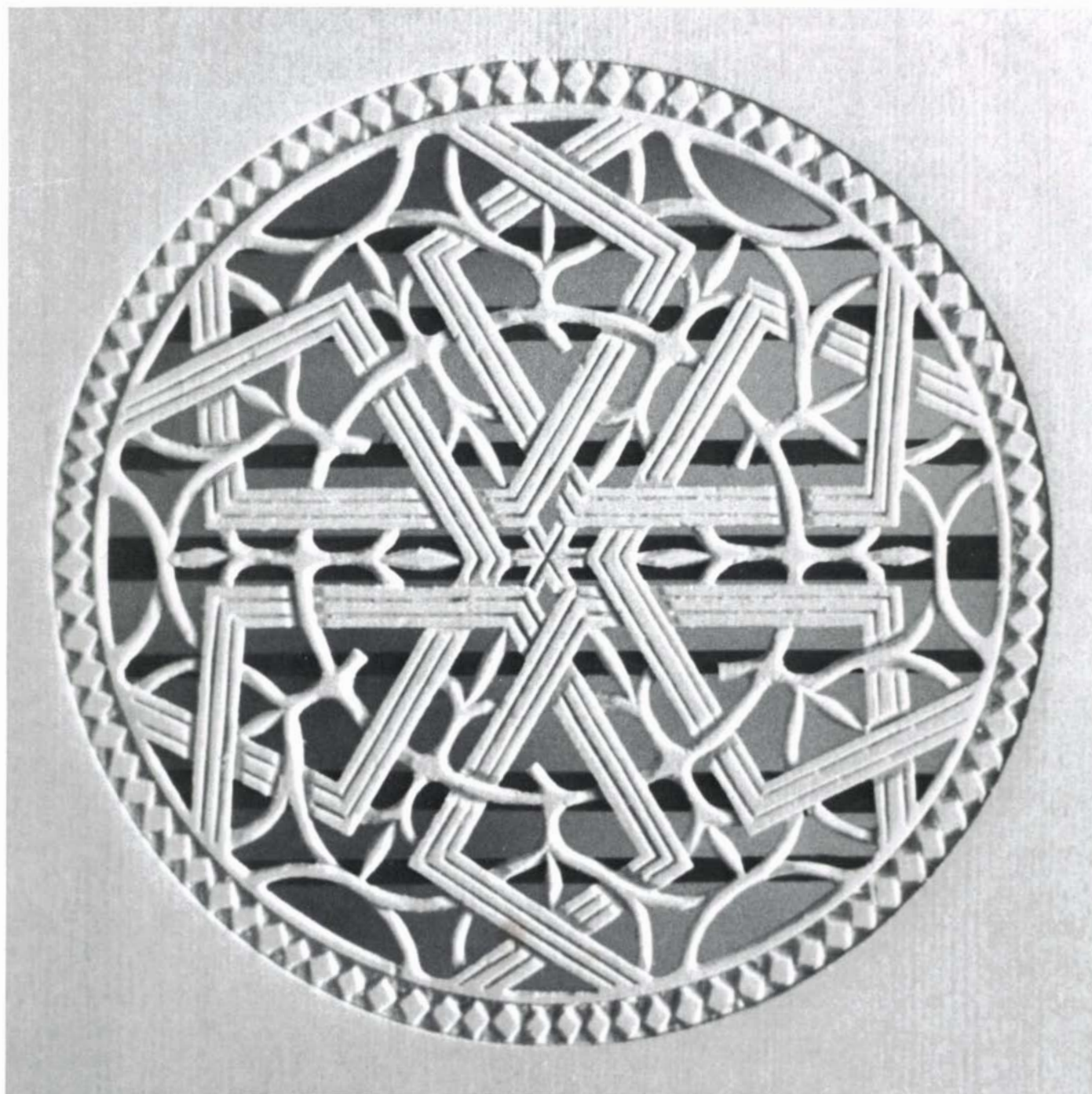


Fine Woodworking



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Fine Woodworking

Summer 1977, Volume 2, Number 1

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Cover: Lute Rose of 16th-century Bolognese style, about twice actual size, carved by master luthier Lyn Elder in spruce that is only 1/16 in. thick. Horizontal bars are supporting braces. Elder discusses the design and carving techniques on page 38.

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Design book is ready

Fine Woodworking's Biennial Design Book has gone to press and is being mailed about June 17 to subscribers who ordered it. The price in bookstores and for new mail orders received after that date will be \$8.

The book consists of about 600 photographs of current work in wood by more than 400 craftsmen. It was compiled by the senior editors of *Fine Woodworking* from 8,000 photographs entered by woodworkers from all over North America. Photos for the second *Biennial Design Book* will be accepted during 1978 for publication in mid-1979. Entries will be restricted to 8x10 glossy black-and-white photographs. Color prints and slides will not be accepted.

To keep pace with rising production costs over the past year and a half, the subscription price of *Fine Woodworking* magazine is being raised a dollar. A one-year subscription now costs \$9, two years \$16, and three years \$23. Add a dollar a year for Canadian and overseas subscriptions. The single-copy and back-issue price remains \$2.50. These changes are effective June 1, 1977.

Woodworkers form guild

A woodworker's guild is forming in New England, sponsored by the League of New Hampshire Craftsmen, to exchange technical and business information, and possibly to form cooperatives for buying machinery and wood. The new guild plans to meet quarterly. Dues are \$5 a year, plus \$6

annual membership in the League of New Hampshire Craftsmen. Contact the league office, 205 N. Main St., Concord, N. H. 03301. Telephone (603) 224-3375.

Exhibitions and shows

Paint on Wood: Decorated American Furniture since the 17th Century: An exhibition of 55 painted wooden objects, through Nov. 13 at the Renwick Gallery, Smithsonian Institution, Washington, D. C.

International Wood Carvers Congress: A large annual show held Aug. 4 to 14 at the Great Mississippi Valley Fair, Davenport, Iowa. Entry deadline is July 20; contact Chester D. Salter, 2815 Locust St., Davenport, Iowa 52804. Entrants in this show may, upon request, have their work shipped to Toronto for the **First Canadian Agricultural Wood Carving Exhibition**. This show is to be part of the annual Canadian National Exhibition held in Toronto Aug. 17 through Sept. 5. The organizers, who include the National Wood Carvers Association, expect it to be among the largest shows ever mounted, with \$13,000 in prize money. Details from Ross T. Farr, Agricultural Manager, CNE, Exhibition Place, Toronto, Ont., Canada M6K 3C3.

Young Americans: Fiber/Wood/Plastic/Leather. A prestigious show held every ten years by the American Crafts Council for artists and craftsmen between the ages of 18 and 30. The exhibition opens June 7 and runs to July 15 at the ACC national conference in Winston-Salem, N. C., and then shifts to the Museum of Contemporary Crafts in New York City.

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LETTERS

In your last two issues there have been no fewer than four articles on plywood and lamination... a magazine calling itself *Fine Woodworking* should concentrate on that material more or less as it comes off the tree... The sort of thing Ms. Swartz is doing bears about as much relation to fine wood-working as would, say, origami (paper folding).

The methods of work involved in plywood are quite different than those of wood work. In joinery they tend to be much more primitive. Plywood and laminates show a different response than solid wood to the stresses and climate of use. Plywood, particularly the hardwood variety, is not in fact cheap, either new or used, at least not here in Toronto. Plywood and laminates call almost exclusively for the use of power tools and abrasives. Plywoods and laminates everywhere look different than solid wood. Plywood tends to split out and break off at the edges of the top and bottom layers. Plywood is all too often poorly made, with uneven gluing and large internal pockets even in the better grades. You inevitably find these things out when it's too late. When these pockets show up on the edge of a piece there is no way in the world to fill them effectively. The flattened grain of plywood often has a strained, exhausted and bleached-out appearance. Because the glue is so close to the surface it does not take color well. Plywood will warp if the edges are not sealed...

The constant references to saving time, and saving money, and needing fewer tools, are the giveaway. Compromises should be grudgingly made, not eagerly sought.

—David W. Cumming, Toronto, Ont.

I am moved to remark on the considerable conceit expressed toward uses of wood. There ever seem to be those who would impress upon us their opinions as to what is valid and what is not. It is one thing to transmit one's experience with technology and esthetics. To insist on broad agreement that this then forms the limits of technology or esthetics is quite another matter. Wood itself does not proffer such opinions.

—Newell White, Rochester, N. Y.

Re your article on a woman woodworker, Ellen Swartz, (Spring '77): It's about time you started being responsible to all woodworkers by representing women woodworkers' works, knowledge, attitudes and skills as well as men's. Up to this point your magazine has been blatantly one-sided in its view of the craft and the people in it. You think men are the only woodworkers around.

—Blake Emerson, Berkeley, Calif.

In many of the letters regarding stains I have seen no reference to one that I have used since 1931 and have found to have no peer in bringing out the natural colors of the wood itself and has no tendency whatever to cover any of this natural beauty. It is easily and cheaply made and is a by-product of wood itself.

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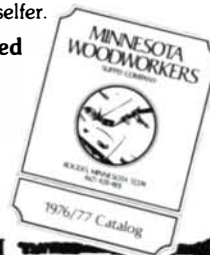
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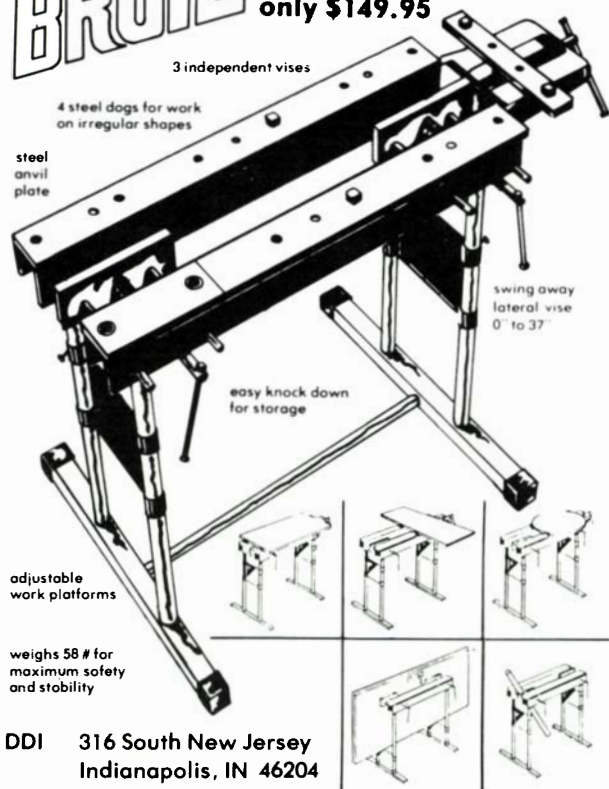
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LETTERS (continued)

"potash" to raise the grain by wiping or brushing it on and then let it dry before sanding the surface to remove the "fuzz." Do this until no more "fuzz" is felt. Then apply the finish of your choice, preferably one that has no tendency to muddy the surface. . . .

—Charles F. Riordan, Dansville, N. Y.

Recently an article by H. C. Anderson et al, *Acta Otolaryngologica*, Vol. 82 (No. 3-4), 1976, appeared that dealt with "nasal cancer and nasal mucus-transport rates in woodworkers." Furniture makers, compared to other woodworkers exposed to wood dust, have the highest incidence of adenocarcinomata. The latency period for tumor development is remarkably long (27 to greater than 50 years). Woodworkers have a very slow mucus transport which impedes clearing of carcinogenic materials from the nasal cavity. Researchers have concluded that wood dust-induced nasal cancer is an occupational hazard for woodworkers.

—James D. Sedwick, Williamsville, N. Y.

I have been doing bent lamination work (Spring '77) for several years and I have persistently encountered a phenomenon called "toe-in." Even though when a part is removed from the mold springback occurs, with the passage of several months the curves tend to tighten up rather than flatten out. . . . This "toe-in" occurs in laminated bends and molded plywood and seems more pronounced in small-radius bends than in large.

—John W. Kriegshauser, Kansas City, Mo.

[Editor's note: Jere Osgood attributes toe-in to glues that continue to contract, particularly yellow glue, after the lamination is off the form.]

The cheap offset screwdriver used as a router-plane cutter (Spring '77) will be just that, a cheap piece of steel. I would use an Allen wrench as the cutting iron. It would be a much better grade of steel. Also it would be safer—no sharp edge pointing at the user.

—Thomas H. Kestil, Hicksville, N. Y.

I must take issue with Donald Murphy (Spring '77) in his assertion that 200 chisels are necessary to be a good woodcarver. I am somewhat acquainted with some of the most successful carvers in New England, and none of them have such a set. I would not question Mr. Murphy on his disdain of rasps; I don't happen to use them myself. But certainly a beginner would be foolish to go out and buy 200 chisels; most carvers probably couldn't afford them. I advise my students to get about ten basic chisels and then add to them as they develop their interest and skills. Skillful use of available chisels is more important than numbers of them.

—C. A. Brown, Waterville, Vt.

Surely Mr. Hall ("The Wood Butcher," Spring '77) has been peeking in my shop window. I alternated between laughing and crying while reading his article, but was left with a very negative feeling at the finish. . . . The article appears to be catering to an elitist group of professional woodworkers and that's my rub. I would venture to say that weekend wood butchers clearly outnumber master cabinetmakers on your subscription list. The fact that most of your



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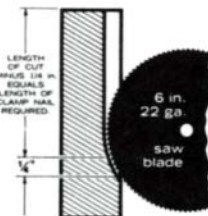
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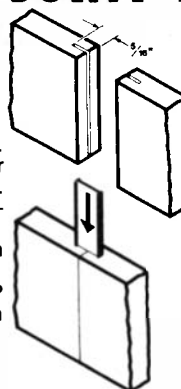
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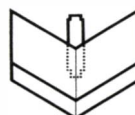
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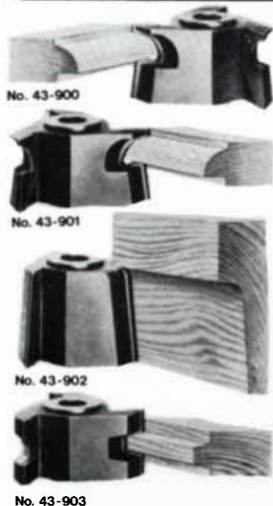
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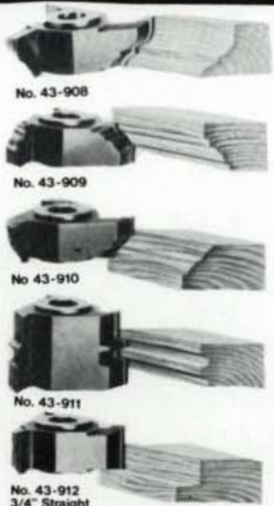
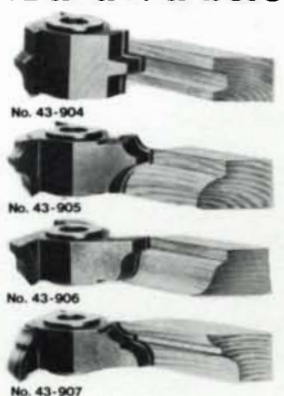
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No. 1124 Millers Falls Mitre Box—Patterned after the No. 74 Deluxe Mitre box but smaller scale. One piece cast iron bed and back. Legs are offset so box will not tip when saw pressure is applied. Swing lever (45° to 90°, right or left) automatically locks in most used angles. All exposed parts except saw nickel plated for longer life. Automatic catch holds saw elevated when desired. Complete with 24" x 4" saw. Capacity: 8 3/4" at 90°, 6" at 45° add \$5.00 for 30 lbs. Reg. \$124.99.

1124-M18 M.F. med. Mitre box \$74.98



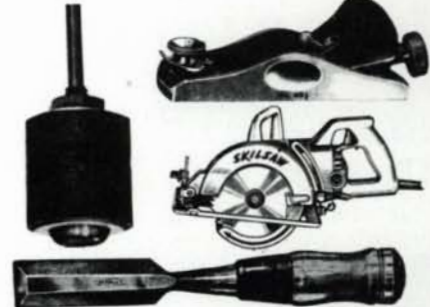
Silvo Steel Dowel Centers—Set of 2 each 7 sizes: 1/4, 3/8, 1/2, 5/8, 3/4, 7/8 and 1" indispensable for accurate doweling. Used by inserting into hole already bored and marking exact center for opposite hole. Made from Solid Bar Steel.

DC7-C13 set of 7 sizes \$3.15



Eclipse Automatic Center Punch—4 3/4" long, just press down and make your punch. No hammering is required. Depth of punch is variable by turning knurled head. Reg. \$7.50

E171-E5 Auto. Center Punch \$5.75



Sanding Drum set—All with 1/4" shanks. Use with drills, drill press, flex shafts etc. for those hard to get at surfaces that need sanding—5 piece set—1/2", 3/4", 1, 1 1/2 and 2" diameters. Refer to our Catalog for complete line of belts available. Add .50 for shipping.

808-SET-C13 Sand. drum set \$4.75

Stanley Block Plane—Fully adjustable, low angle. The cutter rests at an angle of 12°. This angle makes it easy to plane across hardwood. The mouth is adjustable for coarse or fine work. Finger grips in sides. Cutter adjusted endwise with knurled screw. 6" long x 1 3/8" cut. Reg. \$15.95 Add \$1.00.

60 1/2-S19 Stanley Block Plane \$9.99

Skilsaw Worm-Drive Saw—Super-duty, all ball bearing. Unequaled high torque output for fastest cutting. Designed throughout for low maintenance, long life. Has Skill "Super Burnout Protected" Motor. No. 77 Skilsaw has 7 1/4" Blade, Powerful 13 amp motor, cuts from 2" dressed lumber at 45° to 2 3/4" at 90°. Net weight 16 lbs. Add \$3.50 for shipping. Reg. \$165.00.

77-S37 7 1/4" Skilsaw \$126.98

Stanley Chisel Sets—Thin Blades are 3 1/2" long. Tough handle designed for balance and grip. Crown shaped steel cap centers hammer blows. Blades have a polished finish. Blade and tang forged from one piece of alloy tool steel. Each set is packed in plastic roll. Add .75 for shipping.

44-S19 Chisel Set (4 piece) Sizes: 1/4, 1/2, 3/4 and 1" Reg. \$24.60 \$15.59

44-S19 Chisel Set (6 piece) Sizes: 1/4, 1/2, 3/4, 1, 1 1/4 and 1 1/2" Reg. \$41.00 \$25.98

69-S19 Chisel Set (9 piece) Sizes: 1/4, 3/8, 1/2, 5/8, 3/4, 1, 1 1/4, 1 1/2, and 2" Reg. \$68.85 \$41.25



Rockwell 4 1/2" Panel Saw—lightweight only 7 lbs., easy-to-handle saw for cutting trim, composition boards, plywoods, thin non-ferrous metals, plastics, laminates, plexiglass and other problem materials.

Features: Worm Gear drive, Extra large wrap-around tilting base, all Ball Bearing. 4.5 amps, 3800 RPM, Cuts 1 1/4" at 45° and to 1 3/4" at 90°. Add \$3.00 for shipping. No. 314 Panel Saw Reg. \$99.50 No. 9314 Panel saw kit (Includes: 314 Saw, Rip guide and Steel Carrying Case Reg. \$109.00.

314-R7 Panel Saw \$78.98

9314-R7 Panel Saw Kit \$85.98

Rockwell Tungsten Carbide-Tipped Circular Saw blades—Last up to 50 times longer than conventional saw blades—Welded tips, add .50 for shipping. Economy Priced.

12260-R7 4 1/2" dia. x 3/8" hole, 24 teeth \$6.89

12261-R7 6 1/2" dia. x 5/8" hole, 20 teeth \$6.98

12262-R7 7 1/4" dia. x 5/8" hole, 24 teeth \$8.29

12263-R7 8 1/4" dia. x 5/8" hole, 24 teeth \$9.50

Brazed Tip Blades—Carbide tipped Blades have a univ. 5/8" and Diamond Hole.

12264-R7 6 1/2" Dia. 12 Teeth \$4.49

12265-R7 7" Dia. 12 Teeth \$4.98

12266-R7 8" Dia. 12 Teeth \$5.98

Lifetime Carbide Tipped Saw Blades—Lasts 50 times longer than regular Saw Blades. Type "FT"—Precision Blades with 40 Teeth.

Designed for cutting multiple grain directed material such as plywood, chipboard and paneling. Manufactured to cut medium smooth cut but not chip free on all materials. Add \$1.00 for shipping.

FT-725-L4 For 7 1/4" or 7" Saws, with Univ. arbor. Reg. \$17.95 \$10.98

FT-1000-L4 10" Dia. with 5/8" Arbor—Reg. \$29.95 \$17.99



Millers Falls Set of Five Nail Sets—4" long one piece alloy steel hardened and tempered for long life. Black body. Assortment of five nail sets Sizes: 1/2", 5/8", 3/4", 7/8" and 1"—Add .50 Reg. \$5.67.

801-S-M18 Set of 5 nail sets \$2.98

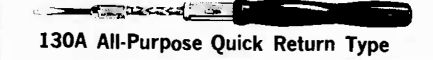


Wen Router Kit — Includes: Router: 25,000 RPM, 1/2 HP, 4 Amps. Use standard 1/4" Bits, Spindle lock for quick Bit changes. Depth control lever and Dial. Plus: Edge & circle guide, 1/4" Bit, Veneer Att. and Router book. Add \$1.50 for shipping. Reg. 49.95

1700K5-W3 Wen Router Kit \$32.98

Drill Grinding Attachment—Complete with Instructions—A precision tool for accurately sharpening twist drills. For machine shops, garages, home workshops, and for all drill users. In use by leading industries. For fractional drills 1/8 to 3/4 in. Add \$1.00 for shipping. Reg. \$10.90.

825-G5 Drill Grinding Att. \$8.19



130A All-Purpose Quick Return Type

131A Heavy Duty Quick Return Type

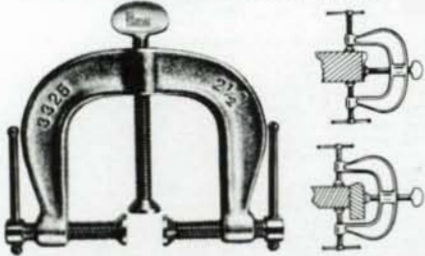
Yankee Spiral Patchet Screwdrivers—Time and labor savers for craftsmen in all fields. Right and left hand drive as well as rigid setting is adjusted instantly by a simple shifter. Two bits furnished with each driver. (Med. Screw driver and #2 Phillips)—Quick Return type. The spring keeps the blade in the screw slot and automatically returns handle to driving position after each stroke. No. 130A for regular work is 20" long. No. 131A for heavy duty work is 28" long. New design, add .75 for shipping.

130A-S19 Reg. \$21.15 \$13.98

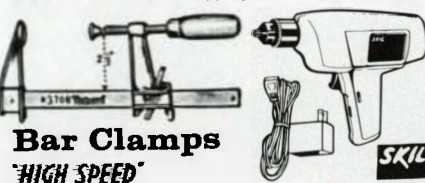
131A-S19 Reg. \$27.70 \$18.29



Retractable Power Cord — (coiled) 16/3 wire — neoprene — 24" long, extends to 144" — CONVENIENCE AND SAFETY. Dangling cords can be messy, troublesome and unsafe. Retractable cords stay neat, allow free movement of the appliance or tool, and prevent accidents. Neoprene jackets retain full retracting memory through thousands of retracting cycles. Add .50
17449-B1 Retractable Cord \$4.39



Pony 3-Way Edging Clamp — 2 1/2" size for installing or repairing moulding, trim and decorative attachments to countertops, furniture, veneers, etc. The unique "3-screw" design permits the "right-angle" screw to be centered, or positioned above or below center, on varying thicknesses of work.
3325-A2 add .75 for shipping \$3.40



Bar Clamps
"HIGH SPEED"
Jorgensen Bar Clamp — Light-Pattern Bar is 1/4" x 3/4" with 2 1/2" reach. Instant-acting. Ideal for patternmakers, wood and metal workers, and homecrafters. Multiple Disc Clutch permits instant adjustment, secure hold and easy release. Add \$1.00 for shipping each. 18" and 36" sizes available.
3706-A2 Capacity to 6" \$3.75
3712-A2 Capacity to 12" \$4.15
3724-A2 Capacity to 24" \$5.05

SKIL CORDLESS DRILL AND SCREWDRIVER

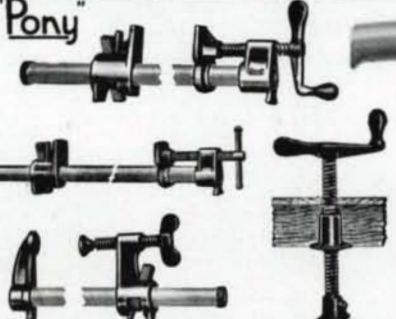
NEW SKIL CORDLESS DRILL AND SCREWDRIVER — with 3/8" CHUCK. Operates forward or reverse and can be recharged hundreds of times to perform with full power. Recharger included. On and off trigger lock, Chuck key stores in handle. No cord needed, self-contained power-house with rechargeable energy cells. High torque, 300 RPM. Use indoors, outdoors, land, sea or air. Light weight only 2.7 lbs. Recharger works on 115 volts A.C. Compares to reg. \$36.99 Value—add 1.25 for shipping.
17025P-S37 Skil 3/8" Cordless Drill \$24.98



Sandy Jet Sand Blaster ALC Abrasive Blasters are ideal for automotive body repair shops. The unit provides a steady power blast of abrasive cutting action that cleans surfaces quickly. Also ideal for use on plastics and fiberglass. (curved surfaces) voids, or angles can be cleaned as quickly and as easily as flat surfaces.
Spec.: air pressure from 50 to 200 lbs.—1 1/2 H.P. compressor, 100 lbs. air pressure req. Complete with gun, container for 50 lbs. of abrasive, 7 ft. hose, face shield, hood, 2 extra 1/4" nozzles and 1/8" extra air jet — add \$2.25 for shipping 12 lbs.
C-A14 Sandy Jet Sand Blaster \$41.98

Jorgensen Handscrews — Adjustable steel spindle — the best holding device for gluing and assembly of woodwork, furniture, cabinets, musical instruments, boats, airplanes, body work, patterns, stairs, metal work, etc. 4" to 14" sizes available.
0-A2 add 1.00 8" jaws—opens 4 1/2" \$7.59
1-A2 add 1.00 10" jaws—opens 6" \$8.65
2-A2 add 1.25 12" jaws—opens 8 1/2" \$9.85

Silvo (BRAND NAME) Tool Catalog Specials



Pony Clamp Fixtures—Head and tail-stop assemblies mounted on ordinary black pipe make bar clamps of any length with the exclusive advantages of "Multiple-Disc-Clutch" — secure hold, instant adjustment and release.

50-A2 add \$1.15 for shipping — uses 3/4" black pipe \$5.35

52-A2 add \$1.00 for shipping — uses 1/2" black pipe \$4.55

54-A2 add \$1.00 for shipping — uses 3/4" black pipe — Heads are reversible to push or spread work \$5.60

Jorgensen Press Screws — For making up veneer-press frames, case clamps, panel clamps, or portable or stationary jigs for all types of gluing, welding, or other assembly operation. Removable swivel permits easy installation for any job—design changeovers.
12" and 18" long screws available.
6709-A2 add \$1.00 for shipping — 9" Press Screw \$5.25



Pony Clamp Pads — Set of 4 pads—Pads slip onto the clamp faces of Clamp Fixtures and Steel Bar Clamps to provide a protective cushion between finished wood, metal or plastic surfaces and the pressure of metal clamp jaws.
7456-A2 add .50 for shipping \$1.80

Pony Web Clamp — 1" x 15 ft. nylon band — for light service — Handy device for all sorts of clamping and holding jobs: mitering frames, gluing furniture frames, securing factory loads, holding moulds, 1" wide nylon band applies pressure all around the work. Self-locking cam provides positive hold and instant release. Complete with 4 steel corners for use in clamping picture frames and other mitered joints.
1215-A2 add .75 for shipping \$4.85



Coastal Flexible Shaft with 1/4" Geared Chuck. A 40" Vinyl Covered Cable for use with electric drills and bench motors. Comfort grip handle with PVC covered handpiece. Add \$1.00 for shipping — Reg. \$19.50
4514-C5 Flex Shaft with Chuck \$10.98

Wen 10" Electric Chain Saw — Double insulated, Fells trees up to 2 feet, 11 Amps, 2 H.P. Motor, Only 7 1/2 lbs. — Reg. 49.95 Add \$2.00 for shipping.
2000-W3 10" Wen Chain Saw \$35.98

Coastal 3/4" Geared Chuck and Key — Commercial quality — Chucks are geared drive, all hardened steel — Made in U.S.A. Chuck Capacity: 1/4" to 3/4" with 3/4-24 thread — Fits most Drills, Flex shafts and any tool that receives 3/4-24 thread.
Reg. \$9.15
4646-C5 3/4" Geared Chuck & Key \$4.50

See Fine Woodworking pages 10 and 11 for other Silvo specials.



Wen Heavy Duty Belt Sander — Double insulated 3" x 18" belt Sander, Powerful 3/4 HP, lightweight. Unique tension lets you change belts in seconds. Lock-on quick release safety trigger. Flat top handle converts to bench sander. Includes 3 sanding belts. Reg. 49.95 add \$1.60 for shipping.
919-W3 Wen 3" x 18" Belt Sander \$33.50

Nicholson Dado Saw Set — Cuts, grooves up to 13/16" in one quick easy operation in any direction. Seven cutters—(2 1/4" outside, 1 1/4" and 4 1/4" inside cutters). Width of cut varies from 1/4" to 13/16" — Made of high quality steel, ground and matched to secure smooth, clean grooves. Hard-chrome finish — for bench, radial arm and swing saws. Add \$1.25 for shipping — 80916-N2 = 6" dia. x 3/8" arbor, Reg. \$21.98 — 80922-N2 = 8" dia. x 3/8" arbor, Reg. \$32.98.
80916-N2 6" Dado Set Special—\$12.98
80922-N2 8" Dado Set Special—\$18.98



Millers Falls Hand Drill — with Drill Set — 12 1/2" long, 4 1/2 to 1 gear ratio, Quality 1/4" Capacity 3 gaw chuck, Heavy cast frame and gears with large drive wheel, Hardwood hollow handle includes a set of 8 drill bits — sizes 1/16" to 1/4".
Reg. \$21.98 Add \$1.00 for shipping.

