If you wear glasses, the steam will fog them.

Failures

Much can be learned from pieces which have failed during bending. In tension failure, the fibers on the outside surface of the bend simply pull apart. It is the result of reduced end pressure caused by the end blocks not fitting tightly against the ends of the wood or distorting during bending. The outer fibers go into tension instead of the inner fibers being compressed. If the bending strap is not wide enough to cover the entire piece of wood, a crack is liable to start at the unsupported edge. Wrinkling, or compression failure, occurs on the inner surface because of over-plasticization, too tight a bend or a bad choice of species for the particular bend.

Bends without a strap

Bending without a strap and end blocks is possible only when the curve is slight or the stock is very thin. I have found that the difference between the lengths of the outer and inner faces of the bent piece should be less than 3%, although this varies from species to species. For 1-in. stock, the minimum radius I would bend without straps and end blocks is about 33 in. Bends made without straps are less stable and more springback can be expected. The bends are not as predictable for duplication because complete distortion of the fibers has not taken place and the "memory" of the wood cells will straighten it out. I seldom bend without a strap.

For shallow bends, or when stock is very thin, bending can be done without a strap. The steamed wood is clamped directly to a combination mold and drying jig such as the one shown above.

Complex curves

Bending a single piece of wood in a reverse, or S, curve or bending in two planes requires only a more complicated mold and strap. The principles remain the same: the strap must follow the convex side, or outside, of each portion of the curve, and end blocks must force the wood fibers on the inside of the curve to compress. Extensions of the end blocks, welded or bolted to the strap, provide handles to help in pulling the wood around the mold. Then it is clamped in place and left to set.

Bending off the corner

Table or stool legs can be bent off the corner by using a 1/2-in. x 1/2-in. x 1/8-in. angle iron as the bending strap. It fits over the outside corner of the steamed piece. Near the ends, the strap is fortified by welding on short lengths of a larger-size angle iron, to which is welded the solid steel end blocks. The small angle iron is flexible enough to bend around a gentle curve. The bending mold is made of two pieces of solid wood bandsawn to the desired curve, with the bandsaw table tilted 45°. The steamed stock is placed in the bending strap, the strap and stock are inserted under a shackle at the end of the bending mold and then the piece is simply forced around the mold and clamped.

Further Reading

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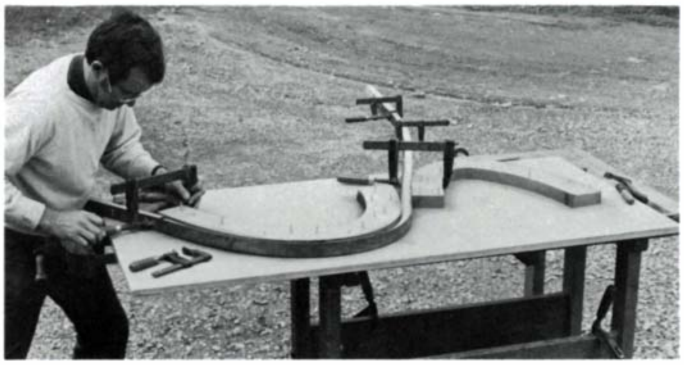
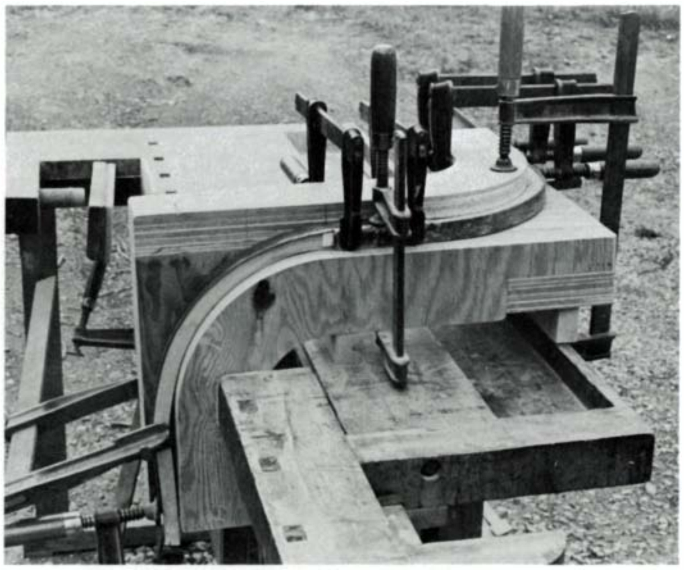


For a reverse curve in one plane, strap iron is fastened to each portion of mold where curve changes direction. Steamed wood is clamped at end blocks, then to mold, and quickly pulled around. End blocks are angle iron, backed up with hardwood fastened by bolts.



For a bend in two planes, ends of two pieces of strap iron are overlapped at right angles and welded edge-to-edge—in effect, forming a few inches of angle iron at point where curve changes direction. Three clamps hold overlapping iron and hot wood to mold; end blocks and handles are lengths of tee iron welded to straps.

Off-the-corner strap, left, is welded from two sizes of angle iron. Steamed wood fits tightly between end blocks, is tucked under shackle on mold, and forced into place, above. After 15 minutes it is removed, placed in drying jig, and clamped with the aid of blocks notched at 45°.

Triangle Marking

A simple and reliable system

by Adrian C. van Draanen

Suppose you are making half a dozen drawers. You have cut all the pieces for them, and they are neatly stacked up. Your next steps are dovetails and grooves for the bottom. As you pick up a piece, you can probably tell whether you are holding a front, side or back. But can you tell which way is up, or which is the outside? Can you tell the left sides from the right? If the drawers are of different sizes, can you find matching pieces without remeasuring?

If you can answer "yes" to all these questions, you must have an adequate system for marking your work. If not, I'd like to suggest the triangle method.

Textbooks ignore marking. One is often advised to "mark the face," or "mark the top." But a particular method is never mentioned, and it is left to the worker to adopt or develop a system. Hence the use of lines, letters, numbers and other devices.

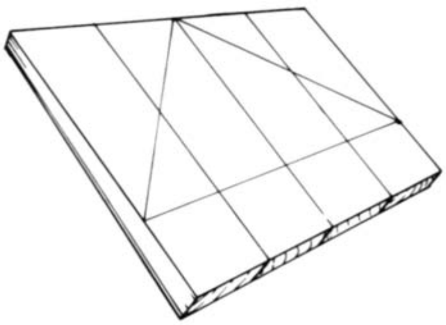
European carpenters and cabinetmakers use a system that employs a triangle, and nothing else. This system is widely used, and it is taught in trade schools. But it doesn't seem to be known outside Europe.

The rules of the system are:

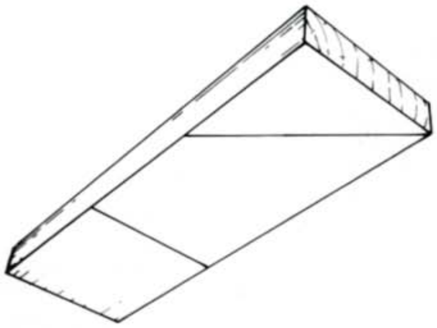
—the triangle is an isosceles triangle and it must point up, or away, from you;

—each piece of wood must have two lines of the triangle on it.

Here is a glued-up panel, marked according to these rules:

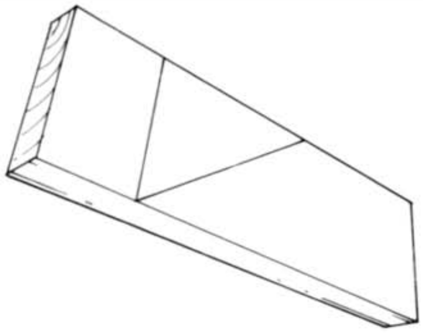


It is possible to take away each piece and put it back in the same place later. And each piece can immediately be identified. If, for instance, you were holding this piece,



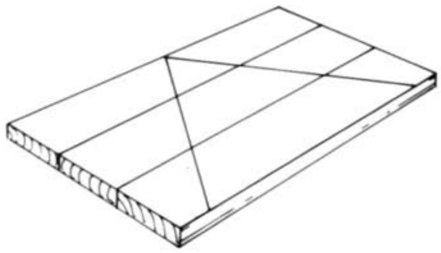
you would know right away that it is an inside piece, located to the left of the center of the panel.

If you had picked up this piece, you



would know that you were holding it upside down. You would also know that it is the rightmost piece of the panel.

A glued-up tabletop is similar to a panel that has been rotated 90°.

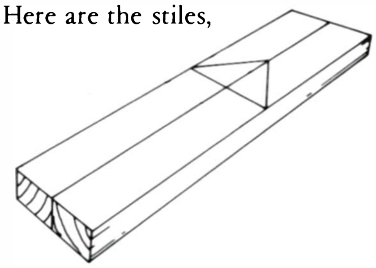


You may draw the base of the triangle on the tabletop, but it is not required and in practice it is never done. Look at each board and you'll find two lines, the two sides of a triangle that points away from you.

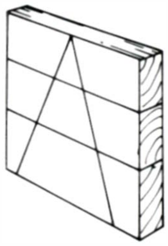
Now we have marked a panel and a tabletop. You can mix all the pieces any way you like and you can always put them back together. Each piece can be identified as either part of a panel (a vertical construction, because the base of the triangle is drawn at right angles to the sides of the individual pieces), or a tabletop (a horizontal construction, because the base of the triangle is parallel to the sides of the individual pieces). Just two lines give you all this information.

You may say at this stage that your own method is just as simple and foolproof, and you are probably right. Very few constructions are as simple as a panel or a tabletop, though. When the work becomes complicated, as with drawers, the triangle method remains as simple as for the tabletop. Let's consider something that has both vertical and horizontal components, such as a door.

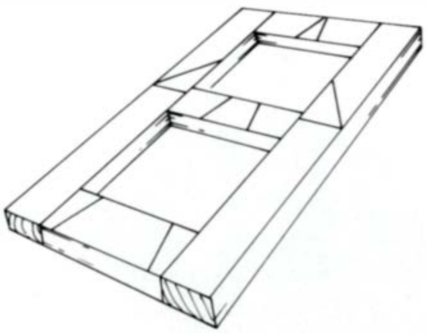
Here are the stiles,



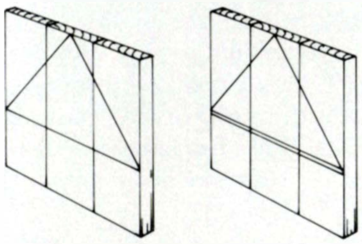
and here are the rails.



The completed door looks like this:

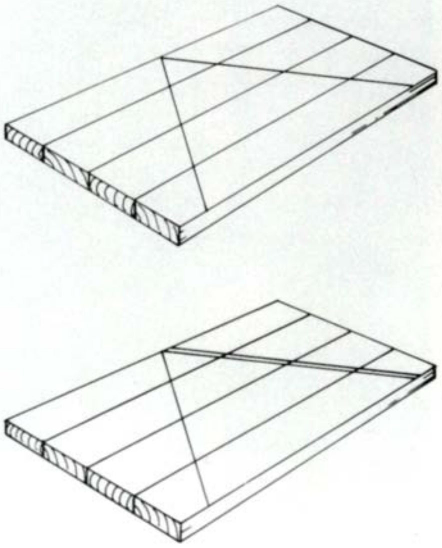


For simplicity the panels have been omitted, but you already know how to mark them. If this door had two panels of equal height, and both were marked the same way, it would be possible to get the pieces mixed up. To avoid this confusion, a double line on the second panel distinguishes it from the first.



The base line on the second panel is the one to double, because it is the only line that is common to all the pieces.

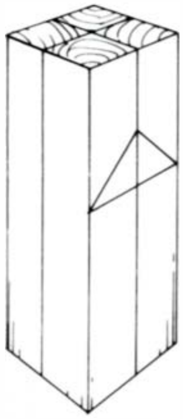
Two identical tabletops would be marked thus:



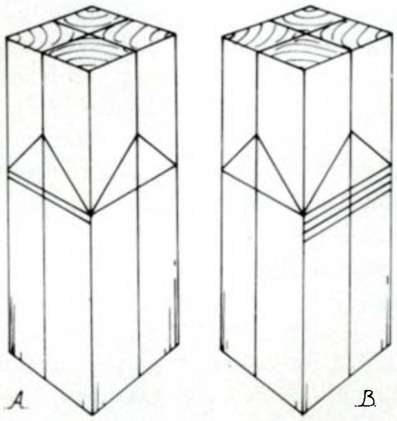
Again, a mix-up is impossible, because of the double line.

So far we have worked only with flat, two-dimensional assemblies. A set of four legs introduces a third dimension. There are front and back legs, left and right, and mortises are worked in the two inside surfaces of each leg.

A triangle drawn across the face of the front legs is clearly not enough.

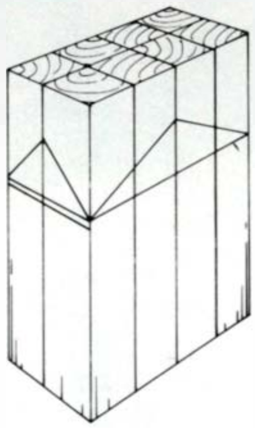


We must mark all four faces of the bundle. Going around clockwise, we draw the second triangle (A), doubling



the base line, as this line is common to the two legs, then the third (three lines) and the fourth triangle (B).

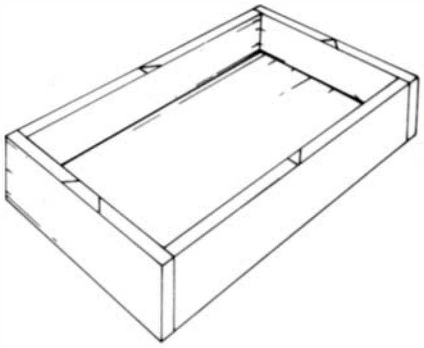
It makes no difference whether the piece has four legs, or more than four



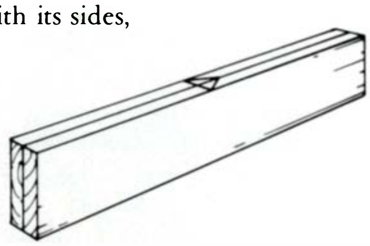
legs; they are all marked in the same manner.

Until now we have marked the sides of the stock, because that was the way the pieces had to be assembled. But in a box or a drawer, the edges, not the sides, are in the same plane; therefore marks are put on the edges.

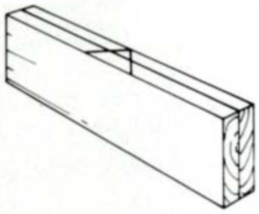
Here is a drawer:

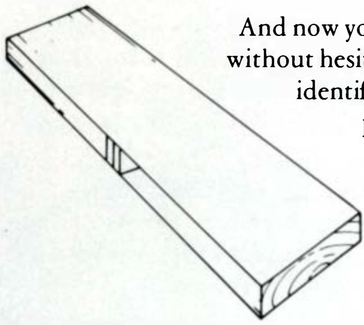


with its sides,



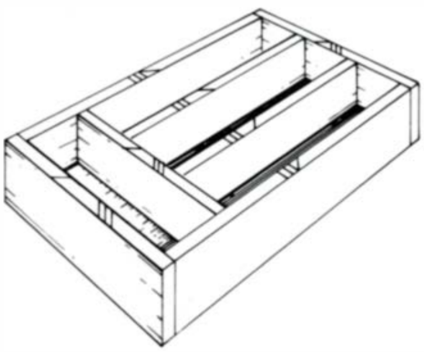
and its front and back.





And now you can without hesitation identify this piece.

It belongs to a drawer. It is the right-hand side of it. You also know which side is the inside, which way is up, and that it belongs to the third drawer.



Adrian C. van Draanen, 49, has worked as a cabinetmaker in his native Holland and in Ottawa, Canada, where he is now a government computer expert.

Painted Furniture

Decorated wood always popular

by Stanley N. Wellborn

Detail: Boston rocker (opposite page).

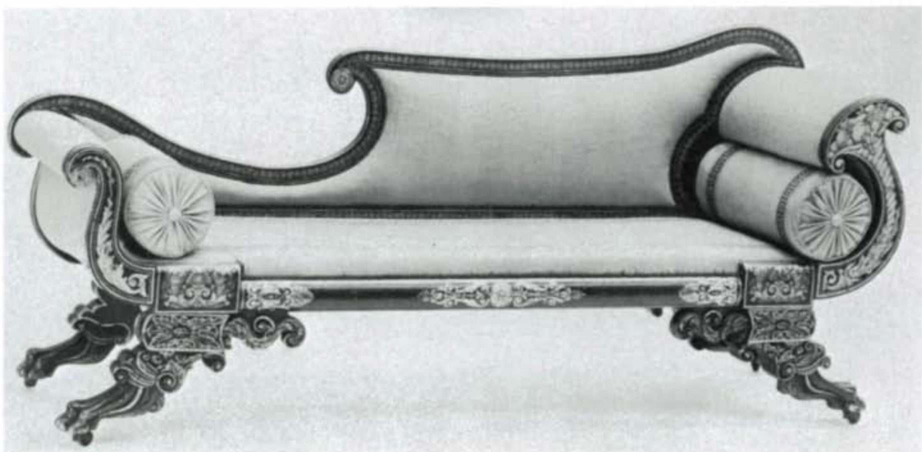
Since Colonial times American woodworkers have used paint, dye, gilding and other surface decoration to enhance the appearance of their products. With the application of attractive finishes, furniture and other objects could be given depth and texture while using less expensive stock having unattractive grain or coloring.

The traditional fondness for the decorated wood surface remains strong among today's craftsmen, and a revival of these techniques by many modern designers is underway.

The results of their work—and a well-chosen sampling of other items going back to the 17th century—is the focus of an exhibition entitled "Paint on Wood" at the Renwick Gallery in Washington, D. C. which continues through November 6. The collection provides a geographic cross section of commercially produced designs as well as folk craftsmanship incorporating the influences of Spanish, German and Scandinavian settlers. Methods range from freehand painting to "japanning," a painstaking process that creates a finish like Oriental lacquer, but is much less expensive. Other items were given simulated grain patterns or stippled with stain and scratch-carved to produce a surface that appears to be embroidered.

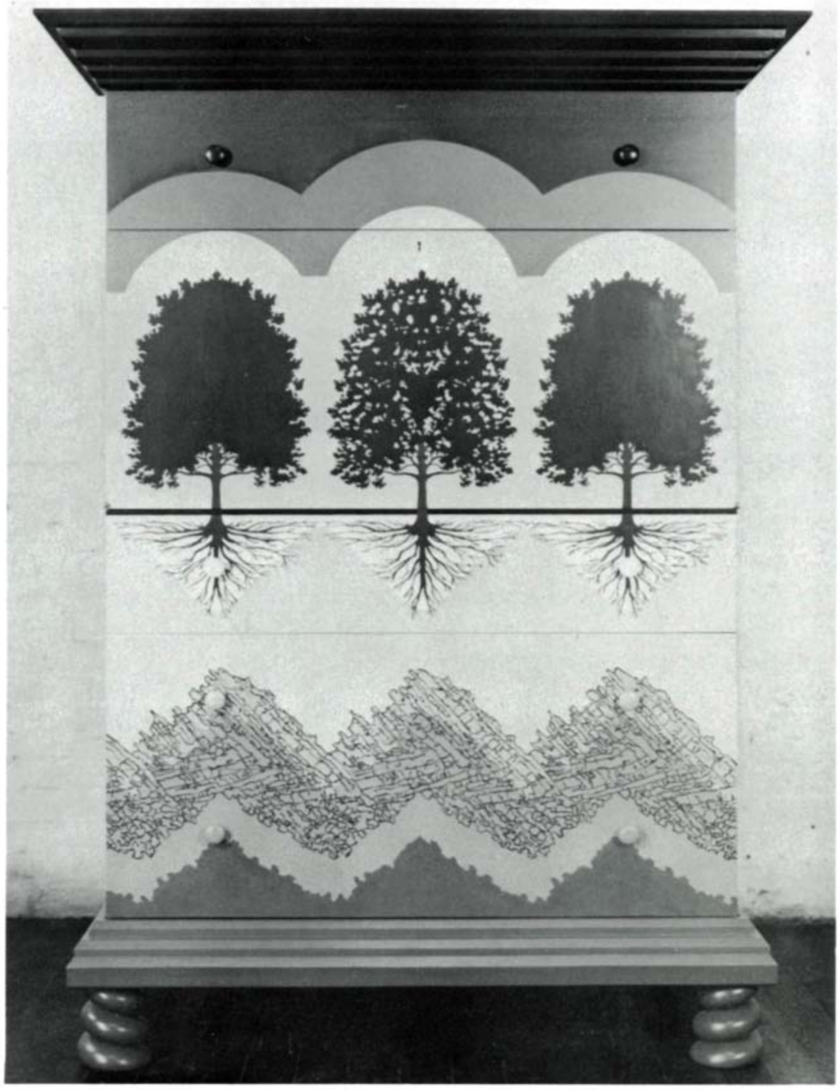
A pine box built around 1835 and found in Maine had been painted and then smoked with a candle flame to produce an abstract image. Another box was painted with an imitation marquetry pattern. A chest of drawers made of pine and maple was painted to appear inlaid with veneer. Unique designs were also produced by feather-graining, marbleizing and low-relief channeling. A highlight of the show is a display of stenciling, a technique widely used in the mid-1800s to produce rich grain patterns and metallic impressions on such items as Hitchcock chairs. Of particular interest to modern woodworkers are the fantasy designs and furniture that combine wood forms with everything from acrylic dyes to automobile finishes.

Representative selections of the 53 items in the exhibit are shown on these pages. An illustrated catalog with some color photos, descriptions of the history and style of each piece and information on techniques is available for $2.25 from the Smithsonian Institution, Washington, D. C.



Top left, New England sewing box (c. 1830), 5 x 12 x 9, maple; hand-lacquered scene on top, with ivory-inlay keyhole. Center, blanket chest (c. 1780), 29 x 52 x 23, yellow pine and poplar; red and white paint on black background. Above, music cabinet (1974), 42 x 23 x 18, by Kate Milner-Wright. Left, Empire-style couch (c. 1830), 33 x 78 x 16, ash, pine, tulip, cherry. Black enamel base is overlaid with gilt bronze.

Above, face chair (1967), 32 x 22 x 21, by Alan Siegel; blue, red and grey enamel over laminated hardwood. Right, 'Maple Mable' chest, 67 x 48 x 22, pine, © 1976 by John Stanley. Top is dark blue; scene progresses through lighter shades of blue to green trees, then moves through yellow, orange and gradually darker hues of red. Below, Norwegian-American cupboard (c. 1870), 73 x 59 x 21, pine. Emerald-blue stippling surrounds areas of natural grain. Norwegian inscription dedicates piece to the birth of a daughter. Below right, Boston rocker (c. 1850), 43 x 23 x 18, maple, pine, mahogany. Seat is feather-grained in beige and brown.



Chain-saw Lumbering

Cut your wood where it falls

by Robert Sperber

I am a woodworker and have always been turned off by the "supermarket" approach to buying wood. In more and more places we must call up and order so many board feet of one kind of wood or another. We have no opportunity to choose a log and tell the mill just how we would like it cut. We can't even pick through a stack. The wood is banded together and we must take what we get. It has always seemed to me that the best way to avoid this situation would be to saw the log myself. Slicing through a log and taking that first peek inside is a great thrill and a wonderful source of inspiration.

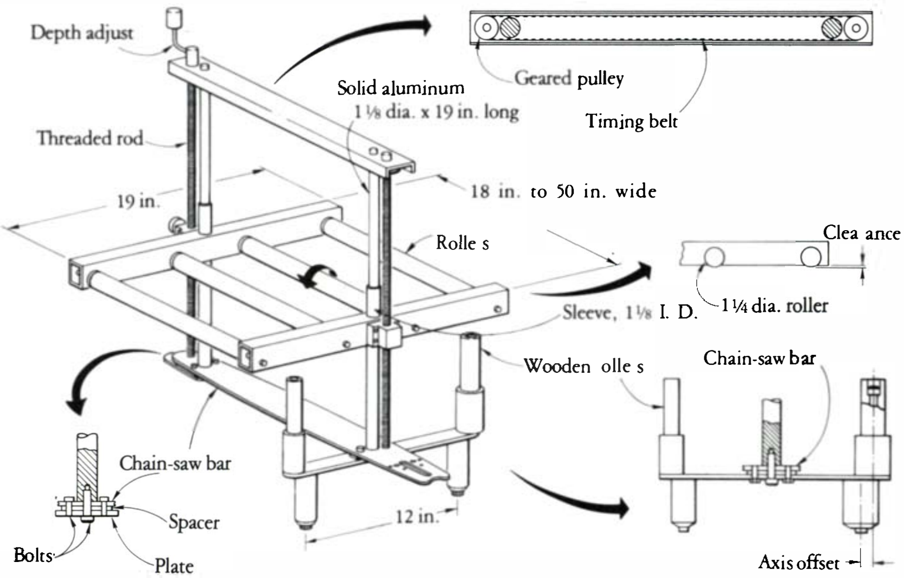
The answer that I found is the portable chain-saw mill. It is the only solution that the individual craftsman can afford. In a few days of hard work I can cut enough wood to pay for the mill. The cutting is done by a saw chain specially ground for ripping (see page 53). Power is provided by one or two large chain-saw engines, with horizontal rollers guiding the cutting bar. There is no need to move the log; it can be cut wherever it has fallen. Rather than the log moving through the mill, as at a sawmill, the operator pulls this mill through the log.