5-M18 Hand Drill & Bits \$13.98
Wen 2-Speed 7" Heavy Duty Industrial Polisher — Sander — Powerful 2 HP delivers 2500 RPM hi speed for sanding, 1400 RPM low speed for polishing. Trigger switch with lock. Built-in top non-mar bumper. Bail suspension. Heavy duty wide face double reduction gears. Ball bearing construction. Double insulated. Includes 7" rubber backing pad, 7" polishing bonnet and 2 sanding discs. 10 amps. 120V AC, 3/8" x 11" threaded spindle. Reg. \$79.95 add \$2.00 for shipping.
1503K7-W3 Wen H. D. Polisher Sander \$49.98

Wen Hi-Speed 7" Heavy Duty Industrial Grinder/Sander Kit Powerful 5000 RPM for quick grinding and sanding. Ball and roller bearings. Wide face double reduction gears. Trigger switch with lock. Main plus 2 position non-slip auxiliary handle. Built-in top non-mar bumper. Double insulated. 2 HP, 10 amps. Includes rubber backing pad, 2 sanding discs and 7" wheel guard (depressed center wheels not included). Reg. \$79.95 Add \$2.50 for shipping.
1501K1-W3 Wen H. D. Grinder \$49.99



Wen Variable Speed Sabre Saw — "Steering wheel" knob turns the blade and lets you cut in any direction without turning the saw. Variable speed, 0 to 2800 powerful 1" SPM. 4 position Blade lock. Double insulated. Includes 7 blades, rip guide and circle cutter. 4 Amps, 120V AC. Reg. \$39.95 add \$1.50 for shipping.
531-W3 Wen Var. Speed Sabre Saw \$30.98

Wen 2-Speed Recipro Saw — A power hand saw. Prune trees, cut logs, plunge or flush cuts wood or metals. Long 1" stroke, 2 Speed 3000 and 2200 SPM. 4 Amps, 120V AC. 5 blades 4 1/2" to 12" long included. Reg. 39.95 Add \$1.50 for shipping.
1600-W3 Wen Recipro Saw \$28.98

Silvo Hardware Co. FW 7-8 107 Walnut St., Phila., Pa. 19106

Silva (BRAND NAME) Tool Catalog Specials



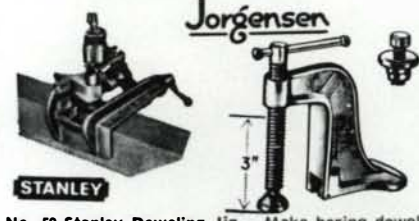
McGRAW-EDISON
All tools U.L. listed.

Record Woodworkers' Vises—The finest vise made. "Toe-in" Jaws give even gripping power. Dual Action Screw. Quick action special buttress threads increase grip with tension. Built-in adj. "Dog" on front jaw. 52D—7" Jaw, opens 8". Wt. 22 lbs. 52½D—9" Jaw, opens 13". Wt. 40 lbs. Add shipping cost to price of vise. (Ask your Post office.)

52D-R10 7" Vise 22 lbs. \$34.50
52½D-R10 9" Vise 40 lbs. \$47.50

McGraw-Edison Power Screwdriver—UL approved—100 to 1 gear reduction—Easily drives and removes screws, nuts, and bolts—Accepts all ¼" hex shank bits and accessories—For industrial and mechanic use—3 amp, 220 R.P.M. motor—Reversing Switch—Positive clutch prevents overload—High torque Burnout protected motor—Net wt. 3 lbs.—Capacity: up to 12 wood screws and ¼" Bolts—Includes 2 Phillips bits, 1 reg. bit and center punch. Add \$2.00 for shipping. Reg. \$56.95

2810-S9 Power Screwdriver \$31.50



No. 59 Stanley Doweling Jig—Make boring dowel holes in edge, end or surface of boards easy—complete with 6 guides ⅜" to ½"—with depth gauge—add .75 for shipping—Reg. \$23.45

59-S19 Doweling Jig \$15.39

Jorgensen Hold Down Clamp—Mounts to hold work in any location on wood or metal work areas. Frames slide "on" and "off" pre-spotted holding-bolt that drops out of the way when not in use.

1623-A2 add \$1.00 for shipping \$4.75



Lifetime Adjustable Carbide Tipped Dado Set—7" Diam., ⅝" arbor, 12 Teeth, cuts from ⅜" to 1½" wide, cuts to ¾" deep. Mike setting just turn the calibrated dial to width of cut you want. Cut wood or plastic laminates smoothly. For use on table or Radial Arm Saws. Add \$1.25 for shipping—Reg. \$24.95

LAD-700-L4 Lifetime Adj. Dado \$14.98

Kol Portable Cement Mixer—(less motor)—Uses 5 gal. steel pail and ¼ H.P. motor—Mixes 8 cu. ft. of cement per hour—50 lb. batch takes 2 minutes to mix—Pail is easily removed by handle for pouring contents—Use for mixing epoxy resins, plaster, paint, feed, seed, etc. Add \$3.50 for shipping.

M58X-K10 Mixer (less motor) \$45.98



McGraw-Edison H.D. 6" Bench Grinder—with Hone Attachment—8 amp Motor, Sealed Ball Bearings. Vibration-free performance. Features hone attach. for fine-edge sharpening. Built-in drill sharpening guides. Eye shields, water trough and adjustable tool rests. Rubber shock mounts and holes for bench mounting. Die-cast Alum. housing. 36 grit and 60 grit wheels. Grinder speed 3450 RPM. Hone speed 78 RPM. Add \$5.00 for shipping. Compares to Reg. \$106.95 Value.

4601-S19 Grinder with Hone Special—\$54.98



Arco "Quik Sand" Belt Sander—Handiest tool you have in your shop. It sands, grinds, polishes and sharpens. Use with any ¼ or ⅓ h.p. 1725 RPM motor. Suction cup feet hold sander firmly to work surface. Uses 1" x 42" sanding belts. Add \$2.50 for shipping. Motor not included.

165-A13 "Quik Sand" Sander \$29.98

Rockwell Speed - Bloc Sander—Palm grip design for one hand use. Thumb control switch, offset pad for 4 way flush sanding, 12,000 OPM. 100% Ball Bearing, 5/64" Orbit, 2 Amps, Direct motor to pad design, Pad size 4½ x 4½ add \$2.00 for shipping. Reg. \$59.99

4480-R7 Speed-Bloc Sander \$47.98

Complete Metal Work Shop—Punches, shears, forms, rivets. A most versatile tool for all industrial plants, experimental labs, repair shops. Spec. punches clean, burr-free holes in metal up to 16 ga. to 1" from edge of stock; Shears metals up to 1" width 16 ga. thickness; Bending & forming dies at back of tool make bends up to 90° in either rod or bar stock. 16 ga.; rivets stock up to 1" from edge and up to combined stock thickness of ¾".

4-I-T9 Metal Work shop \$14.98



No. 4692 Rockwell 16" Porta Plane—25,000 RPM cutter speed—ideal for planing glue bonded doors and panels. 100% ball bearing construction. Extra long shoe. 60° bevel planing range. Finger tip depth adjustment control. Includes spiral type cutter and wrench. UL Listed. 7 Amps, cuts a full 2½" wide and cuts to ½" deep. Add \$3.00 for shipping. Reg. \$126.50.

4692 (126)-R7 Porta Plane \$99.98

No. 4693 Rockwell 16" Porta Plane Kit—Includes: 4692 Plane plus sharpening attachment and carrying case. Add \$5.00 for shipping. Reg. \$175.00.

4693 (9119)-R7 Porta Plane Kit \$124.98

No. 4694 Rockwell 16" Porta Plane Kit—Includes: 4692 Plane with substitute Carbide tipped Spiral-type Plane Cutter and carrying case. Add \$6.00 for shipping. Reg. \$180.00.

4694 (9118)-R7 Porta Carbide Plane Kit \$128.98

No. 4695 Rockwell Door Hanging Kit—Add a router and your set to handle most all door hanging operations from hinge butt mortising to planing. Includes 16" Porta Plane, hinge butt template, mortising bit, lock nut, template guide and carrying case with provision for storing router. Add \$7.50 for shipping. Reg. \$230.00.

4695 (102)-R7 Door Hanging Kit \$169.98

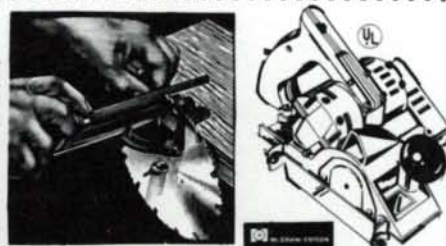


Rockwell 1 H.P. Heavy Duty Router—6.8 Amps. Pin and groove depth adjustment. Self aligning, non-marking base. 100% ball bearing construction. Oversize brushes. 22,000 RPM. Includes ¼" mill type collet and wrenches. UL Listed. Add \$2.00 for shipping. Reg. \$68.00.

4680 (630)-R7 H.D. Router 1 H.P. \$42.98

No. 4511 Rockwell 7¼" Saw—Utility use, Ball Bearing Equipped—9 amp, cuts 2½" at 90° and 1½" at 45°—1¼ H.P. Double insulated to protect the user against electrical shock. Telescoping blade guard. Large base. Accurate depth and angle adjustment controls. Powerful 9.0 amp motor. Add \$2.50 for shipping. Reg. \$34.99.

4511-R7 7¼" B.B. Equipped Saw \$21.98



Circular Saw Blade Sharpener—You can easily sharpen circular saws like an expert. No experience necessary. The secret of a sharp saw is to have every tooth filed with the SAME pitch and angle. Simple positive adjustments make this possible. Complete with file and four interchangeable mandrels to hold saw blades with 6" to 12" diameters and ½", ⅝", ¾", and 1½" centers.

Add \$1.25 for shipping. Reg. \$17.25

10-S1 Saw Blade Sharpener \$12.45

McGraw-Edison Electric Planer—Powerful motor smooths and shapes wood with ease—Timing gear belt drive—Burnout protected motor—Precision ball bearings—Adjustable/removable angle guide fence included—3 amp motor—14,000 RPM—Adjustable planing depth—Net weight 5¾ lbs. Replaceable steel cutting blades. Add \$3.00 for shipping. Reg. \$56.95

2800-S9 M.E. Planer \$31.49



McGraw-Edison Dual Motion Sander—For rough or finish sanding, or bevel or straight line. Sands flush to both sides and front. Sands or polishes wood, metal and plastics. Uses ⅓ standard abrasive sheet. Double insulated, burnout protected motor. 2.5 Amps—Lifetime lube bearings. Reg. \$39.95. Add \$1.50 for shipping.

2503-S9 Dual Motion Sander Special—\$18.98

Eclipse Laminate Trimmer—Scribes and trims plastic laminates to size when fitted to worktops with both straight and contoured profiles, as well as producing parallel strips used for edging. The use of this tool eliminates the risk of costly cutting errors. Add .50 for shipping.

2005-E5 Laminate Trimmer \$4.29



Water Level—with 50 ft. of Rubber H.D. tubing—To take a level over a long distance. Used wherever extreme accuracy is required. Work around corners. Perfect for batter boards, footings, foundation forms, sills, ceilings and lintels. Stanley Mabo Large Plastic Vials, virtually indestructible put in use by turning the stopper ¼ of a turn. Add \$1.00 for shipping.

56-398-S24 Water Level w/50' hose \$14.98

Coastal 3 Way Clamp—Useful for clamping edges of formica and similar materials for gluing and cutting. Durable made of pressed steel. Large swivel tips and sliding tee handles. 2½" opening. Can be used as a Cee clamp. Reg. \$2.40 each. Add \$1.00 for shipping 4 clamps.

60207-C5 3 Way Clamps each—\$1.59

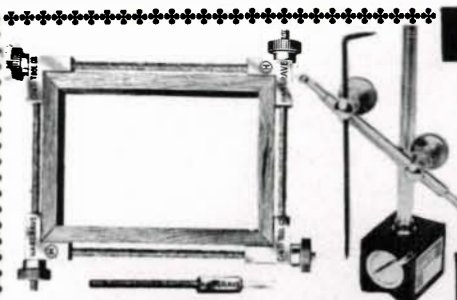
Special—4 for—\$4.98

No. 74 Millers Falls Mitre Box—World famous for quality, one piece cast iron bed and back for strength, Oilite bearing, saw guides, Graduated arc and index plate, travels freely from 45° to 90° right or left and locks at any angle (automatic locks at 0°, 90°, 22½°, 30° and 90° right or left). Complete with 28" x 5" saw. Capacity 10½" at 90°, 7¼" at 45°. Add \$6.00 for shipping weight of 37 lbs. Reg. \$164.99

74-M18 M.F. Mitre Box Special—\$89.98

Silva Hardware Co. FW 7-8 107 Walnut St., Phila., Pa. 19106

Silvo (BRAND NAME) Tool Catalog Specials



Hargrave Miter Frame Clamp—Clamps all four corners at one time. Quickly adjusted. Absolutely accurate. Aluminum alloy corner blocks. Screws and adjusting nuts are steel. Capacity 2 to 14". Add \$1.00 for shipping.

780-C15 Miter Frame clamp \$11.25

Hargrave Extension Screws—Each set increases capacity of No. 780 clamp 12". Any number of extensions may be used. No. 780-E available only in sets of four.

780E-C15 Set of 4 Ext. Screws \$5.29

Magnetic Base Stand—75 lbs. pull, with scriber, accepts all AGD dial indicators. Fine adj. clamp and univ. clamp, on and off lever releases magnet, 9 1/2" high. Add \$1.50 for shipping. Reg. \$19.50

MB1-F6 Magnetic Base Special—\$12.98



Coastal Universal Swivel Vise—H.D. Locks in any position—clamps to any firm surface. Two sets of jaws, one smooth and the other has horizontal and vertical vee slots. Base and jaws rotate 360°. Durable malleable steel. Anvil base. For hobby, jeweler, mechanic and machinist use. Add \$1.35 for shipping. Reg. \$17.98

20274-C5 Univ. Swivel Vise \$9.98

Millers Falls 7-Piece Carving Tool Set. For intricate carving in wood, soap and linoleum. Forged tool steel, heat treated, polished and ground. Six different shaped cutting tools and special sharpening stone. All tools are 6 1/4" long. Add \$1.00 for shipping. Reg. \$14.69

106-M18 Carving Tool Set \$8.98



McGraw-Edison 5" Bench Grinder—3.2 Amp., 3500 RPM motor. 1 fine grit and 1 coarse grit wheel. Light illuminates work area. Features eye shield, e-d bells, adjustable tool rest, water trough, rubber shock mounts and screw mounting holes. Add \$3.50 for shipping. Reg. \$39.95

2601-S9 5" Bench Grinder \$24.98

Eclipse Honing guide—holds securely wood chisels and plane irons at correct angle to the oil-stone and insures a true square edge. Hold from 1/4" to 2 3/4". Reg. \$6.95 Add .50

36-E5 Honing guide \$4.98



Hydrolevel—Layout Level—In just a few minutes you accurately set batters for slabs and footings, lay out inside floors, ceilings, forms, fixtures, and check foundations for remodeling.

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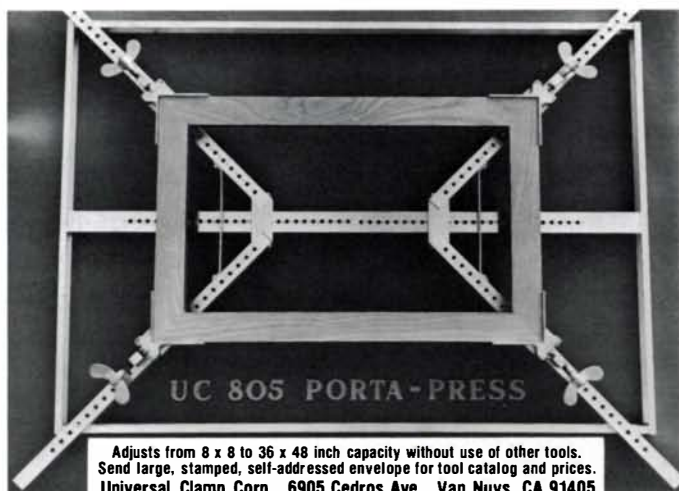
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LETTERS (continued)

articles are clearly beyond my present capabilities does not bother me, but articles such as this remind me of my lack of talent. But if my reach does not exceed my grasp then I will continue making the same mistakes that I am making now. I, too, long to make Hepplewhite chairs and Goddard block fronts and, just perhaps, someday I will.

—Douglas K. Robinson, Chicago, Ill.

Cary Hall's article alone is worth the subscription tag. As one who has forcibly marched hordes of dinner guests into the bedroom to gawk at my bureau, I got at least three laughs (my wife got five) out of his blurb. He deserves a kick in the rump, and maybe more.

—Dave LeCount, Berkeley, Calif.

Re Ellis Thaxton's idea (Spring '77) about waxing saw tables: Wax has its merits but in time will soften. When this happens it acts like a magnet to catch dirt and becomes sticky. I have found that silicone spray does an excellent job in protecting machine platens. First the platen should be cleaned with a solvent to remove any grease and oils. Next spray the silicone over the surface and rub it with a soft cloth.

—Kent Petersen, Janesville, Wis.

Re "Heat Treating" (Fall '76): Tempilstiks and color identification are usually difficult for an occasional user to judge. The transformation range is the temperature at which austenite forms during heating or cooling. As austenite is not magnetic, this temperature can be detected with a magnet.

I hang a small magnet on a string and bring the metal close during the heating process. At a full cherry red the magnet will not swing toward the metal and I quench a few seconds later. During quenching, continually move the workpiece in the quenching liquid so cooling is as rapid as possible.

—Harley Monian, Pleasanton, Calif.

To keep my tools from rusting, especially the less active ones, I make a half-and-half mixture of lightweight motor oil and kerosene. Using a horse wormer or any atomizer, I coat the metal tool with this mixture. This is much easier than rubbing oil on, especially with irregular shapes. It is also much cheaper than the aerosol cans.

—Frank Curran, Kinderhook, N. Y.

I estimate electricity consumption of the 500-BF dry kiln is an average of 108 kilowatt hours per day. On that basis, a 30-day run would use about 3240 KWH of electricity. At 2 cents per KWH, this would be about \$2.16 a day.

—William W. Rice, Amherst, Mass.

I've taught woodworking in high school shops for 22 years and I agree wholeheartedly with James Krenov (Fall '76), "In schools where you begin learning . . . there is an overabundance of woodworking machinery." Perhaps the reason is found in the name of the course—Industrial Arts. We, students and teachers alike, have not had the time to digress from the industrially slanted texts and away from machine woodworking. I've just begun to realize this, and try to introduce some of that "something more" that Krenov speaks of later in his article.

—Gordon R. Warren, Wilmington, Ohio

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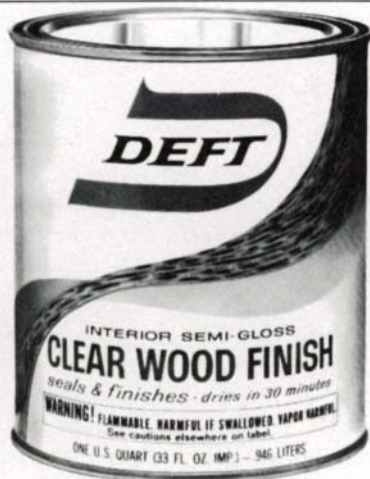
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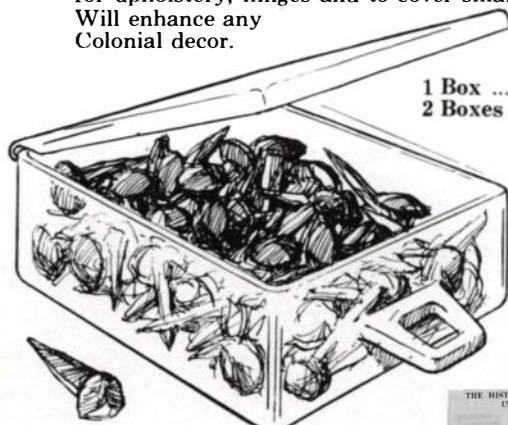
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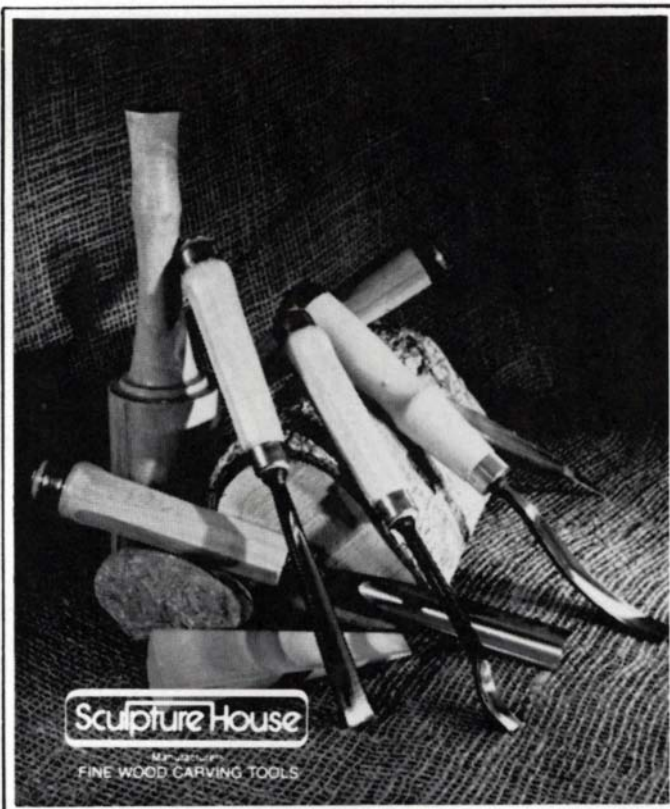
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Fall 1976: Cabinetmaker's Notebook, Water and Wood, Hidden Beds,
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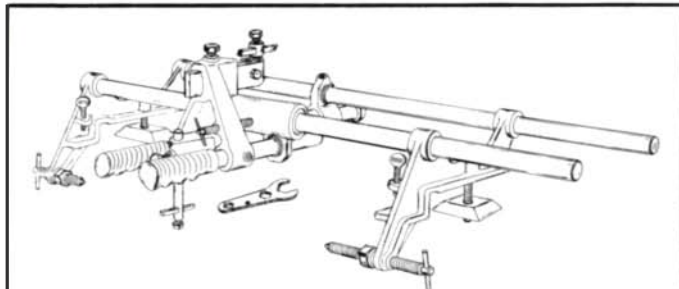
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METHODS OF WORK

Raising arched panels

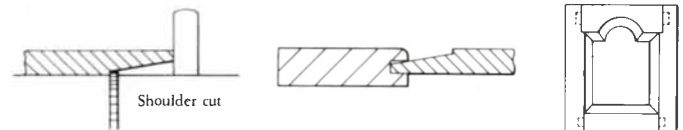
The shaper is the correct tool for making a raised panel door with an arched top. I don't have a shaper, so I do the job with the table saw and a chisel, the hard way.

Make the rails and stiles, with tenons and mortises, in the usual way and cut the panel to shape. Set up the table saw to cut the bevel, with the blade angled to the correct slope, the height set for the width of the bevel, and the fence placed to the edge thickness of the panel. The straight sides are no problem, just run them through. On the arched top, run the piece through resting on the top of the arch, then again



resting on the top and one corner, and again resting on the top and the other corner.

Now set the table saw to cut the shallow shoulders on the bevels, thus removing the waste from the work. This com-



pletes the straight sides, except for cleanup with a rabbet plane, and removes most of the wood from the arched top.

Mark the shoulder line on the arched top and the 45° lines at the changes of direction. Use a wide, sharp chisel to carve the bevel down, making a neat, sharp juncture at the 45° line. Marking the correct thickness on the panel edge and carving back to the shoulder line is one way to do it.

The grooves that accept the panel in the straight sides are easily made with a dado blade in the table saw. To make the groove in the top rail, drill holes somewhat smaller than the desired thickness of the groove, then chisel out the groove to the line. Don't worry about the sloppy bottom of the groove, just make the sides nice and even.

Assemble the door dry, pin through the tenons with dowels, and fit it to its opening. Then take it apart and re-assemble without the panel to round over the inside edge of the frame with a router. The panel should be finished before glue-up to prevent an unfinished edge from showing through as the door expands and contracts over the years. Make sure the panel is slightly loose on final assembly; that's the whole idea, allowing a little room for expansion and contraction.

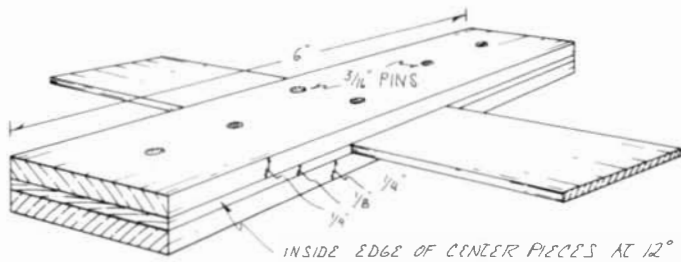
—Cary Hall, Hampton, Ga.

Dovetail square

I do a considerable amount of hand-dovetailing and find an adjustable bevel or protractor a bit awkward. Since pin and tail angles remain constant (I use 12°), I have made a square at that angle that is very easy to use. Mine is made from well-cured cherry with 3/16-in. birch pins. The body is a laminate of two 1/4-in. thick cheek pieces, 6 in. long, and two 1/8-in. center pieces, 3 in. long, cut at 12° on the inner ends. The blade is 1/8 in. thick and 6 in. long.

I assembled my tool dry in clamps to drill the pin holes,

METHODS (continued)



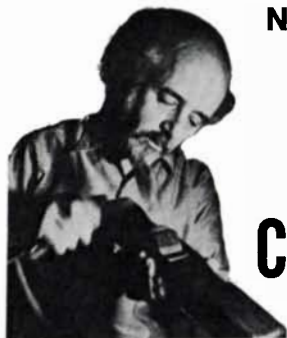
then I removed the blade and pinned the body together dry. After trimming the ends smooth, I lapped all the working edges, including the blade, with 220-grit paper placed on a surface plate.

Reassemble with glue and clamp, and you have a handy tool that never has to be set or checked, and can easily be flopped to pick up the other angle.

—Don Kenyon, Naples, N. Y.

Finishing clocks

I build hall and wall clocks. I use only walnut lumber. When I am finished with the case I don't fill the wood or stain it. I use only hot boiled linseed oil, nothing else. It makes a very beautiful finish. The grain seems to come to the surface in streaks of brown and some black. If there is a knot it turns black. For heating the oil I use an electric glue-pot of one quart size. I heat the oil to a point where it is too hot to put on with a rag, so I use a 1-in. nylon paintbrush. A brush also gets into the corners better than a rag. After the oil is



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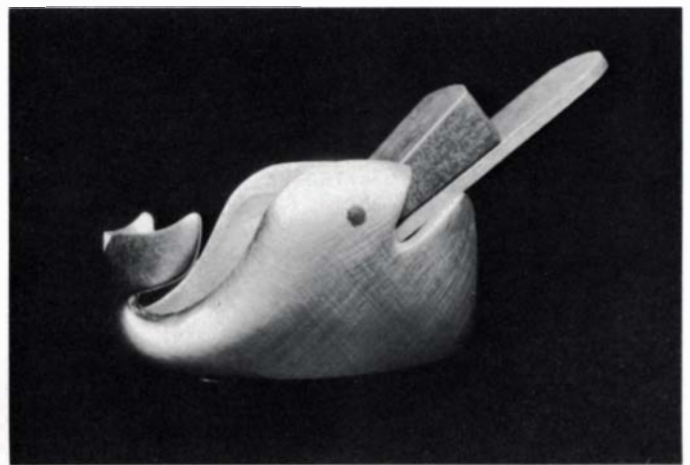
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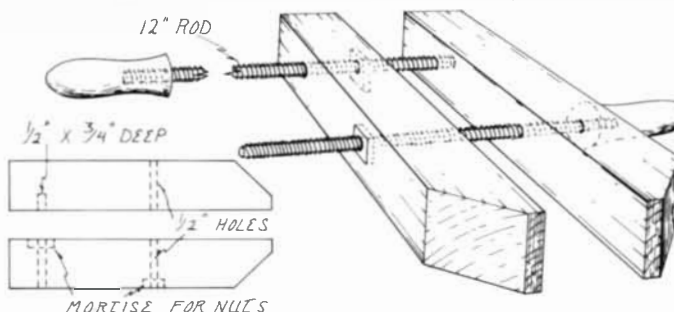
applied, let it set until you see dry spots appear. This could take from 5 to 20 minutes, depending on room temperature and humidity. Then take a wool cloth or pad and rub the wood until the oil seems to disappear. What you are doing is forcing the oil into the wood. One or more coats can be applied. If one of my clocks is scratched or nicked, all it takes is a little sanding and a little hot oil and the scratch disappears.

—George Eckhart, Kenosha, Wis.

More clamps

Here is a simple hand clamp that can be made without any threading or tapping—the only tools needed are a drill and a chisel. The idea is taken from old wooden handscrews that were given to me a few years back. There are no reverse threads and the jaws open and close parallel to each other. I hold the center handle in my left hand and spin the clamp around it clockwise to close the jaws; this keeps the jaws parallel until they are the desired distance apart. A turn or so on the rear handle then supplies enough pressure for any glue joint.

The threaded parts are 3/8-in. threaded rod sold at the hardware store. Get nuts to match and simply mortise them



into the hardwood jaws. If the mortises are loose, you can use epoxy glue to hold the nuts in place, just a dab, and keep it away from the threads. The holes are drilled 1/2 in. to allow easy passage of the rod. The turned handles are held firmly on the rod with epoxy glue pushed into a slightly oversize and overdeep hole.

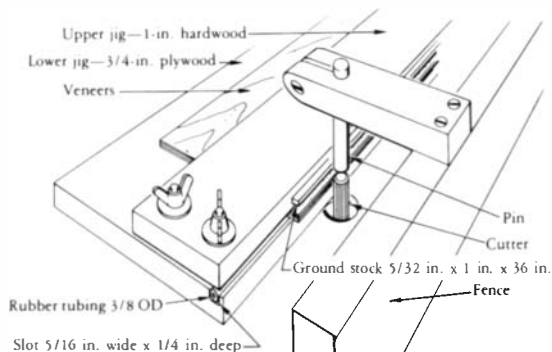
—Albert C. Landry, Richmond, Maine

Trimming veneers

Matching veneer pieces on a long edge requires a truly straight cutting procedure. Bookmatching is particularly fussy, for any departure from a straight line is doubled when the pieces are positioned. The traditional solution is to clamp the veneers between cauls and hand-plane the exposed edges. It doesn't work very well—the cauls do not distribute pressure properly to the veneers (usually puckered), and planing a three-foot length to a few thousandths of an inch is rarely a happy adventure.

By using a form of pattern routing, employing a piece of ground tool steel as the pattern, the precision cutting of veneer edges becomes routine. The ground stock is available at any tool and die supply house. Although it is expensive, (about \$25 for the size shown) do not stint on size; accuracy is based on the stiffness of the steel cross section. To avoid distortion, do not heat-treat the bar or machine it in any way. Simply embed and bond to the upper jig section. I used

METHODS (continued)



polyester resin, instead of epoxy, to make the ultimate retrieval of the steel simpler. Polyester resin develops about one-third the strength of epoxy on metal.

To clamp the wavy veneers, I use a rubber tube that is simply pushed into a snug groove in the lower board. I suspect that foam weather-stripping would work as well.

The upper jig member should be made of a hardwood (mine is cherry) but the wider lower member can be made of plywood. If after clamping a full load of four veneers there is some visible bow in either piece of the jig, do not be alarmed. The only necessity is support along every inch of the veneer edge. Unsupported veneer will chip off.