Portable mills have been available for years, although little attention has been paid to them. Many knowledgeable people believe that the portable mill is too slow to be practical. But using the proper procedures, power units and a sharp ripping chain, a well-designed mill will move along at up to 10 sq. ft. a minute, cutting efficiently and well.

Most of the wood I have cut has been either from dead trees or trees that were going to be taken down for some other reason. People are willing to give away a dead tree rather than see it rot. Once the tree has been felled, I must decide where to crosscut it into logs. There is no set rule for this: it depends upon one's needs and interests. You may want to include the crotches, which a commercial mill would cut out and discard. Some of the most interesting patterns are hidden away inside the crotches, and they may be well worth keeping, if the wood is to be used for furniture or turning. The tree is then bucked up into separate logs, and the first one to be cut is rolled to a position that takes advantage of its features. For example, if the log is oval in cross section, placing the long

Author, right, and Edgar Anderson (page 55) mill lumber in woods. Two-man chain-saw mill cuts up to a 36-in. wide board from 1/4 in. to 15 in. thick. Four horizontal rollers can be adjusted up and down.

Distance between cutting bar and rollers shows on scale on vertical rod. Mill with two chain-saw engines weighs about 75 lbs.; ear protection is essential.



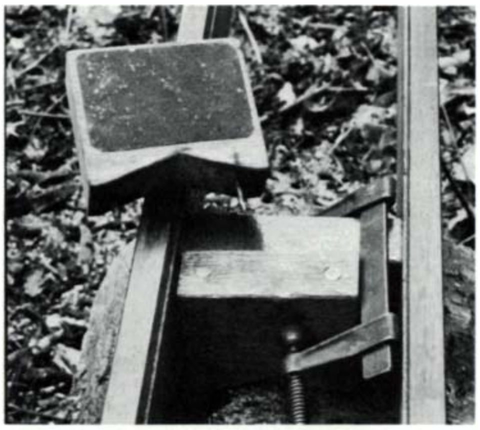


Diagram at left shows principal parts of Sperber's mill. Diagram below shows how home-built slabbing rail guides first cut. Emery-faced vee blocks, detail photo above, are nailed near ends of log, then clamped to rail. Cross-braces are set below rail's surface so clamps don't interfere with rollers.

diameter horizontally yields the widest boards. A knot or crotch in the horizontal plane results in a flame pattern on the board. To get the best pattern from the crotch, the cut should go through both centers on the same pass.

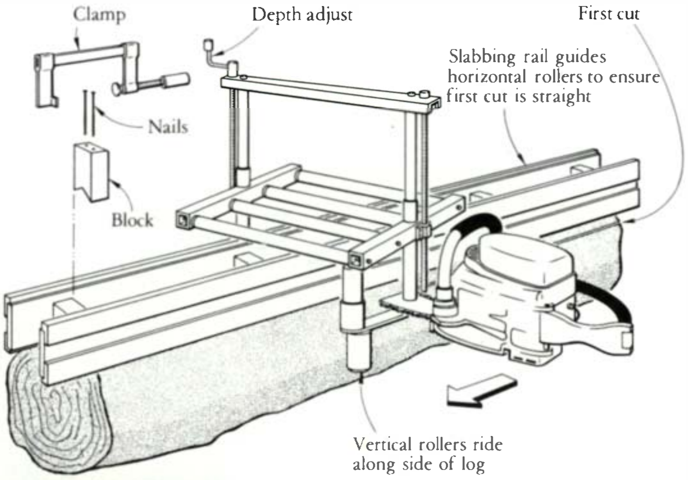
Since a log is irregular, a slabbing rail is used to guide the first cut. This rail, flat on its top edge, ensures that the cut will also be flat. The rail is placed on top of the log and secured by two wooden blocks nailed into the log at either end, with the nails going into the wood about 3/4 in. The rail is then clamped to the blocks with two adjustable clamps.

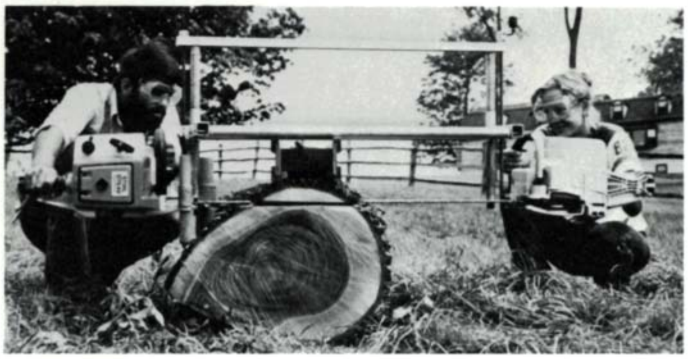
Next, the distance from the top of the rail to where the first cut is to be made is measured, and the mill is set to that dimension. One must be sure that this first cut will clear the nails holding the wooden blocks. The mill is then placed with its horizontal rollers resting on the rail and pulled through the log. It is very important on this first cut to keep the rollers flat on the rail and not allow them to tip to one side. This is not difficult, but some attention must be paid to it.

After the first cut, there is no need to use the slabbing rail, because the mill can roll directly on the flat top surface of the wood. The mill is now set and locked at the desired thickness. For the cabinetmaker 5/4, 6/4 and 8/4 are generally the most useful; for the turner, slabs four or five inches thick might be desirable. The carver might want slabs as thick as 10 inches.

Next the mill is placed on the log and pulled through. As the mill cuts, there is a tremendous amount of side force, which pulls the left-hand engine in toward the log. This pulls the vertical rollers firmly against the log but allows the mill to roll forward. With both front and rear vertical rollers firmly against the log, the mill sits at the slight angle at which it will cut best. As the mill moves along the log, the vertical rollers encounter bumps and depressions. By changing the angle, the side force can be shifted from the front to the back rollers, allowing the mill to move smoothly past these obstacles.

At the end of the log, the mill is pivoted around on the rear vertical roller to complete the cut. This keeps the front vertical roller from rolling off the end of the log, and also keeps the plank from falling onto the cutting bar until the very last second. At this point the bar is almost through the wood and cannot be trapped under the plank. Only when very thick planks are being cut is it necessary to drive a wedge into the kerf to support the plank as it is freed.

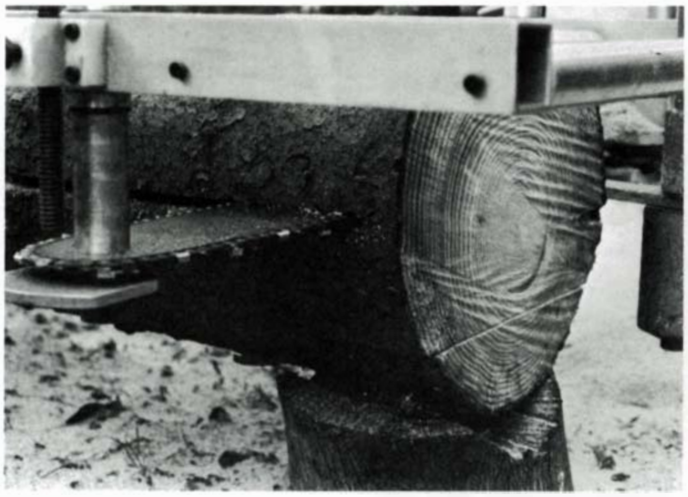




With slabbing rail (end view) in place, first cut is begun.

Chain-sawn lumber is stickered and sheltered to dry in air.

With ends of log resting on vee-cut blocks, Sperber makes bottom cut using one-engine chain-saw mill. Side force generated by engine pulls front and rear vertical rollers against the log. Mill advances at slight angle, at which it cuts best. At end of cut, mill pivots on rear roller as cutting bar swings free.



When making 2x4's or quartersawing, dividing cut stops a few inches short of log end. Then cut is wedged open and mill backed out, to permit 90° rotation of log for next series of cuts. For quartersawing, dividing cut is the first cut, and is made with slabbing rail.

After 90° rotation of log and first cut on top (with slabbing rail), log is square on three sides. Now groups of 2x4's can be sliced off, and separated later. By changing the mill settings, most construction lumber can be cut easily.

When the log has been cut down to a slab about 4 in. thick, it must be lifted up to prevent the lower vertical rollers from jamming into the ground. By the time a log is that small, it is light enough to lift and place a wooden block under each end. I use two 8-in. high blocks with a vee-cut in the top. Then the final cuts can be made.

Flatsawing is only one of the possible uses for the portable chain-saw mill. Sawing construction lumber is another. Anything from 2x4's to 15-in. x 15-in. beams can easily be cut. The length depends only on the length of the slabbing rail.

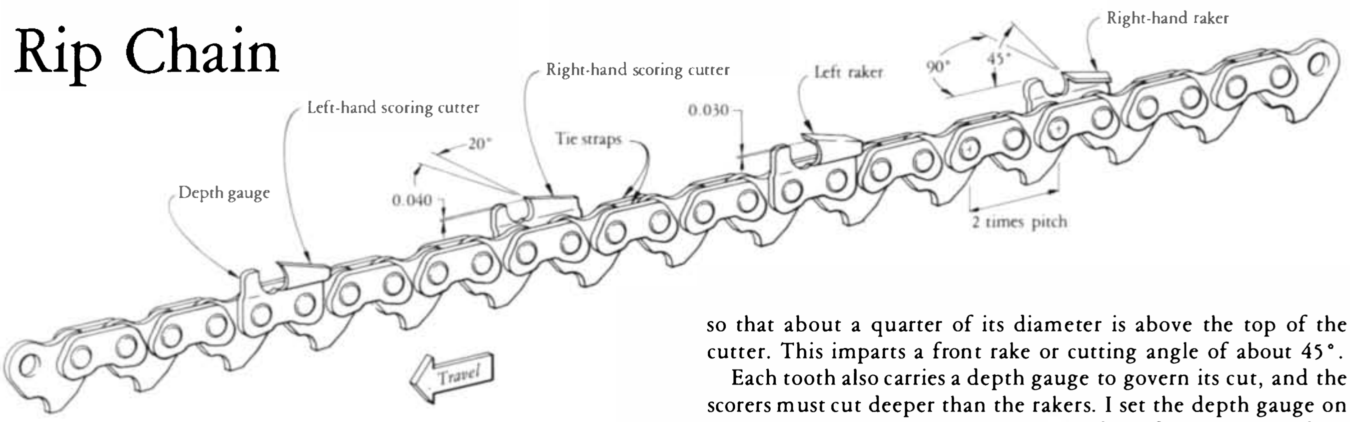
To square a beam or make 2x4's, the slabbing rail is set on the log, as in flatsawing, and the first cut is taken. Next a bottom cut is made (top photo). The log now has two parallel surfaces. If a squared beam is desired, no other cut will be made until the log has been rotated; or if it is to be cut into a number of smaller beams, it is divided into the desired dimensions (4 in., for 2x4's). These dividing cuts should stop about 2 in. short of the end of the log and, with the kerf wedged, the mill should then be backed out of the cut. This allows the log to stay in one piece so that the perpendicular cuts can be made. The log is now rotated 90° and the slabbing rail is once again set up and a top cut is made. Next the mill is set at 2 in. (for 2x4's) and pairs or groups of 2x4's are sliced off, to be separated later. When squaring a beam, once the log has been rotated 90°, a top cut is taken using the slabbing rail and a bottom cut is made to complete the beam.

To quartersaw a log, attach the slabbing rail and cut through the *center* of the log, stopping short of the end and backing out the mill, as in making dimension lumber. Then rotate the log 90°, reposition the slabbing rail and again cut through the center, this time all the way through. Place the halves of the log on the ground, curved side down, and make a top cut. Then split each half in two, leaving the log in quarters. Each quarter is propped up on blocks so that one flat face is horizontal and one vertical. Then make a cut, rotate the log 90° so the other flat face is horizontal, cut, rotate back 90°, cut, and so on. Because of all this manipulation, quartersawing is time-consuming. Unless you begin with a very large log, the boards will be so narrow that quartersawing will not be worthwhile.

The chain-saw mill is safer than the conventional chain saw. Since the chain is always engaged in the log, there is no kickback; if the chain breaks, it simply falls off the sprocket and is trapped in the log. A modern chain saw does not vibrate much, but milling is still a noisy and dusty operation. I always wear goggles and ear protection. I advise wearing a dust mask, particularly if you are working on the side of the mill where the rollers are. Pulling the mill through the log is relatively easy, but positioning the logs and hauling your lumber will wear you out. Chain-saw milling is hot, dusty work. At the end of the day you will be weary and grimy, but you will also have the satisfaction of beginning your woodworking where it should begin, with the tree.

[Editor's note: The mills shown in this article were designed, built, and are now being marketed by the author at Sperber Tool Works, Inc., Box 1224, West Caldwell, N. J. 07006. The 36-in. mill attachment sells for about $500, and for about $1,300 complete with two chain-saw engines. The cost of the small mill is about $450 and $850, without and with engine. Portable chain-saw mills are also made by Granberg Industries, Inc., 200 S. Garrard Blvd., Richmond, Calif. 94804 (pictures on page 54), by Haddon Tools, 4719 West Route 120, McHenry, Ill. 60050, and by Sears.]

Rip Chain

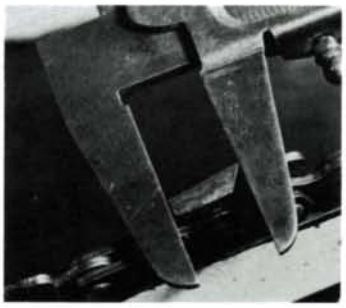


Ripping chain is the key to the chain-saw mill. The chain is designed to allow the fastest possible feed when cutting into end grain, parallel to the fibers of the tree. Chain-saw manufacturers don't make it—it is converted from crosscut chain by manufacturers of portable mills.

Logically, for fast cutting, one wants as many cutters in the wood as possible all the time. But the resistance of end grain is so great that too many cutters just overload the engine and the mill jams. The correct balance depends on the type of wood, size of log and power available. I use the Stihl 075 AV engine (6.7 cu. in., direct drive)—one engine in hardwood up to 12 in. diameter and softwood to 18 in., two engines in larger logs. If a portable mill is underpowered, the chain jams constantly and the work becomes slow and aggravating.

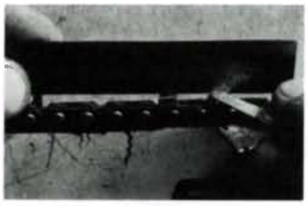
To reduce cutting resistance, skip chain is used. Two tie straps separate each cutter, rather than one tie strap as in ordinary chain. I use chain with .404 pitch, which is the distance between the center of one rivet and the rivet after next, divided by two. Furthermore, the chain consists of alternating pairs of right-hand and left-hand scoring cutters and pairs of raking cutters. As the chain speeds around the bar, a pair of narrow scoring cutters first severs the fibers by cutting a groove at the edges of the kerf. Then a pair of wide, chisel-style, flat-top rakers removes the bulk of the wood. This combination maintains highest chain speed, low vibration, and consequently a fast feed.

As in the diagram, the front edge of the scorers is ground at 20° from a line perpendicular to the face of the sawbar, while the rakers are ground square, at 0°. Rip chain is no more difficult to sharpen than ordinary crosscut chain. The most common mistake is waiting too long between sharpenings—I sharpen at least twice during a day of milling lumber. It's very important to sharpen the cutters uniformly. If one is a little too high it will be overworked, the feed will be slow and the chain may break. It's easy to allow the cutters on one side of the chain to become longer than those on the other side. Then the chain will pull to that side and erode the groove in the sawbar. Soon the chain is traveling so loosely that it flops around as it cuts, leaving the wood rough. I guard against this by checking cutter length with a caliper. If the chain is properly maintained, the surface of the wood will be as smooth as that left by the best circular mill.

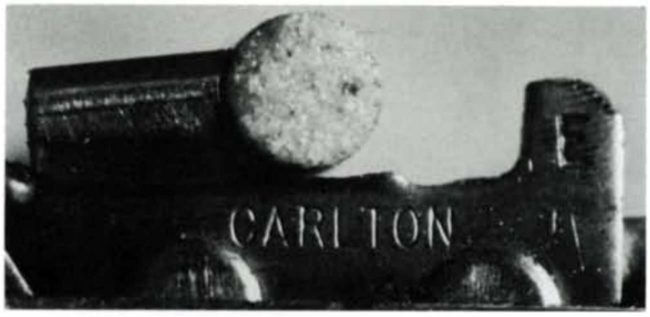


Using a sharpening jig ensures accurate cutter angles and lengths. When I am out in the field I use a hand file, but for no more than two sharpenings before using the jig again. The jig shown at right does a fine job without removing the chain from the bar, and it costs about $18. For about $42 the same jig can be fitted with an electric motor and a grinding stone instead of a file. The electric version is faster, more accurate and worth the extra money. With either method, the file or stone should be set so that about a quarter of its diameter is above the top of the cutter. This imparts a front rake or cutting angle of about 45°.

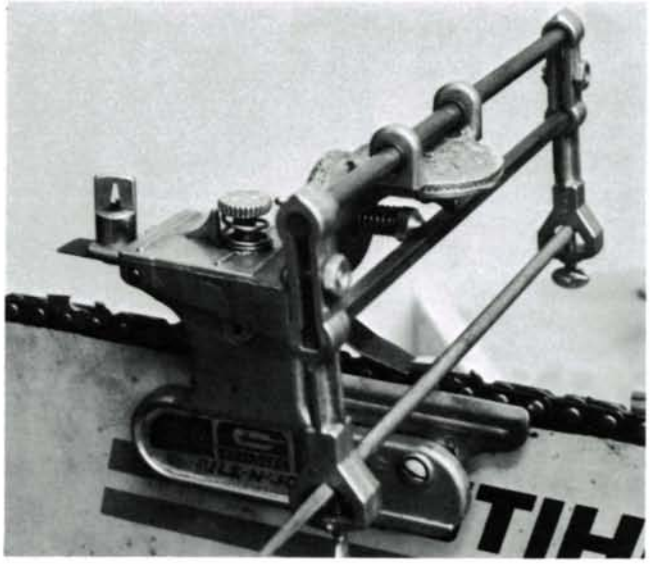
Each tooth also carries a depth gauge to govern its cut, and the scorers must cut deeper than the rakers. I set the depth gauge on the scorers .040 in. below the cutting edge of the tooth, and on the rakers .030 in. below the edge. Sharpening jigs are supposed to file or grind the gauges to the proper setting, but I find that a flat file used freehand and checked with an auto ignition feeler gauge does the best job. Be sure the front edge of the depth gauge remains rounded so it can't grab in the wood.



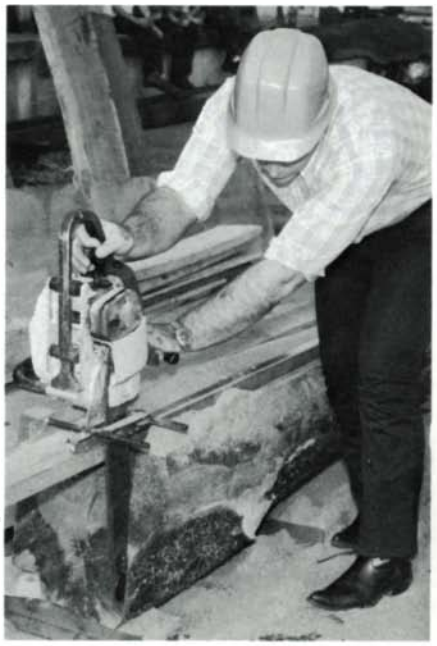
If you are going to use a portable chain-saw mill, you must be able to sharpen the chain yourself. It is impractical to send the chain out from the woods two or three times a day for sharpening, at $10 each time. A hand or electric jig will do at least as good a job as a saw shop. Once you get the hang of it, a 9-ft. chain takes about 15 minutes to make razor sharp. —*R. S.*



Cutting angle of 45° is obtained by setting grinding stone so that one-quarter of its diameter is above cutter top.



Granberg's sharpening jig, about $18, files chain while on bar.



Tools and techniques for milling logs where they fall are ingenious and varied. Above left, Granberg's Mini-Mill chain-saw attachment for vertical cutting (about $50); right, Granberg's two-man Alaskan mill ($350 to $450, depending on size; chain saws not included). Left, Australian machine for cutting eucalyptus logs into railroad ties. The operator straddles the log and steers the whirling blade through the wood, with one wheel on either side of the log. Very few of these tie-cutters still exist; their use is now prohibited for obvious safety reasons. Below left, wedge-splitting slabs off a large chunk. Below right, pit sawing in Honduran forest: two-man teams rip logs into boards to transport to market. Top man raises saw and follows cutting line; bottom man powers downward cut and gets face full of sawdust.

Getting Lumber

Take log to mill, or mill to log

by Joyce and Edgar Anderson

When we started making furniture in the 1950s we could select individual boards from 10-ft. high stacks at the country's largest importer of rare woods. Two men with a forklift truck were willing to pull out from the bottom of the pile two 4-in. x 14-in. x 20-ft. Honduras mahogany planks, or to select one board each of paldao, East Indian rosewood, grenadilla and zebrawood. We could select a 5-ft. diameter walnut log from 20 logs sitting in the yard. It would be cut to our order, air-dried, kiln-dried, planed and delivered ready for use. It was very satisfactory and we would have continued to supply our needs from the lumberyard if our supplier had not started selling in 1,000-board-foot banded lots, discouraging the purchase of smaller, mixed-wood orders.

At that time we were also cutting trees on our property for building our house and studio. With the help of our little bulldozer we towed logs to a ramp and rolled them onto our 1-1/2-ton truck for a trip to the sawmill four miles away. Days later, when the logs had been cut into boards, we trucked them home and stacked them outside until we needed them. Walnut and cherry were further dried inside to become the wall paneling and cabinets. Over the years nearby mills went out of business. We no longer owned a bulldozer and truck, but trees continued to be offered to us so we hired a loader and truck to take logs to a mill 30 miles away. Only trees with very good potential could justify the great expense of hauling.

We learned that the sawyer had very different criteria from ours in judging a "good" tree. His first question was whether we were bringing a backyard or fence-row tree, likely to contain buried metal. Fence-row trees need careful scrutiny. We have found bullets, bolts, rocks, concrete and old socks deeply buried in the wood. Inside a cherry tree, we found a maple board studded with nails, presumably the remains of a tree house. Although such found objects can damage expensive equipment, they can also produce beautiful wood. The blue stain from an embedded hammock hook can extend several feet along the grain and give special interest to an otherwise bland oak plank.

Because transporting a large tree section is so difficult, we have greeted eagerly the other approach of bringing the sawmill to the log. All the lumber we have acquired in the past year has been cut with the portable chain-saw mill. We are convinced this is the most practical way of all to obtain boards from individual trees. The chain-saw rig has proved such popular entertainment that people frequently call to offer their own or their friends' trees. Sometimes the tree owner helps operate the mill and shares in the lumber. Or the owner asks for a couple of pieces from the tree and we do all the cutting. We never take a good live tree that is functioning well where it stands. We have not paid money for any of the trees we have acquired.

We became familiar with an interesting ancestor of the chain-saw mill while working on a craft development program in Honduras. A two-man handsaw 10 ft. long was used in a pit-saw operation, with the logs supported on a log trestle 8 ft. off the ground. The top sawyer pulls up and guides the saw while his helper below pulls down. It is a primitive but fast and accurate way to make lumber. We have also extracted usable wood from trees by rail splitting, wedge splitting, freehand chain sawing and bandsawing.

It is almost impossible to compare the cost of FAS (firsts and seconds, the top grade) kiln-dried lumber from the lumberyard to the cost of green, log-run boards at the sawmill, or to the cost of fresh-sawn planks cut with the chain-saw mill. Some of the factors are not calculable in dollars and cents. And with green lumber one must include the time spent building foundations for the lumber pile, then stacking and stickering the boards.

Costs vary widely from area to area, and the figures below are from people we deal with in northern New Jersey. In the lumberyard, kiln-dried FAS 4/4 red oak now runs about $0.90 per board foot; KD #3 common runs about $0.35. Black walnut is between $1.90 and $2.40 for KD FAS 4/4 and about $3.50 for 4-in. FAS. In some very large yards there is a minimum order (1,000 BF or $500). In others there may be a price difference of $0.15 per BF for quantity increments of under 100 BF, under 1,000 BF, and over 1,000 BF. There may be a surcharge of about 25% to select individual boards.

From the local sawmill, the range is about $0.30 to $0.50 per BF for log-run oak; drier, wider and sometimes thicker pieces command the higher prices. Walnut ranges from $0.75 to $2.00, also depending on dryness and width. Board quality at most mills is not good. It is best to pick up boards as soon as possible after they are cut, to ensure straight planks.

Some mills will also custom-cut trees brought to them. On small orders prices may range from $15 to $20 per hour, and on larger orders from $0.05 to $0.15 per BF. It is unwise to pay an hourly rate if one is not familiar with the integrity of the sawyer and the quality of his machinery; we usually arrange to pay by the board foot. Loading and trucking logs to the mill, and the boards home again, may add considerably to the cost.

The portable sawmill involves a different kind of expenditure: the initial cost of the equipment and the running costs of gasoline and maintenance. The other costs involve time. In one minute, two people operating a double-ended mill can cut approximately six to eight sq. ft. of any domestic hardwood. It takes about a day for two people to slab an average-sized tree. For each day of cutting the chain needs about two sharpenings. In two days two people have cut about 1,300 BF of 6/4 poplar, 700 BF of 6x8's and some firewood. This is about 28 man-hours to cut about 1,200 sq. ft. of wood. Board thickness makes no difference in cutting time.

It seems that over the years we have been devoting more time and physical effort, with less outlay of money, to the business of acquiring lumber. We wonder if some year soon we may find ourselves planting a tree farm.

Joyce and Edgar Anderson, designer/craftsmen for 26 years, give a summer lumbering course at Peters Valley, N. J. Edgar "Shorty" Anderson teaches at Philadelphia College of Art.

Sawing by Hand

Bowsaw is best; keep it sharp

by Tage Frid

A handsaw can replace a machine-powered saw for every cutting operation. The correct use and maintenance of handsaws should be practiced until they are second nature. To saw properly, coordination of the joints in the hand, elbow and shoulder must be achieved. The biggest mistake most people make when using a handsaw is to hang onto it as if their lives depended on it, bearing down much too hard. This makes it hard to start the saw, and once the cut is started, it is difficult to follow the line. A handsaw should lie loosely in your hands. No pressure should be applied, particularly when starting the cut. Once experience is gained, a slight amount of pressure can be applied after the cut is started. Use your thumb as a guide when starting the saw.

There are many different handsaws on the market, and each one is designed for a special purpose. Handsaws are sold by length and by the number of points—a six-point saw has six teeth per inch.

The bowsaw, scroll bowsaw, offset dovetail saw and rip panel saw are the saws I have found most useful in my many years as a cabinetmaker. I don't like and would never buy a backsaw; they are clumsy and heavy. Maybe they are all right in miter boxes, but a bowsaw will do the job faster.

For general sawing, I would recommend buying a 26-in., six-point and an 18-in., eight-point bowsaw. (Lengths might vary, because most bowsaws are made in Europe and so are measured metrically.) I would also buy a 26-in. scroll bowsaw, preferably with interchangeable blades, and a 10-in., or longer, 15-point offset dovetail saw. A 24-in. rip panel saw (the standard American carpenter's saw), six to seven points, is useful for cutting big pieces such as plywood, where the bridge of the bowsaw would be in the way.

Japanese saws are good for special work. I have some but hardly ever use them, except in cramped space where I can't get in with a regular saw. The Japanese ripsaw cuts on the pull stroke. This makes the line fuzzy and hard to see when cutting joints. On the crosscut, the teeth are long and might bend when hitting a knot. Also, the saw is hard to resharpen.

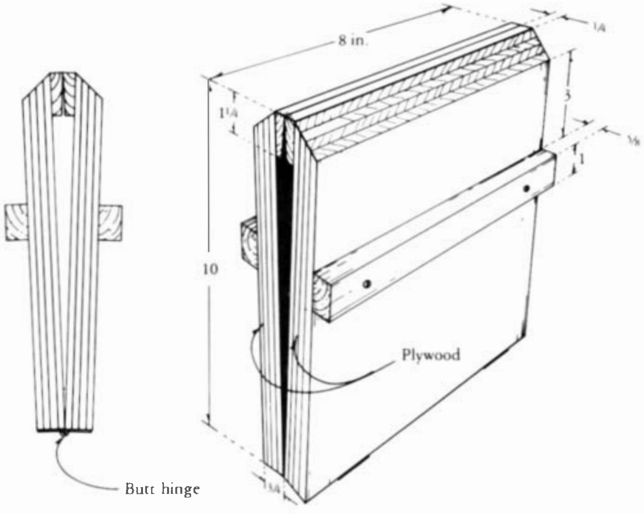
For scroll work, I would of course use a band saw if I could. Or I might use a saber saw. But a scroll bowsaw will cut as fast or faster than a saber saw, and no electricity is needed. The blade on the scroll bowsaw is considerably longer than that of any other scroll saw or coping saw.

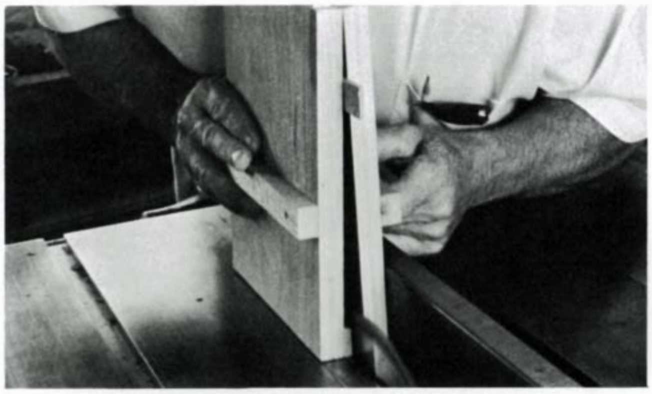
Starting the cut: Frid holds saw loosely, left thumb guiding blade, with eye, blade and cutting line all aligned vertically. Blade is angled so frame will clear wood as cut proceeds.

Dovetail saws: straight (top), offset and Japanese.

Sharpening Vise

You can make a sharpening jig out of two pieces of 3/4-in. plywood. The dimensions can be changed to suit your individual needs. Glue two pieces of maple or another hardwood on the ends of the plywood, as shown at right. These will be the jaws of the jig. When the glue has set, put the two halves together and attach butt hinges at the bottom. Screw or glue on the two side pieces, which keep the jig from falling through the vise. Then cut the jaws parallel, and saw the outside bevel. If you use a table saw, slide a piece of wood in between the two pieces of plywood, below left, to prevent the jaws from binding on the saw blade at the end of the cut. Or handplane the jaws parallel and plane off the bevel, below right. Planing a little off the bottom of the two jaw pieces ensures a tight grip at the top.





Whatever saw you use has to be kept sharp and set right. There are many vises you can buy that hold the blade during sharpening. But I make my own—it is simple to do and considerably less expensive.

For some strange reason, most new handsaws are filed for crosscutting. The first time I sharpen a crosscut saw I change it to a ripsaw (by changing the teeth from a point to a chisel edge). This makes ripping faster and easier, of course, and I find the saw works better even for crosscutting.

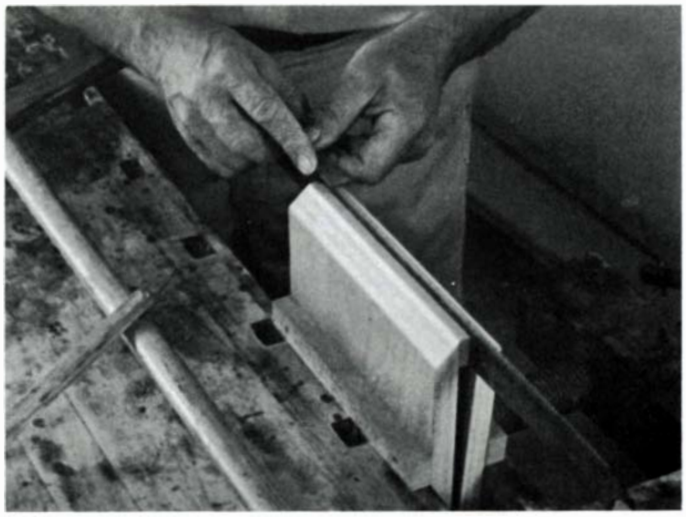
Before sharpening, check to see if all the teeth are the same height. If not, level them off with a mill file. Then file each tooth to a sharp point, and the saw is ready to be set. After setting, file two strokes on each tooth the length of the saw.

All handsaws have an alternating tooth setting; that is, the upper part of each tooth is bent out to one side or the other, to create a kerf that is wider than the saw blade. If the saw is not set enough it will bind. If set too much, the cut will be wide and rough, and the saw will cut more slowly. If the teeth are set more to one side, the saw will favor that side. To correct this, both sides must be reset. A properly set saw that is started correctly, with little pressure, will easily follow the cutting line. There are many good saw sets on the market. I prefer the Sandvik because it is light, easy to adjust and simple to use. It allows you to see what you are doing. Each tooth should be set approximately 1/64 in.

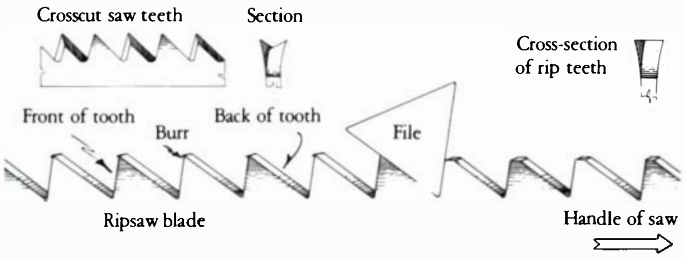
If the teeth are too small for a saw set, use a small screwdriver instead. Press it down between every second tooth and twist it the same amount each time.

Now the teeth are ready to be filed, with a new triangular file. Use only one edge for each saw filing; by using the same number of strokes and the same length of the file on each stroke, all the teeth will be sharpened uniformly. The file gradually gets dull, but so gradually that all the teeth will remain the same length. Turning the file to a new edge in the middle of a sharpening is a mistake, because the new side will cut deeper than the worn side. I never use an old, worn-out file. Use a new file—you get three sharpenings from each one. This way the teeth stay the same length and you won't have to level them off for many years.

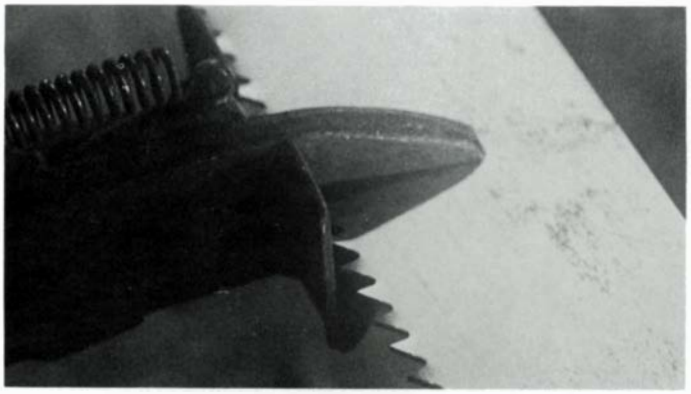
When filing, press down straight on the file, just enough so the file works and doesn't skip over the metal. File both the



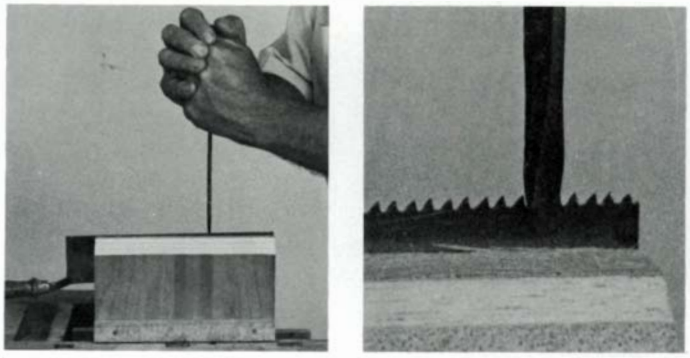
To level the teeth, a mill file is run the length of the blade.



As teeth take shape, tiny burr points in direction of cut.

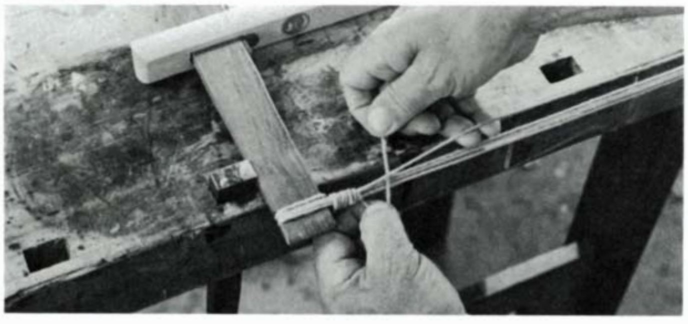


Pliers-like saw set alternately bends teeth away from plane of blade, about 1/64 in. to each side. Set must be even.



Screwdriver twisted in every second gullet will set small saws.

With fingers as stops, whole length of file is used on each stroke.



Tensioning string is wrapped four times lengthwise, woven to finish.

front and back of the teeth at the same time, working from the front toward the handle of the saw. Thus the final stroke on each tooth will be on the back, and the burr that appears when the tooth just comes to a point will be aimed in the cutting direction. Be sure to keep the file strokes at 90° to the blade. Never file or stone the face of the blade, because this would change the set of the teeth. Don't file the teeth of a ripsaw alternately, as is usually recommended in textbooks.

The saw can be refiled four or five times before it needs resetting. Of course this depends on how dull you let the saw get before you refile it. I always file my saws as soon as the tips of the teeth get shiny white. This means the saw has started to get dull. If it isn't too dull, two file strokes on each tooth should be enough to sharpen the saw.

If the wood tears up in the back when crosscutting or ripping, one or more of the teeth are too long. In this case I file across the top to even the teeth, and then refile all the teeth before setting. If the teeth still tear, as is likely to happen in softwood and especially in plywood, scribe a line where the cut will be and make a vee-cut with a chisel on the underside of the piece. This will prevent tearing.

The bowsaw is my all-purpose saw. It takes longer to learn to use than other handsaws, but once you get the hang of it, you will use it for most cutting. All my advanced students use a bowsaw, and I don't brainwash my students. Its advantage is that because the blade is narrower, there is less friction in the kerf. The blade does not whip because it is kept in tension. Because the steel is thinner than in a panel saw, the bowsaw advances more quickly, and it is easier to cut a line.

When you buy a bowsaw that uses string as a tensioning system, you usually get the saw in pieces. Even if it comes assembled, you must know how to string it in case the string breaks. Clamp the saw in the bench so that there is tension in the blade when the string is applied. Wrap the string four times lengthwise, then finish the stringing by weaving the end in and out of the strings about 10 times. Then place the piece of wood that controls blade tension between the strings. Release the tension when the saw is not in use.

When I rip with a bowsaw I clamp the board down on the bench. I can cut faster this way because I am sawing up and down and can put force into the down stroke. I use both hands so I don't tire as easily. Also, by positioning the board with the portion to be ripped extended over the bench, I have to clamp the board only once. If I stand it up in the vise, I have to keep clamping and unclamping to move it into position. If I were cutting a long board, say 8 ft., I would need a ladder if I stood the board up in the vise. The board would vibrate so that it would be just about impossible to cut.

When I rip a board with a bowsaw, I hold it so the blade is perpendicular to the board. All the force is from the right hand, with the left hand acting as a guide. I saw away from myself so that I can see the line, and so that I can move along with the cut with my arms in a comfortable position. On a 3/4-in. thick piece of basswood clamped horizontally, 10 strokes with a 26-in. bowsaw cut 9 in. With the wood vertically in the vise, the same number of strokes cut about 5 in.

For crosscutting, I use the rip-sharpened bowsaw. I lay the board flat on the bench, with the piece I am cutting off to my right, and hold the wood down with my left hand. Then when the cut is almost through I plant my left elbow on the board to hold it, and reach between the blade and the bridge of the saw to catch the off-cut.

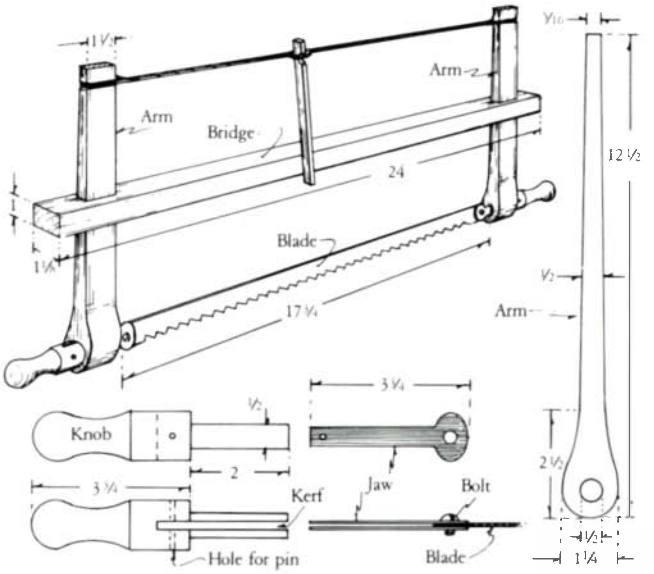
Making a Bowsaw

If you want to make a bowsaw, the first thing to do is to buy the blade, so you can design a saw with the right relationship between the arms, bridge and blade. A bowsaw should be as light as possible. I would use teak or mahogany for the arms, clear pine for the bridge, and maple for the knobs.

To make the arms, drill 1/2-in. holes in the arms first, then mark the wood and cut the taper using a band saw, scroll saw or scroll bowsaw. The arms should be identical. Sand the pieces and break the edges, especially where you will hold the saw. Leave the arms square where they pass through the bridge. The bridge is rectangular in section and has a through mortise near each end for the arms.

Make a 1/8-in. saw cut in the knobs for the two pieces of steel that will hold the blade. Then turn the knobs.

The steel jaw pieces are the most difficult parts of the saw to make. Two pieces go in each knob and sandwich the blade between them. One, 19 gauge, has a hole so the screw can slip in easily; the other, 17 gauge, should have a threaded hole to fit a 3/16-in. roundhead bolt, 1/4 in. long. Remember to put the knobs through the arms before fastening the steel to the knobs with a pin.

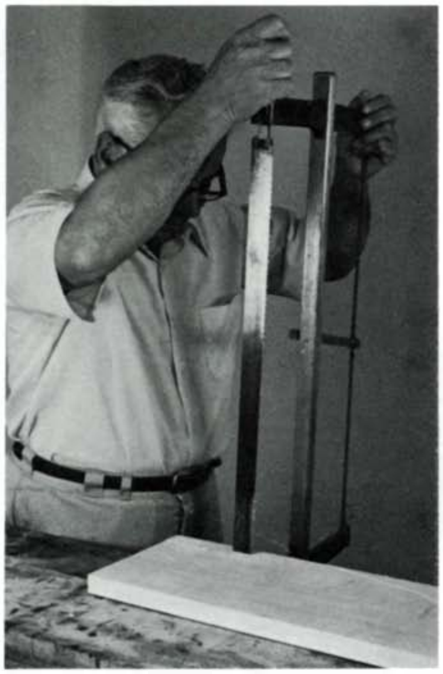


For a 17-3/4-in. blade I would make the arms 12-1/2 in. long; for a 25-3/4-in. blade I would make the arms 14-1/3 in. long. Personally I would not go through all the trouble of making a bowsaw. The wood parts are easy, but the metal parts take time, and I can buy a good bowsaw ready-made for less than $20.

When I have to resaw by hand, I start the same way as sawing a tenon (*Fine Woodworking*, Summer '76), and if it is started correctly it will naturally follow the line. I mark a line on both ends and along one edge of the board and saw down on one corner so I cut the whole end and part of the top. Then I turn the board around in the vise and saw from the other corner. This way I don't have to worry about following two lines at once—the saw drops into the first kerf and this guides it along. For cutting up plywood, I place the panel flat on sawhorses and climb right up on top of it.

For very small work I use an offset dovetail saw. With the offset, I can see the line more easily and I can use the saw for cutting flush anything that protrudes above a flat surface. I also change it from crosscut to rip the first time it needs filing. I don't like the reversible offset. It is very bulky, and because I change it to a ripsaw I can only use it one way anyway.

[Editor's note: Bowsaws are sold by Frog Tool Co., 548 N. Wells St., Chicago, Ill. 60610; Garrett Wade, 302 Fifth Ave., New York, N. Y. 10001; Silvo Hardware, 107 Walnut St., Philadelphia, Pa. 19106; Three Crowns, 3850 Monroe Ave., Pittsford, N. Y. 14534; and Woodcraft Supply, 313 Montvale Ave., Woburn, Mass. 01801. Olson Saw Co., Route 6, Bethel, Conn. 06801, makes blades for most types of frame saws.]



When ripping (left), left hand guides cut and right hand powers whole length of blade downward. Scroll bowsaw (center) also cuts on down stroke, away from sawyer. As saw nears end of crosscut (right), sawyer reaches between blade and bridge to catch wood.

Gaming Tables

Multi-purpose antique furniture

by Alastair A. Stair

Chess, dice and backgammon are games of skill and chance described in English journals as early as the Middle Ages. The first gaming table was a board placed on the floor or on a piece of furniture. Small folding tables covered with a cloth or a carpet of needlework often doubled as gaming tables. Cards found their way into England despite the royal ban on their importation in 1463 and slowly gained popularity, along with dice and shuffleboard. A few shuffleboard tables remain in the paneled halls and galleries of large country houses. These tables were frequently made of elm because of the great length of their tops.

The oldest surviving billiard tables date from the 16th century. Charles Cotten in *The Compleat Gamester* (1674) deals at length with the construction of billiard tables; according to him, "The board must be leveled as exactly as may be, so that a ball may run true upon any part of the table without leaning to any side thereof." But what with ill-seasoned boards and uneven floors, he complains that very few tables were found true, and therefore the rare exceptions were the more esteemed. Cotten says wooden boxes were sometimes placed at the corners and in the middle of the sides instead of nets, but these were undesirable because "a ball struck hard is apt to fly out of them." Billiard tables are not represented in 18th-century trade catalogs and seldom appear to have been designed as decorative furniture.

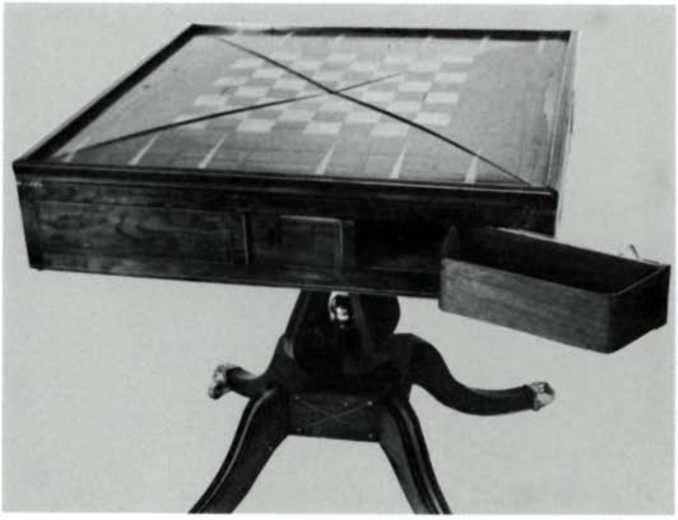
During the Restoration (1660-1688), new card games were introduced from abroad. Elizabeth I took up the Spanish game primero, and thereafter quadrille, loo, basset and picquet became the rage. During the 18th century, ladies and gentlemen of the court played card games far into the night. Everyone gambled; the 18th century became known as the age of clubs—whence the need for special gaming tables and their proliferation in today's antique markets.

The earliest tables designed for cards, introduced at the end of the 17th century, are veneered with walnut and usually have circular folding tops and turned legs united by shaped stretchers. The back legs swing out to support the flap and there are small drawers in the frieze. More common today are the rectangular versions constructed on the same principle. Tables of the Queen Anne period (1702-1714) have shaped tops with rounded corners on which candlesticks with round bases were placed, and often oval depressions called "guinea pockets" for gaming tokens or money. When folded, the outer surface shows a smartly veneered top and so when

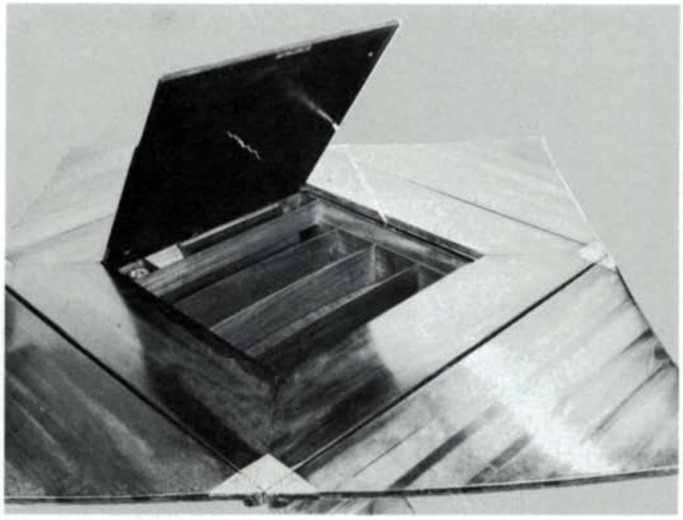
Early 18th-century Queen Anne card table: walnut with cabriole legs. Swing leg hinged to back of framework supports open flap. It looks unbalanced and is uncomfortable.

'Concertina-action' table: Back legs move on hinged framework that folds beneath tabletop. Frieze is complete whether flap is open or closed, and one leg is always in each corner.

Top left, baize-lined card table pushed to wall; swing leg supports flap. Top right, rare Hepplewhite backgammon table, c. 1780, with reversible chessboard top. Center right, sofa table with drawer for counters, playing cards and also with reversible chessboard top concealing backgammon well. Bottom right, writing/gaming table, c. 1800, in calamander wood. Adjustable leather-lined writing panel covers backgammon board; chessboard slides out underneath. Below left, Queen Anne card table with mechanically rising till and gate leg supporting three hinged flaps. Table functions as console, chessboard, card table and writing desk; lever-action hinges allow top to remain level in each mode.



Regency gaming table of rosewood, top removed. Pivoting drawers concealed in frieze pop outward. Sliding panel at center hides keyhole. Chess/backgammon surface is inlaid and diagonally divided.



Hinged flaps of same table unfold to form large writing surface. Central well is covered by hinged flap, which can be locked by means of hidden keyhole. Well holds writing paraphernalia.

pushed against the wall the tables can serve as consoles. The problems inherent in this construction are that the frieze does not follow the curves of the entire top, and the corner of the flap is unsupported. Thus the table appears a bit ungainly when open, and the rear leg that is stationary obstructs the comfort of the player seated by it.

Card tables were made fairly uniform in size—the width of most specimens is about 3 ft., although smaller pieces are known, and these because of their rarity are extremely valuable. These card tables were most often semicircular or elliptical, on elegant squared, tapered or turned legs. The linings generally were of baize and without dishings for candles and counters. As they were often used in pairs as wall consoles, the friezes and outer surfaces of the flaps were painted or inlaid with exotic woods of various colors.