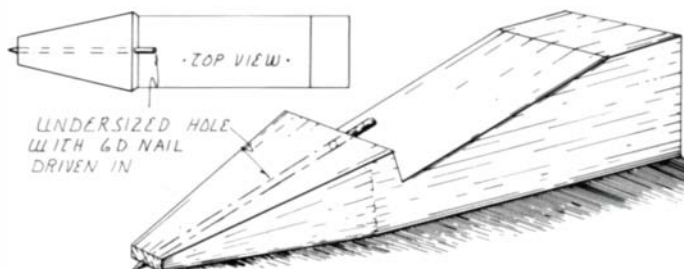
To use the jig, first set your router into a shaper table. Use a straight carbide cutter. Attach a metal pin, equal in diameter to that of the cutter, to the fence so that the pin is centered on the cutter and about 1/2 in. above it. Great precision is not required; eyeballing the pin location is adequate. With the pin guiding the steel bar, the cutter will generate a nearly

perfect edge on the veneers in one pass. Even such hard and brittle materials as Brazilian rosewood are easily cut.

—Leon Bennett, Riverdale, N. Y.

Poor boy's scriber

Perhaps my poor boy's scriber might suggest a useful project. The point is a nipped-off 6d nail in a hole drilled



undersize for a drive fit. This gadget eliminates error that a round-pointed tool might make because of the angle at which it is held.

—Earl Solomon, Orchard Park, N. Y.

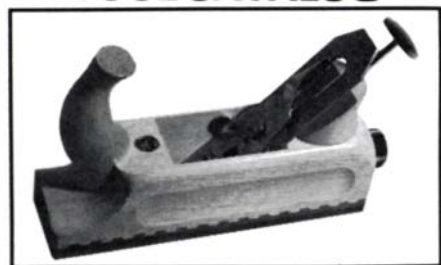
When screws snap

When a screw snaps off in hard wood and there is no way to get it out, I take a 2-in. length of steel gas line. Make some saw teeth on one end and put it in a drill. When the screw is out, fill the hole with some 5/16-in. dowel.

—Edwin A. Chard, Jr., Rochester, Ill.

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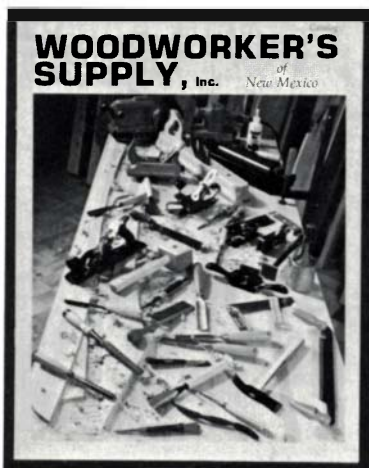
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Q & A

Questions

I am having some difficulty inlaying brass strips into walnut, especially on contoured surfaces. Epoxy does not adhere well and stains the walnut. Contact cement does only a fair job.

—Roy Ashe, Luther, Mich.

I have a problem with walnut and cherry veneer applied with contact cement on particle board. The veneer checks and cracks badly. I have tried eight different brands of glue and no luck. I then tried crossbanding but still had a few small checks. Oven-drying the veneer was the best but after a few days small buckles appeared.

—Richard Putzer, Oshkosh, Wis.

I'm trying to find construction details for a cylinder-top secretary or desk.

—Doug Smith, Rochester, N. Y.

Do you know of any supplier of ground garnet in bulk and several grades, as would be used for made-to-order sanding shapes?

—W. H. Baldwin, Binghamton, N. Y.

Do you know of a finish for cups and mugs that will resist citric acid, alcohol and soaps?

—W. Dalton, Brookfield Ctr., Conn.

The process of restoring a 100-year-old farmhouse has revealed poplar baseboards and woodwork covered with a casein (milk-base) paint, with tooled varnish, defying all attempts to strip down. Have tried commercial strippers, ammonia, belt sander, scrapers and homemade concoction of lye, flour and water.

—A. R. Zigan, Versailles, Ind.

I want to locate information about the construction of globes out of wood.

—E. S. Fleming, Washington, D. C.

For woods like cocobolo and lignum vitae, what glue does one use? I've tried plastic resin and liquid hide without success.

—D. K. LeCount, Berkeley, Calif.

I have constructed a dining-room table of walnut and walnut veneer over Novaply. It is good looking but won't stay that way if we keep using it. The linseed-oil finish cannot take hot and

cold dishes or moisture. Is there a finish I can apply over the oil that will take everyday use? Or could I strip the oil and apply epoxy resin or some other clear matte plastic finish?

—Roland H. Norton, Shalimar, Fla.

I have several Ulmia wooden planes. Is it either necessary or beneficial to treat the planes with an oil application from time to time? If an oil is recommended, which is most suitable?

—A. R. Hoermann, Don Mills, Ont.

I would like to learn the process of making the old-type picture frames, using composite moldings with plaster designs and the gold gilding process. I'd also like to know how to repair such frames.

—Charles Alger, Mantua, Ohio

Answers

To Warren Lawson, whose six walnut table leaves are cupped: A dozen readers say the leaves cupped because they were finished only on the top. Thus moisture could enter and leave the wood only through the bottom. You have to equalize the distribution of moisture in the board and finish both sides. One way is to strip the finish, lay the boards cup side down on a sunny patch of grass and keep an eye on them until they absorb enough moisture to straighten out. Then sticker them flat so they will dry evenly, and finish both sides.

To Richard G. Hawkins, on drilling large perpendicular holes and on using expansion bits in a drill press: Several readers recommend multispur machine center bits, available by mail from Silvo Hardware in Philadelphia. Larry Green of Bethel, Conn., says an expansion bit can be used at slow speed if the screw threads are ground off the point. Joe Rabitaille of Groton, Conn., says you can drill a true hole by hand if you make a braced right-angle jig that can be clamped to the work. The upright member should be made of two layers of wood, with a square rabbet cut in one of them to form a channel that will guide the bit.

To Angelo Pallaria, who wants an oil finish to repel water: Joe Rabitaille of Groton, Conn., recommends an oil-

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Q & A (continued)

varnish mixture. Start with a good synthetic varnish, add an equal amount of thinner and then add two tablespoons of boiled linseed oil to each quart. Soak in two coats, letting each dry 24 hours, rub each with 6-0 wet/dry sandpaper and wipe with a tack rag. Richard Hawkins of O'Fallon, Ill., recommends gunstock finish, which is an oil-varnish preparation, and Graham Wickham of Talent, Ore., says try a varnish sealer followed by wax.

To James Smith, whose varnish cratered and peeled off a refinished table: The problem is known in the trade as "fish eyes," and its cause is residue either from waxes and silicone polishes such as Pledge, or from stripping chemicals. Always wash the wood with alcohol after stripping. Cratering is common in auto body repairing, and auto supply houses sell various brands of a product called fish-eye eliminator. It should be mixed with lacquer, enamel, varnish or sealer before applying each coat.

To Peter Wade, on the weight of a table saw and the relative merits of the Rockwell and Inca saws: Brent K. Morris of Ripley, N. Y., warns that the machine must not move while feeding the work through, and advises bolting the stand to the floor. He owns a Rockwell saw and is very satisfied with it.

Both Morris and R. F. Norton of Shalimar, Fla., advise cutting plywood into manageable chunks with a portable circular saw, and then making finishing cuts on the table saw. Norton says, "To handle a long or wide panel, extensions to the side and rear of the table top help. Floor-standing rollers can also provide support and they are portable."

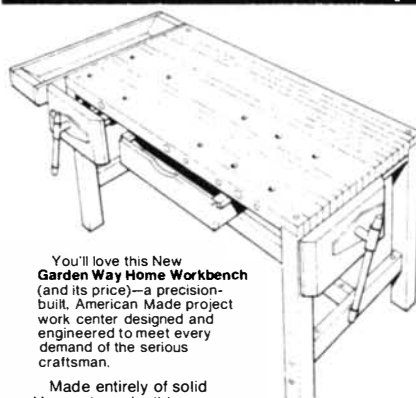
Garretson Chinn of Garrett Wade, Inc., a distributor of Inca saws, says, "Historically, thick sections were needed for machine castings and fittings because the only material available was cast iron, which gave the weight needed to damp vibrations from rotating parts that were not dynamically balanced. Structural steels and aluminums have made it possible to design and build lighter components utilizing ribbed sections with rigidity at least equal to heavy iron castings. . . ."

Chinn continues, "In general, when the great bulk of the cutting is to be on

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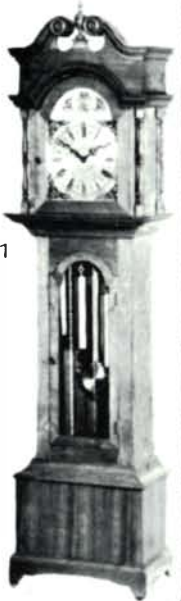
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Q & A (continued)

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To Thomas Parsons, on finishing holly inlay so it won't absorb stain: Glenn Rathke of Pompano Beach, Fla., and Edmond A. Georgi of Plymouth Meeting, Pa., say to apply a thin coat of fresh shellac, not lacquer, to protect the holly during staining. But Joe Rabitaille of Groton, Conn., says to prefit the strips without glue, remove them and stain the work. "When dry, glue strips in place, seal and finish. If light sanding is necessary, it's easier to touch up the stain in a few places than it is to try to keep stain out of the holly."

To D. D. Dickey, on how to soften old hide glue when removing veneer: Several readers say to use a solution of half vinegar and half water, or apply moist heat with a wet bath towel and a steam iron. Either method will soften old hide glue and a putty knife will lift off the veneer. Graham H. Wickham of Talent, Ore., adds, "Save all old veneer scraps. Some are mighty hard to come by these days, hence very useful for repair work."

To Dan Lyneby, on refinishing salad bowls: Several readers say to rub salad oil into the wood and allow 24 hours between coats until the surface remains oily, then wash in warm water and mild soap. Paul Boucher of East Dennis, Mass., recommends mineral oil. "Heat oil over a low flame to just below boiling, about 120° F. Rub oil on wood with a clean, lint-free cloth, allow to dry an hour between coats. A three-coat application will last about a year."

To Roy Matthew, on finishing the gears of a wooden-gear clock: Joe Rabitaille of Groton, Conn., says burnish the wood with a hardwood burnisher, then rub in paraffin oil or lemon oil.

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BOOKS

Restoring and Repairing Antique Furniture by John Rodd. *Van Nostrand Reinhold*, 450 W. 33rd St., New York, N. Y. 10001, 1976. \$11.95 hardcover, 240 pp.

John Rodd's experience as a cabinet-maker and restorer spans 50 years, and he has faced and solved many challenging and unusual repair problems. His work and his book reflect a refined sense of style, good taste and sound common sense. He approaches repairs analytically, with special emphasis on the reasons why the piece of furniture failed and how the wood will behave after it is repaired. This approach allows him to draw upon his vast experience and reach definite conclusions, which form the heart of each section of the book. This provides the reader with the insight he needs to evaluate the work at hand, and Rodd's complete instructions lead him through each step of the process. The author has made many mistakes in his long career; he anticipates the reader's mistakes and questions with many useful hints.

The book includes special sections on the repair and fabrication of hinges, locks and brasses. It also covers mirror repair, and makes some observations on how to be a successful restorer.

Refinishing and chair repair are the day-to-day routine of the restorer, and therefore are two of the best developed subjects in the book. Most of the examples are English period pieces. The text is adequately complemented by the photographs and illustrations. Mr. Rodd's narrative style is knowledgeable, humorous and anecdotal. The book is both a solid instructional manual and a reference for both the novice and the accomplished woodworker. Dealers and collectors of fine pieces will also find it a useful source.

—Ronald Roszkiewicz

Hardwood Purchasing Handbook, 5th edition. *National Hardwood Magazine, Inc.*, 4077 Viscount, Memphis, Tenn. 38118. \$26.80.

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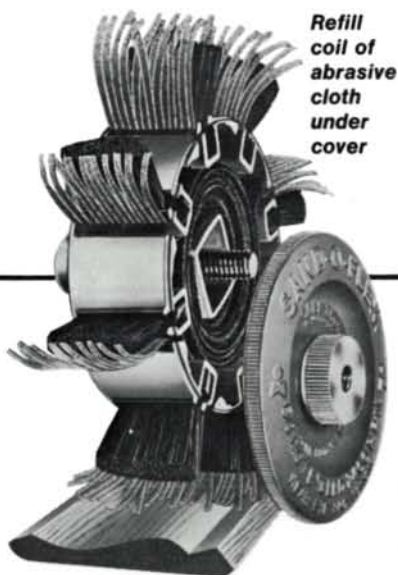
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The *Imported Wood Purchasing Guide* contains a description (source, color, texture, density, seasoning characteristics, working qualities, uses, decay resistance, etc.) of more than 100 imported lumber species, a chart of strength properties and kiln-drying schedules for most of the species listed. The best feature of the book is a cross-index by species of lumber suppliers, which permits one to find a company that sells doug fir or coigue or Danish beech without poring through all the listings. Also noted are ports, banks, brokers, kilns and freight companies that specialize in importing and exporting lumber.

Both books contain an abundance of well-arranged and clearly presented information, but their value to craftsmen or owners of small shops is limited. The books are expensive, and most of the companies listed sell only large quantities (truck or boxcar loads). But when a big job comes along and one needs to find 1000 bd. ft. of 10/4 quartersawn white oak or 16/4 teak, these books are indispensable.

—David Landen

Texas Furniture: The Cabinetmakers and Their Work, 1840-1880 by Lonny Taylor and David B. Warren. *University of Texas Press, Austin, Tex.*, 1975. \$22.50 hardcover, 387 pp.

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BOOKS (continued)

Lonn Taylor is in charge of the Winedale Museum, a restored stage-stop and farm near Round Top, Tex. David Warren is a former curator of the Bayou Bend furniture collection. Their thoroughness and furniture knowledge make the book a model for regional furniture studies.

Texas Furniture starts with a chapter on the historical setting of the state in the mid-1800s. During this period, the demand for furniture was met by small-town cabinetmakers using local woods and hand tools. By the end of the century, cheaper factory furniture, brought in by rail, squeezed out the local cabinetmakers.

The chapter on cabinetmaking covers tools, native woods and construction techniques, but in the context of the early cabinetmaker and his life-style in different regions of the state.

The bulk of the book is given to more than 200 examples of early Texas craftsmanship. Beds, wardrobes, chests, chairs, tables, desks and more are presented in large, clear photographs with descriptions of the pieces. Woodworkers will be frustrated by the short construction descriptions and lack of close-ups of unusual features.

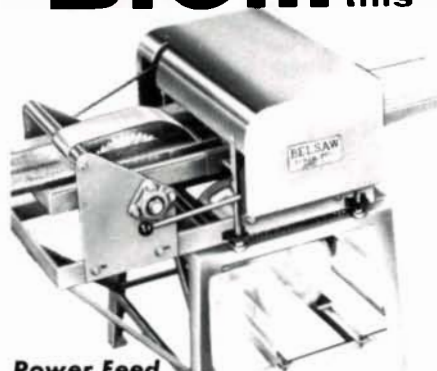
The book is flawed by the selection of pieces included. Although the text states the "vast majority of Texas cabinetmakers were American Southerners . . .," the furniture presented is almost exclusively by German Texans. The disproportionate influence of the Germans is hard to challenge, but to exclude the furniture produced by Americans of Mexican and English descent leaves a gaping hole.

Texas Furniture will be useful to collectors, historians, and specialists in reproductions or restoration. Contemporary woodworkers will be impressed by the simple and functional country pieces more than by the massive and sometimes overdecorated, high-style pieces. All woodworkers, however, will appreciate the workmanship displayed and enjoy a feeling of brotherhood with earlier craftsmen seldom found in other books on early furniture.

—Jim Richey

Ron Roszkiewicz buys tools for Woodcraft Supply Corp.; Jim Richey is an amateur woodworker from Houston, Tex.; David Landen owns Applewood Furniture in Chapel Hill, N. C.

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ADDENDA, ERRATA

The editors of *Fine Woodworking* magazine are always pleased to discuss article ideas with readers. Send us a query outlining the article you'd like to write, with a sample photograph or drawing. Include your phone number and we will get back to you with our comments and suggestions, or we will be able to tell you that we have already commissioned a similar article by another craftsman.

We also invite readers to send us brief accounts of ingenious tricks they have devised to solve cabinetmaking problems, for publication in our Methods of Work column.

Readers have contributed many good leads since we last revised our Sources of Supply listing of hardwood lumber dealers and of tools and machinery. We plan to bring the lists up to date in our next issue.

We will forward letters when readers wish to communicate directly with craftsmen who have written for *Fine Woodworking*. However, if you expect an author to answer your letter, we advise you to enclose a self-addressed stamped envelope.

In Summer '76, page 53: The book *Tricks of the Trade: Furniture Finishing for the Home Craftsman* is now available from Adams Printing Corp., Templeton, Mass. 01468, or from the bookstore at Old Sturbridge Village, Sturbridge, Mass. 01566.

In Fall '76, page 29: Bowl turner Bob Stocksdales starts his sanding sequence with 60-grit garnet, not 16.

In Spring '77, page 62: The School of the Museum of Fine Arts in Boston should not have been included in the listing of woodworking schools. The museum maintains a woodshop for the use of fine arts students, but does not offer courses in woodworking or cabinetmaking.

In Spring '77, page 10: The left-hand tap and die, necessary to make parallel-jaw clamps as shown, are not

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ADDENDA (continued)

standard hardware items. The 5/16-in. tap costs about \$5, but the die ranges from \$25 to \$40. Reader Richard E. Price, who contributed the item, got his left-hander for a few dollars from a wholesaler in Seattle. But it has no brand stamp and we have not been able to track down the supplier.

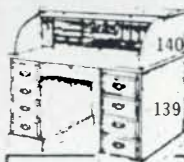
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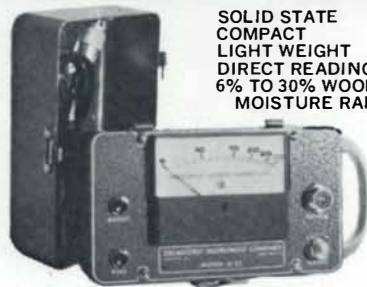
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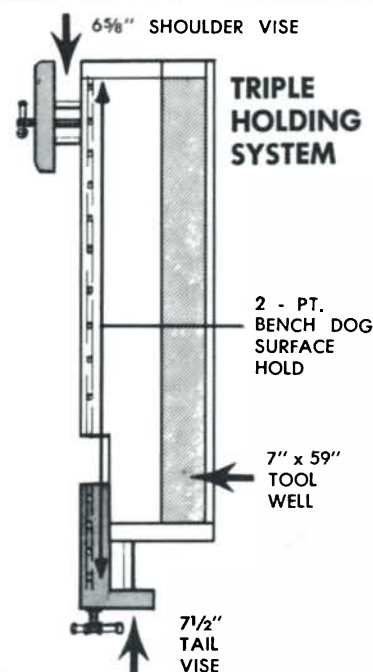
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Cooperative Shop

Group shares machinery, skills

by Rosanne Somerson

In an industrial section of Cambridge, Mass., the Cambridgeport Co-operative Woodshop sits among old factories and warehouses, in a building that once housed a furniture company. The shop already had an extensive sawdust filtration system and fittings for industrial machinery when the co-op rented the 12,000-sq.-ft. space.

A visitor to the co-op first sees long lumber racks loaded with domestic woods. Off to the left is a showroom filled with works including a contemporary dining set, a modular shelving system and a one-of-a-kind cushioned sofa with animals carved on the arms and legs. A finishing room is on the right. Further into the building is the common machinery, mostly large industrial milling and sanding equipment. Around the machines are work areas, each as distinct as the furniture in the showroom.

The workshop, in Cambridge for about three years, is an offshoot of an earlier venture in nearby Roxbury. With the move came an increase in membership, and now the co-op comprises four businesses, ten full-time independent craftsmen, and several part-time members. New Hamburger Cabinetworks has three shop workers and three carpenters who work on various job sites; they build cabinets and custom furniture. Woodgrain'ry, with four members, does store fixtures, commercial interiors and architectural woodworking. Organic Woodworking is two craftsmen whose jobs range from carpentry and custom furniture to interior renovations. Riverside, another group of two, makes custom furniture and tools for craftsmen such as weavers and ceramists. The ten independents do a mix of cabinetry, furniture and limited production work.

Ted Dodd, an independent craftsman, was instrumental in starting the

Roxbury endeavor and still owns most of the common machinery. He explains that the co-op's financial arrangement is defined by two checking accounts. A common account is used to collect and pay rent, prorated machinery operation and maintenance costs, tool purchases and replacements, trash disposal and a machinery moving loan. The second, an inventory account, is used to buy lumber and common supplies, including hardware, screws, sandpaper and glue. Each business keeps track of the lumber it uses and pays for it monthly, plus a small markup to cover the other common supplies. The co-op tries to break even but usually the supplies account shows a small loss, which is then billed into the rent account.

The floor is divided into bays of about 200 sq. ft. each, marked off by the ceiling beams. One bay rents for about \$80 per month: this includes use of the common machinery, tools, spray booth/finishing room and showroom. The jobs of maintaining machinery and collecting and figuring bills are rotated among the members. Major changes in membership, machinery and the like are discussed in group meetings, but each business determines its own financial setup and equipment needs.

The co-op has no formal procedure for admitting new members. Turnover is minimal, and a departing member usually lines up a replacement.

Co-op members find the overhead very low. Stan Dolberg, who has two bays, says, "If I had my own shop my first \$300 or \$400 would go into shop costs. Here the first \$150 or so covers that. This maximizes the chance for experimentation; I can try out techniques that would otherwise consume too much time and thereby be costly." Low overhead also enables the members to learn how to price work and estimate jobs, and to define the direction of

their work before risking a private shop.

The men and women of the co-op have access to a wide variety of equipment and a good lumber inventory, real assets to the professional just starting out. Steve Watt of Woodgrain'ry says, "We all benefit from the fact that people in the various groups know things that others don't know. This raises everybody's general knowledge." Jamie Robertson of Woodgrain'ry says the co-op is an alternative to apprenticeships, not just a building where people are sharing space, but a learning institution.

Occasionally groups team up on big jobs. If work comes in to someone too busy to take it on, the job is passed on to someone else. Carol Neville of New Hamburger says, "We are now getting exactly the kinds of work we want. None of us are in it to make a big killing. We are more interested in keeping the work completely satisfying and still making a living." Many co-op members are supporting families on what they earn woodworking.

Many customers are attracted to the co-op because of the number of woodworkers. Ironically, though, some expect lower prices because the group is a cooperative. "I've learned not even to consider a job not related directly to someone seeing my own work. Interesting work comes from work," says Dolberg. Adds Bill McAvinney, "One of the hardest things is to be able to criticize your customers. When people come in with an idea it's hard to tell them it won't work."

The co-op has its problems, too, such as not enough room for expansion. Often clean-up and machine and tool maintenance do not get the attention they require. Several attempts to devise a communal advertising plan have failed because of the large number of members and the variety of work. Some members feel that a high level of competency is needed to keep the shop running smoothly, and would rather the co-op consisted only of experienced craftsmen. And everyone faces the problems of woodworkers trying to make a living: establishing a reputation, subsidizing one-of-a-kind pieces, and getting the right price for work.

As for the future, Dodd says, "Our lease is up at the end of next year. What will happen then, who knows?" And oh yes, there are no openings for craftsmen in the co-op.

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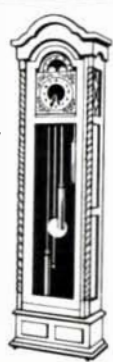
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Glues and Gluing

Woodworking adhesives, used correctly, are stronger than wood

by R. Bruce Hoadley

The general term "adhesive" covers any substance that can hold two materials together by surface attachment. Those most commonly used for wood are called "glues," although materials described as "resins," "cements" and "mastics" are equally important in the assembly of wood products. Today's woodworkers use adhesives in a number of ways: to make pieces larger than available stock (such as carving blocks or laminated beams), to create combinations or composites for physical or esthetic improvement (such as plywood, overlays or marquetry) and to join parts to create a final product (as in furniture, sporting goods or structures). Certain basic considerations which may be overlooked or misunderstood are too often the cause of serious gluing problems and are worthy of systematic review.

A logical starting point is to wonder why glue sticks at all. It is sometimes assumed that adhesion results from the interlocking of minute tentacles of hardened adhesive into the fine porous cell structure of the wood surface. However scientific research has shown that such **mechanical adhesion** is insignificant compared to the chemical attachment due to molecular forces between the adhesive and the wood surface, or **specific adhesion**. The assembled joint, or bond, is often discussed in terms of five intergrading phases, each of which can be thought of as a link in a chain. The weakest phase determines the success of the joint. Phases 1 and 5 are the pieces of wood, or adherends, being joined. Phases 2 and 4 are the interpenetrating areas of wood and adhesive, where the glue must "wet" the wood to establish molecular closeness for specific adhesion. Phase 3 is the adhesive itself, which holds together by **cohesion**.

Fundamentally, then, gluing involves machining the two mating surfaces, applying an adhesive in a form which can flow onto and into the wood surface and wet the cell structure, and then applying pressure to spread the adhesive uniformly thin and hold the assembly undisturbed while the adhesive solidifies. The typical adhesive is obtained or mixed as a liquid but sets to form a strong glue layer, either by loss of

solvent, which brings the adhesive molecules together and allows them to attach to one another, or by a chemical reaction that develops a rigid structure of more complex molecules.

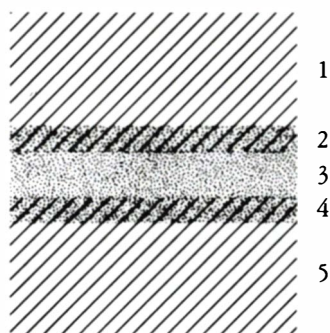
A wide and sometimes confusing array of adhesive products confronts the woodworker. A common pitfall is the dangerous belief that some glues are "better" than others; the notion that simply acquiring "the best" will ensure success tempts disastrous carelessness in using it. With certain qualifications, it can generally be assumed that all commercially available adhesives will perform satisfactorily if chosen and used within their specified limitations. An important corollary is that no adhesive will perform satisfactorily if not used properly. Within the specified limitations, most woodworking adhesives are capable of developing a joint as strong as the weaker of the woods being joined; that is, the wood, rather than the glue or its bond, is the weak link in the chain.

Wood

Wood is a complicated material. Due to the cellular arrangement within the wood and, in turn, the reactive cellulose within the cell, adhesive bonding is maximum at side-grain surfaces, and minimum at end-grain surfaces. This is especially important to realize in view of the large longitudinal-to-transverse strength ratio we are accustomed to in solid wood. Thus end-grain attachment should be considered only in conjunction with appropriate joints or mechanical fastenings. With side-to-side grain combinations, lamination of pieces with parallel grain arrangement is most successful. With cross-ply orientation, the relative thicknesses of adjacent layers must be considered in relation to the dimensional changes the composite will have to restrain.

Different woods have different gluing properties. In general, less dense, more permeable woods are easier to glue; for example, chestnut, poplar, alder, basswood, butternut, sweetgum and elm. Moderately dense woods such as ash, cherry, soft maple, oak, pecan and walnut glue well under good conditions. Hard and dense woods, including beech, birch, hickory, maple, osage orange and persimmon, require close control of glue and gluing conditions to obtain a satisfactory bond. Most softwoods glue well, although in uneven-grained species, earlywood bonds more easily than denser latewood. Extractives, resins or natural oils may introduce gluing problems by inhibiting bonding, as with teak and rosewood, or by causing stain with certain glues, as with oaks and mahogany.

Since most adhesives will not form satisfactory bonds with wood that is green or of high moisture content, wood should at least be well air-dried. Ideally wood should be conditioned



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to a moisture content slightly below that desired for the finished product, to allow for the adsorption of whatever moisture might come from the adhesive. For furniture, a moisture content of 5% to 7% is about right. For thin veneers, which take up a proportionately greater amount of moisture, an initial moisture content below 5% might be appropriate.

Machining is especially critical. In some cases, especially for multiple laminations, uniform thickness is necessary for uniform pressure. Flatness is required to allow surfaces to be brought into close proximity. The surfaces to be glued should have cleanly severed cells, free of loose fibers. Accurate hand planing is excellent if the entire surface, such as board edges, can be surfaced in one pass. On wide surfaces, peripheral milling (planing, jointing) routinely produces adequate surfaces. Twelve to twenty-five knife marks per inch produce an optimum surface. Fewer may give an irregular or chipped surface; too many may glaze the surface excessively.

Dull knives that pound, heat and glaze the surfaces can render the wood physically and chemically unsuited for proper adhesion even though it is smooth and flat. Planing saws are capable of producing glueable surfaces, but in general (with exceptions, like epoxies) sawn surfaces are not as good as planed or jointed ones.

Surface cleanliness must not be overlooked. Oil, grease, dirt, dust and even polluted air can contaminate wood surface and prevent proper adhesion. Industry production standards usually call for "same-day" machining and gluing. Freshly machining surfaces just before gluing is especially important for species high in resinous or oily extractives. Where this is not possible, washing surfaces with acetone or carbon tetrachloride is sometimes recommended. One should not expect a board machined months or years ago to have surfaces of suitable chemical purity. If lumber is flat and smooth, but obviously dirty, a careful light sanding with 240-grit or finer abrasive backed with a flat block, followed by thorough dusting, can restore a chemically reactive surface without seriously changing flatness. Coarse sanding, sometimes thought to be helpful by "roughening" the surface, is actually harmful because it leaves loose bits. In summary, wood should be surfaced immediately prior to gluing, for cleanliness and to minimize warp, and should be kept free of contamination to ensure a glueable surface.

Time

Shelf life is the period of time an adhesive remains usable after distribution by the manufacturer. Unlike photographic films, adhesives are not expiration dated. Beware the container which has been on the dealer's shelf too long. Out-

dated package styles are an obvious tip-off. It is wise to mark a bottle or can with your date of purchase. It is amazing how fast time can pass while glue sits idle in your workshop.

The adage, "when all else fails, read the instructions," all too often applies to glue. It is unfortunate that instructions are so incomplete on retail glue containers. Manufacturers usually have fairly elaborate technical specification sheets but supply them only to quantity consumers. Too often, many critical factors are left to the user's guesswork or judgment. Mixing proportions and sequence are usually given clearly; obviously they should be carefully followed.

Glues with a pH above 7 (alkaline), notably casein resins, will absorb iron from a container and react with certain woods such as oak, walnut, cherry, and mahogany to form a dark stain. Coffee cans or other ferrous containers can contribute to this contamination. Nonmetallic mixing containers such as plastic cups or the bottoms of clean plastic bleach jugs work out nicely.