A particularly clever elaboration of the folding card table has a triple top. When closed it is a console; the first flap accommodates card and chess players; the second, without a gaming surface, can be used as a writing or tea table. A metal knuckle joint on the framework keeps the leaves at the required level. Another multiple form has the creative feature of a mechanically rising till with adjustable book rest; the table can thereby be used for writing as well as gaming.

Tedrille and ombre, games for three players, were played around three-sided tables which usually had tripod bases. These were the craftsmen's answer to uneven floors. A wonderful poker table, c. 1750, with a circular top set on a plain tripod support, has a central mahogany-lined well for chips. The top is made to tilt so that when not in use, the table can be handily pushed to the wall.

Another multiple-use table developed from the Pembroke table, one of the most versatile forms to come out of London workshops. When intended as a gaming table the top was sliding, removable and reversible: One side matched the graining of the flaps, and the other became a chessboard and often a cribbage board as well. These boards were meticulously inlaid with exotic woods such as satinwood, boxwood, harewood, ebony and often ivory. Similarly, the recessed well under the top was often inlaid as a backgammon board, or lined with a leather backgammon surface. A small drawer stored gaming counters.

Fewer card tables appear to have been made during the Regency (1811-1820), but various combination tables abounded and these reflect the general taste for mechanical devices and inventiveness typical of that age. The game/work table in particular received much attention from cabinetmakers. "This ornamental piece of furniture," wrote George Smith, a leading London cabinetmaker, "will admit of every variety of execution and where expense is not an object, the whole frame may be gold, and the ornament in bronze."

I recently purchased one of the most ingeniously constructed Regency gaming tables that I have ever come across in all my years in the antiques business. This square table is constructed of beautifully grained rosewood. Closed, it can be used as a breakfast table. The top lifts off (above left). The interior surface for chess and backgammon is inlaid with satinwood, mahogany and boxwood. It is diagonally divided into four parts, which fold in upon themselves on brass hinges like the folds of a handkerchief. Unfolded, the table assumes the role of a writing table, with a deep, central well hidden beneath a hinged flap (above right). The flap locks by means of a keyhole deceptively hidden behind a small sliding panel in the frieze. The well contains bottles for ink and sand, dividers for pens and other paraphernalia for writing letters. The frieze appears to be all of a piece, but each side contains wedge-shaped drawers for chess pieces and backgammon counters that pop out sideways if pressed in the right spot.

During the Regency, special tables were made for faro, one of the games favored in disreputable London clubs. These tables contained a series of deep oval wells for counters around the edge and a recess in one side to enable the croupier or dealer to be nearer the play. Bagatelle, a game played with a cue and balls on an oblong board having cups or cups and arches at one end, was introduced into England early in the 19th century. The rectangular tables for this game also served as side tables when closed.

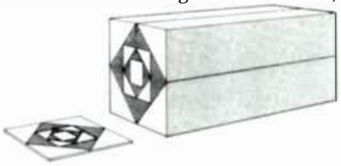
The rich diversity of cleverly constructed gaming tables continued through the Victorian era. Today these tables are mute reminders of the wizardry of English cabinetmakers.

Alastair A. Stair has five floors of English antique furniture at his gallery in Manhattan.

Two contemporary tables

Morris Sheppard's opulent game table, right, unfolds along the chessboard center line to reveal a backgammon well. The table is solid rosewood; inlay and playing surfaces are ivory and ebony; price tag is $30,000. Sheppard, of Big Sur, Calif., spent 1,500 painstaking hours making it.

The chessboard squares contain the pattern shown in the diagram, in ivory and rosewood for the white squares, ebony and rosewood for the black. Sheppard assembled a log for each color, and sliced each into 32 squares, like bologna. The white log began with a square block of ivory, to which he epoxied four triangular prisms of rosewood, then four of ivory, four more of rosewood, and a final course of ivory. The log was carefully scraped and sanded after each glue-up to maintain symmetry and squareness, and checked with a micrometer and dial indicator. Sheppard says he quickly learned the precise thickness of a single scraper shaving. He used a fine tooth, plastic-cutting band-saw blade to cut the logs into thin squares. The epoxy didn't always hold the ivory, Sheppard found, and squares that fell apart were reassembled with cyanoacrylate "super glue." His careful work paid off: The 64 squares fit together so tightly there wasn't a single gap to fill. The playing surfaces were sanded to 600 grit, polished with jeweler's rouge, sealed and French-polished.



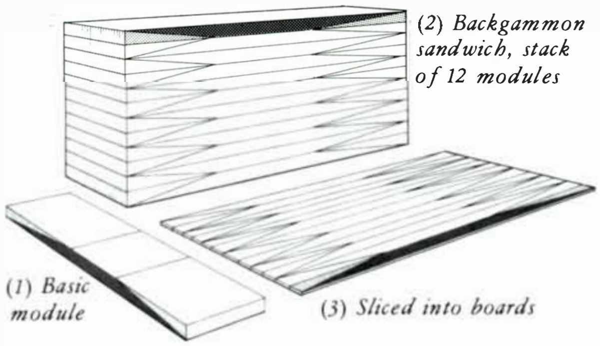
Joe Tracy, of Mt. Desert, Maine, used a thickness planer and a scarfing jig to produce the playing surfaces for 12 backgammon tables, below. The efficient solution, he says, came from realizing that a backgammon board could be divided into 12 parallel strips, each containing half of the spear pattern at each end. Such modules could be made by scarfing a wide board at each end, gluing in place an identically tapered wedge of wood of a contrasting color, and slicing the assembly into strips. Furthermore, 12 modules could be stacked up to make a "backgammon sandwich," which then could be bandsawn into 24 slices for 12 complete tabletops.

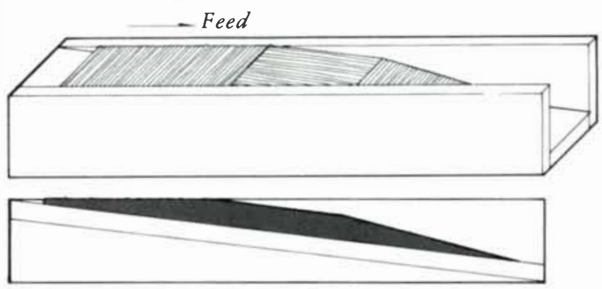
After roughly bandsawing the tapers, Tracy devised a simple jig that would hold each board at a constant angle as it was fed through the thickness planer. The jig was made of 1-in. hardwood lumber, with a combination of small clamping wedges and wooden stops to hold each piece in place. All 12 boards were run through with the thicknesser setting unchanged, then the boards were flipped end-for-end in the jig and run through again. Additional stops allowed him to use the same jig for making the contrasting wedges. He writes, "The trick throughout was to control the feather edges and to work with enough accuracy to make the spear halves meet in uniform points."

He glued and clamped the modules in another jig that held the ends tightly in place, inserting a layer of contrasting veneer to outline the spears. Then he ran all 12 modules through the thickness planer again, continuous side on the bed, and glued the sandwich together. A sharp band saw and a steady hand sliced the stack into 24 identical boards, ready to smooth in the thicknesser and glue to a plywood ground.

Tracy made the table itself and the main part of the board of cherry; the spears are kiln-dried pear (dark orange) and air-dried pear (white), outlined with walnut veneer. He's selling the tables for $400 each.

The same jig could be used to prepare two modules for one backgammon board. It could also be used with a hand plane, the sole bridging the jig's parallel sides. *—J. K.*





Scarfing jig for thicknesser

Wooden Clamps

They're strong, handsome and cheap to make

by Richard Showalter

Author's tub of clamps.

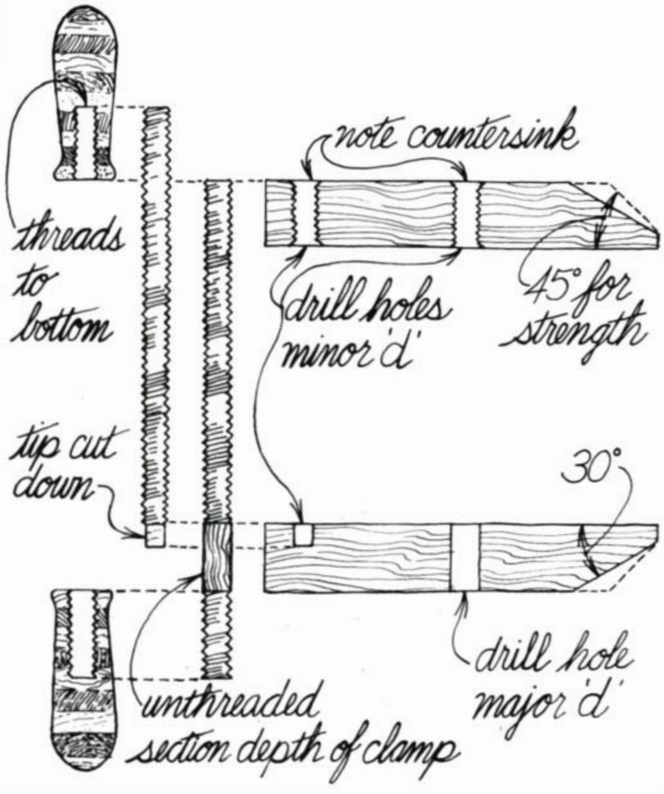
During the six years I've been making my living as a woodworker, I've lived in a small town in Oregon, fifty miles from the closest city. The markets for the expensive children's toys I make are still farther away and it became obvious very early that shipping and packing were going to be an important part of making my livelihood. I became interested in using wooden screws (*Fine Woodworking*, Spring '77) as a way to make my work collapsible and more easily shipped. I bought a wooden threading tool and began making my own screws. They did everything I had hoped in making my work more portable and added to the value of the toy as well.

The most important spin-off has been the manufacture of wooden clamps. My shop is now equipped with a wonderful variety of them. They are fitted to my own hand, suited to my particular needs and esthetically pleasing to me by virtue of their materials and because they were fashioned in my own shop. The financial benefits are not to be despised either—it would cost hundreds of dollars to duplicate the number and range of clamps now at my disposal.

The scale you work on will determine the size clamps you need. If you want to make clamps corresponding to Jorgenson hand screws in the 8-in. to 12-in. range and want to buy only one threading set, the best size is 7/8 in. This makes a screw heavy enough to handle the strains of most applications, but still slender enough to be in proportion to a comfortable handle. One-inch screws make the clamp a little clumsy and the extra strength seems unnecessary. Wooden screws rarely strip. Most hand-screw clamps fail—when they do—by breaking at the center hole in the unthreaded jaw. If you work on a smaller scale, making instruments or doing similar, delicate work, the 1/2-in. and 3/8-in. sizes will make little hand-screw clamps as well as luthier's clamps.

Clamp jaws may be made from nearly any hardwood. (I've even made acceptable clamps using yew, technically a softwood but a very dense and springy one.) Clamp jaws flex considerably in use and should be free of knots, bark inclusions and wind shakes. The slightest fault will be magnified by the stress of use.

The finished width of the jaw should be at least double the diameter of the screw. A clamp using 1/2-in. screws should have jaws at least 1 in. wide. Jaws should be as thick as or slightly thicker than they are wide. These tolerances are critical for large clamps. Obviously, adding more width and thickness increases the strength of the clamp, but in the larger sizes also increases the weight and clumsiness of the tool and ruins its feel. In the smaller sizes bulking up the measure-



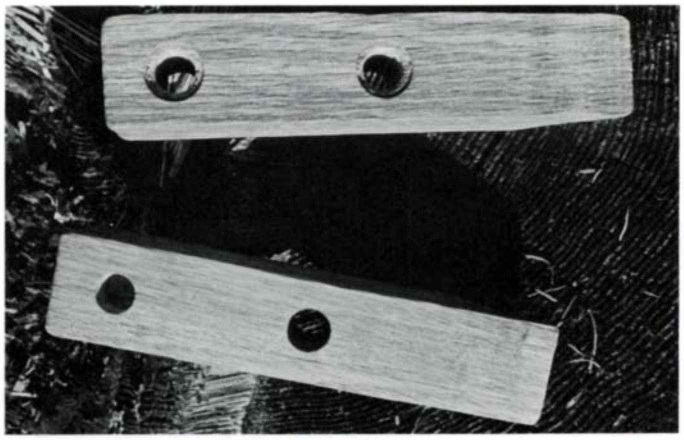
Wooden hand screws may be made in almost any size, with jaws and handles shaped to fit particular types of work.

ments can provide a valuable safety margin and does not make them too clumsy.

Surfaces of jaw stock should be square and parallel. Clamp the jaws together during drilling so the surfaces will mate when the clamp is finished. Holes should be drilled with a drill press or doweling jig. Any skew to these holes will cause the finished clamp to bind in a way that cannot be corrected. The middle hole should be centered from end to end of the clamp. A 12-in. jaw will have its middle screw 6 in. from either end. The rear hole should center 1 in. from the back edge of the jaw in large clamps, 3/4 in. in smaller ones.

Because the tap raises a small curl of wood as it enters and leaves the stock, I use a Forstner bit 1/8 in. larger than the hole I'm drilling and drill a countersink 1/8 in. deep in the top surface of the clamp jaw that will be threaded. (The other jaw is not threaded.) I then use the proper-size bit to drill the two holes to be tapped, stopping the bit when the point breaks through. Using the breakout hole as a guide, I switch back to the larger bit and drill the same 1/8-in. deep hole on the opposite surface. The same result may be achieved by leaving the stock 1/8 in. oversize and planing or jointing to dimension after it has been tapped.

Holes in the piece of jaw stock that is not tapped should be located by allowing the point of the bit—remember, the jaws are clamped together—to break through. The middle hole in the untapped jaw should be drilled the same diameter as the screw, e.g., a 1-in. hole for a 1-in. screw. The rear hole in the unthreaded jaw should extend one-third of the way through the piece of stock, and should be the same diameter as the hole in the threaded jaw before it's tapped, e.g., for a 1-in. screw the hole is 7/8 in. If this hole is too shallow the clamp falls apart in use; if it's too deep the clamp will be weak.



Holes in upper jaw are countersunk with Forstner bit before drilling through and tapping. Rear hole in lower jaw is blind.

I put a 30° slope on the front of the jaws. If you are going to use your clamps to apply very heavy pressure most of the time, the angle should be increased to 45°. This extra material in the nose makes the clamp stronger. It is amazing how such a small change in dimensions will affect the clamp's feel.

I plane or joint a bevel on the two upper edges of each jaw, but this is cosmetic. In use clamps are often laid in piles and banged around, and the bevel keeps them from looking chewed up quite so soon.

No sandpaper, by the way, should be used on any piece until after it is completely threaded. Small pieces of abrasive will cling to the work and dull thread cutters. Although they

Threading Tools

A user's evaluation

I presently have taps and screwboxes (*Fine Woodworking*, Spring '77) in 1/2-in., 3/4-in. and 1-in. sizes. The best commercially available threading tools I've found are made in West Germany (there is no brand name on them) and were formerly sold by Woodcraft Supply. Woodcraft has since begun manufacturing its own version of this tool in this country. My 3/4-in. tool is a Woodcraft product but I like the West German one better because its screwbox handle is fixed to the box with a full-length metal tang, headed over at the end. The Woodcraft handle is attached to the screwbox by a coarse screw threaded into end grain—a poor woodworking practice. The handle constantly unscrews itself in use if you are left-handed, as I am.

The most serious fault of the Woodcraft tool is that the screwbox cuts only a fair thread. The West German tools I have leave a small portion of the original dowel surface intact at the crown of the thread; the Woodcraft tool brings the thread to a sharp crown that makes the threads very delicate.

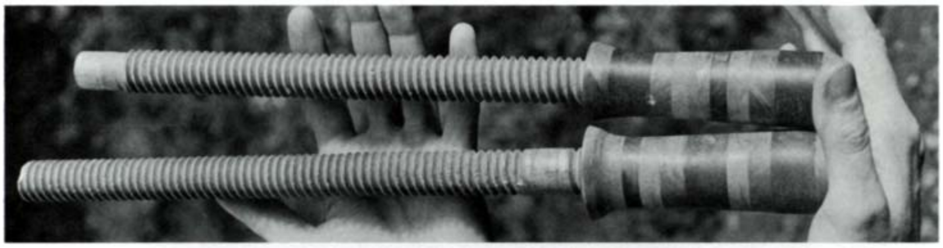
Frog Tool in Chicago still carries the West German imports and I would advise buying from them.

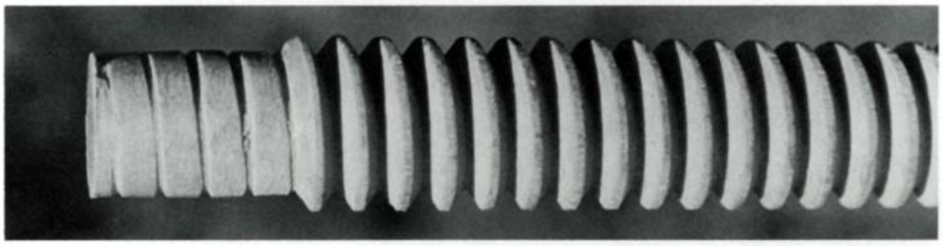
Marples, which ordinarily makes excellent tools, markets a threading set whose 1/2-in. model I found unsatisfactory. The die consists of a wooden box with a metal cutter, the traditional way in which this tool has been made. The tap is cast metal, not machined tool steel. The thread it cuts is sharply crowned and overfine, with too many threads to the inch. The only way I found to make it produce any sort of screw was to cut the wood off to length as it emerged from the box. This inefficient procedure limits the number of things that may be done with the tool. The Marples tap is also very fragile. (My difficulty with this tool is not unique. I spoke with a high-school shop teacher who had purchased the Marples sets in all sizes and was unable to make them perform as they should.)

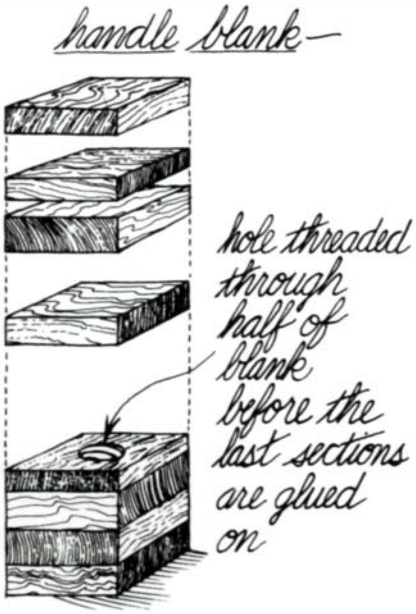
Brookstone Co. markets a threading set in three sizes, made by Conover Woodcraft of Parkman, Ohio. This is almost an excellent tool. Both tap and screwbox produce a clean thread and the tools are attractively priced. But at three inches the shank of the tap is simply too short.

Finding adequate doweling can be almost as difficult as finding a satisfactory screw set. Stanley used to market a hand-cranked dowel maker, and expensive lathe-powered tools are still available. Commercially available doweling is usually birch or hard maple and very seldom truly round. Variations in moisture content during manufacture and storage often produce doweling that is oval in cross section. For the same reason, much doweling is not straight either. Always check doweling for straightness, piece by piece, before buying it.

Woodcraft Supply sells sizing blocks for doweling that consist of a piece of tempered tool steel with accurately sized circular holes. Doweling is driven through them with a mallet to remove excess stock and bring it back to round. These blocks do not include sizes over 1/2 in., however. I have made sizing blocks for larger sizes by detempering a piece of automobile leaf spring and having a machine shop drill appropriate holes, countersunk on the underside. If you do this, have two holes drilled for each size, one the exact size and one 1/32 in. smaller. The reason for this is that the West German tap and screwbox are made on metric lathes that only approximate U. S. sizes. The "1-in." tool, for example, is made for 2.5-cm doweling. A true inch is 2.54 cm. The undersized holes allow you to make appropriate adjustments. Also drill two small holes in the plate so you can fasten it to a bench top. And don't forget to retemper the metal. —*R. S.*







Handle blank is laminated as in drawing at right. Rear screw, top and enlargement, has shaped tip to fit blind hole in jaw. Middle screw is longer of the two, is unthreaded near handle where it passes through lower jaw, and its handle has substantial flange where it bears against jaw.

can be sharpened again, extreme care must be used to make the tools perform properly and you will wish to do it as seldom as possible.

The two holes in the threaded jaw should be tapped next. The tap needs to be backed off one-quarter of a turn every two turns to break the chip and help keep the nose clear of impacted shavings. The tap should turn freely, without much resistance. If the tap becomes difficult to turn, removed stock is probably packing up in its nose. It should be backed out and the chips and shavings removed. For this purpose I use a heavy piece of Bakelite plastic that I have sharpened to a point. A copper or brass rod about 4 in. long and sharpened to a long point will work well too. Steel should not be used; sometimes considerable force is necessary to clear chips from the nose hole and it is easy to slip and damage the cutters. Packing is worst in threading blind holes where there is no place for removed stock to go but the bottom of the hole.

If you find yourself using all your strength to turn the tap, something is wrong. The tap should be backed out and the trouble located. I keep a small lump of beeswax on my bench and after tapping the first hole in a piece of work I run the beeswax over the tap. Friction makes the tap warm, and the beeswax flows on nicely and eases the work. I then stick a small piece of rag or cotton in each tapped hole and drip Danish oil into it until it is saturated. Remove the rag in an hour or so, after the thread is thoroughly soaked. It is not uncommon in use for some glue to drip on the wooden screws. If a drip gets inadvertently turned into the tapped hole in the jaw while the clamp is being adjusted, the oil will keep it from adhering and freezing the clamp. Danish oil also strengthens the threads. If you try your clamp while the oil is wet it will make an ear-splitting squeal with every turn. The squeal disappears as soon as the oil is dry.

After the initial tapping, even with a well-sharpened tap, stresses in the wood and compression caused by the tapping process cause the sides of the hole to expand slightly over a period of two or three days. This can make the screws bind. It is not critical in hand-screw clamps, which can always be taken apart and retapped, but in other applications—C-clamps and bar clamps where the tool cannot be taken apart after assembly—stock should be set aside and retapped after a few days. Take care to start the tap in the same track as for the first threading. Only a very small amount of material will be removed in the second tapping but it will make a great difference in how smoothly the finished tool will turn. If the clamp still binds, rethreading the screw will help.

The jaws of the clamp can be scraped or sanded to final surface finish. I oil and wax my clamps. Besides making them more attractive, wax keeps glue drips from sticking.

Screws should be made from dense, close-grained wood that is free from knots. I've successfully used beech, cherry, pear, apple, dogwood, black walnut, yew and myrtle. I own an antique clamp that has ash screws, but I've had poor results with both ash and oak, though these woods tap well and make good clamp jaws. I have successfully used oak stock taken from root balls rather than the trunks of trees.

There are two methods of making screws and their handles. The standard way is to turn both handle and screw from one piece. I don't have a lathe so I make handles and screws separately. The only difference is that in the lathe-turned method the rear screw cannot be threaded all the way to the shoulder of the handle—it has to be slightly longer to compensate.

Because taps cannot be used in end grain, I laminate handle blocks by alternating blocks of wood according to grain, sometimes as many as seven or eight for each handle. This is a good use for scraps. I laminate half the length of the handle at a time, drill it through and tap it, then glue on three or four blocks to finish the blank. This allows the screw to bottom out in the hole made for it. If the handle is glued together completely and then tapped, the screw will not fit in the portion of the hole left unthreaded by the nose of the tap. This void in the handle will be weak.

When I first started making clamps I drilled a hole the diameter of my screw stock in my handle, inserted the unthreaded end of the middle dowel with a liberal dose of glue and put another, smaller dowel across the handle to secure it. This didn't work because the middle handle undergoes great stress. All of these original handles eventually broke their pins and glue joints and had to be redone in the way I am describing.

I turn handles by removing the appropriate tap from its handle, chucking it in the drill press and screwing the blank onto the tap. With the drill press running, I shape and finish them free-hand with a Surform and sandpaper. The handle of the middle screw should have a good flange of very hard wood at the bottom, where it will bear against the clamp jaw. This flange should be at least 1/8 in. wide all around and well-supported. The handle above it shouldn't be thinned too drastically. The rear handle is under much less stress and need have no flange. Of course very nice handles can be made without turning—simply cut them into hexagonal shapes.

The two screws that fit into the handles aren't identical. The middle screw should have an unthreaded section the depth of the unthreaded jaw. If this section is threaded the clamp jaw tries to ride down the spiral when the clamp is turned two-handed, and it gives a galloping effect to what should be a smooth rotation. If your doweling is accurately sized you will have to scrape or sand this unthreaded portion to get it to fit the hole and turn smoothly.

The tip of the rear screw should also be sanded or shaped to fit its socket in the unthreaded jaw. Shallow grooves showing the bottom of the threads should still be there when the fit is proper. The accuracy of the fit in these holes makes the difference between a sloppy and a tight clamp.