Once glue is mixed, the pot life, or working life, must be regarded. Most adhesives have ample working life to handle routine jobs. The period between the beginning of spreading the glue and placing the surfaces together is called open assembly time; closed assembly time indicates the interval between joint closure and the development of full clamping pressure. Allowable closed assembly time is usually two or three times open assembly time. With many ready-to-use adhesives, there is no minimum open assembly time; spreading and closure as soon as possible is recommended, especially in single spreading, to ensure transfer and wetting of the other surface. If the joint is open too long, the glue may precure before adequate pressure is applied. The result is called a dried joint. In general, assembly time must be shorter if the wood is porous, the mixture viscous, the wood at a low moisture content, or the temperature above normal. With some adhesives, such as resorcinol, a minimum open assembly may be specified for dense woods and surfaces of low porosity, to allow thickening of the adhesive and prevent excessive squeeze-out.

Whereas commercial operations usually have routine procedures for clamping, the nemesis of the amateur is not having his clamps and cauls ready. In the scramble to adjust screws or find extra clamps, parts may be shifted and assembly time exceeded. It is worthwhile to clamp up an assembly dry to make sure everything is ready before spreading the glue.

Spreading

Glue should be spread as evenly as possible, even though some degree of self-distribution will of course result when pressure is applied. Brush application works well with thinner formulations. A spatula, painter's palette knife or even a flat stick can be used as a spreader. A small rubber roller for inking print blocks does a great job in spreading glue quickly and evenly. Paint rollers and paint trays can be used with some adhesives.

Proper spread is difficult to control. Too little glue results in a starved joint and a poor bond. A little overage can be tolerated, but too much results in wasteful and messy squeeze-out. With experience the spread can be eyeballed, and it is useful to obtain some commercial specifications and conduct an experiment to see just what they mean. Spreads are usually given in terms of pounds of glue per thousand square feet of single glue line, or MSGL. A cabinetmaker will find it more

convenient to convert to grams per square foot, by dividing lbs./MSGF by 2.2. Thus a recommended spread of 50 lbs./MSGF, typical of a resorcinol glue, is about 23 grams per square foot. Spread it evenly onto a square foot of veneer for a fair visual estimate of the minimum that should be used. Usually, the recommended spread appears rather meager.

Double spreading, or applying adhesive to each of the mating surfaces, is recommended where feasible. This ensures full wetting of both surfaces, without relying on pressure and flatness to transfer the glue and wet the opposite surface. With double spreading, a greater amount of glue per glue line is necessary, perhaps a third more.

Clamping

The object of clamping a joint is to press the glue line into a continuous, uniformly thin film, and to bring the wood surfaces into intimate contact with the glue and hold them undisturbed until setting or cure is complete. Since loss of solvent causes some glue shrinkage, an internal stress often develops in the glue line during setting. This stress becomes intolerably high if glue lines are too thick. Glue lines should be not more than a few thousandths of an inch thick.

If mating surfaces were perfect in terms of machining and spread, pressure wouldn't be necessary. The "rubbed joint," skillfully done, attests to this. But unevenness of spread and irregularity of surface usually require considerable external force to press properly. The novice commonly blunders on pressure, both in magnitude and uniformity.

Clamping pressure should be adjusted according to the density of the wood. For domestic species with a specific gravity of 0.3 to 0.7, pressures should range from 100 psi to 250 psi. Denser tropical species may require up to 300 psi. In bonding composites, the required pressure should be deter-

mined by the lowest-density layer. In gluing woods with a specific gravity of about 0.6, such as maple or birch, 200 psi is appropriate. Thus gluing up one square foot of maple requires pressure of (12 in. x 12 in. x 200 psi) 28,800 pounds. Over 14 tons! This would require, for an optimal glue line, 15 or 20 cee-clamps, or about 50 quick-set clamps. Conversely, the most powerful cee-clamp can press only 10 or 11 square inches of glue line in maple. Jackscrews and hydraulic presses can apply loads measured in tons. But since clamping pressure in the small shop is commonly on the low side, one can see the importance of good machining and uniform spread.

But pressure can be overdone, too. Especially with low-viscosity adhesives and porous woods, too much pressure may force too much adhesive into the cell structure of the wood or out at the edges, resulting in an insufficient amount remaining at the glue line, a condition termed a starved joint. Some squeeze-out is normal at the edges of an assembly. However, if spread is well controlled, excessive squeeze-out indicates too much pressure; if pressure is well controlled, undue squeeze-out suggests too much glue. Successful glue joints depend on the right correlation of glue consistency and clamping pressure. Excessive pressure is no substitute for good machining. Panels pressed at lower pressures have less tendency to warp than those pressed at higher pressures. Additionally, excessive gluing pressure will cause extreme compression of the wood structure. When pressure is released, the cells spring back and add an extra component of stress to the glue line.

The second troublesome aspect of clamping is uniformity, usually a version of what I call "the sponge effect." Lay a sponge on a table and press it down in the center; note how the edges lift up. Similarly, the force of one clamp located in

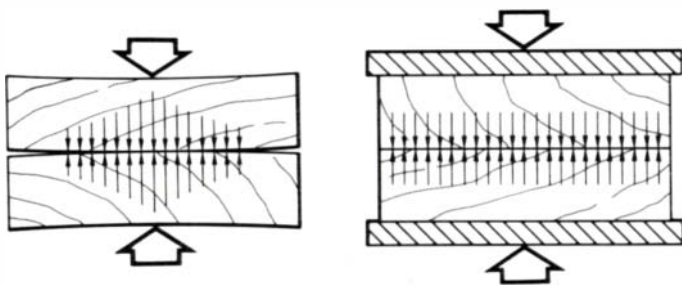
To find out just how much pressure typical woodworking clamps could apply, Hoadley attached open steel frames to the crossheads of a universal timber-testing machine. With a clamp positioned to draw the frames together, the load applied was indicated directly.

The clamps are described in the table, with the last column giving the average of three trials by average-sized Hoadley, tightening as if

he were trying to get maximum pressure in a gluing job. The quick-set clamp listed first in the table was used to calibrate the setup: A secretary squeezed 330 lbs., a hockey player squeezed 640 lbs., and Hoadley squeezed 550 lbs. Repeated trials by each person yielded readings that agreed to within 10%. An asterisk indicates that the clamp began to bend and the test was stopped at the value listed.

	Brand, size, handle style	Screw dia., thread type	Load, pounds
	Lust, 5-in. jaw, straight handle	.645 in., square	550
	Hartford, 4-in. jaw, straight handle	.370 in., square	400
	Jorgenson, 4-in. jaw, straight handle	.375 in., V	420
	Stanley, 6 in., T-bar handle	.375 in., V	355*
	S.H. Co. bar, crank handle	.625 in., square	2060
	Sears 3/4-in. pipe, butterfly crank	.625 in., square	1120*
	Jorgenson, 4 in., T-bar handle	.610 in., square	2110
	Jorgenson 8 in., butterfly handle	.750 in., square	1100
	Pony, 8 in.	spring	25
	Craftsman, 10 in., straight handle	.435 in., square	920
	Unknown C-clamp 2-in. jaw, T-bar	.310 in., V	560



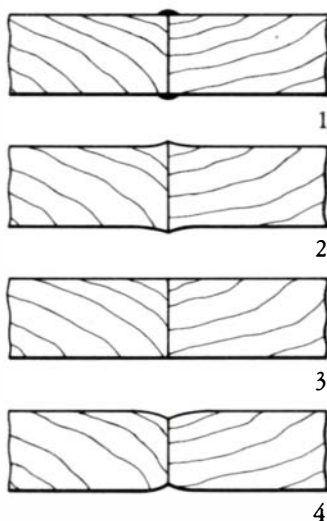


the middle of a flat board will not be evenly transmitted to its edges. It is therefore essential to use heavy wooden cover boards or rigid metal cauls to ensure proper distribution of pressure.

Clamp time must be long enough to allow the glue to set well enough so that the joint will not be disturbed by clamp removal. Full cure time, that is, for development of full bond strength, is considerably longer. If the joint will be under immediate stress, the clamp time should be extended. Manufacturer's specified clamp times are established for optimum or recommended shelf life, temperature, wood moisture content, etc. If any of these factors is less than optimum, cure rate may be prolonged. It's best to leave assemblies overnight.

Most glue specifications are based on "room temperature" (70° F). Shelf life is shortened by storage at above-normal temperature, but may be extended by cold storage. Normal working life of three to four hours at 70° F may be reduced to less than one hour at 90° F. Closed assembly at 90° F is 20 minutes, against 50 minutes at 70° F. A curing period of 10 hours at 70° F can be accelerated to 3-1/2 hours by heating to 90° F.

Finally, cured joints need conditioning periods to allow moisture added at the glue line to be distributed evenly through the wood. Ignoring this can result in sunken joints. When edge-gluing pieces to make panels, moisture is added to the glue lines (1), especially at the panel surfaces where squeeze-out contributes extra moisture. If the panel is surfaced while the glue line is still swollen (2, 3), when the moisture is finally distributed the glue line will shrink (4), leaving the sunken joint effect.



Adhesives

No truly all-purpose adhesive has yet been manufactured and probably never will be. A general-purpose adhesive cannot hope to attain all the individual capabilities and attributes of closely designed ones. Although any of the standard commercial glues will do a satisfactory job if the moisture content of the wood is below 15% and the temperature remains within the human comfort range, there is an increasing trend toward development of special adhesives. Adhesive selection must therefore take into account factors such as species, type of joint, working properties as required by anti-

cipated gluing conditions, performance and strength, and, of course, cost.

One interesting adhesive is water. It is easily spread, wets wood well and solidifies to form a remarkably strong joint. It is delightfully inexpensive. However, it is thermoplastic and its critical maximum working temperature is 32° F. At temperatures at which it will set it has a very short assembly time. But due to its temperature limits water will never capture a very important position among woodworking adhesives.

Glues made from natural materials have been used from earliest times. Although synthetic materials have emerged to the forefront, traditional natural adhesives are still in use.

Hide glue (LePage's Original Glue, Franklin's Liquid Hide Glue) is made from hides, tendons, and/or hoofs of horses, cattle and sheep. It is available in granules which must be soaked in water, but more commonly in ready-to-use form. Hide glue sets by evaporation and absorption of solvent. It has a moderate assembly time and sets in a matter of hours at room temperature. It develops high strength but is low in moisture resistance. Hide glue is used mainly for furniture. Its popularity in recent years has declined drastically with the development of synthetic glues.

Casein glue is primarily a milk derivative although it contains lime and other chemicals in various formulations. It is purchased as a powder that is mixed with water; after mixing, it must be allowed to set for about 15 minutes. Casein glue has the advantage of fairly long assembly time (15 to 20 minutes) but cures rather slowly (8 to 12 hours at room temperature). The glue line is neutral in color but may stain many woods and is somewhat abrasive to cutting tools. The claim of being a good gap-filling adhesive seems somewhat doubtful. Casein has moderately good heat resistance and bonds show significant short-term moisture resistance, but it is not recommended for exterior use. Casein is used extensively for laminating and large carpentry jobs.

Polyvinyl resin emulsions are probably the most versatile and widely used wood adhesives. These are the white glues (Elmer's Glue-All, Franklin's Evertite white glue, Sears' white glue), also called PVA because of their principal constituent, polyvinyl acetate. White glues have a long shelf life and can be used as long as the resin remains emulsified. Setting is by water absorption and quite rapid at room temperature; clamping time of less than one hour may suffice if the joints are not to be stressed immediately. The white glues are non-staining and dry clear. The glue does not dull tools but excess squeeze-out may clog or foul sandpaper under frictional heating because the adhesive is thermoplastic. These glues develop high strength but have low resistance to moisture and heat. An important characteristic is their "cold flow," or creep under sustained loading. This is an asset where dimensional conflict is involved, as in mortise and tenon joints. However, in edge gluing and lamination, "shifting" of adjacent pieces may in time produce visible unevenness at joints. In chair seats, joints may open along end grain due to drastic moisture change.

Numerous modified PVA glues give greater rigidity and improved heat resistance. The so-called **aliphatic resin glues**, commonly called yellow glue (Franklin's Titebond, Elmer's Carpenter's Wood Glue) fall into this group. The low viscosity of the white glues was always troublesome in furni-

ture assembly, since any dribble of glue from joints caused difficulty in later finishing. The aliphatic glues are much more viscous and greatly reduce this problem. Some consider these glues as representing an intermediate position between the white glues and the urea-formaldehyde glues. However, yellow glues are not sufficiently weather-resistant to replace urea resins in carpentry.

The development of modern plywood and laminated products that have outstanding durability under extremes of outdoor exposure was possible only with the thermosetting resin adhesives. Several of these types are available to the woodworker.

Resorcinol-formaldehyde (Franklin or U.S. Plywood Resorcinol Waterproof Glue, Elmer's Waterproof Glue) are the woodworker's mainstay because of their high strength and resistance to heat and moisture. The most common form is a dark reddish liquid resin with a tan powdered hardener, paraformaldehyde. The mixed resin has four or more hours of working life at room temperature and its ample assembly time allows for complicated clamping operations. With high-density woods, double spreading with open assembly of 10 or 15 minutes is recommended to prevent starved joints. The adhesive will set at room temperature; cure periods are 8 to 12 hours, but can be drastically shortened by elevating temperature, which also ensures maximum durability. Use of the adhesive below 70° F is not recommended. Resorcinols are invaluable for room-temperature bonding of laminated timber and of assembly joints that must withstand severe conditions, such as marine and outdoor use. Phenol-formaldehyde adhesives have the superior durability of resorcinols but require heat for curing and are thus not readily suited to the average cabinet shop. They are used mainly for commercial production of plywood and particleboard.

Urea-formaldehyde glues (Weldwood or Craftsman Plastic Resin Glue), often marketed as "plastic resin adhesive," have become extremely important for the woodworker. The ureas represent perhaps the most versatile resin type, capable of bonding at room or elevated temperatures and curable with electronic gluing equipment. They are widely used in cabinetmaking, veneer work, plywood, interior particleboard and furniture. They can be modified with filler to form excellent gap-fillers. They commonly come as a tan powder consisting of both resin and hardener, activated by mixing with water. Liquid ureas are also available. Working life of mixtures is 3 to 5 hours at 70° F. Use with wood at moisture contents below 6% is not recommended, because of the rapid rate of water absorption from the glue. Assembly time of 15 minutes is allowed and the inconspicuous white-to-tan glue lines cure in 6-8 hours at room temperature. Glue bonds are highly water-resistant but lack durability at temperatures above 120° F.

Melamine adhesives are similar in appearance and mixing properties to ureas. They are very strong and resistant to water and heat. They are especially useful where the dark glue line of phenolic or resorcinol resins is undesirable. However, they require heat for curing, and find greatest use as a fortifier for urea in industrial applications and for high-frequency edge gluing.

Hot melts (Sears Glue Gun, Franklin's hot melt) are thermoplastic synthetics marketed as solid sticks that are softened in an electrically heated gun. These glues are applied hot, the assembly quickly closed, and rapid setting effected as cooling takes place. Hot melts are not a new concept, for

great-grandfather's double boiler glue-pot used hot animal glue in just this way. Modern hot melts are new chemically, however, and include polyvinyl esters, acetals, cellulose esters or polyamides. Their principal advantage is the rapid development of initial strength upon cooling; a disadvantage is the very brief open assembly time. Hot melts are convenient for applying edge banding, furniture reinforcement, blocking, toy parts, and the like. They are easier to use if the wood is heated to extend assembly time.

Epoxy glues (Elmer's epoxy, Devcon clear epoxy) are among the modern "miracle" adhesives. There are several chemically different types, but all involve two liquids, a resin and hardener, which are mixed in equal amounts to initiate curing. The rate of cure varies widely. In the rapid-set types (Devcon 5-minute epoxy) open assembly is limited to a couple of minutes, but stiffening takes place quickly and a high percentage of full-bond strength is developed in less than ten minutes. Other formulations have up to an hour of working life but take up to 24 hours or more to cure. Epoxy resins will bond to glass, ceramics, tile, brick and many plastics (but not polyethylene, polypropylene and Teflon). They cure by chemical reaction rather than loss of solvent, and are excellent gap fillers. It has been reported that epoxy bonds better on clean, sanded surfaces or even sawn surfaces than on smoothly planed wood. Most glue lines are clear or nearly clear and waterproof. The major disadvantages of epoxy are relatively high cost and rather short pot life.

Contact cements (Goodyear Pliobond, Weldwood Plus-10, Elmer's Acrylic Latex Cabinetmaker's Contact Cement) are thermoplastics applied by double spreading and allowed to dry until no longer tacky. When the adhesive layers are touched together, cohesive bonding forms up to two-thirds of the ultimate strength immediately, hence the term contact cement. They will bond to many materials in addition to wood. Although contact cements have lower strength than conventional adhesives they are suited to many applications where clamping pressure would be difficult to apply and sustain and where high strength is not a requirement. Contact cements are perhaps best known for applying plastic laminates to counter tops. They are liable to fail about 120° F. Water-soluble formulations are available but have relatively low moisture resistance. A major disadvantage is the zero closed assembly time: surfaces bond immediately and cannot be repositioned once contact is made.

Mastics include a variety of thick, pasty cements. They are commonly marketed in caulking cartridges and many are termed "construction adhesives," intended for use in bonding subflooring to joists or plywood wall paneling to studs. They vary widely in rate of cure, usually developing slowly and retaining some flexibility in the adhesive layer. Their gap-filling capability is an additional advantage.

Acrylic adhesives (Franklin's Rexite) are used by applying the thick resin to one adherend, the activator to the other. Within minutes after bringing the surfaces together, amazingly high strength develops. I bonded together two maple dowels 1 in. in diameter and 4 in. long, end-to-end. After allowing a full half-hour for curing, no one was able to break the joint apart by hand. Another outstanding feature of the adhesive is that it cures by polymerization, and so it is a great gap filler. On the other hand, this adhesive so far has only about a six-month shelf life and has therefore not been made available for retail distribution.

Winter Market

Woodworkers show in Baltimore

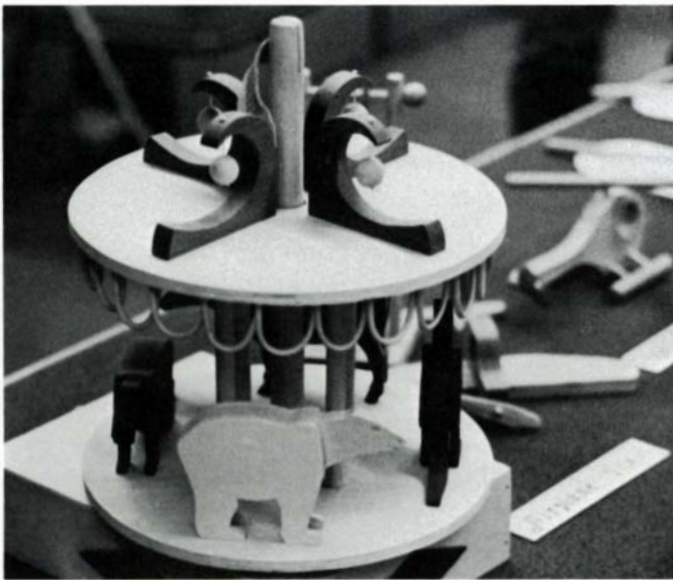
Editor's note: More than 50 woodworkers from states east of the Mississippi were among 330 craftsmen at the first Winter Market of American Crafts held Feb. 17-20 in Baltimore.

The fair, now to be an annual event, grew out of the Rhinebeck fair organized each June by Northeast Craft Fairs Ltd., an arm of the American Crafts Council. The idea was to make crafts available year round to wholesale buyers, and it seems to have been a success. The organizers aren't releasing gross figures, but they do say that participating craftsmen, on the average, did about as well as at last year's Rhinebeck fair (*Fine Woodworking*, Spring '77). There were 1,300 wholesale buyers among the fair's 25,000 visitors.

Fine Woodworking asked Stan Wellborn, a Washington journalist and amateur woodworker, to photograph the work on sale. The commentary is from Wellborn's notes.



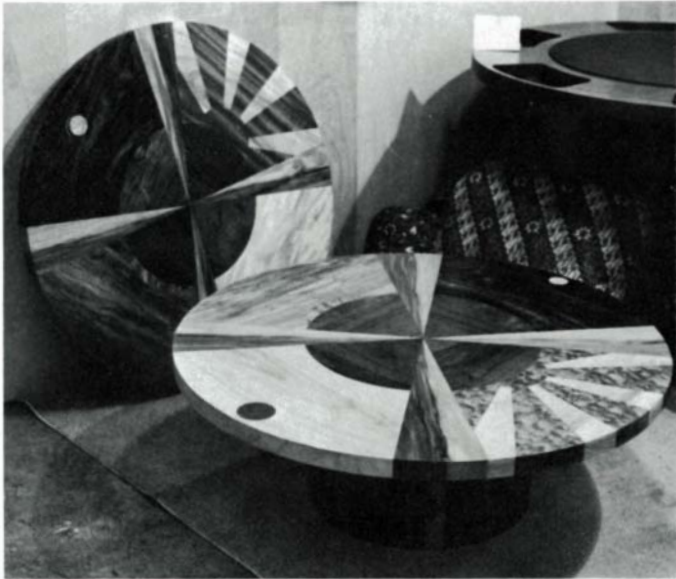
Douglas Amidon, Sandwich, Mass. "This guy is good. He's primarily a carver; most of his stuff is in the round. This mirror and jewelry box, wall mounted, sells for \$3,600—his most recent piece."



Charlie Maiorana, Washington, D. C. "Delightfully intriguing toys. These aren't toys in the cars-and-trains sense. They are the kind of thing Sesame Street would build a whole show around. They draw heavily on Appalachian folk life, fairy tales, fantasy, carnivals, acrobatics. Kids watched these things perform for hours, working flawlessly."



Peter Kwasniewski, Poughkeepsie, N. Y. "I admired his small boxes. Nothing very fancy in a design or craft sense, but he had isolated some imperfections in the wood that complemented the plainer boxes. Kwasniewski spoke of the difficulty of making a living, as did many of the exhibitors. 'You have to produce things fast and yet maintain quality. That sounds pretty basic, but many woodworkers don't realize it. They take their time, measuring and remeasuring, going back and forth from one operation to another. You have got to force yourself to push on, getting it right the first time. The biggest difference between a successful commercial woodworker and one who is not successful is the way he uses time.' "



Stephen Jones, Washington, D. C. "Jones is the veneer specialist in a five-man woodworking cooperative. Several people who stopped by his booth were convinced his coffee tables were solid, not inlaid. This one is entitled 'The Four Times of Day,' depicting high noon, midnight, dawn and dusk. He lays his veneer across a plywood core using contact cement. Jones succeeds in what he terms 'an attempt to give each piece depth and a strong focus.' "

Peter Kramer, Washington, Va. "Not everyone appreciates this fellow's work, and I'm not sure I would like it as a steady diet. Kramer uses only rustic pine to create modern versions of what the antique dealers call 'primitives.' It is the kind of furniture you see in farmhouses in West Virginia and southwest Virginia, all pine, natural oil finish, distressed from heavy everyday use."



Steven Mackintosh, Deansboro, N. Y. "A budding talent, who can execute his distinctive designs with alacrity. He apprenticed with a woodworker in Vermont. I went back to his booth several times, because his work has an esthetic, touchable quality. Reasonably priced, too, but not for long, I'll wager."

Winthrop Schwab, Allisoria, Va. "Simple designs in weed pots, lamp bases with original bark from trees on his farm. A thoroughly pleasant guy, Schwab has just finished the long task of putting together a shop capable of producing furniture and cabinetry. He says, however, that he will still have to rely on income from his turnings, which have a good market around the South."



Three-Legged Stool

Design around the construction

by Tage Frid



I hate three-legged chairs, especially those with a full seat and back, and one leg under the back. They always look ridiculous when viewed from behind and make dangerous contraptions to sit in. If the person seated in such a chair leans slightly sideways against the back, the chair will tip over. The person might get hurt, and you might get sued if you are the designer and maker of the chair.

Many students and designers mistakenly decide to make a three-legged chair just to be different. They must then construct around the design. This usually results in some awful kind of hodge-podge. There are well-designed chairs that are a result of their function or space allowance dictating three legs instead of four. For example in some valet chairs, the rear leg and back are designed primarily to support clothes hanging on top. The requirements of such chairs do not include the comforts of long-term sitting and leaning, as would a lounge or dining chair.

Three-legged chairs might also be made for a round dining table where the designer wants to fit as many seats as possible. The natural solution is to make the chairs pie-shaped, with the one leg in front. This is fine, because the person's two legs will help support the front, and the chair will be very stable.

There are sculptural three-legged chairs made of wood or metal that are so heavy it is impossible to tip them, but this of course doesn't mean they are well designed.

The designer of a seating unit should first decide precisely what function the chair or stool is to have. Then he should choose his construction technique and design around the construction. The result is usually a well-designed and functional seat. Of course the designer must have a feeling for form and dimension. The forms must be consistent so that the piece ties together and doesn't look like one base with a different top placed on it. I found proportion—the right relationship in thickness, width and sizes—the most difficult thing to learn. Most of my students have the same problem. A poorly proportioned chair can spoil an excellent design.

When I started designing my seat, I did not have in mind at all that I wanted to make a three-legged stool. But as the design progressed, I did not have any choice. I wanted a stool with a back, and a system where I could use the same seat in three different heights by changing the length of the legs. I wanted the stool to be comfortable, but of minimum size—as light but as strong as possible. The middle-size stool is more like a small chair, but I will refer to them all as stools in this article.

Here is how the whole thing started: My wife and I went to a horse show. We were sitting on a six-inch wide rail for several hours, yet we felt quite comfortable. Of course I am well

upholstered, but my wife is just right. And she didn't complain either. All of a sudden I realized that when you sit on a straight wooden seat, you sit only on your two cheek bones. The rest of the seat is unnecessary. Of course, a full wooden seat allows a little freedom for moving around, unless it is carved to hold you in position.

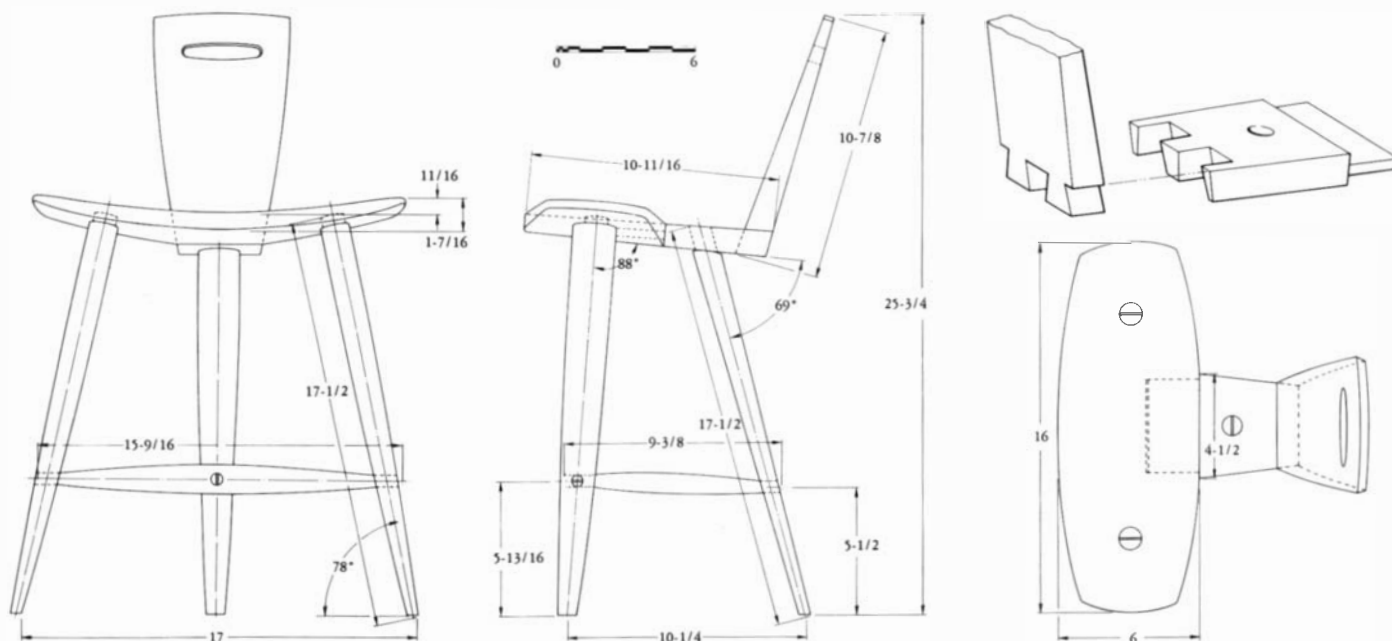
I began experimenting to find the smallest comfortable seat I could get away with. I came up with a piece 6 in. wide and 16 in. long, with a 7/8-in. curve. This piece is very pleasant to sit on, and I could bandsaw it out of an 8/4 plank.

I wanted a back, but I wanted a minimum of wood for the seat, so I mortised and tenoned a small section to the back of the seat. This piece connects to the backrest with a through dovetail. (In production, finger joints could be used.) Now, because the piece behind the seat was small, there was only room for one leg in the back. This meant the backrest had to be narrow and low, which was fine as I only wanted to support the lower part of the spine.

The tee-shaped seat counteracts the tendency for the stool to tip over, because there is no seat area in the back to push against. The weight of the body locates on top of the two front legs. I ended up with a stable three-legged stool, with the third leg in the back. Of course, with a little extra effort this stool can be toppled more easily than a four-legged chair.

As mentioned, I wanted the chair to be comfortable and strong yet as light as possible. I needed width at the top of the backrest for support, but not at the bottom. So I removed the excess and curved the two outside lines, which resulted in a pleasant oval-type shape. At the same time, I needed the full wood thickness at the backrest bottom for a strong joint, but not at the top. I removed the excess, but in a straight line, because in the side view all tapers are straight lines. If a curved line had been used it would have looked bulky, since there was not much thickness to play with. I also replaced the corners of the seat with a rounded line which gave me more of an oval. I needed the thickness of the seat at the center for the mortise and tenon, but not at the ends, so I removed the excess there also, which added another curved line. Now from the front and top view everything was oval. I continued this form in the handle for moving the stool. I curved the ends of the seat and backrest, and eased the corners so that all the lines would flow together smoothly. I eased off the front edge of the seat for comfort, but gradually brought the line crisply around the top of the back. This type of detail gives a piece a little more of a handmade feeling. A hand router that removed the same radius all around would have given the piece a machine-made look.

The legs were turned on the lathe and angled out to give



To avoid errors, Frid superimposes front, side and top elevations into one full-size drawing. In the shop, each view would be in a different

color. Dimensions shown above are for middle-sized stool; detail at top right shows seat and back joinery.

the stool more stability. The ends were turned down to 3/4 in. and joined through to the top of the seat. (When wedging legs through a solid top, always place the wedge so it goes across the grain of the top to prevent splitting.) The stretcher was a simple tee, joined through the legs and wedged.

I made my prototype after making simple preliminary drawings. I always make a mock-up when I make a new chair or other seating unit to test the comfort and to see how the shapes relate in three dimensions. I assemble the prototype the easiest way possible, usually with nails. I make it out of the cheapest materials I can and don't bother to sand it.

In this case, I made my mock-up stool exactly like my preliminary drawings, and found it very comfortable, but it looked awful. I could not put my finger on what was wrong,

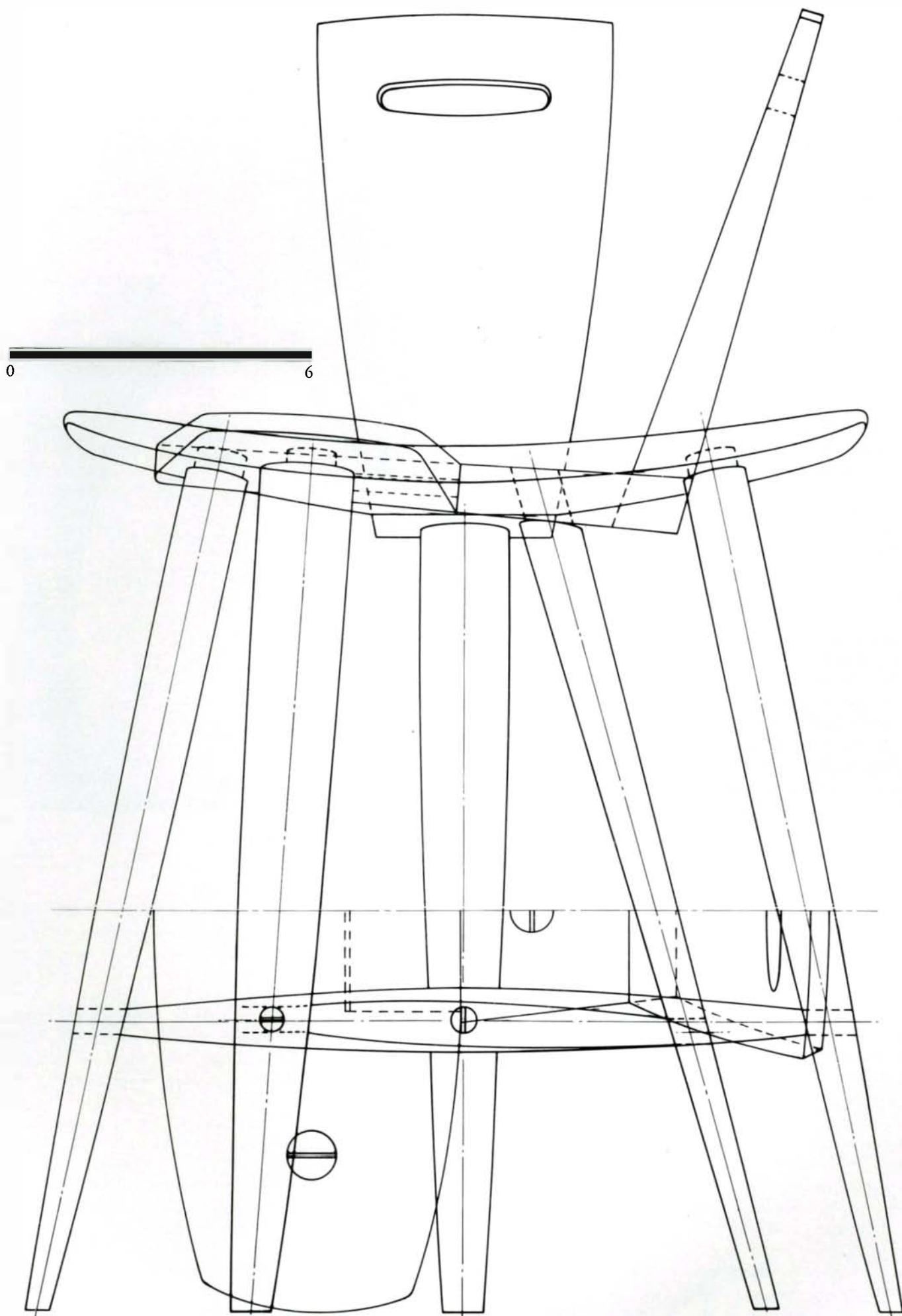
so I set the stool aside in my shop in a place where I could not miss it when I came in. During the next few weeks several people came in and sat on it and found it very comfortable, but no one was crazy about its looks. One day I was sitting and staring at it, and I suddenly realized what was wrong. Everything on the stool was oval except for the legs and stretchers which were turned round. The piece looked like a base from one chair with a top from another. I cut off the legs and made the legs and stretchers oval, and then the stool looked like one unit. Testing the prototype a little further, I discovered that if I moved the backrest one inch back, I could sit on the stool just as comfortably backwards. I didn't start designing with the notion of making a three-legged stool, but the shape resulted naturally from the construction and from the requirements I originally assigned to the design.

Then I was ready to make the final working drawings for the stool. It is impossible to make a chair or stool without a full-scale working drawing from which to take all angles and measurements. The drawing must have a side, top and front view. (In some chairs, a back view is also necessary.) I always superimpose the three views, using a different color for each view. Having all three views on one drawing takes up less space in the shop. But more important is that by superimposing the three views, it is harder to make mistakes. If a small mistake is made in a dimension on one view, it will be transferred to the other two, and easily noticed. This ensures that the chair will go together. With three separate drawings it is much easier to make an error because dimensions have to be transferred from view to view by measuring. But when the three views are on the same drawing, all the lines can be projected from one view to another.

Three-view drawings might seem a little confusing at first, but after a short time you get used to reading them. It is possible to transfer the lines onto three separate drawings by projecting them, but this requires a big drawing table. I still prefer to make one drawing with all three views, and if later I want separate drawings I can trace them from the three-view drawing with less chance for error.

Seat heights shown here are about 12 in., 16 in. and 21 in.





Lute Roses

Delicate patterns are cut or sawn

by Lyn Elder

Today there is a tremendous revival of interest in Renaissance and Baroque music. Naturally the demand for authentic copies of historical instruments has caused many craftsmen to specialize in their production. Much study has been devoted to these instruments and to discovering the design principles and working techniques of the old makers, so that high-quality reproductions can be built to satisfy exacting scholars and performers. As a builder of historical stringed instruments, mainly lutes, I have spent several years examining museum pieces and compiling data and design information to facilitate my work. A large part of my effort has been devoted to cataloging and studying lute roses.

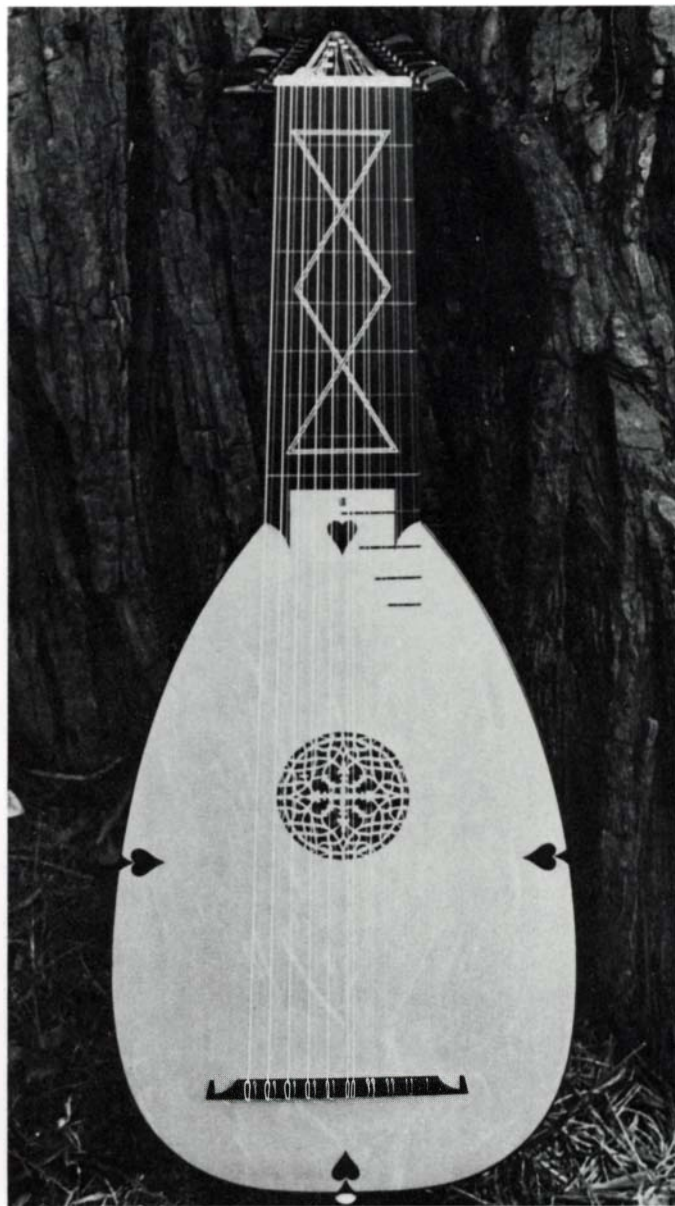
During the Renaissance the lute occupied roughly the same position the piano does today. It was the instrument every serious musician was able to play; in addition to its immense solo repertoire it was used by composers and to accompany rehearsals and performances. In keeping with its role as a working instrument, it was usually quite plain in appearance, as the modern grand piano is usually stark black. The only decorative element found on all lutes was the rose, or carved soundhole. This feature is present in the earliest lutes we know of and changed very little between the Middle Ages and the Baroque period, when the popularity of the lute declined.

The word "lute" derives from *al-'ud*, an Arab musical instrument whose name means "the wood." The lute was probably introduced into Europe during the Middle Ages, either by returning Crusaders or by the Moorish conquerors of Spain. It was already a venerable instrument when the Europeans discovered it. Although European craftsmen continually modified the instrument over the next several hundred years, they never discarded the pierced rose or strayed far from its original style. Most 17th and 18th-century lute roses are identical with, or similar to, those seen in the earliest surviving lutes and in paintings of even earlier instruments. The Islamic character of these designs persists through many variations on the symmetrical geometric figures.

Although most historical lute builders probably carved their own roses, there is some evidence that at certain periods lute bellies could be bought with the roses already carved in. This may account for the prevalence of some patterns. In large shops the job was probably assigned to apprentices, as it is tedious and time-consuming.

There is considerable disagreement among lute builders and acousticians concerning the effect, if any, of the complex

Lyn Elder, 33, apprenticed with a master instrument maker and started his own workshop in 1968. He is craftsman-in-residence at Dominican College, San Rafael, Calif.



Lute made by author is decorated in style of early 17th century, with Venetian rose of fourfold symmetry.

rose on the sound of the instrument. The sound of a lute with a normal rose would certainly be different from that of the same instrument with a three-inch open hole, because the total open area of the former is smaller. But whether the sound would be changed with a smaller open hole equal to the total open area of the rose is questionable. Some think the sound must be strained through the sieve-like pattern, while others dismiss this idea as fantasy. Whatever effect there is, however, must be minimal, perhaps unnoticeable to the average listener.

The size and position of a historical lute rose bear a definite relationship to the geometry of the lute of which it is a part. Depending on the school to which the builder belonged, the rose is centered either five-eighths or five-ninths of the way from the bottom of the lute belly to the neck joint. Although some instruments do not conform exactly to these proportions, most old lutes seem to fall into one of the above categories. The diameter of the rose is usually between one-fourth and one-third the width of the belly at the rose center line. Occasionally the rose may seem larger than one-third,

but this is usually because of a decorative border and not the open-work of the pattern itself.

Patterns

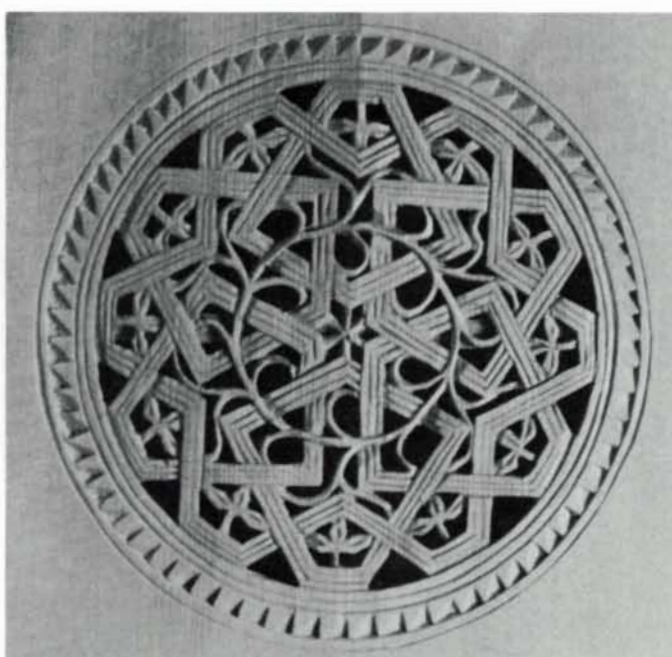
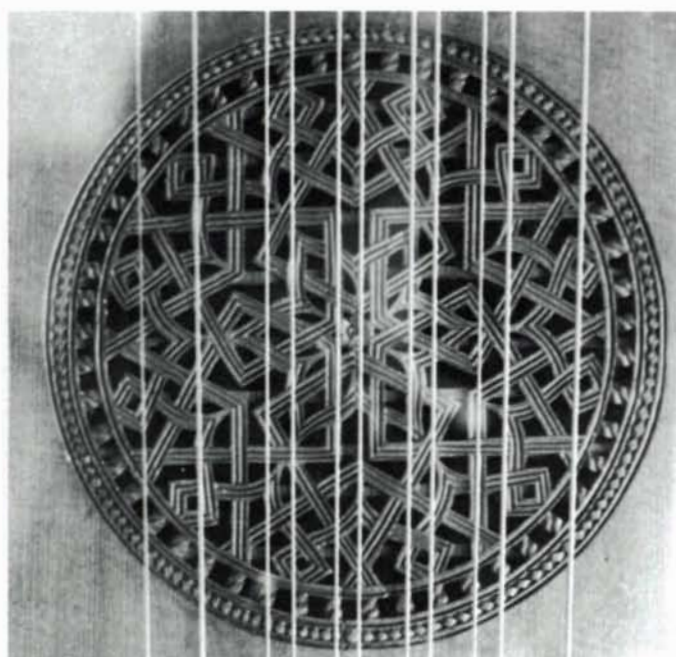
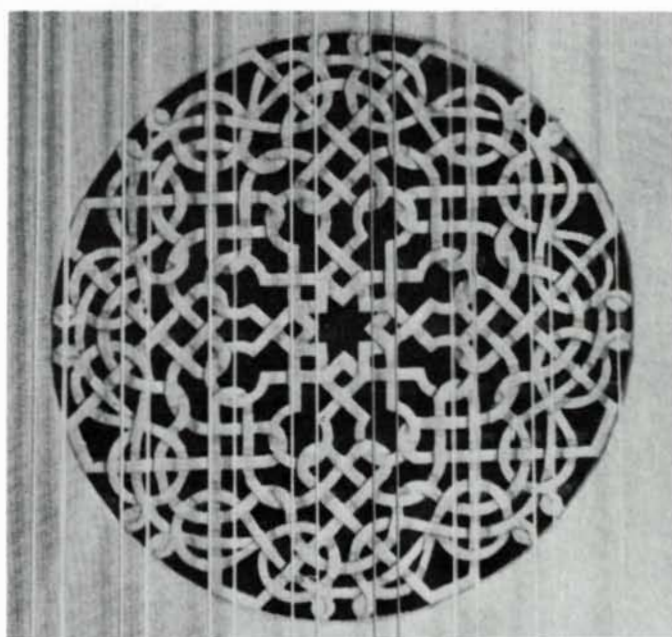
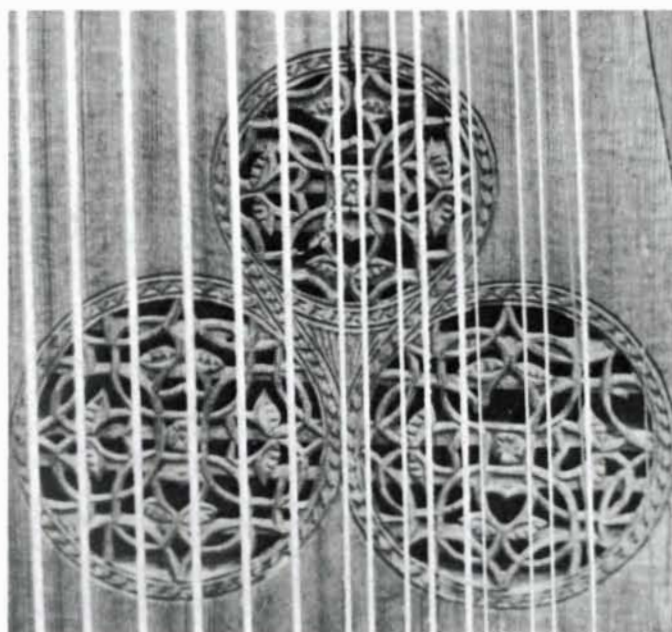
Dozens of historical rose patterns are known, but all may be categorized by their rotational symmetry, whether fourfold, sixfold or eightfold. Fourfold patterns are often seen in paintings of early lutes and were used by some Venetians and some Baroque builders. Sixfold patterns were by far the most common and varied during all historical periods. There are relatively few eightfold patterns, but one is the most famous of all lute roses: the Knot of Leonardo da Vinci, said to have been designed originally as an embroidery pattern but soon borrowed by lute makers.

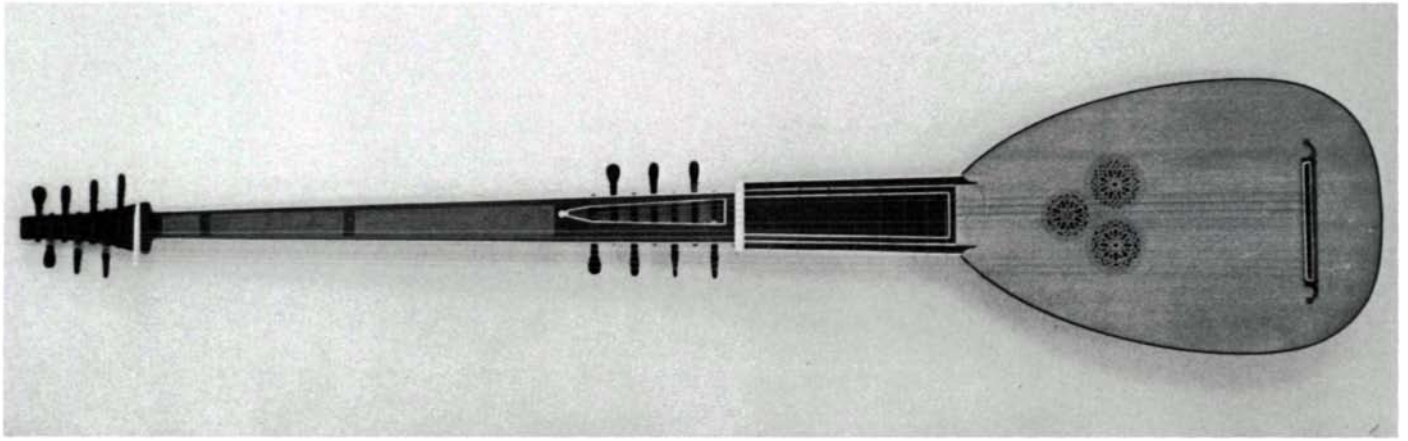
Most common patterns contain both a straight-line geometrical design and some kind of curved line motif weaving through it. The main exceptions to this general rule are the roses of the Venetian builders mentioned above. Their roses are more flowery in appearance because of the almost total absence of straight lines. These delicate patterns are the most difficult to carve because of their many unsupported figures.

Most normal-size lutes seem to have plain, borderless roses. The relief-carved border was used to increase the apparent size of the rose for a larger instrument such as a bass lute or an archlute. Since the paper patterns had to be printed with hand-cut wood blocks, it was impractical to have the same rose in several different sizes.

Theorboes and chittarones, collectively known as archlutes, have somewhat larger bodies than normal lutes and extremely long necks with two separate pegboxes. These instruments often have a group of three roses carved all together in the normal position, probably originally for the reason mentioned above—to save making an entirely new pattern block. The style caught on and was used throughout the history of these instruments, along with larger single roses. Some of the

Rose of sixfold symmetry, below, is from a 16th-century bass lute. At right from top: triple rose from 17th-century chittarone; eightfold Knot of Leonardo, carved by author; 16th-century Italian rose by author. All are slightly smaller than actual size.





Chittarone by master luthier Donald Warnock of Boston University has two pegboxes, triple rose.

triple roses are combinations of familiar designs, but some are entirely new. Most have a carved decorative border.

A characteristic of all rose patterns is the weaving effect, achieved by cutting out minute chips crossing some elements of the pattern but not others. The visual impression is that the branches are, indeed, woven through each other. This effect often amazes the unsophisticated viewer.

Carving techniques

The belly of a good historical lute is made of very thin, very close-grained spruce, usually *Picea excelsa*. It is usually of two pieces, bookmatched and joined with the finer grain at the center. Many old lutes have small additional pieces or "wings" at the very edges, presumably because the main pieces were not quite wide enough or well-grained enough all the way across. The belly blank was planed and scraped to a final thickness of less than two millimeters. Often the area under and around the rose was further reduced to around one millimeter, for ease of carving.

From close examination of museum lutes and from workshop experimentation we can tell how the old makers must have executed their roses. All the work seems to have been done with a knife or a combination of knives. This method is still in use by many contemporary builders.

First a paper pattern of the rose is glued on the underside of the belly. Then work is begun with a very thin, sharp,

pointed knife, such as the small scalpel favored currently or a specially ground X-acto blade. The piercings are made from the underside with stabbing cuts through the pattern and the spruce into a soft backing of cork, hard felt or very soft wood. This is an extremely painstaking procedure, as a little too much pressure applied in the wrong direction will split the thin wood. After the initial piercing is complete the belly is turned over and the pattern is cleaned up from the front side.

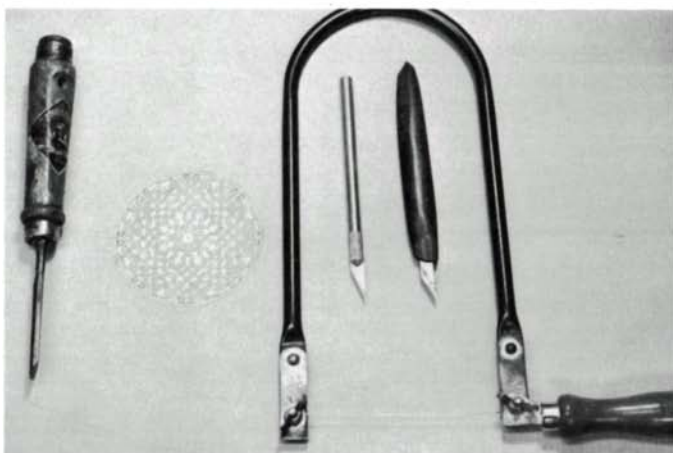
Finally the weaving is done, with either the same knife or a slightly larger one. This process can be facilitated by the application of a little water to soften the spruce. If a border is to be carved it is left for last to ensure concentricity with the main pattern. The paper is usually left glued to the underside to provide some support for the delicate pattern.

It is possible, and often necessary, to repair minor mishaps in the carving. A small piece is merely glued into place and shaped to fit the missing element. Sometimes it is so small that it must be handled with needle-nosed tweezers. The very complexity of the pattern ensures that a small discrepancy of grain or color will never be detected by most observers.

Knife carving can produce a fine, clean-looking rose and is used by some of the finest modern builders. With some experience it is quick and neat: a rose can be finished in six to twelve hours, depending on its complexity, the carver's skill and the degree of precision desired.

Many modern makers prefer the method favored by the

Rose-carving tools: Chisel, X-acto knives and jeweler's fretsaw flank paper pattern pasted on spruce lute belly.



In German method, which author prefers, paper pattern is glued to front of belly and cut with a fretsaw.



German school. It is much easier for a novice to use and can give extremely fine results. In experienced hands the German method is almost as fast as the knife method. The belly wood is prepared the same way.

First the paper pattern is glued onto the front side of the belly. (Many modern makers use zexed or offset-printed patterns.) Directly behind the rose, on the underside of the belly, a backing paper is glued, a little larger than the rose. If a border is required it is usually carved first. Then small holes are drilled through the belly to allow the introduction of the saw blade—most patterns require these holes to be 1/16 inch or smaller.

Piercing is done with a deep-throat fretsaw or jigsaw using jeweler's blades #0 or #00. With practice this can be done so precisely that little further work is necessary. After piercing, the pattern is cleaned up with small needle files, usually #4 or #6 cut. The most practical cross sections for rose files are triangular, square, half-round, flat and mousetail.

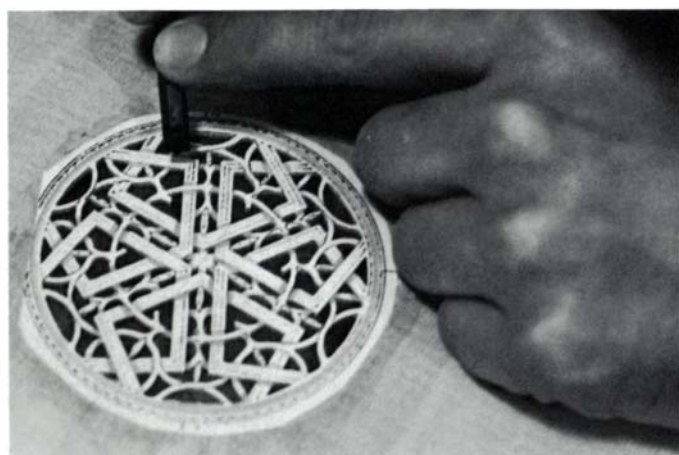
Weaving is done with a small chisel and a sharp knife, such as a pointed X-acto blade. The rose is finished off by sanding away the remains of the pattern paper with fine garnet paper and touching up wherever necessary. The paper backing is left for strength.

Before the belly is glued onto the lute shell it must be braced to resist the pull of the strings. One main brace runs directly under the rose; most old lutes also have two to nine smaller auxiliary braces under the rose. These auxiliary braces help to stiffen an otherwise weak area of the belly. All the braces are glued in place. Some makers dye them black with India ink so as not to confuse the pattern visually, while others leave them white.

Historically, lute bellies were not varnished, as were other parts of the instrument. They were either left bare or lightly sealed with thin sizing or egg white. They may have been waxed after sealing, but it is hard to tell from examining museum lutes. Most old lute bellies are quite dark and dirty after all these centuries.

Lute building is only one of the historical crafts that are being rediscovered today. We seem to be heading into a modern renaissance of hand work of all kinds. The techniques learned from studying historical crafts are useful not only in reconstructing authentic copies but also as inspiration for current designers and decorators.

Small gouge "weaves" a delicate rose of the 16th-century Bolognese style. Then remains of pattern will be sanded off.



Bowl Turning

On the inside

by Peter Child

It is preferable to turn the outside of a bowl until it is ready to finish-sand before removing any wood from the inside. This should prevent troublesome vibration. Then, starting on the inside, there are three main problems facing the amateur:

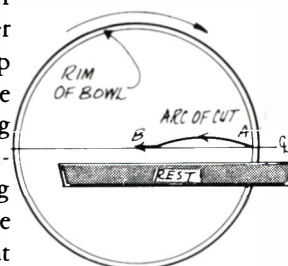
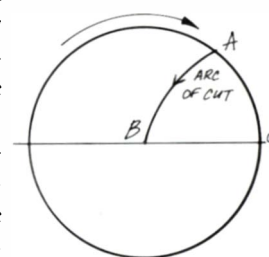
- the outward thrust of the whirling wood on the gouge;
- starting a cut exactly where wanted without the risk of any sideways "kick," which if not expertly controlled can ruin the work, especially at or near the rim of the bowl;
- two inside areas that have to be cut against the grain and thus can tear out.

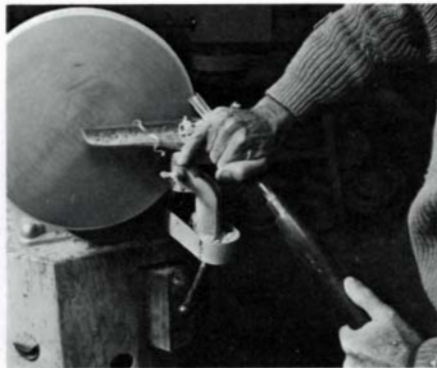
The long-and-strong bowl gouge at work on the outside of a bowl shears an arcing cut from hour hand 12 noon to 3 p.m. or to 9 a.m. depending on which way we are going. It should follow that the same action would be correct when taking out the waste from inside the bowl.

However, doing it this way actually invites a dig-in because whirling wood tends to throw the gouge blade over onto its back. The trailing edge and wing (the right-hand half of the blade) contact the wood and damage is inevitable. Without starting the lathe, place the gouge blade, bevel rubbing, at point A. Rotate the disc toward you slowly by hand and at the same time try to travel (bevel in contact but not cutting) from A to B. The wood surface pushes the blade back over to its right-hand edge, and the effect is more pronounced the nearer the blade gets to point B.

To start the cut correctly, set the rest below the center of the disc. With the gouge handle only slightly down from horizontal, the cutting edge can enter at A, the same height as the center of the bowl B. For small bowls—up to 7-in. diameter—entry near the outside rim is fine, and the cutting arc is slight. In large diameters, entry can be made anywhere along the straight line A to B. The gouge will enter quite easily an inch out from B, and successive cuts can be taken until point A is reached. However, the farther away from B, the more skittish the gouge will behave, and the more difficult it will be to start cutting exactly where wanted. In large bowls the arc of the cut ends before B is reached and the cut finishes in line with and across to B. Cutting from above and down to B can cause trouble.

I will now give a simple instruction. Place the gouge blade





One complete cut in leveling the surface of the rotating disc: The gouge is held motionless, its bevel tangent to the corner of the disc, flute outward, and then it is rolled toward center to start the cut with full bevel rubbing. Top of cutting arc is reached at center below. Gouge finishes horizontal, flute outward, its center at the center of the wood. Right hand, firmly on rest, is fulcrum and does not move throughout cut. Left hand holds gouge butt on thigh and lifts it to navel as cut progresses. Turner sidles to right so wings won't jam.



on its side, flute facing towards center, handle only just downward from horizontal. Push the blade in and start the cut. There appears to be no reason why this should not work every time, and the instruction surely could not be made any plainer. Sadly, the majority of my pupils disagree. So I have had to analyze why. First, the front surface of the disc may not be quite flat so it wobbles in rotation, and the unevenness can knock the gouge away from the desired route. So we will level it from outside to center.

A 1/2-in. gouge is held on the rest, handle almost perpendicular, edge at disc center height, distanced a little way outside the rim of revolving wood, and with flute facing outward. The handle is pulled slightly forward towards the body so that the full bevel of the blade will make contact with wood as soon as the cut starts. The blade is rolled over to the left and makes cutting contact with the wood while rolling. This forward roll of the blade is what provides control. Then the handle is lifted sideways to the right to continue a light cut to center. The rolling action can be stopped else the cut become too thick, and just enough forward pressure is used to keep the cutting edge traveling smoothly to center. If the full distance cannot be accomplished in one sweep, start where you leave off, and begin again. This is the quickest and cleanest way of flattening any disc, including tabletops.