On large clamps I make the screws long enough to open the jaws 9 in. I rarely use the clamp opened this far because flex in the center screw cuts down on the pressure that may be applied. Occasionally, however, it has been nice to have this

A Dowel Maker

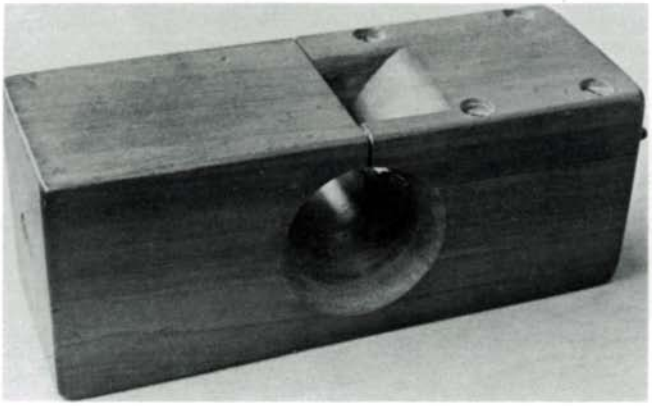
by Trevor Robinson

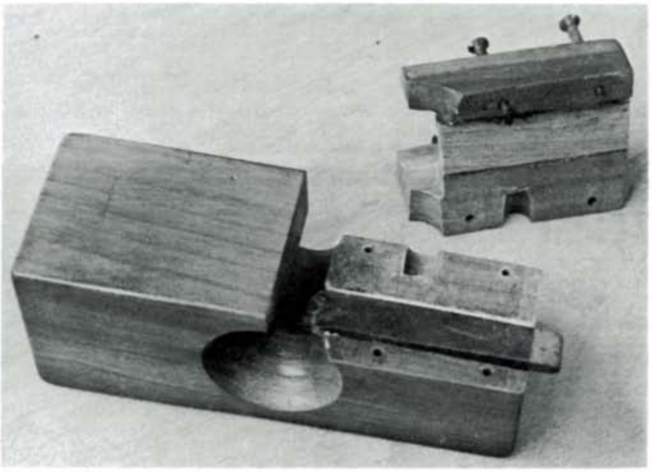
Because commercial dowels are made only in birch, beech or maple, and large diameters are expensive or hard to get, it is useful to be able to make your own with the simple tool shown here. Properly sharpened and set, the tool turns easily around a square length of hardwood, cutting it smooth and round in a single pass.

The body of the tool is made from a block of hardwood about 2-3/4 in. square and 7-1/2 in. long. First locate and bore a hole the diameter of the desired dowel. Then on the lathe a conical depression is turned to meet the hole so that about an inch of cylindrical bore remains. For a 1-in. dowel, the mouth of the cone is 2-1/8 in. wide; for other dimensions the cone should allow the square of wood to enter about 1/2 in. before it encounters the cutter. This means that the large diameter of the cone is about twice the small diameter. The next step is to drill the holes for the four screws that will fasten the two sections together. By drilling them before sawing the block; alignment is automatic. Two saw cuts separate the clamping section from the main block. Mating channels are then chiseled along the inner faces of the two pieces to hold the cutting blade, which is just a saw kerf thicker than the resulting channel. Thus the cone remains smooth, and the screws hold the blade tightly.

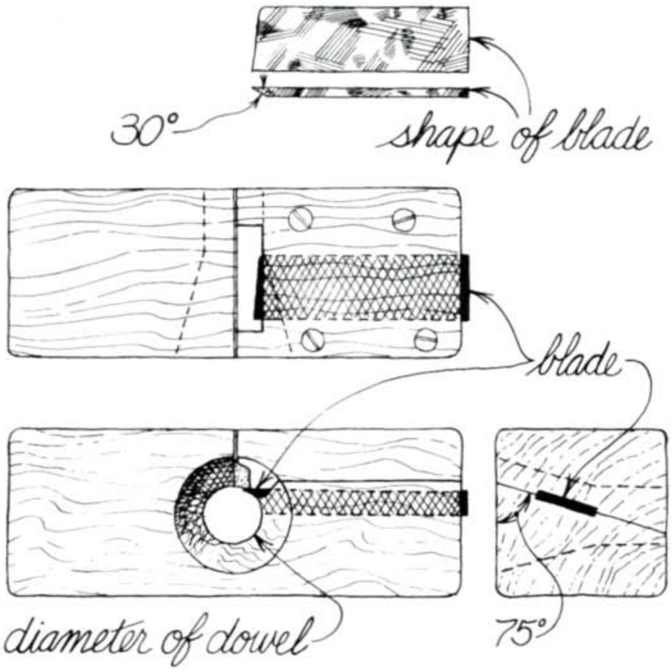
Blades can be made from old files. The file should first be annealed by heating red-hot and cooling slowly. Then a suitable length can be cut off and shaped. Before the final sharpening the cutter should be retempered by heating red-hot, quenching, and reheating to 475° F (light-orange oxidation color) before the last quench (*Fine Woodworking*, Fall '76).

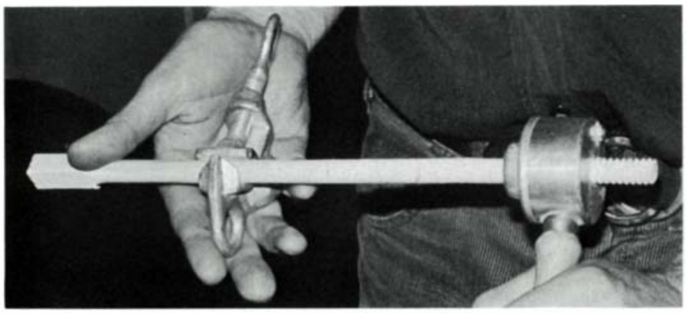
The position of the cutter is very important for getting a smooth dowel. The heel end of the cutting edge should just graze the surface of the finished diameter so that the dowel is a snug fit as it comes through. Waxing the bore will make it go more easily. The square of wood to be cut should be just slightly larger than the diameter of the dowel—about 1-1/16 in. square for a 1-in. dowel. It helps to chamfer off the four corners at the leading end of the piece to get it started without splintering. Then the wood can be held vertically in a vise and the tool turned without forcing it down. With a sharp, properly positioned blade the weight of the tool is enough to keep it moving along the wood.





Dowel maker, top, is made of one block of wood cut into two parts, bottom. Note rounded heel of cutter—it just grazes finished dowel.





Modified tubing cutter propels dowel through German screwbox.

capacity. If you make both screws 14 in. long from handle flange to tip, you can shorten them until they feel right.

When threading doweling, you can insert it in a bench vise and turn the die round and round the dowel. If the wood you are using is brittle or of small diameter, however, the dowel may twist, cracking the threads. If this happens, hand-hold the dowel and turn the die around it. The flex then takes place in your wrist. Large doweling, 3/4-in. diameter and up, can be hand-held successfully without undue fatigue. Smaller sizes are difficult to grip and your hands are liable to cramp. I have modified a small tubing cutter by removing the cutting wheel and reshaping the bottom jaw into a doweling holder to help thread small screws.

To glue screws to the handles, drip glue into the hole; don't coat the screws with it. If possible, try not to get any glue on the threads in the upper half of the hole. Most of the holding is done by the threads on the screws; the glue is only to keep them from turning off the handles. Too much glue can cause the screw to freeze before it seats because frictional heat rapidly sets the glue. Turn the handles on slowly and evenly without stopping until you feel them seat. It is best to turn the screws in dry first and mark them when they are fully seated. This allows you to stop when you should. The screw provides a lot of mechanical advantage and it is easy to pop the end off the handle. Too much glue and this mechanical advantage can produce a hydraulic effect, causing the end to come off or the sides to rupture.

The design of the C-clamp I am about to describe is from an article in *USSR* magazine describing a contemporary Soviet woodworker's shop. I've seen a similar clamp in a 17th-century print of a French cabinetmaker's shop.

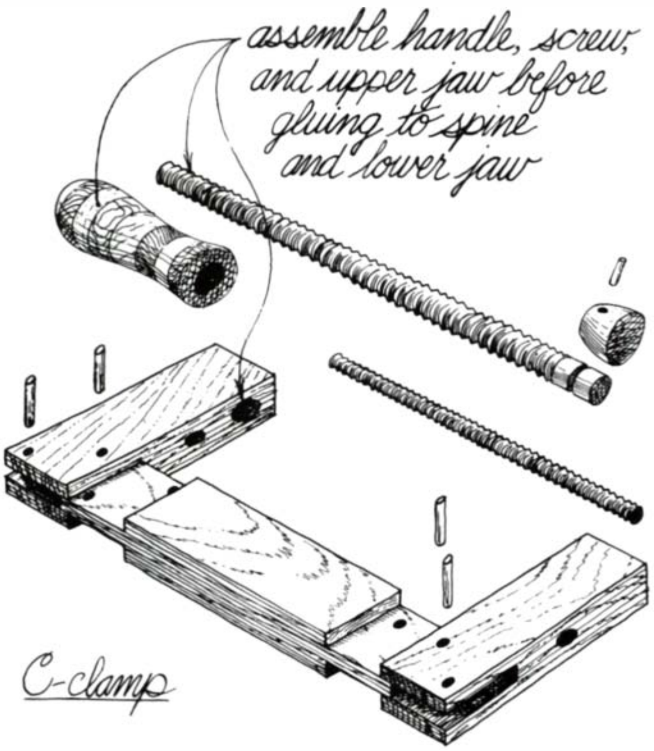
Wooden C-clamps are bulkier than their metal counterparts and because of the center brace look deeper than they should to someone used to metal clamps. The center brace in the Russian clamp was made from a piece of brass rod threaded for a nut at either end. I use a wooden brace because I have a suitable small threading set.

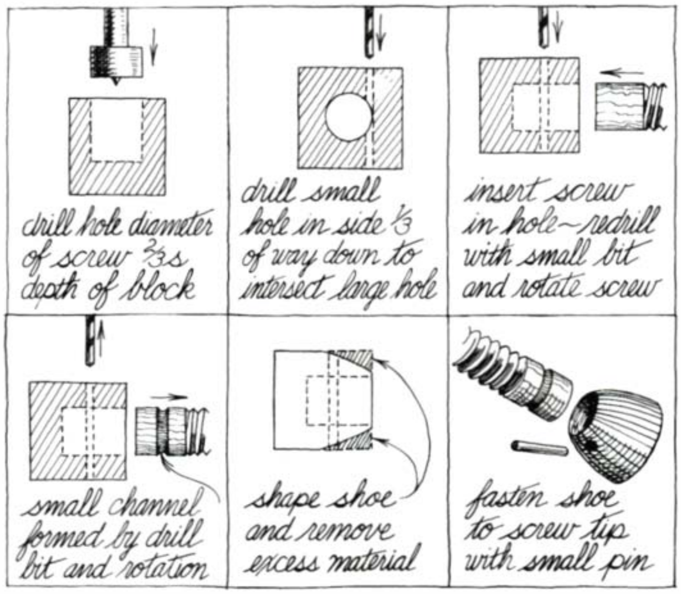
The three parts of the clamp body are held together by mortise and tenon joints. If you are using a wooden screw for the center brace, make up the upper and lower jaws of the clamp body first and thread the holes. Screw the small-diameter dowel through the holes and then measure for the long piece that will form the spine of the clamp. If you are using a metal rod, all three pieces may be made at the same time, to arbitrary measurements. With a metal rod it is possible to draw the rod down to the dimensions of the clamp; with a wooden rod, clearance in the mating threads can result in play of 1/16 in. in the length of the spine piece.

The threaded hole in the clamp jaw that will receive the main screw should be made slightly less than 90° to the axis of the jaw. Two or three degrees is enough. There is a certain amount of spring in the clamp that, because wood is flexible, cannot be eliminated. If the hole is drilled at the logical 90° angle, the clamp will spring under pressure and tend to slide off the work. This is true not only for the C-clamp but for wooden bar clamps as well.

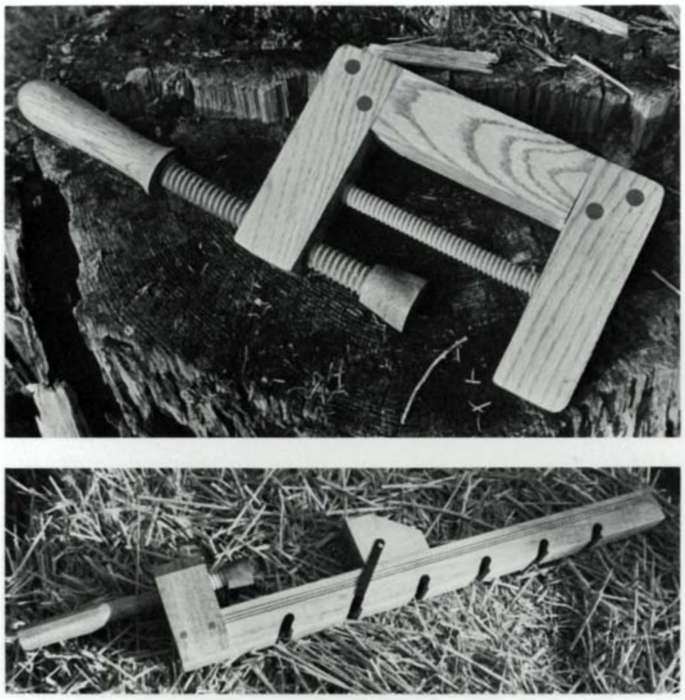
Handles for these clamps can be made in either of the ways described earlier.

Since the hole in the upper jaw will not be accessible when the clamp is assembled, all C-clamp parts should be set aside for two or three days and the upper jaw hole rethreaded. The screw assembly should be attached to the upper jaw before gluing the spine and lower jaw to this piece.





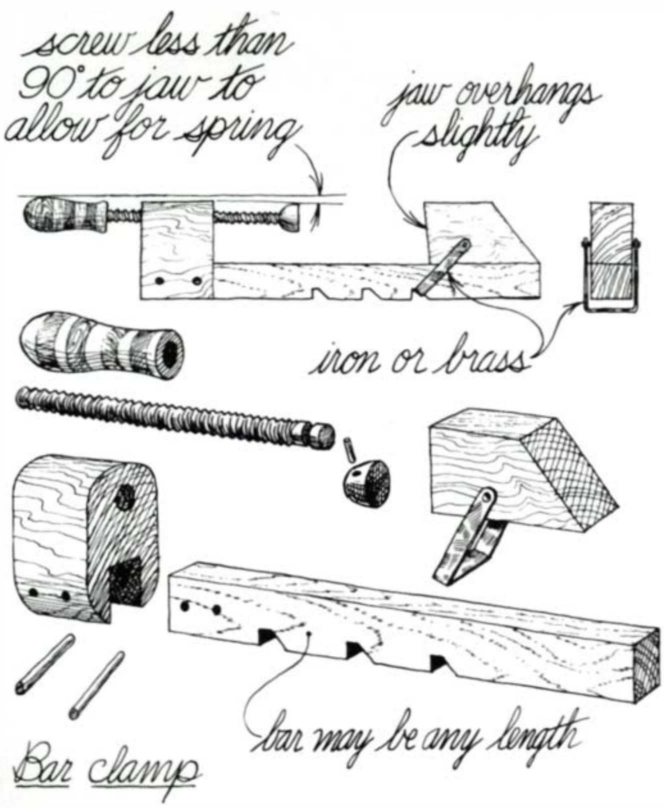
Basic C-clamp, left, can be fitted with freely turning wooden shoe, above. Shoe is made of toughest available wood—author starts with square chunk of hardwood root and drills across the grain, not into end grain. Shoe will break if tip of screw isn't cut truly square. For delicate work, surface shoe with scrap of leather.

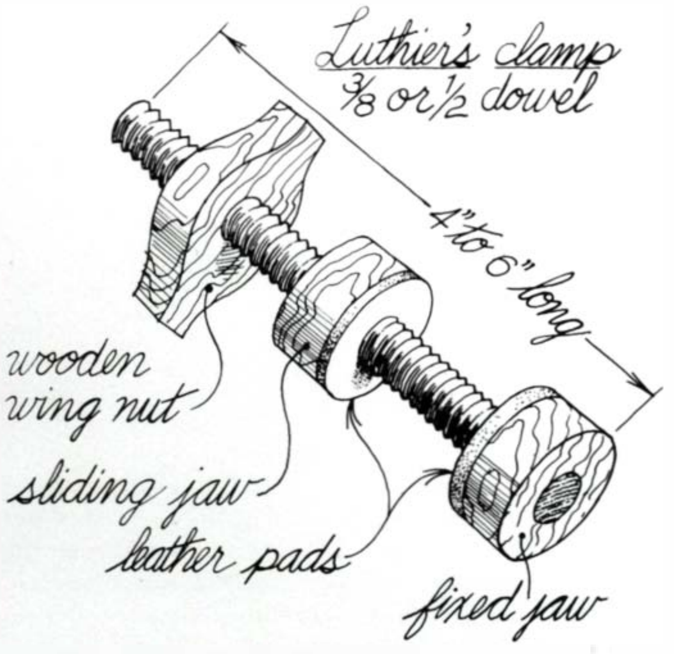


Screws of C-clamp, top, and bar clamp are slanted to allow for flex.

Bar clamps, because they must adjust to material of greatly varying widths, cannot have a center brace. Consequently, they must be more massive. The jaw of the clamp that takes the screw is fixed and heavily made. Again, depress the angle of the screw hole a few degrees from square to allow for spring. The adjustable jaw of the bar clamp should also be slanted a few degrees for the same reason. The bar that secures the adjustable jaw of the clamp can be made from iron or 1/8-in. sheet brass cut to shape and bent with heat.

Luthier's clamps can be made using 1/2-in. or 3/8-in. threaded dowel. The wooden wing nut shown in the drawing





above has numerous applications in clamps and other kinds of woodworking using wooden screws.

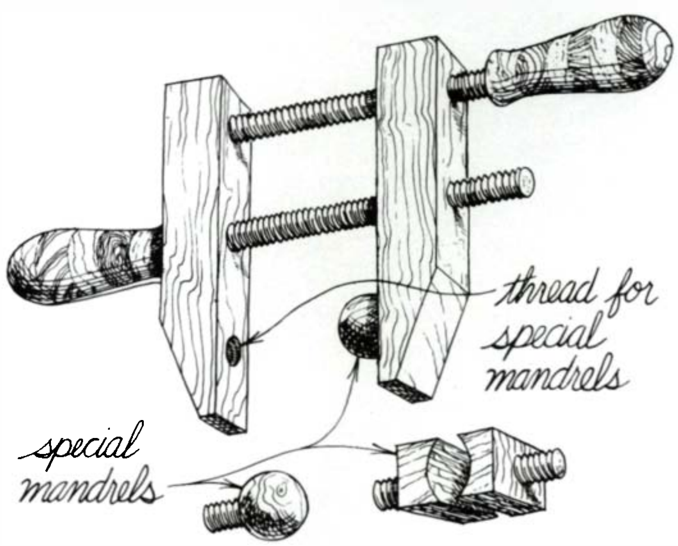
Gang clamps for marquetry should be easy to make using the protective tip described for the C-clamp, although this application is outside my personal experience.

By making threaded holes in the tips of the jaws of a standard hand-screw clamp you can increase its possible applications. Different mandrels can be made to screw into the tips, to produce deep engagement clamps or clamps specially tailored to shaped work.

The action of wooden clamps, like all wooden machinery, improves with time. Small mechanical irregularities wear to accommodate one another and the combination of wax, oil, heat and pressure forms bearing surfaces like glass.

I have described the assembly of a single clamp. Obviously it will always be a more efficient use of drill and saw setups to make a number at once. I have a box under my bench where I save likely pieces of material. When it begins to overflow I take a day off and make a batch of clamps. I try to make clamps using all the woods that pass through my shop. This allows me to show wood samples to visitors and it keeps a variety of wood in front of me. The choice of wood for a piece I am making is often suggested by the clamps I am using.

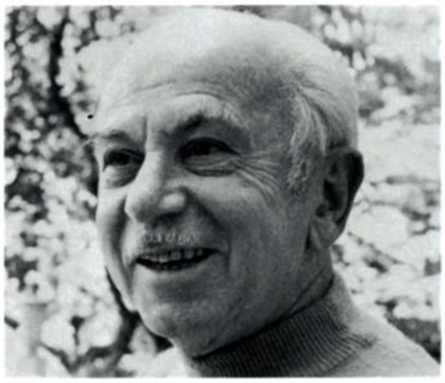
Once you have been through the process you will find you can make five or ten clamps a day without much difficulty.



Elegant Fakes

34 chairs for the palace at Alexandria

by George Frank



The year was 1935; the place, my atelier in Paris; and the man who opened the door to my tiny office was Monsieur Sylvestre Baradoux, master cabinetmaker. Even though the late winter morning was cold and unfriendly, Baradoux was in his warmest mood—so much so that he agreed to buy a round at a nearby bistro.

Baradoux had every reason to be triumphant: an hour earlier he had met with an emissary from the Royal Court of Egypt and had received an order for most of the furnishings for a palace being built in Alexandria. The order would keep Baradoux and his crew of 40 craftsmen busy for at least two years.

My friend was blissfully ignorant of geography and had no idea where Egypt was, but as a craftsman he was a dogged and uncompromising perfectionist. After the third drink his smile faded, and I learned the real reason for his visit. It seemed that the Egyptian emissaries expected all the work to be of the first order, but in one room quality alone would not suffice—only perfection would be tolerated. . . or else. The contract made this clear in rather frightening small print. The furnishings of the Blue Salon, 34 chairs and two consoles, had to be so close in design, shape, construction and finish to genuine Louis XIV antiques as to confound experts. Baradoux was to build new furniture with the facade of authentic 300-year-old pieces. . .or else.

Now, my trade is woodfinishing, and I am as much a perfectionist as my friend Baradoux. Said he: "You have repeatedly deceived me with pieces of furniture that I would have sworn were genuine antiques. I have been stunned to learn that they were younger than my beard. Now tell me, George, can we meet these stringent specifications, or shall I refuse the order?"

I had already consumed four aperitifs and in my elated condition I felt I could carry out the contract with my hands tied behind my back. I replied, "Sylvestre, my friend, you are crazy. You have received that once-in-a-lifetime commission, an order that every cabinetmaker in Paris would sell his soul to have. Yet you dare to think of giving it up? If we cannot carry it out, who can? Who? Take it, take it, take it." And thus began one of the most difficult tasks of our lives.

The layman is amazingly ignorant about antiques. Any crudely built piece of furniture, shaped more or less in the style of the period it represents, beaten with a chain, mauled with a screwdriver, dropped from the roof of the shop and repaired with sawdust and glue, will probably pass at auction. Compound these mutilations with wormholes made with an awl, or with the legendary shotgun blast, and add a million flydroppings of dark shellac, spritzed on with an old toothbrush through a bit of screening—such a piece would fool half of the experts. But the specifications of the Royal Court left no doubt that such a hackneyed approach would not do. They wanted perfection.

We began by ordering two truckloads of the best horse manure and by making sure we could obtain enough old wood, for using aged wood is the first requirement in copying antiques. Baradoux had a lot of old beams in his warehouse, salvaged from demolished houses. He also knew all the wreckers. Although World War I had been over for almost 20 years, the salvage industry still flourished. While timbers of choice woods older than 200 years were becoming scarce, there still were plenty of excellent logs that had been removed from churches, ships, buildings and barns, all at least 100 years old and nicely weathered. Some even contained lively, hard-working worms in their bellies. The price was high, but so was the fee Baradoux was charging the Egyptians.

Using old wood in antique reproductions helps achieve the proper coloring, shading and finishing. But it also creates problems of strength. The function of a chair is to support sturdily and comfortably a person who may weigh more than 200 pounds. A new chair is built of sound, clear lumber that has been dried to a moisture content of 7% to 10%—wetter, and the wood will shrink, loosening the joints; drier, and the wood is dangerously brittle.

Since the chairs would have upholstered seats and backs, we could use new, kiln-dried lumber for the hidden parts. The partly exposed parts, such as the back legs, were made of sound old lumber, but not too old. We cut the pieces roughly to shape and buried them for three months under the mound of horse manure. From the manure they picked up alkaline juices, appropriate base coloring and the necessary moisture. The fully exposed parts, such as front legs and stretchers, got the same treatment, except they stayed in the manure only six weeks before being removed, cleaned, dried and shaped.

Our next problem was a basic one—we had to know precisely what it was we were copying. Fortunately, we both had done restoration work for the Louvre and other museums, and we could borrow a couple of chairs made during the reign of the "Sun King." We spent weeks studying these chairs, observing and noting every detail of their construction, carving, joining and finishing. We studied tools and working methods of the period, and once the wood was past the rough-cutting stage no machine or power tool was ever used. Baradoux went

George Frank, 74, is a master cabinetmaker and furniture finisher who left Europe during World War II and set up shop in New York City. Now retired, he has time to reminisce.

so far as to confiscate from his men some hand tools he deemed too advanced.

I made him disconnect the electric grinders the craftsmen used to sharpen their tools. We replaced them with an ancient *meule*, a stone 3 ft. in diameter that was turned with a foot pedal and revolved in a trough of water. Every man had to use this grinding stone, but no one except me was allowed to clean the water and the mud from the trough. I mysteriously saved this dirty water and mud.

Now it is early summer, 1936. Baradoux and I sit in my shop admiring the 34 chairs and two consoles. We agree that they are masterpieces, but Baradoux wants to know: "How will you copy the 300-year-old finish of the models?"

My answer hit him like a bomb: "The finish of the model chairs is less than ten years old."

Baradoux became red in the face. Then he icily removed the covering sheet from one of the model chairs, pointed to the brass plaque of the Louvre and said: "George, you don't mean to tell me this is a fake?"