Even with the front surface nicely flat some will still not be able to enter the wood on target—the first attempt sends the blade outward into limbo, or at best, along a crazy path in the wood surface. If this happens the turner must smooth it before trying again. Otherwise the blade can find the path again and really go crazy.

There is an easy way out which I do not recommend, but it can be a start and may lead to increased confidence, and then

a determination to succeed. Use a 1/4-in. parting tool horizontally at a scraping angle to put a groove or notch into the wood at the site of proposed entry. Only a very shallow groove is required. Then hold the gouge blade, handle just down from horizontal, flute facing toward center, and cut. The groove will hold the blade and there will be no sideways "kick." When this has been proved, discard the parting tool and try a slight vee-cut made with any suitably shaped scraper. Even this should be enough to stop the blade from slipping outward. Now try the proper method. Present the blade as described and push it slowly forward so that it just contacts and rubs the wood. Hold this position for a few seconds, then slowly but firmly push the blade into the wood.

The square-nosed, deep-fluted, long-and-strong bowl-turning gouge is the most difficult tool to master, but when mastery is fully achieved the tool is a joy to use and well worth the effort. After the many years in which the woodturner's hook tools were in use, the comparatively modern cutting gouge has been so thoroughly developed that it can do its job by itself with the minimum of guidance by its user—if the user knows what to do!

It will be obvious by now that only half a gouge blade can be used at any time, which half depending on whether the cut is from right to left. The inside of a bowl can only be cut from right to left, using only the center (where the point would be in a spindle gouge) and the left-hand wing. The best cutting action is a roll from center to engage part or all of the left-hand wing.

To simplify matters we will dispense with the rolling action at first. Start a cut as described. If the blade is just pushed straight forward without any sideways movement of the handle, then all the left-hand wing will enter the wood and jam. In order to use the left-hand edge to full effect, the extreme end of the left-hand wing must be kept just clear of the wood, and to do this the handle has to be moved progressively over to the right. At entry the bevel is not in contact with the

Peter Child, English master turner, continues the discussion begun in Fine Woodworking, Winter '76 of using long-and-strong bowl gouges.



Starting a cut: Gouge just contacts wood, with left-hand corner of blade clear to avoid a dig-in. The bevel, center, as yet has no support

from the wood, so the tool must be held very firmly and pushed straight in to start its arc toward the center.

wood, but the sideways movement puts it in contact and then the blade cuts more or less cleanly. Cutting thus, in a straight line from A to B and ending up with the center B in the bottom of the flute, is the first step in using the gouge properly.

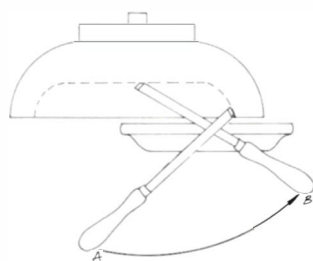
More than just "hand-power" is needed to use a heavy-duty gouge to its full capacity. The right-hander will naturally have the palm of his left hand on the rest, with any unrestricted fingers curled over the blade. The nearer the hand to the cutting edge, the more control is gained. Therefore, he has only the grip of his fingers to prevent the gouge from ripping outward, especially at the starting cut. The left-hander is much better placed, as he naturally has the palm of his right hand behind the blade.

The correct position is:

- right hand on the rest behind the blade with what fingers that can do so curled around it, and thumb possibly against the barrel of the blade;
- left leg in front of right, right leg back with knee bent, so that pressure can be exerted by the left leg to provide the "push-power" for the cut.

In action, the right hand is a pivot for the blade (the palm does not move during any one cut). The butt of the handle is held on the left leg, and the left hand holds it at the very end in a hammer grip. With both blade and handle held firmly, the only way a cut can be made is with a sideways swing of the hips. The cut is a scoop.

Looking down on the work, A to B is the distance traveled by the handle in a complete cut from rim to center. In a small bowl, this is insignificant but in a 12-in. bowl the handle has to travel quite a way, and you are holding it.



A professional turner is mobile, and walks the distance A to B with the gouge cutting its way continuously from rim to center. The handle never leaves the body, which provides the power. An amateur can start a cut as described, swinging to the right as far as is comfortable without actually falling over, stop the cut, step a little way to the right, continue the cut, and so on, in several stages. Depending upon the height of the lathe and the turner's height and leg-length, the handle can be on the leg, rising to the upper thigh, into the groin, and possibly ending up on the rib cage when the cut is completed at dead center.



Gouge nears completion of cut, top, coming down toward center line before horizontal push to center itself. Close-up shows full left half of blade cutting, but tip of wing is clear.



Turner fails to shuffle to right, and left corner of gouge enters wood, causing a jamming ridge.



Cut taken without use of left hand demonstrates proper body control. With right hand as stationary pivot, power comes from thigh as left foot lifts entirely off floor. Photo at right shows full-power cut:

Left leg provides lift, while left hand governs forward roll of tool. Palm of right hand does not move, but turner swings to right to keep blade cutting without jamming.

There is a second method of removing the waste from the inside of a bowl, one that many amateurs might prefer. Take a disc, say, 3 in. thick, and before mounting it on the lathe, drill a hole in the center about 1 in. in diameter and 2-1/2 in. deep, thereby removing the core of the center so that waste can be removed progressively from hole to rim. When starting the first few cuts from the side of the hole, the amateur can try an experiment that may prove the importance of body control. The gouge is presented to the right side of the hole, the flute facing left, the handle held against the left leg slightly down from horizontal, with the right leg behind the left, and the right knee bent.

The test is to be able to take the first couple of cuts without any help from the left hand. The left leg pushes the gouge into the wood and the body swings over to the right so that the blade travels to center through the pivot of the right hand. It will be found necessary to raise the heel of the left foot off the ground to lift the handle, and after the first two cuts, the entire left foot has to leave the ground and you resemble the stork. However, in successive cuts, instead of the left foot leaving the ground, the left hand is used only to lift and roll the gouge, and the leg and body power the cut.

The perfect gouge cut is a rolling action of the blade from left to right using only the left-hand wing of the gouge and swinging over to the right so the tip of the left-hand wing is just out of the cut. This shearing action is kind to the two areas of wood where we have to cut against the grain. Any other cut or scrape can wreak havoc in these areas and no amount of sanding will completely remedy the damage.

Try placing the blade into a cut with the middle just in contact and the right-hand wing backed over just short of dig-in contact. Then roll the blade over to the left to engage the center and left-hand wing. This push-roll towards the middle counters the outward thrust and a much better cut is obtained than by merely pushing the gouge towards center without any roll.

Thousands of words have been published for and against using scrapers in turning. Those in favor say that in comparison to gouges, which are difficult tools and can be dangerous,

scrapers are easy to handle and with careful use can achieve the same results. Those against maintain that the best finish is a cut finish and scrapers are just not needed. The truth, as usual, falls between.

When a bowl has been cut and fashioned to such a degree of finish that it does not need any scraping—then, and only then, should a scraper be used. A good cut finish is improved by scraping. A bad finish can easily be made worse. Only the minimum of wood should be removed by scraping. A scraper should be used as a finisher—not as a wood remover.

The scraper tends to bounce back and forth as the bowl revolves and different surfaces—end grain, quick-growth areas, knots—come round and have to be dealt with at speed. Every bounce of the tool can inflict slight damage, especially to the two end-grain areas. The bounce can be overcome by forcing the scraper into closer contact with the wood but the damage caused by this viciousness is much worse.

For maximum control, a scraper has to be of heavy thick metal, with a blunt angle bevel (almost none at all), and equipped with a long handle so that, like the gouge, the hands hold the tool but the body does the work. Unlike the gouge, the scraper bevel must not come into contact with the wood. The edge must be kept sharp, either by honing or straight from the grindstone. Since the edge can be blunted in two or three strokes, depending on the type of wood, I prefer the grindstone method of sharpening as it is quick.

The scraper blade is held firmly down on the rest and the handle tucked into the side of the body. Imagine that the wood surface consists of peaks and valleys. The scraper should remove only the peaks without touching the valleys. This minimizes bounce.

However sharp the tool, it is still a scraping edge, not a cutting one, so the wood fibers are laid over in one direction. All my lathes have reverse switches so I can scrape both ways.

To finish up, I find the best abrasive paper is open-coated garnet, of the "finishing" variety. The "cabinet" grade is much too stiff. I use two grits, 100 followed by 150. Very rarely I might use 220, but nothing finer. With reverse, I can sand the bowl both ways.

Wharton Esherick

Museum is sculptor's masterpiece

The influence of Wharton Esherick on contemporary American furniture is vastly greater than most woodworkers know—as a visit to the Esherick Museum in Paoli, Pa., makes clear. Before his death in 1970 and since, a steady stream of artists, teachers and woodworkers have made a pilgrimage there to study his work. That is why so much of it looks familiar—there are no books about Esherick, but his work is so good and so fresh that it has been widely imitated, often unawares.

In 1913 Esherick came to his hillside in Paoli, near Valley Forge, to be a painter. He started to carve the frames for his paintings, then to make woodcuts and bas-relief carvings, then sculpture and furniture for the home and studio he was building. His achievement was to merge furniture and sculpture, elevating furniture to the level of art. His early work shows the curving line of art nouveau and the planar experiments of the cubists. The later work settles into a controlled style of natural forms that call out to be touched, sat upon, used. He worked only in local hardwoods.

Esherick's masterpiece must be the studio itself, a deceptively complex structure where he lived and worked, and which he enlarged and modified during 40 years. It is a two-story workspace where whole logs could be brought, with a balcony studio and with living quarters tucked away above and to one side. The whole is united by a marvelous branching tree of a twisted stairway so cunningly constructed that

Paneled doors carry runners for trays and writing surface of cabinet-desk, made in 1958. At left, a music stand and several stools.



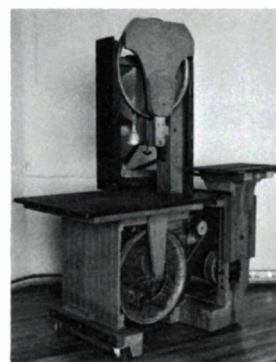
View across studio shows twisting staircase and hanging lamp in background, and large sculpture rising from floor below.

the feet and hands slide effortlessly where they should. Every detail of the building and everything inside it was designed by the artist and made by hand. The coat pegs are carved with the faces of the workmen who used them. The counterweight for a hatchway into Esherick's upstairs bedroom is a carved figure climbing on the rope. Everything is fluidly carved except the kitchen corner by the window, where Esherick liked to look across the vast, wooded valley, seated on a simple plywood bench with a plywood back and loose cushions.

The deep well where he worked is filled now with monumental sculptures carved from whole logs, surrounded by a forest of smaller pieces. The balcony contains furniture and a welter of small carvings, toys, models and accessories. Two large cabinets open into desks, with trays to store drawings and writing surfaces that slide out on runners set into the doors themselves. Several of the chairs have a knobby look that pops into focus when the director, Bob Bascom, explains that Esherick once was given a barrel of hammer and ax handles. The construction principle he discovered in the hammer-handle chairs was the start of a long series of chairs, all designed to withstand tilting back on two legs.

Bascom and his wife Ruth, who is Esherick's daughter, live next door to the museum in the building that once was the furniture workshop. The artist's band saw, an ingenious transformation of a bicycle, graces their living room. They are the volunteer staff of the museum, along with Miriam Phillips, an old friend of Esherick who now is cataloging his papers. The museum operates as a nonprofit corporation, supported by the \$2 admission fee, sales of prints and postcards, and donations. It is open every weekend, and school groups can be accommodated during the week. Bascom asks visitors to write ahead to make a reservation. The address is Box 595, Paoli, Pa. 19301; the telephone number is (215) 644-5822. He sends a map giving directions from the Pennsylvania Turnpike with the reservation confirmation.

—J. K.



Doweling

The whole secret is absolute accuracy

by James Krenov

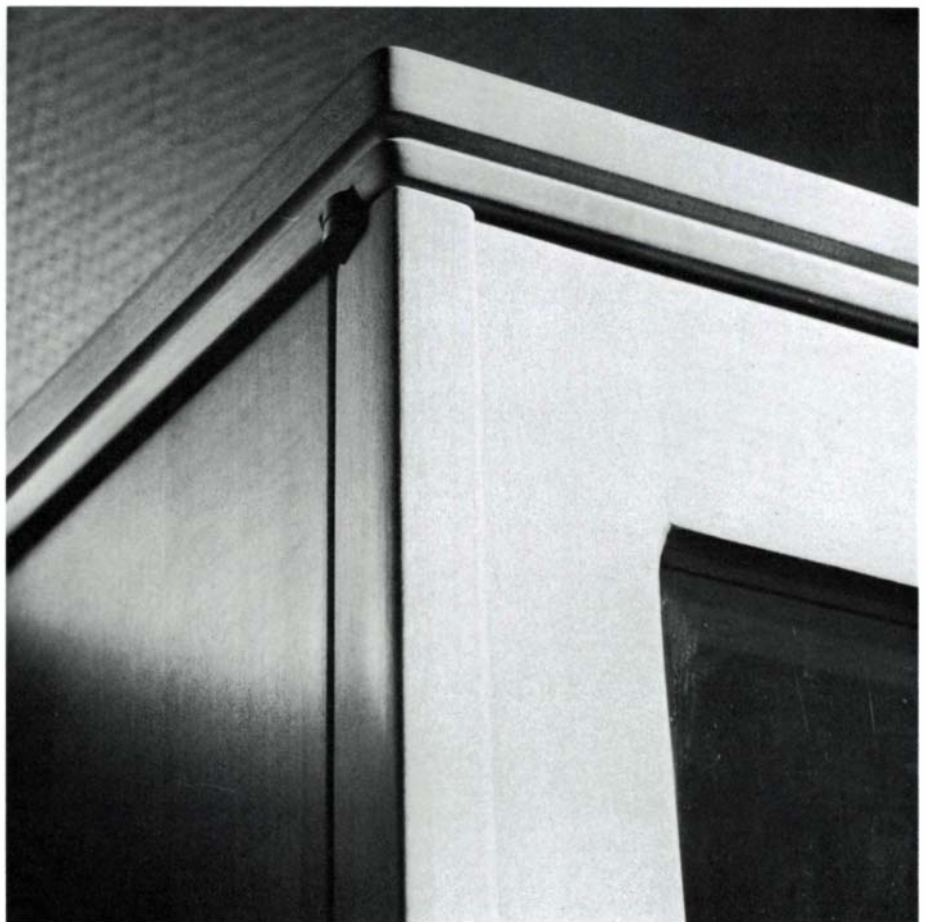
There is a lot of misunderstanding about doweling. While it is a widely used method in industry, rather little is known about it among craftsmen, at least in America; in Europe it is more commonly used. Because doweling is not visible as a joint, some craftsmen tend to be suspicious of it. When we use this technique without proper knowledge we use it badly, with bad results that increase our doubts.

By its nature, doweling is not convincing; the eye does not see how this joint is put together, and there is no pattern there to reassure you that those pieces of wood will stay together. When done right and used in a sensible relationship to the piece, to its character and its aims, doweling is a very good way of putting cabinets and even chairs together. It is primarily a commercial or production way of joining pieces, which I suppose is a part of our prejudice against it.

Maple showcase cabinet is doweled together to permit subtle shaping of overhanging top. Sides of carcase are veneer on solid, with the

The cabinetmaker's use of doweling should always be a matter of judgment. If you are making a seaman's chest that is going to be thrown downstairs or onto a ship, or a solid wood piece where other joints, visible and decorative, would be better, then use other joints. I do not think a seaman's chest should be doweled; it should be dovetailed. But a cabinet case can be doweled, especially if it is going to be a wall cabinet, and it will last for generations. One reason for choosing to dowel is visual, the character of the piece we are making. By doweling the case you can achieve a definite and fine-lined character; you get a visible top and bottom piece that can be made to protrude as you wish beyond the sides to give a horizontal outline at these extremities. You can do all sorts of nice things with these horizontals. You are free to bevel as you wish, to polish the end grain beautifully, to play

thick veneer bandsawn from the same stock as top, bottom and doors, thus stretching a choice piece of wood.



with touches such as little roundings, and achieve the shadings which will emphasize the shape of the piece itself—lending it a very special air. Dovetailing, in contrast, is rather binding, since then the sides will probably be flush with the top and bottom pieces. All too often this results in a naked, stripped-down effect. You can put the carcass together with a false top and bottom on the inside and then add outer pieces, yes, but that is a complicated method and not always desirable. In many cases it is awkward, too, and there is a chance that the outer pieces will warp and crack away from the inner pieces which are dovetailed. And then, of course, the appearance of the cabinet is definitely limited by the fact that the sides are flush with the top and bottom, and there is this pattern of the joints which, however pleasing, is not always appropriate; it lacks elegance in some respects, since it almost always has a rustic air.

Although I myself do not often work with surfaces that are veneered, they should be mentioned here in connection with doweling. On a fine bandsaw like mine it is possible to saw veneer $3/32$ inch thick from solid stock; that is, from a chosen part of *the same wood you will use for the rest of the piece*. This I do on a few occasions, and the resulting veneer is so evenly sawn that I need not even surface it before gluing. The thickness, not over $3/32$ inch, *allows me to work the wood as wood*—which some of the commercial veneers can hardly be called in these days of microthin cuts and the whole almost clinical process of using such veneers. With edge-gluing that allow for pleasant roundings, I have surfaces which are as fine as I want them: they can be polished with a plane, oil-finished or waxed—and they are alive, real wood. Here doweling is most handy as a way of putting carcasses, small boxes and other pieces together. One can again work with fine shadings and proportions—but now, without the end grain being visible, these details are even more subdued and refined—if we so want them in a certain piece.

The whole secret of doweling, and it is somewhat of a secret because of lack of common knowledge, is accuracy. You must be absolutely accurate. Some of us imagine we can make a jig and hold it against the piece to be drilled and then casually drill these holes. We can try, but the result will probably be a disappointment because the torque of the drill itself, and a number of human factors, result in holes that are not as accurate as they should be. A little bit here, a little bit there, and we've lost it; a sixty-fourth and a thirty-second and the whole thing gets out of hand; we have lost the very exactness that is the essence of making this joint. *This is definitely a case where it pays to do everything right, to take the extra time of making the jig, and of doing each step perfectly.* This way, doweling becomes an easy, not unpleasant, and very useful part of our cabinetmaking.

To do this kind of work we need a suitable electric drill and a stable horizontal surface on which to rest our work. This surface needs to be adjustable in relation to the drill or vice versa; we can raise and lower the drill itself, for instance. A fine simple machine for this purpose is the horizontal mortiser—just the basic machine without any special feed adjustments or other finesse. A poor man's version can be set up according to resources and inventiveness: it can consist of anything from a small portable drill mounted on a wooden stand, to a stable motor with a fine chuck and an adjustable rest made of metal. Such a set-up takes rather little floor space. It is absolutely essential for doweling. Besides this, it is

a most useful piece of equipment when it comes to making mortises.

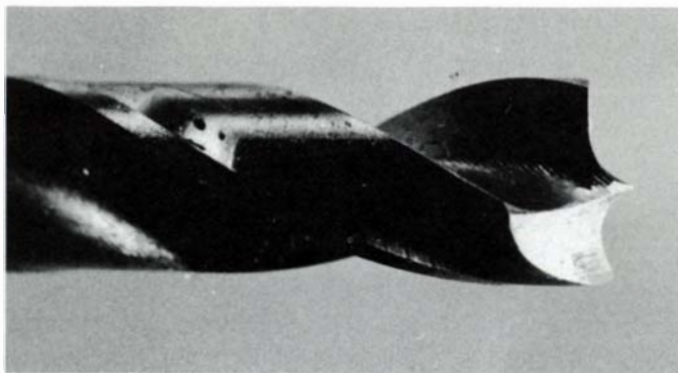
Fine fluted dowels are available in various sizes. However, they are not a hobby item, and are not likely to be found in the store around the corner; most of us are apt to end up with plain, smooth dowel stock in lengths of three feet or so, which is available in woodworker's supply shops and hobby shops. Simply lay the long piece of dowel on your bench, place a rough woodrasp diagonally on the dowel and roll the dowel along the bench with it. This will produce a series of scores which, although they don't hold the glue as well as do flutes, nonetheless increase the holding power of the dowel. Cut the dowels to suitable length.

Now you have to choose a drill that will give you a tight fit, even on end grain. I point out this matter of end grain because a drill which produces a good fit cross-grain tends to make a hole in end grain that is a bit too large. Another point to keep in mind is that though you will have a jig, you still want a drill that really centers and does not drift, causing oval holes and general inaccuracy. What you want is a drill that tends to center itself and cuts very clean even in end grain. There are cabinetmaker's drills available with a lip and a center spur but these come only in limited sizes and often are not very high quality. A simple way to make what we in Europe call a cabinetmaker's drill is to regrind an ordinary straight-shank metal drill. This may sound complicated but it really is not; with a small grindstone in an electric drill you can easily produce drills with a sharp center spur and very sharp, clean-cutting edges. When ground right this type of drill will cut beautiful holes in any kind of grain, producing a perfect result and crisp shavings. Once you have practiced grinding drills this way, and done a few, and achieved the first successful result, you will want to use these kinds of drills more and more on wood. With better and better results. As to sizes: try the dowel and the drill together, and achieve a snug fit in cross-grain as well as end grain. This usually means the drill size will be just under the diameter of the dowel itself, and here again the reground metal drills are an advantage because they are available in a great number of different sizes.

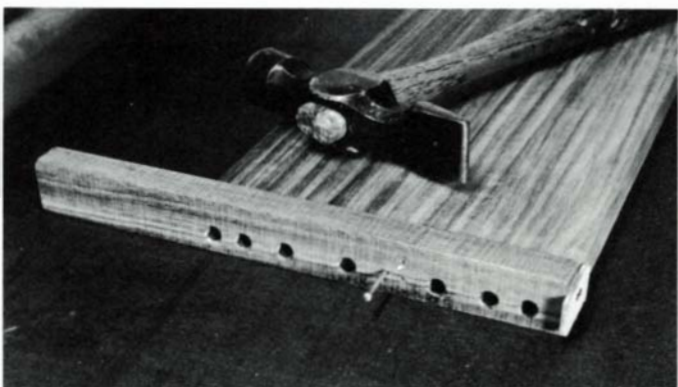
The jig is simply a piece of straight wood squared off and with a plywood or a thin solid wood heel on one end which will correspond to the back side of our cabinet or box or whatever. As an example: if the width of the area we are to dowel together is six inches there will probably be from six to eight dowels. Space these according to your judgment, evenly if you choose, but preferably a bit closer together at the front and back edge, since you do need a bit more holding power there than in the middle of the joint. The short heel at the back should be absolutely square with the rest of the jig. It is well to remember that the holes for dowels should be drilled along the center of the end pieces, and not near the inner or outer edge.

It is an illusion to think that you can hold the jig in place simply by hand as you do the drilling. Therefore, obtain a nice thin brad or perhaps a hardened nail that is used for hanging pictures on walls, and drill a hole in the jig somewhere near the middle area that is a snug fit for the small nail or brad. This is very important, since with a tight fit and the brad driven in properly the jig will not slip.

All the parts you are to drill and assemble should be properly marked. This may sound obvious, yet it is amazing how often we forget to mark the pieces or, when we do mark



Ordinary drill bit is reground, on slightly rounded edge of small stone, to leave sharp center spur and clean-cutting edges.



With heel tight against back edge of board, a single nail holds doweling jig in place for drilling on horizontal mortiser.



them, achieve results that are confusing. We use A, B, C, and 1, 2, 3, and X, Y, Z—all sorts of codes that may or may not work out properly for us, but usually do not. It is a puzzle to me why the classic cabinetmaker's mark of the pyramid or triangle is neglected, because when it is used properly, it is infallible once you get used to it and begin to think in terms of inside-outside, front-back, top-bottom, then this mark is so clear in its message that there is no room for confusion.



The illustration shows how this works. *We determine whether we shall use the inside or the outside of our side-pieces as a point of departure; that is to say whether the most important thing for us is the exact placement of the outside surface or inside surface.* Then we mark the pieces accordingly. We put the piece to be end-drilled on the table of our circular saw or joiner, place the jig against it and drive home the brad—making sure the heel is tight against the back edge. Check and recheck this. Think through the way the piece is going to be put together, the relationship of the jig to the surfaces, and the measurements that are most important, before you fasten the jig! Drive home the brad deep enough to hold, but not all the way; you will be removing it as you change the jig from one end of the piece to another. Drill carefully and steadily, holding the jig (even though it is nailed) firmly with your hand. Drill a little deeper than the length of dowel which is to go into the sides or the end-grain pieces. If you do not drill deep enough, then when you drive the dowel in for keeps the glue will run and make the work messy, so allow a little space at the bottom for excess glue and for the dowel to be able to “breathe” a little. Before you put the dowels into the parts with the end grain (which usually contain a larger part of the length of the dowel than do the cross-grain top and bottom pieces), countersink the holes a little. Then decide how much of your dowel is going to go into cross-grain pieces—the top and the bottom for instance, or the short ends of a box or a case—and allow approximately that much dowel to protrude. You can drive the dowels home with the help of a small block which corresponds to the thickness that you want to allow for, or you can insert the dowel a bit less deep than needed and then saw the protruding ends to an even length with the help of a strip of wood.

Prepare for gluing by getting together all you need: glue, a little piece of thin dowel with which to coax the glue into the holes, pieces of rag, a proper hammer, and a little spacer block to use as a stop when tapping the dowels into place. Work carefully and methodically. Blow out extra shavings or crumbs from the holes, put in enough glue but not too much, be careful in every respect, even to the extent of checking and rechecking that the ends of the pieces into which you have drilled holes are square and true. Glue the dowels properly, and then set these pieces aside.

Now you are going to use the jig on the top and bottom pieces themselves. There is the edge of the jig which you had

turned *down* as you drilled the first holes: this edge is now your line of orientation; you will use it flipped to correspond with 'in' or 'out' to achieve the exact relationship between top, bottom and sides that you want. Mark the top and bottom pieces carefully, place the jig there with the heel tight against whatever is the back edge, and then clamp it firmly in position. See that your drill is of the right size; use this in a small portable electrical machine or even a hand-drill. *Do not drill without a wooden stop on that part of the drill shank which is beyond the depth that you want.* Check and recheck this! Remember: you want the hole in the cross-grain of the top and bottom piece to obtain the maximum holding power. But if you do not want an accident you don't drill all the way through. So check this wooden stop, which can be a little block of wood that you have drilled and placed on the shank of the drill, or a piece of thick dowel with which you have done the same. Check the depth against the jig itself before you proceed. Drill the holes carefully, holding the drill vertically, so that you really are drilling all the holes straight down neatly without wobbling too much. This whole thing is a matter of accuracy, and of thinking clearly. The tendency is to be too much in a hurry because you are nearing the point where you are going to put the case together and look at it for the first time. But do be patient; think of the consequences of each mistake, and avoid making it.

After drilling and slightly countersinking the holes in the top and bottom comes the proof of the care and accuracy with which you have worked: You should have a good strong fit and be able to tap the piece together without undue violence. When you have it together dry, consider what should be done next: maybe a door that needs to be fitted, or the back piece; also how the interior of the case will be. *Think in terms of several steps; don't take one little detail at a time and then knock the case apart and do a small bit of work on it and put it together and think about the next little step.* Try to go through as much of the process in your mind as possible at one time. I usually take a chip of wood or a piece of paper and jot down the various things that need to be done, such as planing the back of the piece flush all around early so that whatever machining need be done there later, a rabbet or a groove, will be accurate. Consider the overhang of the top

and bottom in relation to the doors or door, the shadings with which you will want to mark various details, the bevels you will make. All these things are important. And since you are making something that you hope will be graceful and interesting and neat, you do want to do each part of the work at the right time. If there are to be partitions in the box or cabinet, you need to make the grooves for these before you glue the piece together. There will be holes for shelf pegs, or a recess for a latch or hinges. We'll think about how we shall finish the inside of our piece. All these things must be done before it is too late—not just before it becomes impossible but before doing them becomes more difficult than it should be. That way you are apt to make mistakes and produce a piece not as neat and clean and appealing as you hoped it would be. We want all the time to work towards success, towards achieving the result we strived for, really, and not to have to say: "I was in too much of a hurry to glue the piece together, and I forgot to do this or that; I had to do it later, and it didn't turn out so well because I just couldn't get in there to do it right..." The time we take to think and rethink is time saved, not lost. Once we get into this habit we develop a step-by-step logic which we use without any strain and this adds to the ease and enjoyment with which we work.

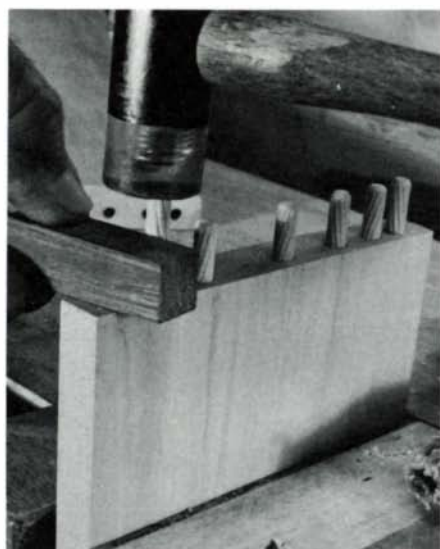
This article is taken from *The Fine Art of Cabinetmaking* by James Krenov, published this spring by Van Nostrand Reinhold. It is about woods, tools, techniques and attitudes, a sequel to his *A Cabinet-maker's Notebook (Fine Woodworking, Fall '76)*. It's about what Krenov calls "working well," responding to the nuances of the wood, making refined, harmonious little cabinets. To work as well as Krenov is neither easy nor practical. But he strikes a romantic chord in many, and a few will have the fortitude to make fine cabinetry their own life's work. His plea is that such people be understood and appreciated, and encouraged to carry on.

I met Krenov when I was a student at Rochester Institute of Technology and he came one day to speak to us. I took notes, but one comment I did not write down. It hit home and I'll never forget it. He was talking of how students often apologize for their work, "You know, I made this drawer...it's not quite right, I goofed over here...next time I'll take more care." He paused, this wiry little gnome of a man, and said, "That's all very well and human, but when will you stop having to apologize, and start doing the very best you can? When will you begin?" —J.K.

With the holes slightly countersunk for glue squeeze, dowels are tapped home. Block

gauges depth. Same jig is used to drill cabinet top, which has not yet been

trimmed to length. Wooden stop on bit prevents catastrophe. A good fit.



Spalted Wood

Rare jewels from death and decay

by Mark Lindquist

There is no official documentation of spalted wood that I have been able to find. Apparently nobody was crazy enough to consider using “rotten” wood in the past, or at least nobody would come out and show that he had used it, and accepted it. I’m sure one important reason it wasn’t used was the lack of the kind of abrasives that are available today. Any turning done with spalted wood requires extensive sanding to get past all the pecks and chips that occur from working the brittle wood, even with the sharpest tools. Working with it is like working with torn end grain everywhere, but that’s part of the challenge. In the end, the pain is forgotten as the piece comes to life.

Spalting is caused by water and fungus. If you’ve ever noticed a piece of sheetrock or plywood that accidentally got wet from the water on the floor or ceiling, you’ll recall the edge where the water stain stopped, leaving an interesting pattern. The material soaked up the water like a sponge, and the water combined with chemicals in the wood or sheetrock, to leave a stain in a random, arbitrary pattern. Spalting is like this, but far more complex. Combine this staining with the fungus at work breaking the wood down, the mineral content of the soil that the tree grew in, the mineral content of the water trapped in the tree, the temperature and other climatic variables, the softer and harder parts of the wood in the tree, and countless other biological functions, and suddenly there is an incredibly complex system that results in spalting. I can’t explain exactly how the process occurs; I can only speculate that the prominent black lines are caused by the accumulation of mineral deposits within the wood that separate the harder and softer areas as well as define the zones that have been attacked by fungus.

There is one thing so far that I have found consistently predictable: the absolute unpredictability and inconsistency of the wood and its structure, the spalting, and the patterns. Each piece is completely different from the next, even six inches down the same tree. That, too, is part of the challenge of the material. One tree may have good workable spalted wood, while the next, although appearing the same, will be useless. So working with the wood requires patience, faith, stamina, and above all, experience. With each piece of spalted wood comes a program of rules and problems that have to be worked out. Only by working the wood can one gain the knowledge, experience and understanding necessary to appreciate and succeed with the material.

Mark Lindquist is a sculptor who earns his living by turning and carving spalted wood and burls. He’s 28, married, has two children and lives in Henniker, N.H.



Lindquist amid treasure trove.

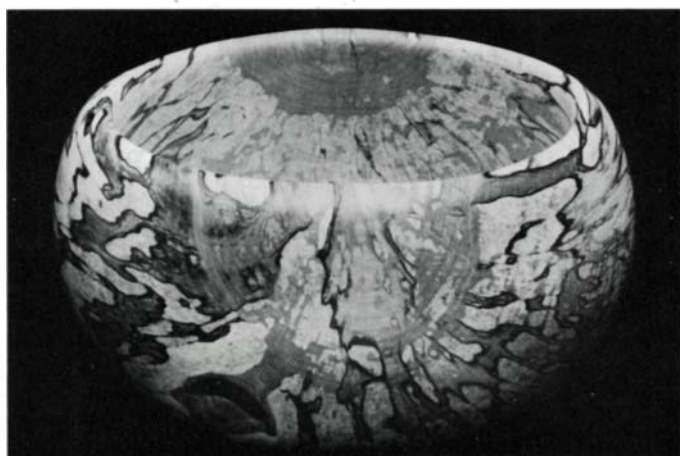
Finding spalted wood at just the right point is crucial, because if the wood decays too long it will be really rotten, unworkable, and useless even as firewood. If the wood is found too early, it lacks character and seems bland like conventional wood, which, after one has once seen beautiful spalted wood, is plain to the eye. Spalted wood that is too soft will have very punky spots that are impossible to do anything with, which, in combination with harder spots, will not allow the piece to be turned. Spalted wood that is too hard will most likely check, because it’s right in between and is really unstable. One beauty of spalted wood is that in a sense it has been allowed to age. It is no longer green, and needs only to dry out. For some reason, spalted wood caught in the right stage is stable enough to resist checking. I attribute this to the relaxation of tension within the wood that ordinarily causes splitting.

As far as I know, spalting occurs mainly in these woods: all birches, beeches and maples. It occurs in elm, but rarely in red and white oak. Apple spalts, but spalting is relatively unknown in walnut and butternut. Most of the white woods show good spalting. The process occurs at different rates for different trees, and of course depends on climate and environmental variables.

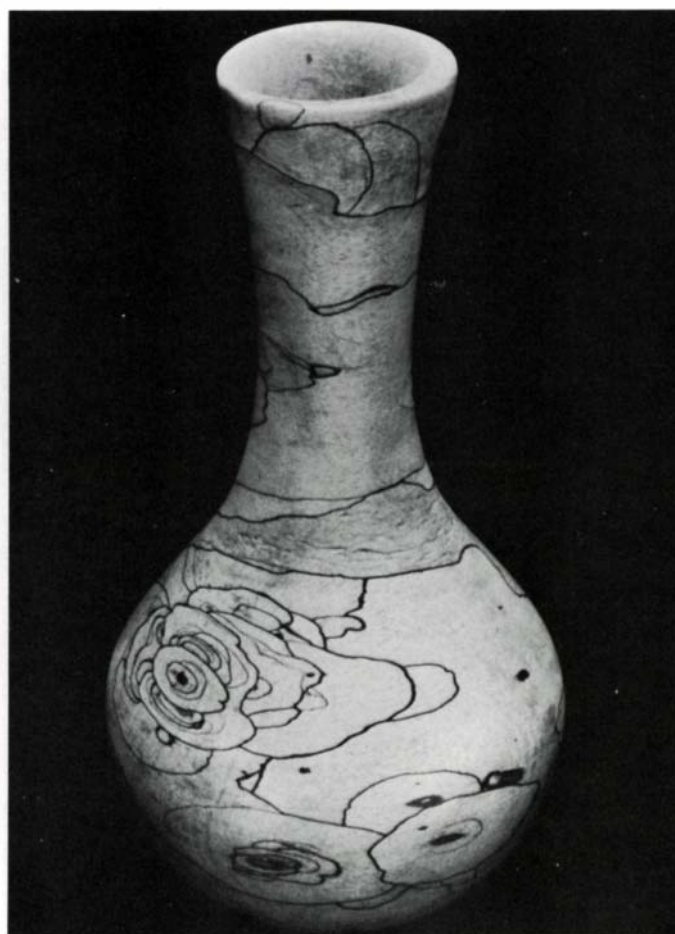
White, yellow and gray birch spalt very quickly after felling. White birch usually starts showing some figure within a year and a half; gray birch and yellow birch take a bit longer, but they spalt quickly nevertheless. Black birch spalts

[Editor’s note: According to J. S. Boyce in *Forest Pathology* (McGraw Hill, 1948), “Narrow zone lines, usually black but sometimes dark brown, are a common phenomenon of many decays. They are frequently formed in the white rots, and they are more common in decayed wood of hardwoods than in conifers. At times black zone lines may be fantastic in pattern.” Boyce goes on to identify the various fungi, bacteria and parasites responsible for each type of decay, and the characteristics and colors typical of each.

In essence, a fungus first invades the wood (incipient decay), establishes itself, and then breaks it down. The zone lines mark the intermittent progress of each type of fungus as it advances into the wood, or the point where the tiny filaments (mycelia) of two competing fungi clash for possession of the tree’s tissues. Generally the wood is softer behind each zone line and harder ahead of it. Says Boyce, by way of example, “In aspen three stages of decay have been recognized. In the incipient stage the wood is faintly colored from light pink to straw-brown; in the intermediate stage it is colored from straw to chocolate-brown, but it is still hard and firm; and in the advanced stage is included all soft, punky wood irrespective of color. Wood in the incipient and intermediate stages is utilized for some purposes but in the advanced stage is always rejected.”]



Spalted maple bowl with ladle, 10-in. dia., \$375; spalted yellow birch fruit bowl, 12-in. dia., \$250. Both bowls were made and



priced for museum collections. Maple rosebud vase, right, 2-1/2 x 6 in., about \$50, is by Melvin Lindquist, author's father.

the slowest of all the birches because it is the hardest; however, when it spalts it is very beautiful, and if caught at the right point will work easily and still remain hard. Birches tend to spalt regularly and predictably with the grain because of the straightness of the tree's normal growth.

Beeches also spalt predictably with the grain, but the wood is often unstable and checks easily. Spalting occurs after two years in most cases. Elm spalts rather quickly, also within two years. However, it frequently lacks character and often looks anemic. But if it's found at just the right time, and the wood has good figure in it, some beautiful pieces may result. Apple spalts, but oh boy does it crack! Oak may spalt, but it tends to rot from the outside in. Occasionally, though, oak will provide a splendid, magnificent piece of spalted wood.

But the best of all spalted woods are the maples, especially old New England sugar maples. Old sugar maples contain infinite grain configurations with fantastic and beautiful patterns. The old-time makers of fine furniture and musical instruments covered the beautifully grained maple wood that someone's grandfather had stored for generations to come. There are names for the recurring grain configurations, although today it's difficult to get such wood, and the cost is unbelievable. There are tiger maple, fiddleback maple, bird's-eye maple, blister maple, curly maple and burly maple, to mention a few. Because of all these various grain patterns and because of the hardness of the wood, old sugar maple trees can contain remarkable patterns, designs, and even pictures of recognizable objects.

Soft maple will spalt in anywhere from two to four years.

Rock maple, or sugar maple, starts to spalt after two to five years, and once the process is working, there is a point at which it quickly speeds up and the tree goes rotten all the way. Just before that is the time to get it. I once found an old sugar maple, full of maple sugar taps, on the side of a dirt road, and I estimated the tree had begun to grow two hundred years ago. It was full of tiger, curly, and blister configurations, all magnificently spalted. The lines were so intricate that it looked as though an ancient Chinese calligrapher had deliberately penned his designs within the wood. The wood itself was still very hard; its texture was sensuously creamy, and the color of the aged wood was rich and golden. I was amazed at the beauty that was hidden within the old rotting hulk of a tree. The farmer must have thought I was crazy to touch it, but he didn't say anything for fear that he might scare me away and the blasted mess would stay there forever. There were maps of the world, animals, birds, fish, mountains, even a detailed "painting" of a rose, all done in fine lines like a pen and ink drawing. The most amazing thing was that the wood between the dark lines changed color from area to area, so that it seemed to be a carefully executed design of the most sophisticated combination of lamination and marquetry.

By far the most exquisite of spalted woods, and in my opinion better than the rarest exotic, is a piece of choice, aged, pictorial-figured, spalted sugar maple. The pictures within such wood seem to be a record of the tree's history: the storms, the sunny days, the cool moonlit nights, the wars that happened during its time, the sunsets, the pain and cold



Block cut from spalted maple log, above, shows fungal zone lines extending throughout the wood, a three-dimensional lattice. Dark area at center is completely decomposed. Downed rock maple tree, left, shows spalted end grain. Mushrooms growing on end of maple log, below, are reliable clue to spalting inside.



of the ever-changing New England weather. There is mystery locked inside, and infinite beauty—a worthless old tree making a last attempt to display its glory.

Think of the availability of the material: the cost is your time. Quality depends upon your perseverance and faith that the right piece is there, free for the taking. The process of working spalted wood begins with finding the material—in essence, found art. Finding spalted wood is very simple once you know what to look for. All I do is go out in the woods and look for fallen or dead standing trees. Maples are the best, because they take longer to spalt. Birches are often disappointing because the bark almost always looks intact, but the inside of the tree may be rotten to the point of mush. But no matter what you look for, you'll never know what's inside the log until you cut it. A lot of it is guesswork, a lot is based on experience and keys or signs to look for. The best source for exceptional spalted wood is the dead, fallen tree that has been lying around and looks as if it's not worth the powder to blow it to oblivion. Check the soil that the tree is resting on. If it is rich dark earth, or mossy, or covered with rotting leaves, that's a good sign. If the end or side of the log is covered with mushrooms it is a good bet that spalting will lie within. Many times you can see spalting on outer layers of the wood, where the bark has come off the tree. After a while you acquire X-ray vision and can guess what is going on inside the log. But there is no substitute for cutting into the wood to find out what's there. Most of the time, it's a surprise.

Normally I approach the end of the log that has been exposed to the weather, and cautiously crosscut off about three inches of the end. This usually takes out the end checks and the "mock spalting" that often occurs on the surface. Having exposed the face of the log at that point, I usually make a second cut about 16 inches down the log because I work with relatively small sections that are easy to carry out of the woods, and happen to be the length of the bar on my lightweight saw. If the figure or picture is good, I rip six-inch thick sections working around the center, cutting through any

faults, cracks or spots that might check later. Stay away from the center or pith because it's a sure thing that it will check. The other possibility at this point is to take the log or butt to a mill (they may not saw it, fearing metal or doubting its worth) and have it cut into boards. It's difficult to work it this way because you never know what you'll run into.

Cutting spalted wood is theoretically similar to cutting gems and lapidary work. As in cutting picture jasper, the object is to get the greatest possible amount of picture from the piece at hand. The wood must be carefully studied and observed before cutting, to ensure the best picture within the chunk, relative to the bowl being turned. So this introduces the sculptural theory of the object being contained within the mass, which it is the artisan's function to release.

Spalting has characteristics too numerous to list, but among them are some that govern cutting methods to produce the best figures. The end grain of a log gives a clue to what is inside. The picture will often be very beautiful and full, if the log is well spalted, and it can be worked, providing the entire crosscut disc is not used (because it will definitely crack). So the best use of spalted wood, allowing the most control, is side grain or ripped stock. The lines forming the picture in the end grain will normally travel parallel, lengthwise with the log. So if the figure is double-lined, making swirly star-shaped patterns in the end grain, the log may be crosscut several times, like slicing ham. That same picture will occur several times, with slight variations, for a considerable distance until the pattern shifts because of a limb or irregular growth. The lines that make end-grain patterns also make side-grain patterns. Birches, which spalt more regularly, have fairly straight, predictable lines, sometimes close together, traveling the entire length of the log. The side-grain figure will resemble zebrawood, but the color will be far brighter. The end-grain picture will be a network of fine black lines.

If a good spalted log is found at just the right point, the markings may be consistent and predictable throughout, and thus easy to cut, because the broken-down, partially rotten wood is very soft and cuts nicely. Deciding where to cut is the real problem. You must learn to see the wood, the finished

object, in your mind's eye, and then balance that against your observations of the log, its faults and patterns. In essence, you must flow and harmonize with the wood and the wonder of the graphics and design within. A wrong move will spoil the picture; the right move will unfold unbelievable beauty.

Here is an opportunity to cut the wood with the same care that later will make the object. The tree was carefully grown, and your object must be carefully made simply because of the nature of the material. So the harvesting or gathering of the wood must be equally special. It really is like a crop. The tree dies and begins to decay; when it spalts just right, harvest.

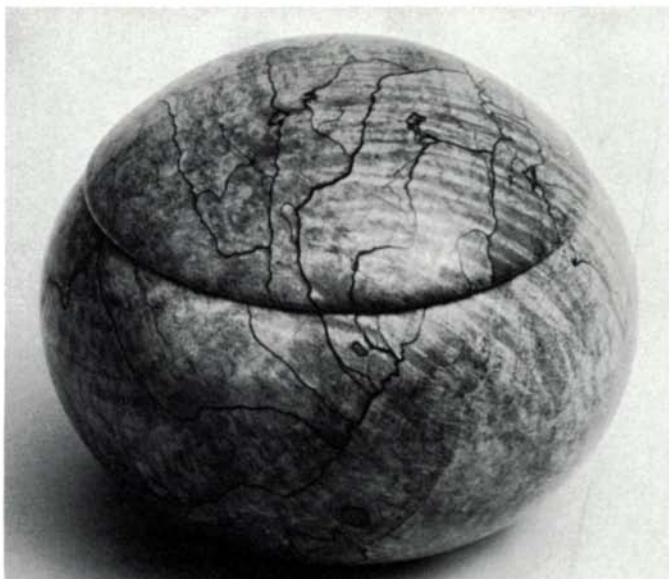
After the wood is cut, I usually paint the ends of my chunks with an inexpensive white glue and water solution, applied liberally, to keep the ends from drying too quickly. I use epoxy to seal the very best pieces, because they come only once in a lifetime. I see them as uncut diamonds, so the expense is worth it. After sealing I stack the wood in an open-air shed, making sure to sticker between the pieces for air circulation. I leave the blocks in the shed for a year, and then bring them into an indoor shed. The indoor shed is closed with less air circulation, but it freezes in the winter and heats up during the summer. I do not sticker the blocks indoors, but merely pile them on top of each other. After a few years, they are dry enough to turn. The thinner the block the quicker the drying. The usual green bowl methods (*Fine Woodworking*, Summer '76) may be used, but the risk of splitting may be large, depending upon the piece. I'm three years ahead of myself on wood, so I let it age and mellow by itself. A climate-controlled room would be effective, I'm sure, but nature will do the job given the chance.

Spalted wood has always been around; it might be right in your own back yard. Recognizing the potential, and the limitations of the material, anyone can have free access to wood so rich and alive with color and character that it transcends the nature of the wood it was before its metamorphosis. Realize the wood has made a transition, a long journey from one life to another, and catch it, discover it, at just the right moment. Your woodworking will enter a new phase unlike any other you've experienced.

Fresh-cut end of spalted maple log shows advanced decay and highest degree of spalting in rainbow colors, a rare find. Covered jar



made of spalted tiger maple, 6-in. dia., is production work to retail in the \$50 to \$100 range in craft galleries.



Antiqued Pine Furniture

Distressing won't hide sloppy work

by B. D. Bittinger

Antiqued pine furniture has become increasingly popular in recent years. This style of furniture is characterized by thick (1-in. to 1-1/2-inch) table and case tops, and correspondingly sturdy carcase construction. It is constructed from knotty white pine. The antiqued and distressed finish is medium dark brown, with lighter brown highlights.

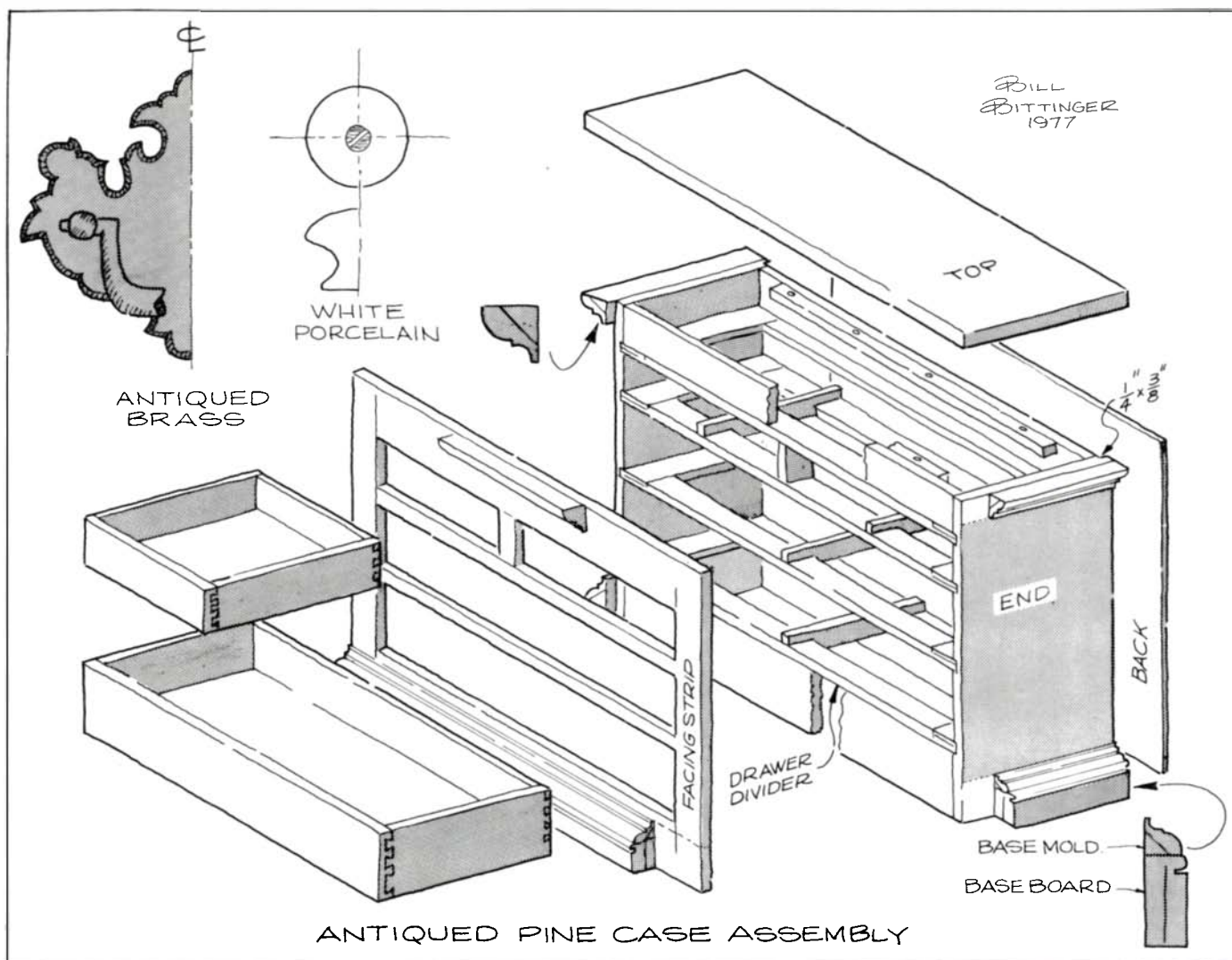
The line of commercial antiqued pine furniture marketed under the Ethan Allen trademark is a good example of this furniture style. I view the style as a romanticized version of the pine furniture built by skilled joiners in rural America during the last half of the 18th century—not rustic or common, but well-made country pine furniture.

"Probably it is the spirit of frank simplicity that gives this work (pine furniture) its fundamental appeal. It is on friendly terms with open fires, with wrought-iron hinges, with hewn beams and cornerposts. . . But 'ware lest you introduce a piece of mahogany to such company! The mahogany raises its eyebrows at favorite scratches and rounded edges of the pine, while the pine peeks out of the corners of its eyes at the painstaking satinwood inlay and wonders what it is all about.'"

The Pine Furniture of Early New England
Russell H. Kettell, 1929

Antiqued pine furniture designs for use in present-day homes are necessarily adaptations, not authentic reproductions. After all, rural colonial families did not have king-size beds with "sleep sets" or stereo and TV cabinets. Free-standing desks were rare and all-drawer chests with large, plate-glass mirrors were unknown. They had as much use for coffee tables and bookcases as we have for dough boxes and flax wheels. Antiqued pine furniture designs are based more on feeling than on fact.

Eastern white pine was used by early cabinetmakers and knotty eastern white pine can still be found. Western white pine serves as well and is available at most lumberyards. There



are several varieties of western pine, ranging in color from almost white to tan to pink. Kiln-dried knotty white pine is generally available as #3 common 1x12 shelving in lengths of up to 16 ft. Sugar pine is my choice when I can get it. It is usually tan in color with rust grain lines. Some boards also have a distinctive brown fleck marking. The knots are generally small and red-brown in color.

Most furniture parts are less than 4 ft. long and 5 in. wide. In selecting material, I look at a 1x12 shelving board in terms of the number of good pieces it may contain, not its overall appearance. Some white pine boards are full of sap, heavy and sticky, and are useless for making furniture. Thick (4/4, 6/4, 8/4) knotty white pine is not available at most lumberyards so I usually order from a dealer such as Educational Lumber Co. in Asheville, N.C.

White pine is weak compared to most cabinet woods and this must be considered when designing joints. Tenons in pine, for example, should be as large as possible and somewhat longer than they would be in hardwood. Chair turnings should be hardwood, but heavy pine seats and arms may be used in combination with the hardwood. Pine turnings for table legs should be heavy with simple, bold patterns. I prefer to glue up turning blocks from 3/4-in. stock. Small, firm knots in a turning block will usually cut and finish well.

Tools must be extremely sharp for cutting pine because it is so soft that the fibers tend to tear. I use a plywood-tooth saw blade on the radial arm saw and always crosscut with the good side up. Even with a sharp, small-tooth blade the fibers may break out on the bottom and leave a rough surface. Carving chisels must also be extra sharp.

Let me emphasize that workmanship must be of the highest quality. Antiquing and distressing will not cover or hide sloppy or careless work. Quite the opposite, antiquing will emphasize poor joints, hammer marks, clamp marks, and other evidence of careless workmanship.

Carcase construction

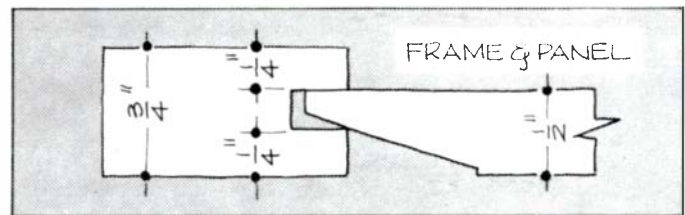
A carcass for a large chest of drawers includes most of the particular problems of working with white pine. The large drawing shows the basic construction of such a case. What follows are the working methods and finishing techniques I have developed for achieving the style I like.

Carcass end pieces (using 3/4-in. stock) may be solid edge-glued pine or frame-and-panel assemblies. Doweling or shaper-edge joining is not necessary with Titebond glue. It is important, however, to align the boards in the clamps, thus minimizing planing and sanding the finished panel. Wide shelving (12 in. or more) should be ripped into at least two strips and the grain alternated before gluing, to reduce cupping. Excess glue squeezed out of the joints should be removed at once with a wet cloth. Glue will seal the wood and cause light spots when the stain is applied.

If solid ends are used, special consideration must be given in assembly to avoid restraining the boards across their width, else the case will be damaged by shrinkage or expansion.

Raised-panel case ends are visually pleasing and solve the problems of expansion and contraction. Although a frame

made from 3/4-in. stock with a 1/2-in. thick panel is light in weight and relatively weak, it is satisfactory for this application because it will be amply reinforced by the back drawer dividers and facings. The frame is assembled with mortise and tenon joints and the panel is retained in grooves in the stiles and muntins. The front edge stile should be 3/4 in. narrower than the back stile so that after the facing is applied the stiles will be the same width.



After the end panels (frame-and-panel or solid) are cut to size, a series of 3/4-in. wide by 1/4-in. deep dadoes is laid out and cut to house the drawer dividers. Remember to cut a rabbet 3/8 in. wide by 1/4 in. deep on the back edges of the carcass sides to accommodate the back panel of the case.

Drawer divider units are made from 3/4-in. pine joined with mortise and tenon or half-lap joints. The width of the divider strips will vary according to the overall dimensions of the case. The strips at the ends of the divider frames, which run from front to back, should be about 1-1/2 in. wider than the vertical facing strips of the front frame, so that they can support and act as a bearing surface for the drawer sides.

The carcass is assembled with glue—on the front edge only of solid end pieces—and plug-covered, flat-head wood screws through the end panels. Plugs may be surface-cut round plugs, end-grain round plugs or square patch plugs. Finishing nails, set below the surface, may also be used for case assembly. After setting the nail I use a modified nail set with a square tip (about 1/8 in. by 1/8 in.) to make a square set hole. The small round or square holes will blend with the overall distressed appearance. The facings and back panel will be glued and fastened to the edges of the end panels and to the drawer dividers, to provide adequate strength whether the case is assembled with nails or screws.

The front facing frames may be assembled as a unit with dowels, mortise and tenon joints or half-lap dovetails and then fastened to the carcass; or each strip may be individually attached with butt joints. I prefer the latter. In either case, the facing is fastened with glue and plug-covered screws or finishing nails. If nails are used, they should be located at random on the facing boards to avoid a regular pattern. Plugged screws, however, should be placed in a symmetrical pattern. Whether or not the facings were preassembled with mortise and tenon joints, 1/4-in. dowels may be set into the surface to simulate draw-bore locking pins.

I usually make the base boards about 1-1/2 in. thick to balance the thick top overhang. They may be scroll cut or left full width. The base is assembled with mitered corners and is glued and fastened to the carcass. On some pieces, such as dower chests, the base boards may look better if they are joined with through dovetails. The base mold is a modified stock molding.

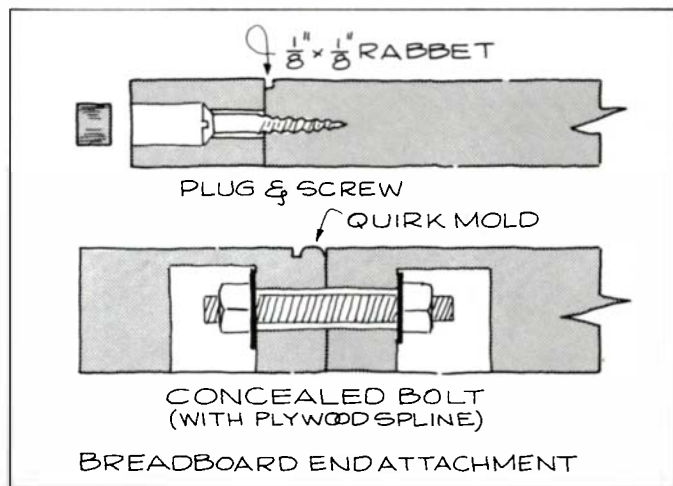
The bottom dust panel and back (lauan plywood) should not be attached until the drawer slides are installed and each drawer is accurately fitted to its opening.

Case tops vary in thickness from 7/8 in. to 1-1/2 in.,

Bill Bittinger, 48, has been a woodworker for 20 years. Trained as an engineer, he is production superintendent at a tire cord factory. He lives in Shelbyville, Tenn.

depending on the scale of the piece and the width of the carcase facing strips. Tops are made from solid edge-glued pine. I use dowels on edge-glued thick pine to help level the pieces in the clamps. If bread-board strips are not used, the end grain of the top should be carefully sanded or it will soak up extra stain. Case tops are attached with screws from underside in oversize holes in the top mounting strips.

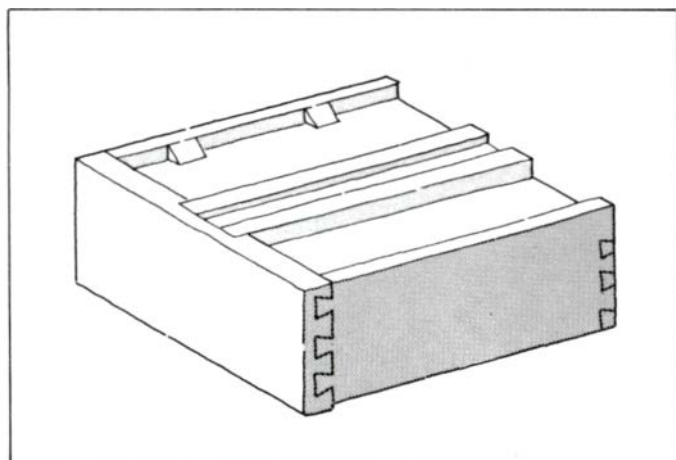
Bread-board strips across each end of the top add to the appearance and strength of projects such as coffee tables and heavy trestle tables. Before joining the strips, I run either a 1/8-in. by 1/8-in. rabbet across the ends of the top or a quirk mold on the joining edge of the strip. Narrow strips may be attached with screws through oversize holes, to allow for expansion. The counterbored screw holes are covered with round or square plugs. The edging strip should be glued only at the center on a tabletop, or at the front edge on a case top. To attach unsupported strips to tabletops that are subjected to heavy loads, I use 2-in. wide stopped splines made of 1/2-in. plywood and two or more concealed tie bolts cut from 1/4-in. threaded rod. The spline is glued only at the center, to equalize misalignment caused by shrinkage or expansion of the top.



Drawers

I don't think pine drawers should be lipped because a thin lip is fragile and a heavy lip is clumsy. I install drawers and doors with 1/8 in. of the edge exposed. When they are rounded by sanding, the chest has a soft—not flat—appearance.