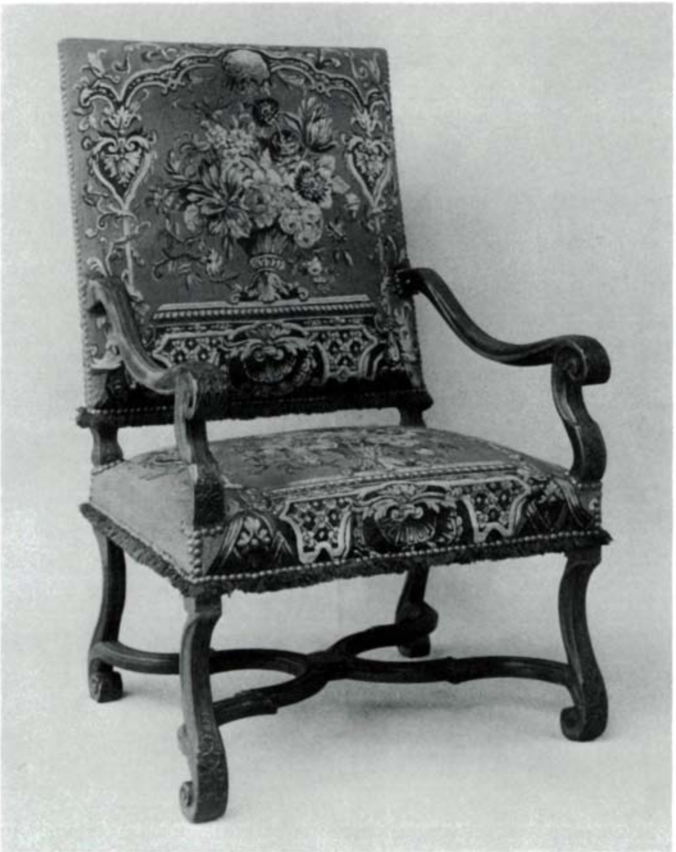
"But no, all I said is that the finish is not old. I do not mean that it was refinished, but every time a servant polished it, waxed it or oiled it something was added to the original finish. So the original finish now is modified by 300 years of caretaking, carelessness, wear and accidents. These chairs were rewaxed very recently at the museum. Furthermore I will have to copy all these nicks, caused by rough moving between the shops. Now you see, the finish of these chairs is as old as the last addition to it. To copy all of it I intend to use the same ingredients, the same ways and means that caused the models to look as they do."

I had done much research on the coloring and staining of the wood and discovered some surprising facts. One of the great achievements of Louis XIV was the establishment of the *manufacture des Gobelins*. It was not only a huge workshop where the famous tapestries were made, but it was also a craft center where hundreds, maybe thousands, of skilled people found rewarding jobs. Joiners, carpenters and cabinetmakers worked not too far from the vats where the wool was dyed, and they soon discovered that most of those dyes worked well on wood too. The art of wood staining progressed amazingly fast. Colorants were derived from insects, trees, weeds, fruits and minerals imported from faraway lands and prepared with lye, vinegar, soda ash or alcohol to produce all the colors of the rainbow.

While the woodworker of the time tried out new colorants, in his own shop he usually stuck with the old proven methods of staining. The most important stain of the time was derived from the dried, green shell of the walnut. Brewed with some soda ash or a bit of lye and strained, this was and still is among the most popular and pleasant of stains. Today it is called walnut crystals or cassel extract.

The wood most frequently used in the shops at that time was oak, and the craftsmen knew that the water from the grindstone would turn this wheat-colored wood grey, or brownish-grey, especially when the grindstone water contained some urine, as it often did. In theory this iron-rich water worked only on oak, but some smart carpenter discovered and used mordants, or prestains. The simplest of these was a brew of acorns, which conveyed the necessary amount of tannic acid to any wood. Then the grindstone water would work well on it also.

I had saved every drop of water from Baradoux's grindstone, hoping to use it to stain the chairs. But after three solid weeks of experimenting, the grindstone mud turned out to be useless. Finally I hit upon a prestain mixture of equal amounts of dried sumac leaves (a common American plant) and acorn cups, brewed and strained. Washing down the chairs with this liquid imparted enough tannic acid to the wood so it would accept my final stain. This was the classical *brou de noix*, or walnut extract, described previously, modified by adding a generous portion of strong ammonia. The proportions of each component mattered less than the process itself—endless experimenting with the original ingredients to find the correct combination of mordant and stain, then refinement of the mixtures to obtain the perfect deep, brilliant color.



This is an original Louis XIV chair, much like the one Frank and Baradoux borrowed from the Louvre to copy for the Blue Salon.

Personal observation is by far the most important factor in learning this, or any other, trade. Let me illustrate:

While working for the Louvre around 1930, I detected the faint smell of perfume inside a cabinet that had been made by one of the masters of the Louis XV era. I attributed this to accidental spilling and paid no special attention. A few weeks later I came across the same sweet perfume inside another old chest. My curiosity aroused, I discovered the same scent inside many fine cabinets of the same period. Since perfume works by evaporation it was hard to believe these interiors had been perfumed on purpose, or that the smell could last through several centuries. My investigation drew a blank—no one could give me a clue about the mystery of the perfumed interiors.

In Paris every cabinetmaker makes his own *popote*, or polish, or has the secret of one. The *popote* is used to clean and restore the lustre of old furniture. At the cost of many aperitifs I learned a number of these secret formulas, most of them childishly simple. Generally they consisted of rainwater to which a few drops of oil and alcohol were added, plus some Tripoli earth, which is a fine abrasive similar to rottenstone. Bolder ones added a few drops of vitriol (a commercial version of sulfuric acid), to enhance the mystery of the product, not its efficiency. There was nothing earthshaking in any of this, until one of the old-timers disclosed that he dissolved some *benjamin* in the alcohol before adding it to the polish. This was new. I soon discovered that the proper name of the material was *gomme benjoin* (gum benzoin), and that it came in the form of pale, rust-colored, peanut-shaped lumps. When crushed, it had the very smell I had detected in the antique cabinets. From then on this subtle perfume became a trademark of my shop. In France I bought the benzoin in the paint store, but in America I had to order it from a large chemical company. The product I received was white, much like powdered milk, with no scent whatsoever. It had been refined out. To get the smell, one has to order unrefined gum benzoin, crush it and dissolve it in alcohol.

Observation, perseverance and a bit of luck also helped me find the proper lustre for my antique reproductions. I observed that beeswax applied to the wood long ago had a dry shine, while freshly applied wax looked greasy. I had to reproduce the dry shine, and I decided that the way was to dissolve the wax in water, rather than turpentine or some other greasy solvent. I asked dozens of chemists, but the answer invariably was the same: wax cannot be dissolved in water.

Still I never gave up. One day standing in line at the post office, I was able to help an embarrassed gentleman who had reached the window only to discover he had forgotten his money. A few hours later he was at my door with repayment, and we talked. He owned a small outfit that manufactured beauty products. He invited me to invest money in it and his pitch went something like this: "There is money in cosmetics, the cost is negligible, the markup is great and so is the profit. The base of 80% of our products is wax in water..." My heart stopped. Incredulous, I asked him to repeat what he had said: "The base of most of our products is emulsified wax." Here was the key—wax cannot be dissolved in water, but it can be emulsified in it. Not long after, I had my own emulsion, and triumphantly, the dry shine. It can be done in a blender.

This dry wax was the most important ingredient in the finishing of the furniture for the Blue Salon. With its help I could copy to perfection the shine and patina of true antiques. Moreover I could easily mix stain into my water-wax, to correct minor color deficiencies.

The remainder of the finishing secret involved some chain cloth from the armor of a medieval warrior, some old spurs, some sharkskin, bonesticks with rounded edges, and sunshine. The spurs reproduced spurmarks found on the models, very authentically. The old shops used sharkskin as sandpaper, and so did we. The chain cloth and bonesticks were used to burnish the waxed wood, and to achieve silky smoothness. And nothing can replace the rays of the sun when you want colors to fade.

To my knowledge the Blue Salon is still one of the most beautiful rooms at the Royal Palace of Alexandria, but Sylvestre Baradoux, one of the fast-shrinking clan of proud and true craftsmen, died in 1961.

Aztec Drum

Resonating tongues produce sound

by Ray Nitta

The drum is probably the earliest and most universal musical instrument. Used in initiation rites, magic, dance, religious ceremony, war, rock concert or symphonic orchestra, the hypnotic effect of rhythmic drumming is known to all cultures and peoples.

The instrument described here is patterned after the teponaztli, an ancient Aztec drum. Unlike the conventional skin-covered membranophone, the teponaztli was a unique idiophonic instrument with tongue-like protrusions to produce the sound. Perhaps best described as a two-keyed xylophone, the teponaztli resembled a narrow wooden barrel laid sideways. An H-shaped incision cut laterally into the top formed two tongues that vibrated when struck. The teponaztli was tuned by altering the thicknesses of these tongues to create different pitches, the most desirable being those with intervals a minor or major third apart. The hollow interior of the drum was its resonant chamber and a rectangular opening on the bottom of the instrument increased its volume, like the acoustical port on a guitar. The teponaztli was placed on a stand and played with rubber-tipped mallets (cured latex).

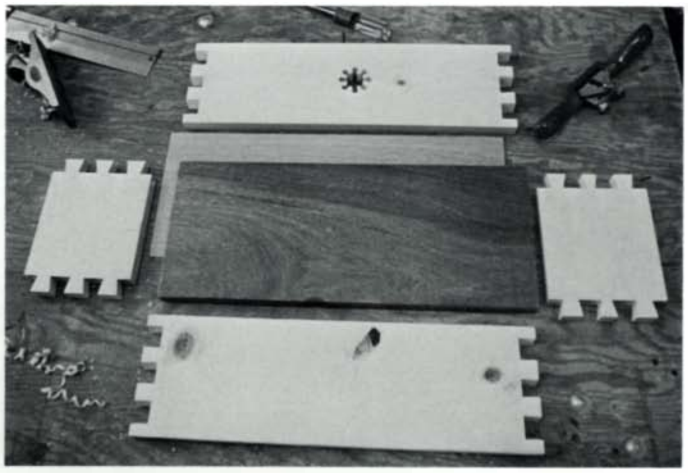
I have used the sound-producing principles of the teponaztli to make the drums shown here. The design, tongue proportions and resonant chamber have been carefully worked out to produce a pleasant progression of natural tones with good volume ranging around minor and major thirds to diminished and perfect fifths, just as in the original drum. The two tongues used by the Aztecs have been increased to six: three low-pitched bass tones and three contrasting higher ones. The woods used by the Aztecs can be expanded to include other resonant hard and soft woods such as padauk, redwood, bubinga, fir and Hawaiian koa.

Multiple factors govern the sound produced by this drum, among them the size and shape of the resonant cavity, the length and width of the tongues and the environment in which the drum is played. Any wood may be used for the sides and bottom of the drum, but the type (hard or soft) and grain of the top govern the sound. A softwood top makes a low thud. I advise using an even-grained hardwood: The harder the wood, the more crisp and metallic the sound.

The dimensions and proportions used here are to give the woodworker a concrete example to follow. However, there are no limits to what can be done to modify this basic design or to create a new one.

Cut the wood to the dimensions shown. The top slab is where the sound-producing tongues are to be cut. The 1/8-in. lauan ply on the bottom acts as a pliant membrane that mellows the tones. Remember to allow enough wood for the corner joinery. Although simple butt joints work well,

Six-tongued drums of various woods. Inlaid dots mark location of purest tones. Drumsticks are 3/8-in. dowels fitted with superballs.



A dovetailed drum ready to assemble and cut. Butt joints, locking miters or rabbets may also be used to join sides.

dovetails, locking miters or rabbets enhance the strength and beauty of the corners.

Make an acoustical port with about the area of a silver dollar in one of the long side pieces. This opening supports the bass tones and amplifies the sound. Carefully glue the pieces into a well-sealed box. I find that vibration-resistant aliphatic resin glue works best.

Draw the tongues onto the top as shown in the diagram. Drill eight 3/8-in. holes at the tongue bases to serve as slit stops. Cut the tongue pattern with a saber saw. If the resultant pitches don't ring clear, enlarge the base holes to 1/2 in. or even 5/8 in. This will narrow the base of the tongues and make them more flexible.

Gluing the box together before cutting the tongues, a reversal of usual procedure, allows the maker to experiment with tones. By starting the cutting in the center (without predrilling slit stops), the maker can cut, strike the drum, cut again, and so on until the desired tone is achieved. The top is firmly supported on all edges and is unlikely to split.

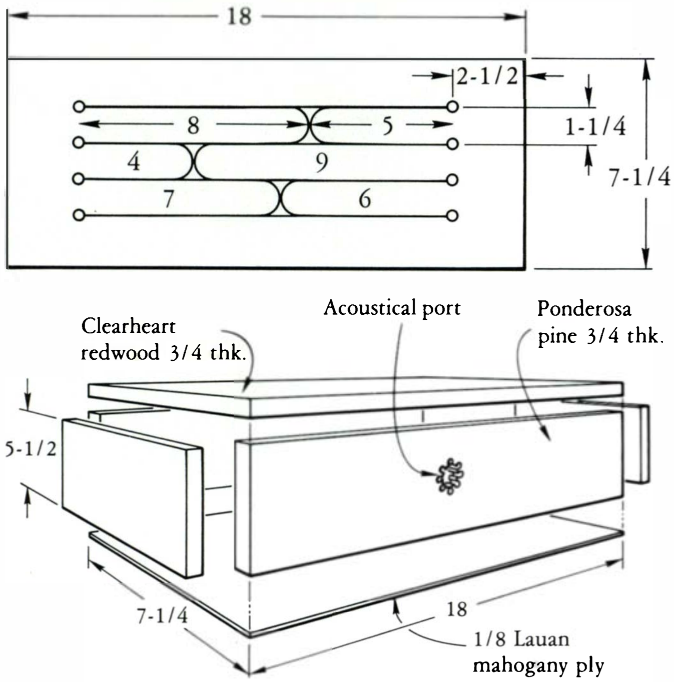
Now tap along the length of each tongue with a drumstick and mark the spots where the pitch seems purest, with the fewest overtones. These nodes are the spots to aim for when playing the drum. While they can be marked with paint, inlaid wood is prettier. I drill with a 1/2-in. spade or Forstner bit and plug with a 1/2-in. dowel, then sand smooth.

To finish the drum, round and form the edges with a drawknife and a plane. Sand with 80-grit garnet, then 120, and finish with 220. I use three coats of Watco and apply the final coat with 600 wet or dry sandpaper.

Make the drumsticks from 3/8-in. dowels 12 in. long, and 10-cent superballs from a toy store. Drill the balls with an 11/16-in. bit and press on.

Stands should be made to keep the drum from rattling when played on the floor or table and to increase its resonance. Good cushioning pads can be made from 1/2-in. foam or felt glued to matching blocks of wood.

The drum is magic. Place it on the foam stands, cradle it in your arm or set it on your lap. Start by playing softly and try to sustain a simple beat (about heartbeat tempo). Become one with the sound, let it move and merge with the natural rhythms of your body and feel the influence and power of the drum to move you physically, emotionally and spiritually.



Left, these tongue lengths produce pleasing bass and treble tones. Woods and dimensions can be changed to suit the maker.

Author and drum. Nitta teaches curriculum development to teachers in Berkeley, Calif. His Aztec drum was designed as a project for beginners in school shops on restricted budgets.

Gout Stool

Double ratchet adjusts height

by H. G. Carter

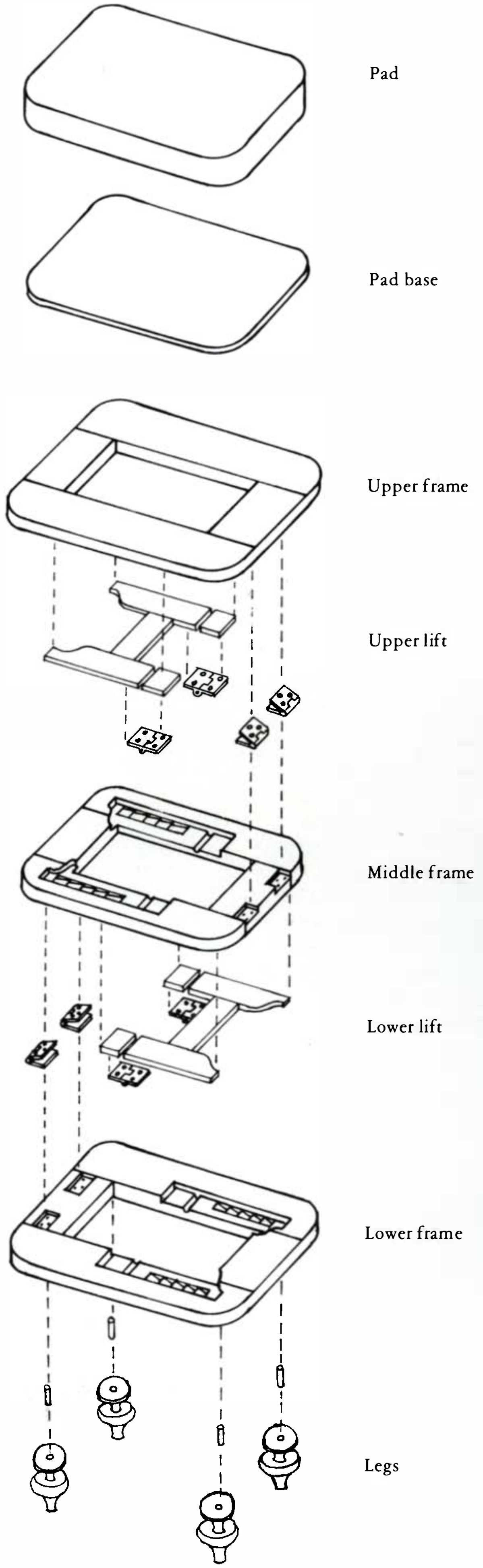
To make an adjustable surface, the ratchet mechanism is as simple and as reliable as gravity. The cabinetmakers of the 18th century frequently used single ratchets (*Fine Woodworking*, Spring '76) to support adjustable slanting tops for architect's tables, writing flaps, reading rests and music stands. The double ratchet was used to reach a greater height or to provide a raised horizontal surface, as in the gout stool described here.

This design was adapted from an antique stool purchased in South Carolina. Its double jacking mechanism will rise from the closed height of 6-1/2 in. to a full 20 in., just right for supporting the legs, whether they are tender from the gout or simply tired from jogging. If the jack were made sturdy enough, and the reactive mechanism and pivot pin strong enough, there is no reason why a large tabletop, elevated platform or even a chair could not be raised and supported.

The material layout shows how the entire stool, including leg glue-ups, can be cut from standard 1x10 stock, 65-3/8 in. long. I find the glued-up legs acceptable because they are masked by the overhang of the lower frame, but purists will need an additional piece of material 2-1/4 in. x 2-1/4 in.x 16 in. I have made three of these stools in pine, mahogany and wormy chestnut; one stool takes about 35 hours to make.

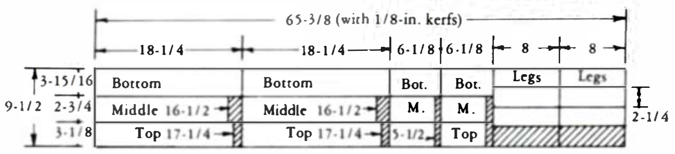
The legs have an uncomplicated contour and could easily

H. G. Carter, 56, is a mechanical engineer with Westinghouse Electric Corp., and an amateur housebuilder and furniture maker. He lives in Severna Park, Md.

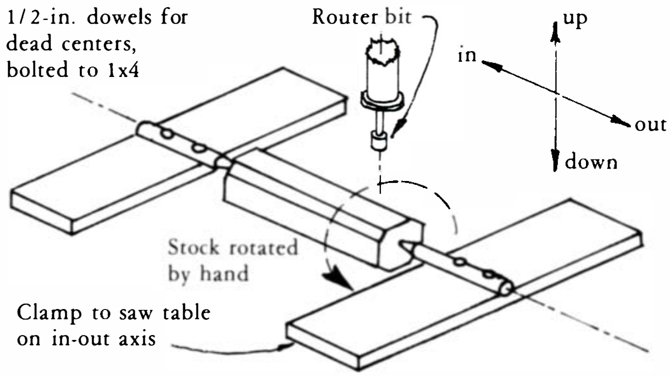


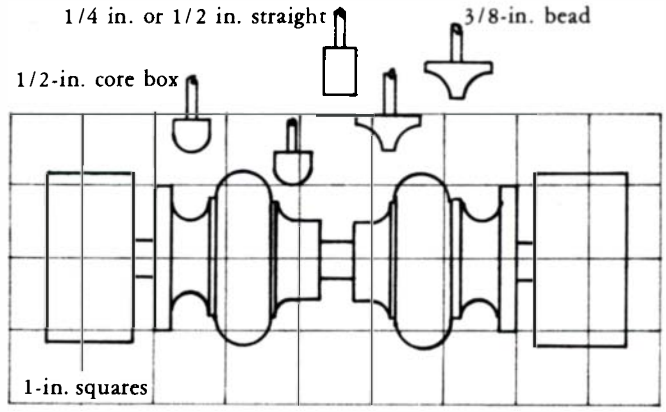
Gout stool anatomy.

Ratchet mechanism supports feet and legs, but is too light to sit on.



Frame and legs—1 x 10 x 65-3/8 (see cutting plan)
Lifts—two at 1/4 x 1-3/4 x 31 (pine or oak)
or two at 1/4 x 7-3/4 x 8-7/8 (birch plywood)
or two at .090 x 7-3/4 x 8-7/8 (metal)
Pad base—1/2 x 11-1/2 x 17 (solid or plywood)
Dowels—32 at 3/8 diameter
Pad—2 x 12 x 17-1/2 (foam)
Hinges—Four pairs at 1-1/2 wide x 2 (brass)
Covering—20 x 25 (antique velvet)





Above, cutting plan and bill of materials. Right, jig attached to radial arm saw table produces router-turned legs.

be lathe-turned. I don't have a lathe, so I devised a method using the radial arm saw. It is simple and surprisingly quick.

A pair of dead centers was made from 1/2-in. diameter dowels, sharpened at one end and screwed to strips of 1x4 stock with a shallow vee-groove to help secure the dowels. To allow enough swing, the saw table was removed and the dead-center strips were clamped to the table frame. The center line of this assembly must be on the center line of the saw's in-out axis.

The stock was prepared by drilling shallow 1/4-in. diameter holes in the center of each end and lubricating them with beeswax. About 1-1/4 in. was left on each end of the turning stock to provide a handhold. The subsequent rounding operation was made simpler by sawing 45° cuts off each corner. This piece was then placed between the centers and adjusted so that it revolved freely but without looseness.

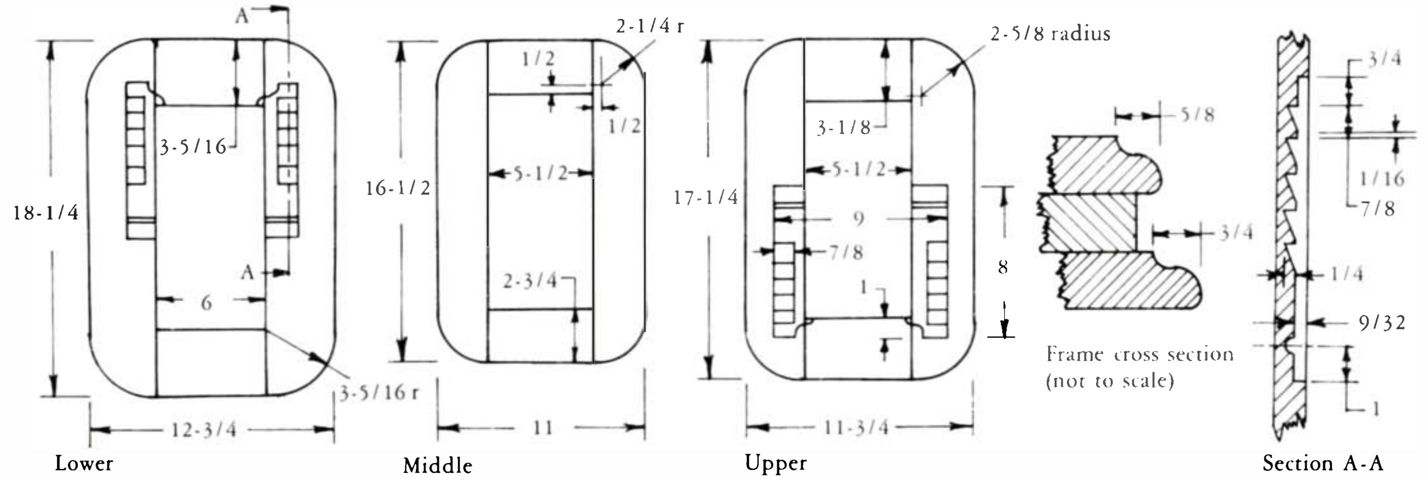
My radial arm saw has a high-speed take-off for router bits. To round up the stock, a surface-cutting bit was chucked up and lowered with the saw mechanism so that it just touched the surface of the wood. After checking the in-out movement, a safety stop was clamped onto the saw arm so the bit would not come closer than 1-1/4 in. to the forward end of the stock; this "safe area" protects the hand while cutting. The saw head was moved in so the bit was off the rear end of the stock and lowered until it would make a cut about 1/16 in. deep. The stock was held in the safe area on the forward end with one hand to keep it from rotating, and the saw head was slowly pulled forward to the stop with the other hand. The material was then rotated about 15°, held, and the saw head pushed to the rear, until a rough cylinder was formed.

For contouring, the appropriately shaped router bit was chucked, lowered until it just touched the surface of the cylinder, positioned at the correct in-out location, and the head locked in position. The stock was held with one hand and the cutter bit lowered with the saw mechanism; then with one hand on each end, the stock was slowly rotated 360°. The trick here is to rotate with one hand while restraining with the other. It does not require much force to rotate the stock, but if it is not restrained it may be caught by the revolving router bit. It is not wise to try to remove too much material at a time; about 1/32 in. is about right for a first try. The process of lowering and turning was repeated until the correct diameter was obtained. The combination of bits shown in the diagram was used in a like manner to obtain the complete contour. A narrow surface-cutting bit was used at the top and bottom of each leg to plunge-cut to about a 3/8-in. diameter. After the material was removed from the centers, the legs were separated with a miter saw and drilled for the attachment dowel. With sharp router bits, little sanding is required before finishing.

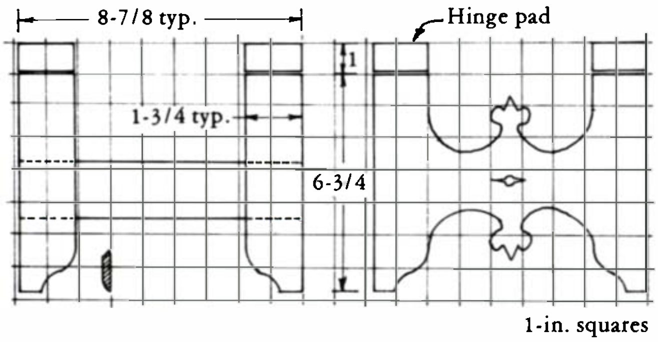
The three frames were doweled and glued, and the corners radiused. The frames could also be assembled with mortise and tenon. The beading on the edges of the upper and lower frames was also cut with router bits in the radial arm saw. However, for this operation the table was left on and the bit plunged down into the wooden rip fence for the first setup. The beads were then run by passing the frames under the bit and against the wooden stop. The short sides with the end grain were done first, the long sides next, and the radiused corners last. The frames were rotated while cutting the corners so that the center of the radius was held as closely as possible on the in-out center line of the saw. Three different bits (with some sanding) were used to form the outline shown.

The recess in the middle and lower frame into which the lift mechanism fits was again made with a surface-cutting bit in the radial arm saw, moving the frame on the table under the bit and using appropriate stops to prevent over-cutting. The internal corners were squared with a chisel. The semicircular groove for the hinge-pin housing was also added here. Since the overall recess is only slightly deeper than the jack thickness, it may be necessary to recess slightly for the hinge wings if everything fits together perfectly. However, in the three stools that I've built, this recess was not necessary because of play in the frame hinges. It's worth the gamble to leave this operation to the final fit-up.

The slanting grooves that position the lifts were chiseled in; the angle is not critical and was set by using a 1-1/2-in. block as a gauge under the handle end of an 8-in. long chisel.



Above, frame layout; left, glued-up lift layout and metal lift.



Be sure to leave a flat about 1/16 in. wide at the top of each wedge, for strength.

I've made three different types of lifts. The first, and the type used on the original stool from which this design was adapted, was glued up from 1/4-in. flat stock. The cross-halving joints were made with a straight-cutting router bit on the radial arm saw, with the strips flat on the table against the rip stop. When properly made and glued, this is amply strong. The second type was made from 1/4-in. birch plywood. Ply is easy to work with, fabrication requires only the single cutting operation on the scroll saw, and it stains to give a good match to the lighter woods. The third was cut from .090-in. aluminum on the scroll saw and painted gold. This has adequate strength and a satisfactory appearance; it would be very handsome in brass.

To allow room for the upholstery material, the pad base of 1/2-in. stock was cut about 1/16 in. smaller all around than the top surface of the top frame. The pad, of 2-in. soft urethane (or foam rubber), was cut about 1/8 in. larger all around than the base, using a power scroll saw. The base attaches to the upper frame with four 1-1/2-in. flathead screws put through from underneath.

The pad covering material was stretched around and stapled to the base, with care to make the corners even and neat. Even though excess covering material is removed at the corners, there will always be more thickness under the corners than in between. This can be compensated for by inserting narrow strips of cardboard under the covering material along the edges between the corners. Then when the top is pulled down, a good fit of pad to frame is assured.

With all the parts fabricated and sanded, an assembly fit-up was made to install the hinges and adjust any misalignments. The hinge rabbets were first chiseled in on both sides of the middle frame and the hinges installed. The middle frame then was positioned on the lower frame and the hinge locations marked and chiseled in; the hinges were attached and the fit-up checked. Install only one screw in each hinge leaf, so minor adjustments may be made by repositioning the other screws. The upper frame was positioned on the middle frame, and attached by the same procedure.

Then the hinges were attached to the two lift stands. These are nominally 1/4 in. thick and #5 or #6 screws are required to fit the hinges. Since this size screw is not readily available in a 1/4-in. length, 1/2-in. screws were cut to length. First the hinges were attached to a scrap piece of 1/4-in. stock and the protruding portion of the screws was cut off and filed flush with the wood; only three screws per hinge need be prepared this way. A regular screw was used to form the lead-in on the actual lift and then removed and replaced with the shortened one. The aluminum lift was attached to the hinges with pop-rivets in countersunk holes, the holes filled with body putty and sanded smooth before painting. With hinges attached, the lower lift was positioned between the middle and lower frames and the hinge location marked; the hinges and small lift blocks were installed and the alignment checked and adjusted. This operation was repeated for the upper lift. The four countersunk screw holes were then made for attaching the pad and its base.

The legs could be doweled in and attached now, but I decided to prepare them and not to glue them in until the end. This made it necessary to scrape away the frame finish under the base of the legs, but made it much simpler to sand and finish the frame.

After the assembly fit-up, everything was taken apart and given a good finish sanding. I then applied a wash coat of shellac, a 3-lb. cut diluted about 6 to 1 with alcohol; for the mahogany version I applied, and wiped, a brown mahogany paste wood filler before the shellac seal coat. On the end-grain portions, two more shellac coats were used to prevent excess absorption of stain. After another sanding, an oil stain suitable for the wood was applied and sanded. Next, four or five coats of Minwax oil were applied with sanding between. I usually start with a staining type, then switch to the natural color when the proper depth of stain is achieved. All parts were finished off with a heavy coat of paste wax and reassembled. The objective was to achieve the look of a carefully refinished antique, not the shiny look of a new piece.

[Editor's note: Hit Products Inc., Box 6906, Hollywood, Fla. 33021, makes a bracket for attaching a standard router to the yoke of a radial arm saw. It costs $29.95; when ordering, specify brand and model number of saw and router, and diameter of router without base.]

Two Tools

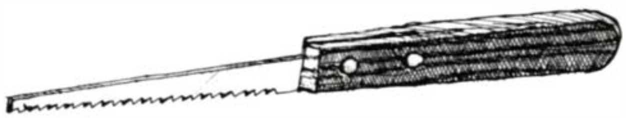
Small saw, marking gauge

by Jim Richey

If there is a class of tools missing from modern workshops it is those simple hand tools designed around a specific function. As a result, many of us find ourselves making a delicate little cut on a small piece of wood with a giant power saw, or designing our work around our equipment.

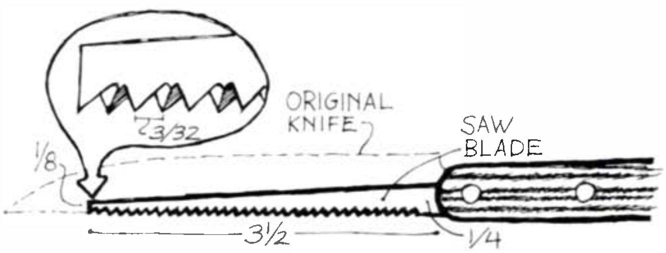
The planemaker's saw and a small marking gauge are members of the missing class—simple hand tools whose function has dictated their design. They are related in another way: The saw is used to make the gauge.

The planemaker's saw was originally used to cut the wedge dadoes in wooden planes. It is also quite effective for sawing through mortises or wedge slots, trimming protruding tenons or pegs without scratching the wood, and sawing curves in pierced work. In tight places it has no equal.



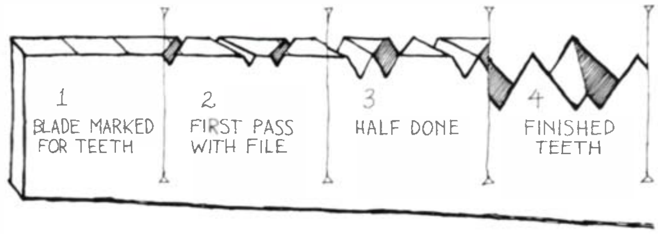
This planemaker's saw was made by cutting teeth into the back of an old kitchen knife. If you choose to go this route, pick a long, slim carbon-steel knife of the type readily available for a couple of dollars. Avoid the harder stainless-steel knives. Knives that taper in thickness from handle to tip are unsuitable. If you want to go through the annealing and heat-treating steps (*Fine Woodworking*, Fall '76), any scrap of tool steel about 1/16 in. thick will do.

Let your plans for the saw and the thickness of the blade dictate its length, width and taper. I needed a blade that could start its cut in a 1/4-in. hole, hence the slim design.

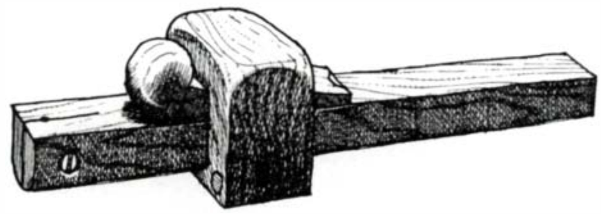


Slowly and carefully, grind the blade to shape, dipping frequently to avoid overheating. File the sides of the blade so that the front is a shade thicker than the back. Not much taper is needed, just enough to prevent binding.

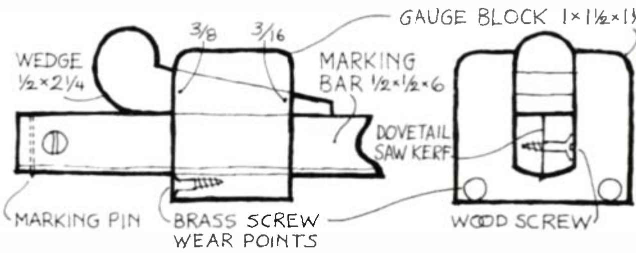
Now file the business edge of the blade perfectly straight and lay out the teeth. I spaced the gullets 3/32 in. apart. To cut in the teeth, hold the triangular file level at an angle (50° to 60°) toward the handle of the saw. File every other tooth four or five strokes and turn the blade around. Holding the file at the same angle to the handle, file the remaining teeth four or five strokes. Repeat until the teeth take shape.



By tilting the file slightly you can give the teeth more or less rake. Old-timers claim that more rake is better for soft woods, less for hard woods. Exact angles are less important than consistency. The filing process sounds difficult but it takes only about 10 minutes.

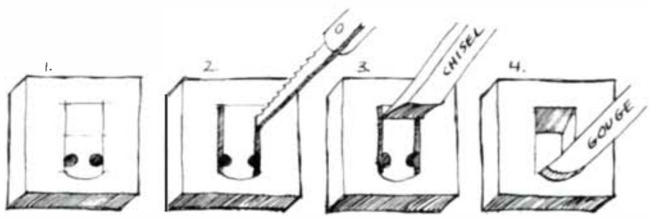


Although I have a beautiful old (but clumsy) marking gauge, I needed a small gauge designed specifically for mortise and dovetail work on thin wood. Designing the gauge around these functions resulted in the following dimensions.



As to variations, most would prefer a wider block with more lip for general use. The wedge could be moved to the back or side. The marking pin could be installed at an angle. Design your gauge around its intended uses.

The bar was made first so that its profile could be transferred to the gauge block. The bottom rounding of the bar is quite helpful in using the gauge and should be included. I drilled two 1/4-in. holes through the block and used the planemaker's saw to cut the tapered mortise, as shown. When



the mortise was trimmed so that the bar would fit smoothly, the wedge was rough-cut and trimmed to fit. I used a taper of 3/16 in. through 1 in. This is rather steep, but seems to hold well. Less taper would hold tighter.

The marking pin is a small brad held in a dovetail saw kerf with a screw. If the gauge is to be worked only one direction, the pin should have a knife-like point slightly angled so that the lip is pulled into the work. Those who mark both directions would prefer a pointed pin.

Wear points or a wear strip should be installed if the gauge is expected to have lots of use. I used two brass screws partially countersunk and filed flush.

Measuring Moisture

Portable meters prevent guesswork and grief

by R. Bruce Hoadley

Problems that result from using wood at the wrong moisture content continue to be among the most common frustrations and failures plaguing the woodworker. Many of the symptoms are all too familiar—warp or dimensional change in parts, opened glue joints, raised grain, end checks, finish imperfections—all because the moisture content of the stock was inappropriate.

Perhaps the excuses are also quite familiar. The job just had to get started and there simply was no time to allow the material to come to equilibrium in the shop. Or, the boards were bought from a dealer's bin; the oven-drying of samples just wasn't possible. Such woes can be avoided by using modern moisture meters, which give immediate and highly accurate readings. These magical little meters use the electrical properties of wood, and their development has followed the usual trend in electronics toward portable and miniature units with simplified operation. A wide range of models is now available to suit virtually every situation, from the hobbyist's use to production operations, in the shop or in the field.

For typical woodworking applications two principal types of meters are available. One is based on the direct-current electrical resistance of the wood and involves driving small, pin-type electrodes into the wood surface; the other uses the dielectric properties of the wood and requires only surface contact of the meter with the board.

The resistance meter takes advantage of the fact that moisture is an excellent conductor of electricity but dry wood is an effective electrical insulator. The meter itself is simply a specialized ohmmeter which measures electrical resistance. The piece of wood is arranged as an element in an electrical circuit by driving the two pin electrodes into it. The current (usually supplied by a battery) flows from one electrode through the wood to the other, then back through the ohmmeter. Actually, by simply driving pairs of nails into a piece of wood for electrodes and taking resistance measurements with a standard ohmmeter, readings could be obtained that would indicate relative moisture content. Perhaps some useful values could be obtained this way, but resistance varies nonuniformly with moisture content and a mass of data would have to be accumulated to make a useful and versatile meter. Commercially manufactured meters have the meter scale printed directly in percent moisture content instead of ohms of resistance. Because electricity follows the path of least resistance, the wettest layer of wood penetrated by the electrodes will be measured. For boards that dry normally, a drying gradient usually develops from the wetter core to the drier surface with an average moisture content about 1/5 or 1/4 the board thickness from the surface. Thus for 1-in. lumber, the pins should penetrate only 1/4 in. to measure average moisture content. In the smallest models, the electrodes are a pair of pins extending from one end of the unit, which can be pushed into the wood by hand. More commonly the electrode pins are mounted in a separate handle, attached by plug-in cord to the meter box. Electrodes of various lengths, up to 2 in. or more, are available for measuring thick material so the same meter can be used for thin veneer and heavy planks. Electrodes should be inserted so current flow is parallel to the grain. Electrical resistance is greater across the grain than parallel to it, although the difference is minor at lower moisture-content levels.

Meters using the dielectric properties of wood have a surface electrode array which generates a radio-frequency field that extends for a prescribed distance when placed against the wood. Some meters measure the power-loss effect which varies according to moisture content, whereas others respond to changes in electrical capacitance. Different models have electrodes designed for field penetration to various depths. Field penetration to about half the stock thickness is usual. Where moisture content is uneven, a more or less average reading will be given.

Green wood may have an extremely high moisture content, but woodworkers are most concerned with moisture measurement of seasoned stock. Depending on geographic location, air-dried wood will reach moisture equilibrium levels in the 12% to 15% range. For interior products, stock must usually be kiln-dried or conditioned to the 6% to 8% range. Fortunately, the electrical properties of wood are most consistent at moisture levels below fiber saturation (25% to 30%), the range of most interest to woodworkers. Dielectric meters can indicate moisture contents down to zero. The electrical resistance of wood becomes extreme at low moisture contents, limiting the lower end of the range of resistance meters to about 5% or 6%. More elaborate meters sometimes have scales extending to 60% or 80% moisture content; however, electrical properties are less consistent above fiber saturation so readings in this range must be considered approximate.

Moisture meters usually give scale readings of percent moisture content that are correct for certain typical species at room temperature. Instruction manuals give correction factors for other species and different temperatures. Since density has little effect on electrical resistance, the species corrections are usually less than two percentage points for resistance meters; correction factors may be greater with power-loss meters. Resistance readings must also be corrected about one percentage point for every 20° F departure from the calibration standard. With dielectric meters the correction is more complicated, but is well explained in the instruction manuals. For anyone using meters under regular conditions—with one or a few common species and always at room temperature—correction factors either are not applicable or become routine.

The values obtained with a resistance meter can be expected to agree within one-half a percentage point with those obtained by oven-testing for samples in the 6% to 12% range; within one point in the 12% to 20% moisture-content range, and within two percentage points in the range from 20% to fiber saturation.

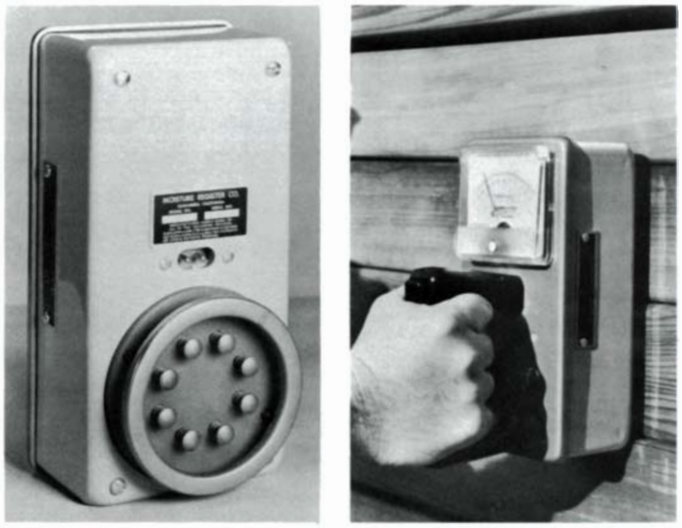
It is important to appreciate that a meter in good condition will faithfully and accurately measure the electrical properties of the wood being sampled. The operator must understand the vagaries of wood moisture and interpret accordingly. For example, a new owner of a meter might discover a variation of two or three percentage points up and down a given board. The common reaction is, "the meter is only accurate to within three percent" or, "it gives variable readings." But in fact the meter is properly measuring moisture variations that exist in the board. Thus one must measure average or typical areas of boards to avoid the ends or cross-grain around knots, which dry most rapidly.

Each type of meter has its strengths and weaknesses. Resistance meters have the disadvantage of leaving small pinholes wherever the electrodes were inserted, which might be unacceptable in exposed furniture parts, gunstocks and the like. On the other hand, a given meter can be used with a variety of electrodes in a wide range of situations. Resistance meters with a 6% to 30% range are available down to pocket size, with both built-in short pin electrodes and separate cord-attached electrodes, for about $150. Radio-frequency power-loss meters in compact hand-held models, with electrodes for one-inch field penetration and scaled from 0 to 25% moisture content, cost about $400. Their distinct advantage is the ability to take readings without marring surfaces, thereby allowing measurements of completed items, even after the finish has been applied. These meters are extremely quick to use, but are less versatile because a given electrode style works only for a particular area and depth of field.

The actual dollar value of moisture measurement is very difficult to assess. It should be given serious thought, however, as it is most commonly underestimated. Many woodworkers buy machinery costing hundreds of dollars to attain close dimensional tolerances that are later lost when parts shrink or swell because there was no way of measuring moisture. What is the real cost of a solid cherry dining table that is ruined because of the errant moisture content of just one edge-glued board in its top?

Nobody would buy meat without knowing the grade, or a used car without the mileage, and nobody should buy lumber without knowing its dryness. Yet some lumber dealers sell millions of board feet a year and don't own a moisture meter. A relatively tiny investment would allow them to provide this valuable service to their customers.

[Author's note: For more about moisture meters, see *Electric Moisture Meters for Wood* by William L. James (U. S. Forest Products Lab. Gen. Tech. Rpt. FPL-6, 1975), available from the Superintendent of Documents, U. S. Govt. Printing Office, Washington, D. C. Portable moisture meters are made by Delmhorst Instrument Co., 607 Cedar St., Boonton, N. J. 07005; Moisture Register Co., 1510 W. Chestnut St., Alhambra, Calif. 91802; Electrodyne Inc., 2126 Adams St., Milwaukie, Ore. 97222; and Valley Products and Design, Box 396, Milford, Pa. 18337.



Electrode array of dielectric meter, left, generates radio-frequency field when pressed against face of board, right. Strip arrays for edge measurement are also available.

Pin electrodes of resistance meter are pushed into board, parallel to grain. Center pin gauges penetration.

Electrodes are attached to case of pocket-size resistance meter.

The Flageolet

Basic woodwind is turning, drilling exercise

by Kent Forrester

Over the last couple of centuries, most woodwind instruments (flutes, clarinets, oboes, and others) have accumulated a bewildering variety of keys, levers, springs, bushings and extra note holes. Because of this, making a woodwind instrument seems beyond the skill of the average woodturner. However, stripped of modern embellishments, woodwinds make interesting and relatively easy woodturning projects.

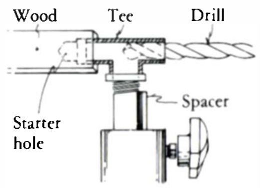
The modest little woodwind known as the flageolet is not as versatile as a clarinet and not as pretentious as an oboe (you'll never get a job playing it in the Philharmonic). But it has nevertheless been a favorite of musicians for centuries—the 17th-century diarist, Samuel Pepys, loved his flageolet almost as much as he loved barmaids. With a pleasant, high-pitched piping sound and a range of more than two octaves, the flageolet can be used both for accompaniment (it goes particularly well with guitars and voice in folk music) and for solos.

To make a flageolet, first cut a 1-in. turning square 14 in. long out of the best hardwood you have. Cherry, walnut and maple are fine for flageolets; rosewood, cocobolo and ebony are even more handsome.

The boring operation will require support for the tailstock end of the wood. Buy a brass or steel plumbing tee with an inside diameter of at least 1/2 in. and an outside diameter of no more than 7/8 in. Also pick up a 4-1/2-in. long piece of pipe, threaded on one end, that can be screwed into the bottom of the tee. This pipe will be mounted in the lathe's tool post.

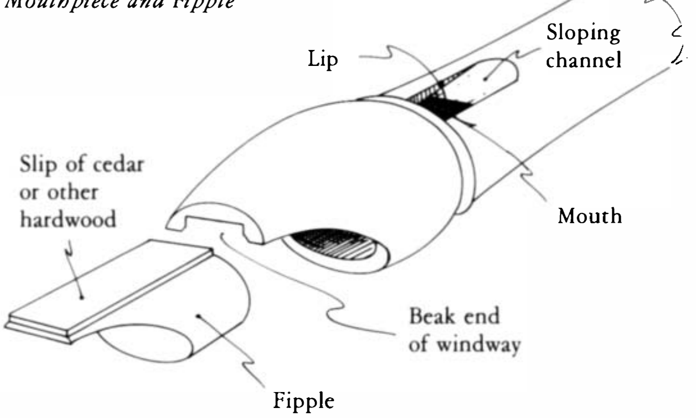
Now drill a hole about 3/8 in. deep in the center of the end of the stock, of the same diameter as the outside diameter of the tee. Drill a 1/2-in. starter hole for your bit in the center of the previous hole. Because the stock will be turning on the tee, rub soap inside the larger hole to reduce friction.

Now mount the stock between a headstock spur and the tee jig. With the tee loose in the tool post, pull it up so that the end of the tee enters the hole in the stock. Mount a 1/2-in. twist drill bit in a chuck in the tailstock and push this bit into the starter hole in the stock. This will center the tee on the lathe. Cinch up the tee tightly, lock it to the tool post and lock the tool post to the lathe bed.

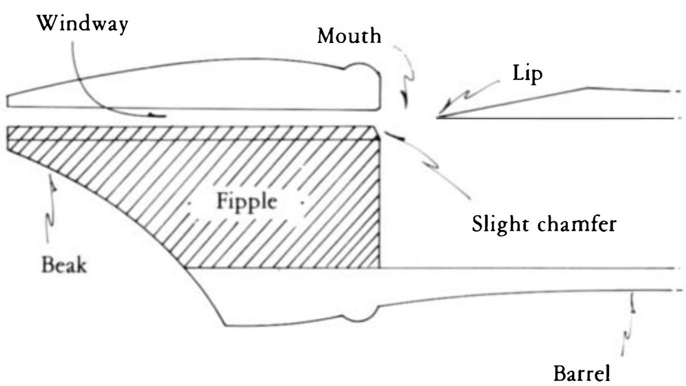


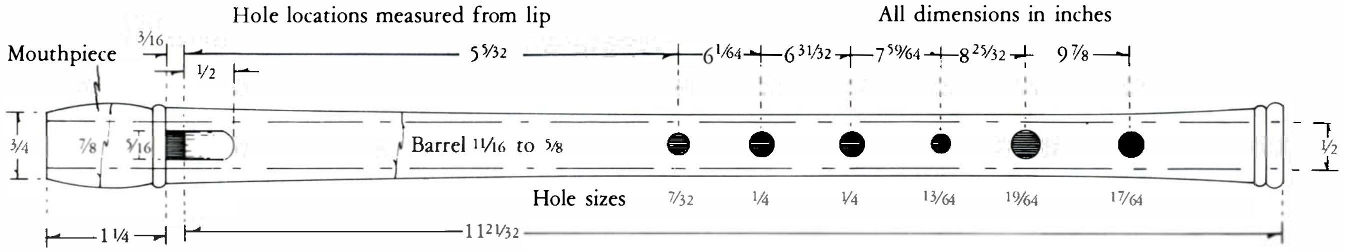
A 1/2-in. shell auger mounted in the tailstock will bore a straight, smooth hole. A bell hanger's bit (of the type electricians use) or a 1/2-in. twist drill mounted on a bit extender

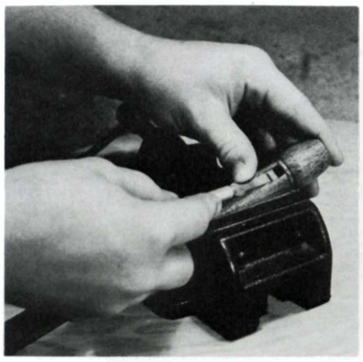
Exploded View of Mouthpiece and Fipple

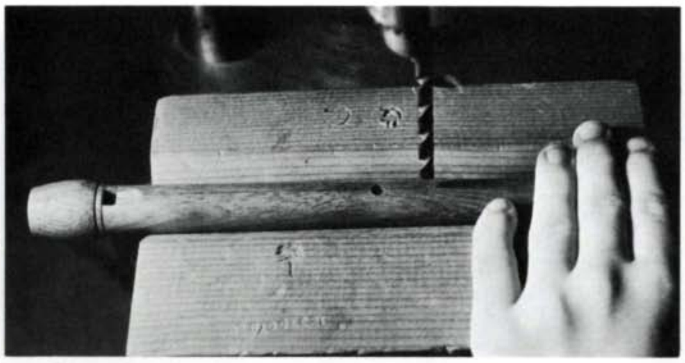


Side View

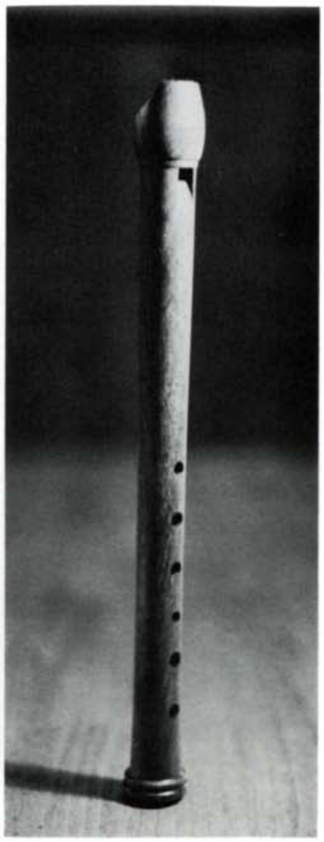








The flageolet is basically a whistle; sound is produced when wind hits sharpened edge of lip, formed by filing sloping channel in front of mouth, left. Note hole locations are carefully measured from lip, right.



Flageolet is held in V-block, left, to file channel behind mouth that forms upper surface of windway. To sand inside of bore, right, garnet paper is wrapped and glued around dowel and chucked in lathe.

will also do the job. These bits will drift a little, but the stock is cut oversize to allow for it.

Carefully measure the distance to the spur and stick a piece of masking tape on the bit where it must stop. Run the lathe at its slowest speed, drill slowly and clear the chips frequently. Now remove the stock from the lathe and saw off the end, in small increments, until the hole appears.

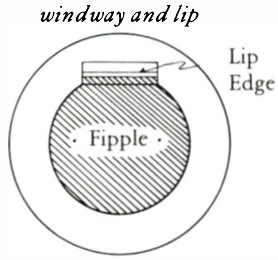
To facilitate turning, plane or saw off the corners from the 1-in. stock. Now place a cone-shaped abrasive wheel with a 1/4-in. or 1/2-in. shank in a chuck in the headstock and a cone center in the tailstock. Mount the wood between these two cones and cinch up tightly so that the abrasive cone grabs the stock and turns it. Turn the flageolet to shape and sand.

Begin shaping the mouth by drilling two or three 5/32-in. diameter holes. Then file to the dimensions of the rectangular shape, as shown in the drawing. Now measure from the lip and drill the six note holes. To sand the inside of the bore, wrap and glue sandpaper around a 3/8-in. dowel and chuck the dowel in the lathe. Then turn on the lathe and run the bore over the sandpaper until it is smooth. Smoothness is important, so go down to 120 or 220 grit.

To make the windway, use a flat file that is 5/16 in. wide or less. File a channel at the center of the top of the bore until the underside edge of the area that will form the lip is flat. Cut and file the sloping channel that forms the sharp edge of the lip. Now finish filing the channel back of the mouth, to form the upper surface of the windway. A piece of soft wood or leather in the mouth will prevent the file from damaging the lip. Continue filing until the lip, as you sight down the windway, is about 1/64 in. below the top of the windway.

To make the fipple, cut a 1/2-in hardwood dowel to length and sand a flat that is 5/16 in. wide. On this flat, glue (with waterproof glue) a slip about 1/16 in. thick of maple, cherry or cedar. If you use maple or cherry, coat the surface with varnish to prevent the grain from rising. Moisture has so little effect on cedar that all it needs is a coat of penetrating oil. Sand this slip until it is 1/64 in. below the lip when, fipple in place, you sight down the windway. The height of the windway at the mouth end will now be 1/32 in. and the lip will appear in the center of the windway. The height of the windway at the beak end is not critical, but 1/16 in. or a little more is about right. Now cut the beak to shape.

End view of windway and lip



To hold the flageolet, let the instrument rest on your thumbs and use the first three fingers of each hand to cover the six note holes. Rest the mouthpiece between your lips and blow with sufficient strength to produce a soft, steady tone.

The primary scale is produced by uncovering each hole in order. The lowest note, "C," is produced when all holes are covered. The semi-tones (half-notes) are produced by withdrawing the tip of your fingers so that they cover only half the holes. The second octave is achieved by blowing harder.

Test your flageolet by running through at least two octaves. If the low notes are very weak (almost inaudible), remove the fipple and increase the chamfer or sand the fipple lower. If the high notes will not blow, you have sanded the fipple too low.

To eliminate air leaks between the fipple and the bore, coat the fipple with hot wax before you insert it. Finish the bore and the exterior with a few coats of penetrating oil or varnish.

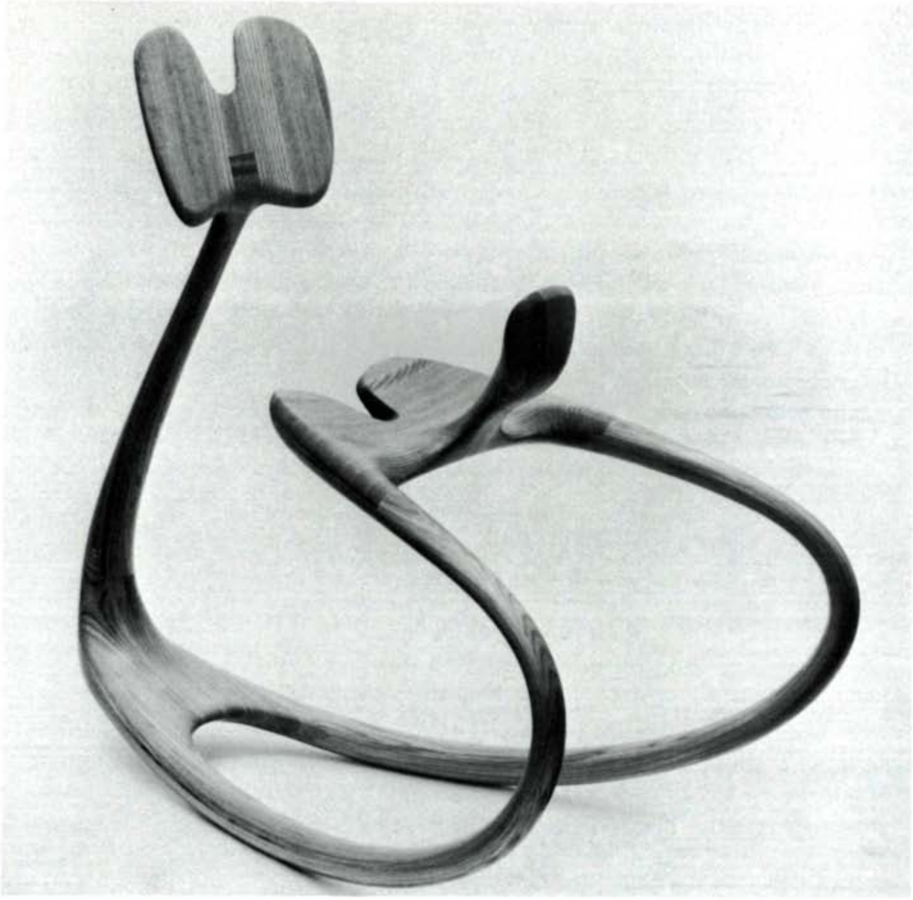
Kent Forrester, 39, is associate professor of English at Murray State University, Murray, Ky. He researches and builds medieval, Renaissance and 18th-century woodwind instruments.

Young Americans

A prestigious show

The work on this page is by four of the 22 woodworkers represented at the American Crafts Council's prestigious show, ''Young Americans: Fiber, Wood, Leather, Plastics,'' which was on view in June and July in Winston-Salem, N. C. ''Young Americans,'' a rare opportunity for craftsmen under 30, consists of three separate competitions: clay and glass will be judged next year, metal and enameling in 1979. The exhibition reopens Oct. 15 at the Museum of Contemporary Crafts in Manhattan, and after Jan. 1, 1978, it will travel across the country. More photos on page 84.

Top right, poplar burl bowl, 20 in. long, by Howard Werner, 27, craftsman-in-residence at Peters Valley, Layton, N. J.; center right, wallcabinet, 22 in. x 18 in. x 12 in., in maple, rosewood and brass, by Bruce Beeken, 24, a student at Boston University; below right, rocking stool in bent and laminated ash, 32 in. high, by William Hammersley, 27, woodworking teacher at Virginia Commonwealth University; below left, hand table in sycamore, bass, teak and purpleheart, 40 in. high, by Bruce N. Decker, 28, of San Bernardino, Calif., a graduate student.



HARDWOOD SOURCES (*continued*)

This is the second addition to the listing of hardwood suppliers that first appeared in the Fall '76 issue of Fine Woodworking. We hope readers will continue to inform us of other suppliers 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: dom.—domestic lumber; imp.—imported lumber; AD/KD—air dried/kiln dried; min.—minimum board-foot quantity of lumber sold; veneer—if sold in less-than-a-flitch quantity; planks—if thicker than 8/4; logs—if available; plywood—hardwood plywood. Specialties are listed last.

Alabama:
Dilworth Lumber Co., 415 Church St. NW, Huntsville 35804. (205) 539-4123. Dom. AD/KD, imp. KD, no min. Planks, plywood. Walnut, birch, maple, cherry.

Arizona:
Austin Hardwoods, 4161 E. 45th St., Tucson 85713. (602) 623-7186. Dom. & imp. KD, min. 10. Planks. Padauk, zebra, goncalo alves, rosewood, purpleheart.

Arkansas:
Nations Hardwood Co., Inc., Prairie Grove 72753. (501) 846-2412. Dom. AD, min. 10. Planks, logs. Ash, walnut, cherry, hard maple, cedar, sycamore, elm, oak.

California:
Baker Plywood Co., Inc., 2969 Century, Costa Mesa 92626. (714) 549-3073. Dom. & imp. KD, no min. Dom. & imp. veneer, plywood, moldings.

Cali'co Hardwoods, Inc., 1648 Airporr Blvd., Windsor 95492. (707) 546-4045. Dom. & imp. AD/KD, no min. Planks, logs. Walnut, madrone. Gunstocks.

Custom Wood Craft, 2818 N. Main St., Walnut Creek 94596. (415) 938-2818. Dom. & imp. KD, no min. Dom. & imp. veneer, planks.

Norcal Walnut Products, Pray Rd., South Redding 96001. (916) 241-2997. Dom. AD, no min. Planks, logs. California black walnut, lathe blocks, stump slabs.

Colorado:
Bill Collins Hardwoods, Inc., 500 W. Wesley Ave., Denver 80223. (303) 744-6261. Dom. & imp. KD, no min. Veneer; planks, logs, plywood. Walnut.

Connecticut:
Moore's Sawmill, 44 West St., Bloomfield 06002. (203) 242-0656. Dom. AD/KD, min. 50. Planks, logs. Oak, cherry, maple, birch, ash, beech.

Tech Plywood & Lumber Co., 110 Webb St., Hamden 06511. (203) 777-5315. Dom. & imp. AD/KD, no min. Dom. & imp. veneer; planks, plywood. Cocobolo, zebra, rosewood, bubinga, padauk, teak, cherry.

Delaware:
Shields Lumber & Coal Co., Kennett Pike, Greenville 19807. (302) 656-2541. Dom. AD/KD, imp. KD, no min. Plywood.

Georgia:
Leon W. Colwell, 236 Peachtree Way, Atlanta 30305. (404) 237-0095. Dom. AD, min. 10. Planks. Walnut, cherry, maple, birch, beech, ash, wormy chestnut.

King Hardware, 1837 Piedmont Rd. NE, Atlanta 30324. (404) 872-7532. Dom. AD/KD, no min. Walnut, ash, cherry, maple, poplar.

Hawaii:
Earthwoods, 2632 Kilihau St., Honolulu 96819. (808) 847-5066. Dom. & imp. AD/KD, no min. Plywood. Koa, monkey pod.

Illinois:
Handcrafted, 744 W. Fullerton, Chicago 60614. (312) 549-2389. Dom. & imp. KD, no min. Dom. & imp. veneer; planks, plywood.

Indiana:
Cash and Carry Lumber Co., Inc., State Route 32, Daleville 47334. (317) 378-7575. Dom. & imp. AD/KD, no min. Dom. & imp. veneer; planks, logs, plywood. Ebony, Osage orange, walnut burl. Custom millwork.

Northwest Lumber Co., 5035 Lafayette Rd., Indianapolis 46254. (317) 293-1100. Dom. KD, no min. Plywood.

Louisiana:
Enchanted Woods, 205 W. 70th, Rear, Shreveport 71106. (318) 868-4929. Dom. & imp. KD, no min. Planks, plywood. Padauk, rosewood, ebony, mahogany.

Maine:
Architectural Woodcraft Corp., Bridge St., N. Vassalboro 04962. (207) 872-2382. Dom. & imp. KD, no min. Planks, plywood. Birch, maple, poplar, mahogany.

Maryland:
MacLea Companies, 801 Aliceanna St., Baltimore 21202. (301) 837-3060. Dom. & imp. AD/KD, no min. Planks, plywood. Teak, mahogany, obeche.

MacLea Lumber, 5904 Ritchie Highway, Baltimore 21225. (301) 789-6100. Dom. & imp. AD/KD, no min. Planks, plywood.

The Wooden Era, 234 Main St., Reisterstown 21136. (301) 833-1444. Dom. & imp. KD, no min. Bubinga, rosewood, cocobolo, tulipwood, satinwood, oak, cherry.

World of Hardwoods, Inc., Harmans 21077. (301) 766-3991. Dom. & imp. AD/KD, no min. Dom. & imp. veneer; planks, plywood. Bubinga, purpleheart, wenge, satinwood, zebra, shedua.

Massachusetts:
Albany Street Woodshop, 533 Albany St., Boston 02118. (617) 338-8011. Dom. & imp. KD, no min. Planks. Custom millwork.

Violette Plywood Corp., Northfield Rd., Lunenburg 01462. (617) 582-4896. Hardwood plywood, no min.

Michigan:
Beyster, Inc., 2905 Beaufait Ave., Detroit 48207. (313) 921-3029. Dom. AD/KD, no min. Planks.

Johnson's Workbench, 563 N. Cochran St., Charlotte 48813. (517) 543-2727. Dom. & imp. KD, no min. Dom. & imp. veneer; planks, plywood. Padauk, obeche, hickory, willow, cocobolo, zebra.

Montana:
O'Neil Lumber Co., 424 Main St., Kalispell 59901. (406) 755-4596. Walnut, maple, mahogany, redwood.

New Hampshire:
Gurian Guitars Ltd., Inc., Canal St., Hinsdale 03451. (603) 336-7491. Dom. AD/KD, imp. KD, min. 50. Dom. & imp. veneer; planks. Woods for musical instruments and furniture.

New Jersey:
Interstate Hardwood Lumber Co., Inc., 850 Flora St., Elizabeth 07201. (201) 353-5661. Dom. & imp. KD, min. 1 board. Planks, plywood. Birch, oak, ash, maple, cherry, mahogany, zebra. Turning squares.

Orange Valley Hardware, 610 Freeman St., Orange 07050. (201) 676-0900. Dom. & imp. KD, no min. Dom. & imp. veneer; planks, logs, plywood.

New York:
David A. Buckley, RD 1, Box 6484, West Valley 14171. (716) 942-6631. Dom. AD/KD, no min. Planks, logs. Maple, walnut, butternut. Turning & sculpting blocks.

Ohio:
Charles F. Shiels & Co., 1301 W. Eighth St., Cincinnati 45203. (513) 241-0239. Dom. AD/KD, imp. KD, min. 200. Planks.

Oregon:
Santiam Hardwoods & Sales, Inc., 960 Commercial St. NE, Salem 97301. (503) 585-2262. Dom. KD, imp. AD/KD, no min. Dom. & imp. veneer; planks, plywood. Myrtle, yew, dogwood, oak, curly maple.

Pennsylvania:
Diamond Hardwood, Paulson & Nelson Sts., Pittsburgh 15206. (412) 441-1354. Dom. & imp. KD, no min. Planks. Teak, mahogany, banak.

The Sawmill, Inc., PO Box 329, Nazareth 18064. (215) 759-2837. Imp. AD/KD, min. 100. Planks, logs. Rosewood, ebony, cocobolo.

Tennessee:
Woodstream Arts, 107 Northview St., Knoxville 37919. (615) 588-2878. Dom. & imp. AD/KD, min. 10. Planks, logs, plywood. Tulip, rosewood, walnut burl.

Texas:
Austin Hardwoods, 916 Tony Lama Dr., El Paso 79915. (915) 593-0126. Dom. & imp. AD/KD, no min. Dom. & imp. veneer; planks. Mansonia, padauk, ebony, teak.

Vermont:
Sterling Pond Hardwood, 412 Pine St., Burlington 05401. (802) 863-5820. Dom. KD, no min. Planks. Bird's-eye maple, butternut.

Virginia:
Arlington Woodworking and Lumber Co., Inc., 1560 Spring Hill Rd., Arlington 22101. (703) 893-4770. Dom. & imp. KD, min. 10. Dom. & imp. veneer; planks, logs, plywood. Custom millwork.

Cornerstone Cabinetry, Newington 22122. (703) 550-9167. Dom. & imp. KD, no min. Plywood. Ebony.

W. A. Smoot & Co., Inc., Box 88, Alexandria 22313. (703) 549-0960. Dom. AD/KD, imp. KD, no min. Planks, plywood. Teak, Sitka spruce. Special millwork.

Washington:
Hammond Ashley Associates, 19825 Des Moines Way South, Seattle 98148. (206) 878-3456. Dom. AD, no min. Planks. Woods for stringed instruments.

Hardwood Specialties, Inc., 810 SW 151 St., Seattle 98166. (206) 242-0462. Dom. & imp. AD/KD, no min. Dom. & imp. veneers; planks, plywood.

Canada:
A. & M. Wood Specialty, 358 Eagle St. N., Cambridge (Preston), Ont. N3H 4S6. (519) 653-9322. Dom. & imp. AD/KD, no min. Veneer; planks, logs. Exotics.

A. B. Clarke, Ltd., 2900 Ave. Francis Hughes, Laval, Que. H7L 3J5. (514) 663-8770. Dom. & imp. AD/KD, no min. Planks.

Goodfellow Lumber Sales, Ltd., 101 Stinson Blvd., Montreal, Que. H4N 2E4. (514) 748-6511. Dom. & imp. AD/KD, $200 min. Planks. Teak, mahogany.

Jones Wood Specialties, Ltd., 771 Warden Ave., Scarborough, Ont. Dom. & imp. AD/KD, min. 500. Planks. Teak, mahogany, afrormosia.

MacLean and Murray, Ltd., 100 Mill St., Box 275, Woodstock, Ont. N4S 7X6. (519) 537-5591. Dom. & imp. AD/KD, no min. Dom. & imp. veneer; planks, logs, plywood.

Oliver Lumber Co. of Toronto, Ltd., 85 Vickers Rd., Islington, Ont. M9B 1C1. (416) 233-1227. Dom. & imp. KD, no min. Planks, marine plywood. Ipe, angico.

Ontario Hardwood Products, Ltd., 45 Ernest Ave., Toronto, Ont. M6P 3M8. (416) 535-3191. Dom. & imp. AD/KD. Planks.

Oriole Lumber Ltd., 7181 Woodbine Ave., Markham, Ont. L3R 1A3. (416) 495-6242. Dom. & imp. KD, no min. Dom. & imp. veneer; planks, plywood.

Unicorn Universal Woods, 290 Shuter St., Toronto, Ont. (416) 861-1418. Dom. KD, imp. AD/KD; min. 1 board per species. Dom. & imp. veneer; planks.

SOURCES OF SUPPLY (*continued*)

As an editorial service, we periodically list sources of tools and woodworking supplies. This listing expands the update that appeared in chart form in Fine Woodworking, Winter '76. It includes only mail-order firms.

American Woodcrafters, Box 919, Piqua, OH 45356. (513) 778-1942. $1 catalog, mail order, retail store sales. Veneer, hardwoods, carving & turning blocks. Hand & power tools. Hardware, marquetry supplies, finishing materials, books, plans.

Big Tool Box, Inc., 2000 S. Havanna St., Aurora, CO 80232. (303) 755-3522. No catalog; mail order, retail store sales. Hand tools; power tools. Hardware, finishing materials, books.

Bimex, Inc., 487 Armour Circle NE, Atlanta, GA 30324. (404) 873-2925. $2 catalog, mail order, retail store. Cabinetmaking, carving hand tools; power tools.

Brazco Enterprises, 2900 Binyon, Ft. Worth, TX 76133. (817) 923-4360. $.25 catalog, mail order. Books, plans.

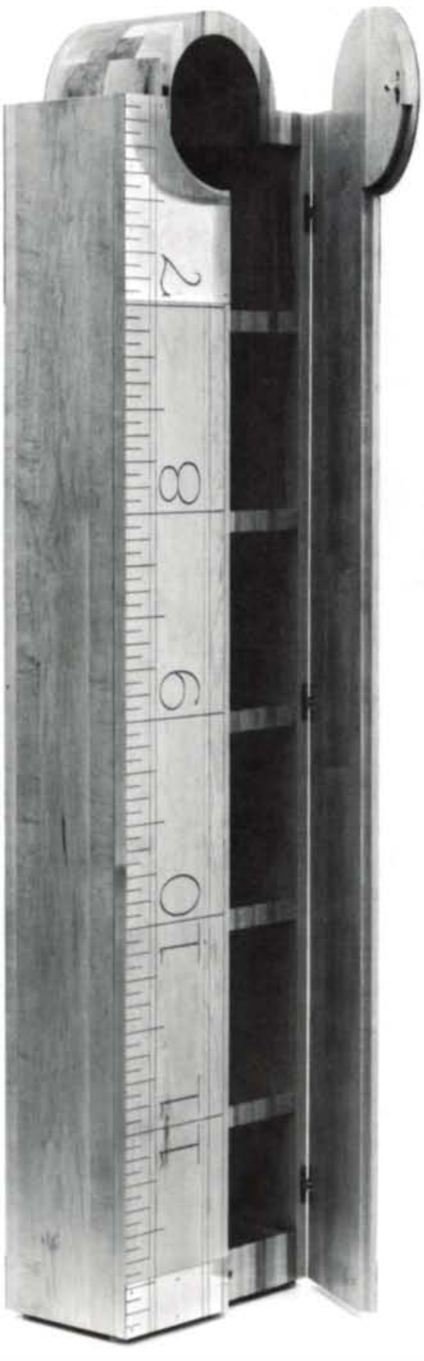
Peter Child, The Old Hyde, Little Yeldham, Halstead, Essex, England. Free catalog, mail order, retail store sales. Hardwoods, turning blocks. Turning tools, lathes.

Conover Woodcraft Specialties, Inc., 18124 Madison Rd., Parkman, OH 44080. (216) 548-5591. $1 catalog, mail order, retail store sales. Hand tools, stationary power tools.

Handcrafted, 744 W. Fullerton, Chicago, IL 60614. (312) 549-2389. $1 catalog, mail order, retail store sales. Veneer, hardwoods, plywood, carving & turning blocks. Hand tools; power tools. Hardware, finishing materials, books, plans.

Ross Tool Co., 257 Queen St. W., Toronto, Ont., Canada M5V 1Z4. 598-2498. No catalog, mail order, retail store sales. Cabinetmaking, carving and turning hand tools.

Smith's Knife & Stone, 262 Central Ave., Hot Springs, AR 71901. (501) 623-8128. Free catalog, mail order, retail store sales. Carving hand tools, whetstones.



Winners

It's been nine years since the American Crafts Council last organized a "Young Americans" competition. This year the jurors selected 95 craftsmen from 728 entrants; 22 are woodworkers, and two, Lee Schuette and Rory McCarthy, were award winners. Schuette's "Boxwood Rule Cabinet," left, of laminated maple and brass, is 78 in. high, 18 in. wide and 10 in. deep. The grain of the wood is vertical in the top, bottom and shelves, for uniform movement with changes in humidity. Schuette, 26, teaches woodworking at the University of New Hampshire. McCarthy's dining table, 80 in. long, of shedua, padauk, wenge, bubinga and imbuya, has a removable center leaf that hangs on the wall as sculpture; the end portions then close around the built-in cluster of implements. The turned accessories include salad tools, salt and pepper mills, cruets, carafes and candleholders. McCarthy, 29, owns Artworks studio in Tucson, Ariz. The dining chair was laminated and carved in walnut by Stephen Proctor, 29, of Scottsville, N. Y. More photos on page 82.