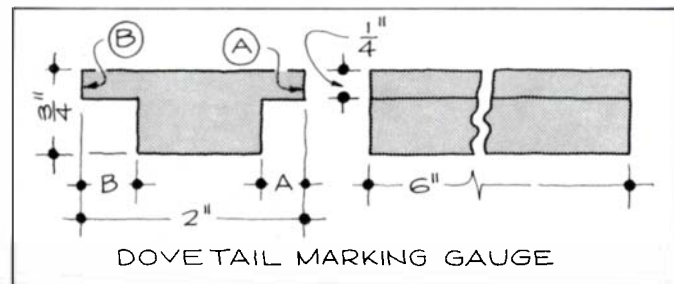
Cut the 3/4-in. drawer fronts for a snug press fit in the openings, and index-mark each front to its corresponding



opening. Knots should be at least 1 in. from each end.

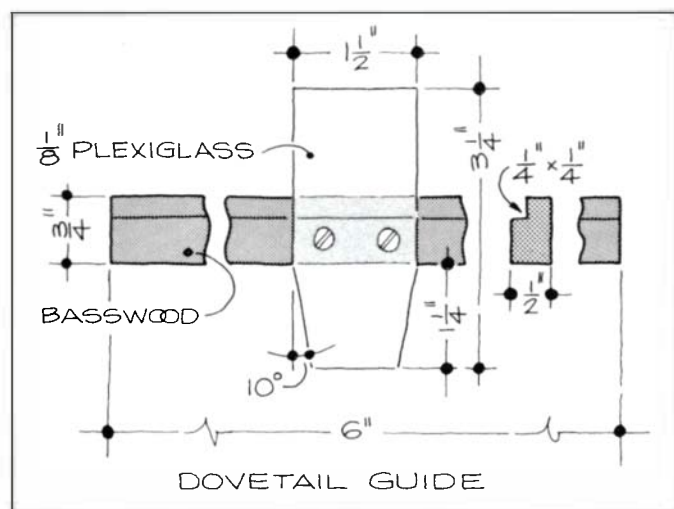
Cut the sides about 1/8 in. narrower than the front and about 2 in. shorter than the case depth. Drawer sides should be about 5/8 in. thick. Cut 1/4-in. by 3/8-in. bottom retaining grooves in the sides and front, and cut a mortise on the bottom edge of the back side of the front for the drawer slide part.

Dovetail joints should be cut by hand. It is difficult to obtain sharp clear lines in soft pine with an ordinary marking gauge. I use a sharp 3H pencil with a shop-made marking gauge to lay out the dovetails. Dimension A is usually about



two-thirds the thickness of the drawer front and dimension B is 1/32 in. greater than the thickness of the side pieces. Side A is used as a marking gauge on the end of the front and on the matching side piece, to provide cutting lines for the length of the dovetails. Side B is used to mark the dovetail depth line (side thickness plus 1/32 in.) on the inside end of the front piece.

I use another shop-made marking jig to lay out the half-blind dovetail on each drawer front end. The marker is used to draw the pins and the vertical-cut guide lines on the inside of the front.



I start marking with a half-pin on each end, so that a tail will cover the bottom retaining groove in the side, and then fill in between by eye. Each end of the drawer front has the same number of pins and sockets but they are not all identical in size or spacing. Pins in pine should be only slightly smaller than the dovetail sockets. After sawing on the waste side of each pin line, I clamp the front to the bench to remove the waste with a very sharp chisel to within 1/16 in. of the guide lines. I trim the pins and the sockets to exact size with the front held vertically in a vise. Then I lay the side piece on the table saw and stand the front piece on top of it, using the saw fence to hold the front piece vertical. With the ends of the two pieces exactly aligned, I can use a sharp pencil to trace the

pin outlines onto the side piece. I cut the tails to size on the band saw. There should be enough interference in the joint to require moderate pressure to assemble. I do not dry-fit dovetail joints because this compresses the pine and causes a weaker joint. The dovetails are assembled with glue.

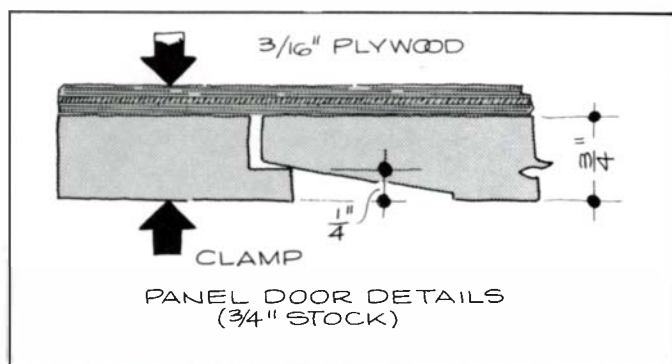
The back piece is joined to the drawer sides with through dovetails. The bottom (lauan or pine plywood) is nailed to the lower edge of the back part with coated box nails. The drawer slide is attached with brads and glue. Beveled glue blocks keep the bottom from rattling.

When the glue in the assembled drawer joints has set, I sand the protruding ends of the front with a belt sander. This sanding, if carefully done, will leave about 1/32-in. clearance at both sides when the drawer is installed.

Install slides in the case and adjust them to center the drawer fronts in their openings. Sand to round off the top edge of the drawer front, to provide about 1/32-in. clearance. A gap of up to 1/16 in. around the drawer is acceptable. Attach the 1/4-in. plywood back panel with glue and small coated box nails to the drawer frame edges and all around the case edges for maximum strength.

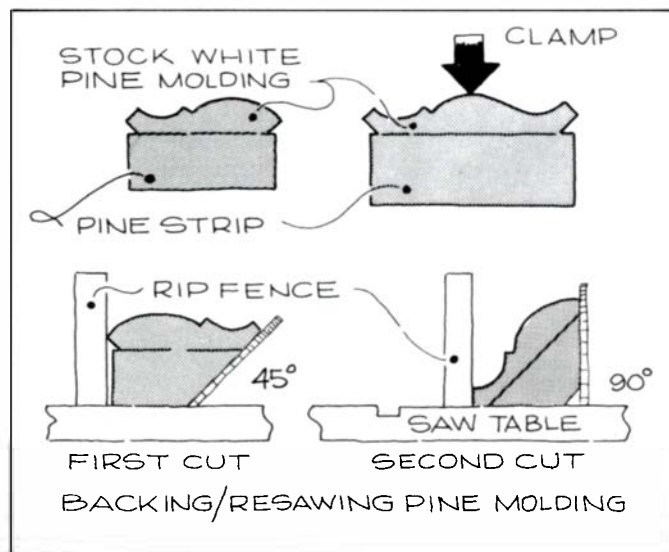
Doors

Raised panel doors are included in some case designs such as a hutch base. Doors may be made from 1-in. or 3/4-in. pine stock. But conventional frame construction for a raised panel door of 3/4-in. pine is structurally weak, and the door does not feel comfortably heavy. To avoid weakness and add weight, I set the panel in a rabbet instead of a groove and add a back plate of plywood. First, I assemble the frames (rails, stiles and muntins) with dowels and glue. Then I rout a rabbet 3/8 in. deep by 1/2 in. wide on the inside back edges of the frame, squaring up the rabbet corners with a chisel. Then I cut the panels from 3/4-in. solid pine, allowing 1/8 in. for clearance on all four sides. I "raise" the panels by cutting a bevel all around the front face, so that when the panel is laid into the frame it will protrude by the merest 1/64 in. at the back. Finally I glue a piece of 3/16-in., 1/4-in. or 5/16-in. pine or lauan plywood to the back of the frame only, thereby pressing the panel into the rabbet and completely covering the door.

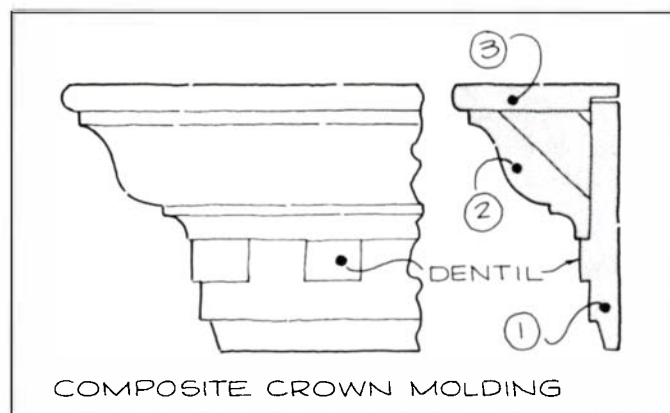


Moldings

One of the advantages of working with pine lumber is the wide range of commercial moldings. Before mitering and applying commercial flat molding, I glue a pine backing strip to the molding and then resaw to provide a larger glue surface. This is particularly important when attaching large cornice molding around the top of a cabinet. Resawing to 45° also helps in cutting miters on large moldings.



Large crown molding may be assembled from several parts. The three-part composite molding shown below is made up from: 1) shop-made dentil backup piece, 2) modified commercial flat-crown molding, and 3) a nose-molded pine strip. The dentil backup piece is machined to leave a 1/4-in. to 3/16-in. raised strip. The dentil is laid out and cut after the backup strip is beveled to fit the cabinet. The "teeth" should be laid out from the center to ensure symmetry, taking care to locate one full tooth on each side of the bevel joint. The pieces of crown molding and the pine strips are mitered and installed in turn over the backup strip.

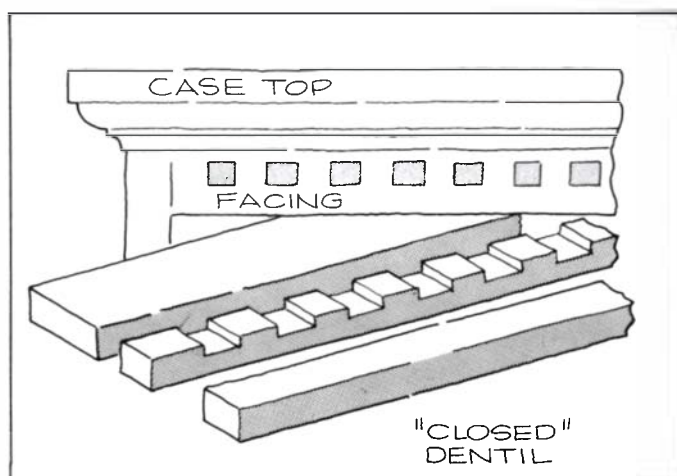


Some projects are enhanced by a closed dentil molding (a row of square depressions) along the top horizontal facing strip. This decoration is particularly effective in bedroom sets where it can be incorporated in chests, mirror frames, bedside tables, headboards and footboards.

To make the closed dental facing strip, cut the facing about 1/2 in. wider and longer than finished size. Rip out a strip from the facing board where the molding is to be located. Start the dado layout in the center of the strip to ensure symmetry, and plan the cuts so that a raised tooth, at least full width, will remain on the end of the strip at the facing joint. Cut and sand the dados, joint the glue edges and edge-glue the strip back in place.

Distressing

The piece should not be distressed until after complete assembly and coarse sanding. Experimentation is the only way to determine the amount of distressing that will suit your taste. The procedure includes surface marking and removal of



material to create a worn appearance, and special finishing to make the marks look authentic.

I do not like excessive surface marking. I usually make a few dents with the corner of a hammer claw and a few randomly spaced holes with an awl. The claw indentations are triangular and the awl holes appear as small black dots when the finishing glaze is applied. Distress marks are always randomly spaced and are more numerous around the bottom and on the top of a piece than on vertical surfaces. A tall bookcase, for example, would have very few indented distress marks above the height of 4 ft.

Wear distressing should correspond to the imagined, as well as the actual, use of the piece. Stretchers and legs that are rubbed with shoe soles should be much more severely worn than areas touched by other parts of the body. Wear distressing may be done with planes, coarse sandpaper or even rasps and files. In any case, the worn surfaces should be carefully sanded so that no tool marks remain.

After the piece is distressed, I sand with a high-speed orbital sander using 100-grit, 120-grit and 150-grit garnet paper. I complete the sanding by hand with 180-grit garnet paper wrapped around a felt pad. If scratches or other unplanned surface defects show up at this stage, they should be removed by going back to a coarser grit paper. Distressing does not camouflage sloppy and clumsy work or incomplete finish sanding.

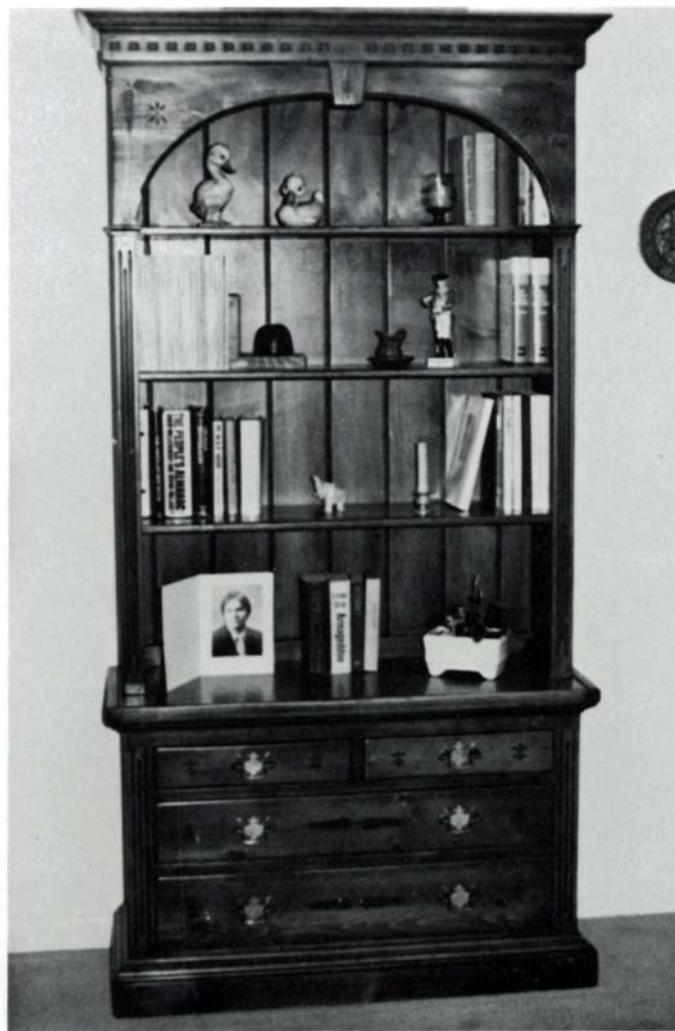
Finishing

I use Minwax Early American oil stain to antique pine furniture. Apply the first stain coat to all surfaces, inside and outside, following the manufacturer's directions. After 24 hours, apply a second coat to the outside surfaces. This leaves drawer and case interiors lighter in color than the exposed surfaces. At this point in the finishing schedule your beautiful piece of furniture will look very disappointing—dull and splotchy—but do not despair.

I spray McCloskey Eggshell or semigloss Heirloom Finish for the seal coat and the final varnish coat. Glaze solvents do not soften it and it has good rubbing (sanding) qualities. It can also be brushed on.

After the seal coat is dry (depending on the climate, this may take up to a week) sand all surfaces with wet/dry #320 paper. When the varnish is properly dry, sanding will form a white powder on the surface.

There are a number of antiquing glazes on the market and James M. O'Neill, in his book *Early American Furniture*, gives a formula for mixing an antiquing glaze. I use Tone 'n



Tall chest: Designs are based on feeling more than on fact.

Tique deeptone antiquing glaze, made by C.H. Tripp Co. But I suggest you make up sample blocks to determine your preference. Rub or brush the glaze on the outside surfaces of the project and take care to fill all the distress marks with glaze. Wipe off when the glaze begins to appear dull. The glaze changes the color of the finish even though most of it is wiped off. Leave a film but not streaks. Wipe in the corners and at surface intersections with a wadded cloth so that some of the glaze remains. If too much glaze is wiped off, you can recoat and start over. At this point the finish on your project will look very good and it will improve with the final steps.

After the glaze has dried for 24 hours apply the second coat of varnish. Allow several days for drying and rub again with used #320 emery cloth and 2-0 steel wool. The final step is to coat the entire piece with a good grade of paste wax. The wax should fill any nail set holes. Rub and polish.

If you want an antiqued painted finish, substitute the paint of your choice for the stain and first coat of varnish and proceed as described above. I like the clean, bright appearance of painted interiors on pieces such as hutch bases and dry sinks. Light blue paint goes well with the antiqued finish.

I usually use antiqued brass drop bail or white porcelain pulls and mortised antiqued brass hinges. Black-finished H or L hinges and hardware are also suitable for some pieces.

These comments on design, construction and finishing also apply to small decorative pine projects such as spice cabinets, letter boxes, spoon racks, stools and picture frames.

Solar Kiln

Boards emerge bright, check-free

by Paul J. Bois

Curtis L. Johnson of Madison, Wis., has designed and built a sun-powered kiln for drying small quantities of furniture-grade lumber. His kiln is slower than a steam kiln (*Fine Woodworking*, Spring '77), but it is gentler. The boards emerge bright and clear, with virtually no checking.

The kiln is an insulated, stud-framed wooden box that measures 10 ft. wide and 12 ft. long at floor level. It holds 800 bd. ft. of lumber in two stickered piles. The south wall slopes 40° from the vertical and is enclosed by storm windows of single-strength glass facing solar collector panels. Each collector consists of a flat box whose front is sheet metal painted flat black and whose back is a sheet of hardboard. An air space of 1-1/2 in. separates the glass from the collectors. The bottom of each collector is vented and the top is open.

Johnson piles the lumber in equal stacks, well stickered,



Solar panels on Johnson's kiln are tilted to catch early morning and late afternoon rays. Small door gives access to rear of solar collector, large door to stickered lumber.

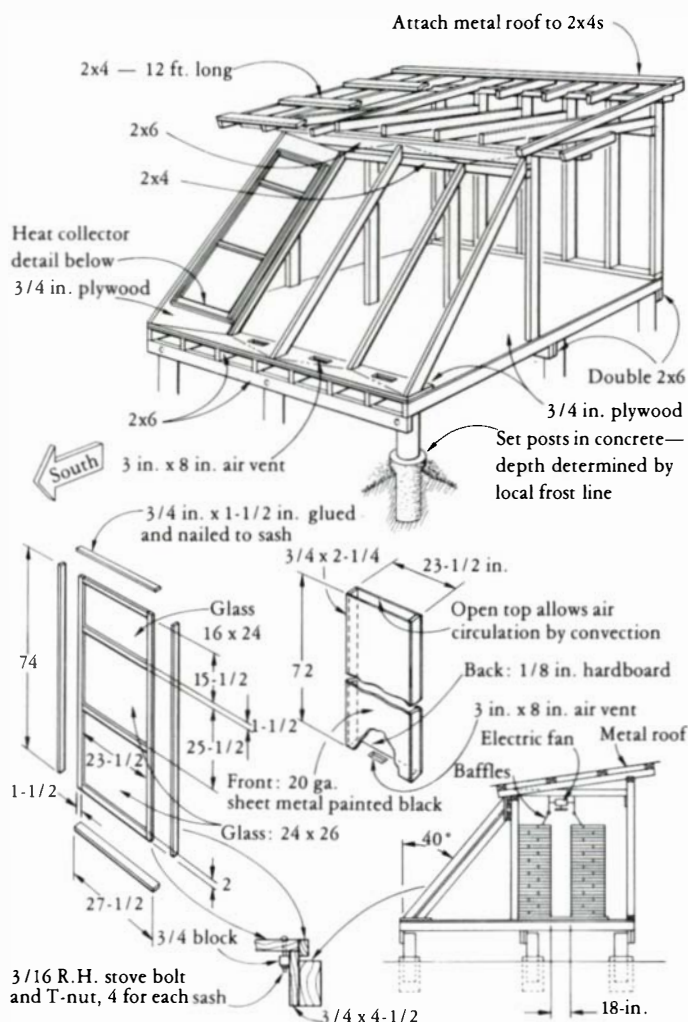
leaving a central plenum 18 in. wide. Two overhead fans, spaced evenly atop the 8-ft. load, each deliver 1,200 cubic feet of air per minute into the plenum. Hinged baffles hanging from the fans ensure that all the air is driven down between the two stacks and out between the stickered boards. A thermostat turns on the fans when the interior temperature reaches 80° F. Two floor vents, each 4 in. by 10 in., admit outside air to the central plenum. The vents are screened against rodents and can be gradually closed as drying progresses, to keep the relative humidity as low as possible.

The sun heats the kiln as high as 130° F in summer and 90° F in the Wisconsin winter. The temperature climbs as the moisture content of the lumber drops below 20%, because evaporation is slower and its cooling effect is less.

To monitor the drying, Johnson cuts a sample from a representative board, weighs it, dries it in an oven and reweighs it. This allows him to calculate the initial moisture content, and he repeats the process throughout the run. Drying time depends on species, initial moisture content, thickness, season and latitude. Madison's latitude is 43° north.

On July 15, 1975, Johnson loaded a green stack of 4/4 cherry at 60% MC and a stack of 4/4 white oak that had been air dried to 15% MC. Fifty-two days later, the cherry had dried to 6% MC and the oak to 7-1/2% MC. The following July 14, he loaded the kiln with 2x4 cottonwood studs at 130% MC and 4/4 black walnut at 85% MC. After 47 days of excellent drying weather, moisture contents had reached an average of 10% and 12%, respectively.

Johnson figures that about 80 summer days will dry most hardwood species from green to 8% MC or less. These figures assume 70 days of sunshine, or 400 hours of direct sunlight. Winter drying takes longer, from 150 to 200 days. A load of mixed green and air-dried stock will dry only at the rate of the green stock, but a full charge of lumber that has already been air dried to 15% MC will dry considerably faster.



This article is taken from *Forest Products Utilization Technical Report No. 7*, by Paul J. Bois, a wood drying specialist with the U. S. Forest Products Laboratory in Madison, Wis. The report is available from FPL.

Carving Fans

Reproductions gain richness, authenticity

by R. E. Bushnell

One characteristic of Queen Anne, Georgian and Chippendale furniture is the use of fans and shells as decoration. These are often found on the central drawers of highboys, lowboys and secretaries, on crests and knees of chairs, and on smaller pieces like mirrors and pipe boxes.

The addition of such carvings can make your reproductions more interesting and add richness and authenticity. Such forms are easy to carve and require only the minimum in tools and equipment.

Described here are the tools required and the procedures to be followed in making the simple convex fan and the more complicated concave-convex fan.

Convex fan

The first step is to lay out the form by drawing a base line on the item to be carved. This is generally 5/8 in. to 1 in. above the bottom of the board. Next, with proper proportion in mind, determine the overall size of the fan and mark the midpoint or center on the base line. From this point draw a half circle with the compass and erect a bisecting perpendicular center line.

Determine the approximate size of the rays desired, and with this as a starting point, use the dividers or compass to mark off the half circle into equal segments, by trial and error. Now, at the midpoint on the base line, draw a second and much smaller half circle. If you are making a drawer, the knob will be located at the center of this circle. Using a ruler, connect the equally divided marks on the outer circle with the midpoint on the base line and draw a line from each mark to

the inner circle line.

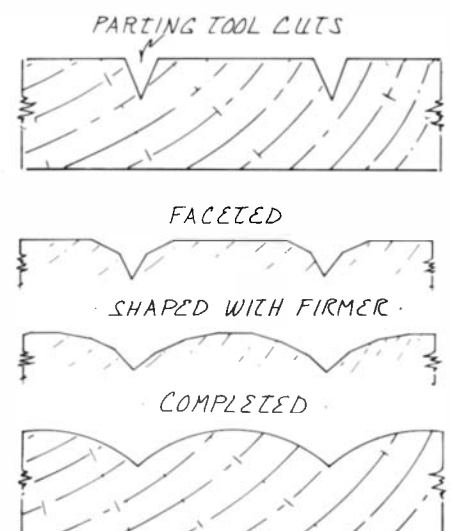
To start the actual carving, clamp the board to a working surface. Use a jackknife to outline the outer circle, making several passes until the cut is about 1/8 in. deep. Be sure to make these cuts exactly on the circle line. With the parting chisel, start precisely at the inner circle line and follow each ray line to the outer circle. Put considerable downward pressure on the chisel as the outer circle is reached to avoid making nicks or chisel marks beyond that point. Do the same when using the firmer chisel later on. About three passes with the parting chisel should do. If you wander slightly on the first pass, don't worry, as this can be corrected on the succeeding cuts.

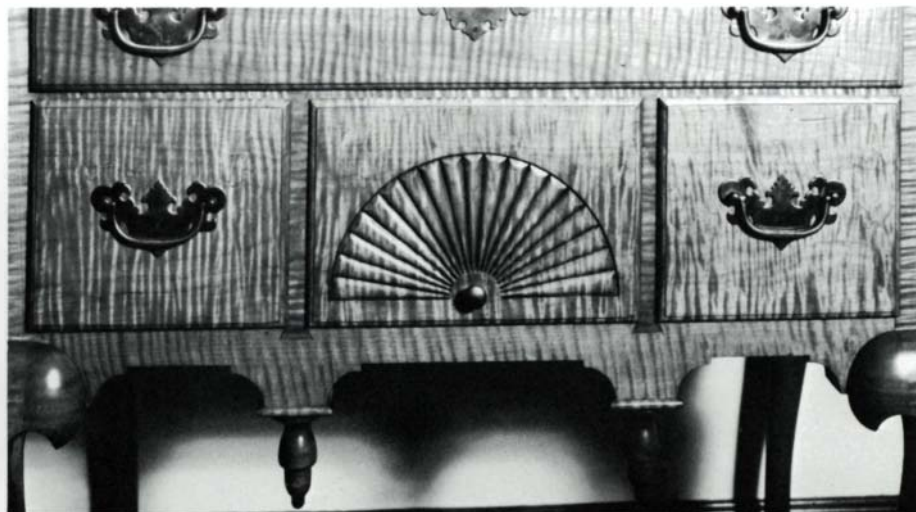
If you do not have a parting chisel, you can use the jackknife to cut exactly on the ray lines before making the successive rounding cuts. Further, 1/4-in. and 1/2-in. cabinet chisels can be used in lieu of the 6-mm and 10-mm firmers.

With all the ray lines delineated, start rounding each of the rays with the 1/4-in. or 6-mm firmer chisel. You don't have to worry about grain direction with the two nearly perpendicular rays on each side of the center line because you are carving across the grain. As the rays progress downward, however, the grain direction must be carefully watched: one side of the ray will be carved from the inner to the outer circle; the other side of the same ray will be carved from the outer to the inner circle.

It is easiest to start each cut by inserting the corner of the chisel down to the proper depth with a shearing or slicing cut. Complete the rounding by making successive passes with the

Photo, cross-section drawing show sequential steps in carving of simple convex fan.





Author uses 6-mm #7 gouge to hollow concave portion of concave-convex fan. Simple convex fan enhances author's reproduction of Queen Anne lowboy, circa 1750.

chisel, each pass progressively less steep than the preceding cut until the form is as round as possible.

Each ray can now be smoothed by lightly scraping with the 1/2-in. or 10-mm chisel. If you own rifflers, these can also be used in the smoothing process.

To finish off the ends of the rays, draw a third circle about 1/8 in. inside the outer circle across the end of each ray. With the 1/2-in. or 10-mm chisel, make a sloping cut from the third to the outer circle. Sand the fan first with 100, then 150, and finally with 220 garnet paper before applying the finish.

Concave-convex fan

Slightly more complicated and time-consuming is the concave-convex fan. This is more than compensated for, however, by the added richness it conveys.

To make this fan we need three more chisels: a 2-mm firmer chisel, a 3-mm veiner and a 6-mm #7 gouge. Unlike carving the simple convex fan, it is not possible to substitute cabinet chisels.

The concave-convex fan is laid out in similar manner to the convex fan except that an odd number of rays is required to make the alternating concave-convex pattern. To accomplish this, determine the approximate size of the rays desired.

Then, by trial and error, use the dividers or compass to mark off the circle into equal segments. Start with the convex center ray, since it must be centered over the perpendicular line.

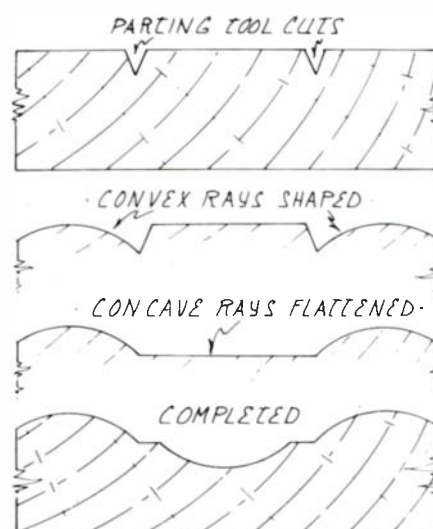
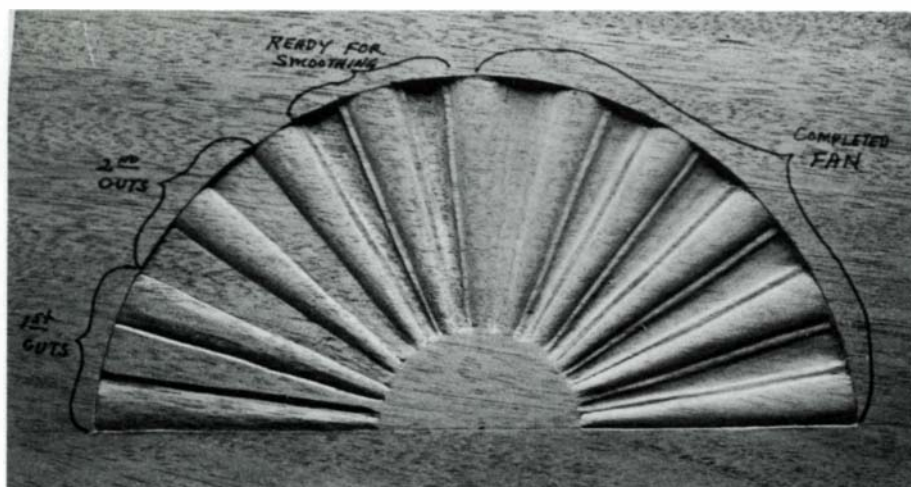
Carve this fan exactly as the convex fan but incise the outer circle only lightly with the jackknife to delineate the circumference. After the convex portion of the fan is carved, begin carving the concave portion by flattening every other ray. Use the 2-mm firmer chisel at the inner circle, followed by the 6-mm firmer as the rays widen toward the outer circle. Incise the outer circle quite heavily with the jackknife where each of the flattened rays ends.

When all alternate rays are flattened, start hollowing the flattened rays, beginning with the 3-mm veiner, followed by the 6-mm gouge. When cutting the concave portion, leave a shoulder approximately 1/32 in. wide on each side of the convex ray. You should do this by eye only, so work carefully. Be sure to work only with the grain, as the carving can easily be ruined at this point.

Judicious scraping and sanding will complete the carving.

Reg Bushnell is in charge of antique restoration at Old Sturbridge Village in Massachusetts.

Concave rays are outlined, flattened and hollowed after the convex portion has been carved.



Bending a Tray

An experiment with lamination

by Jere Osgood

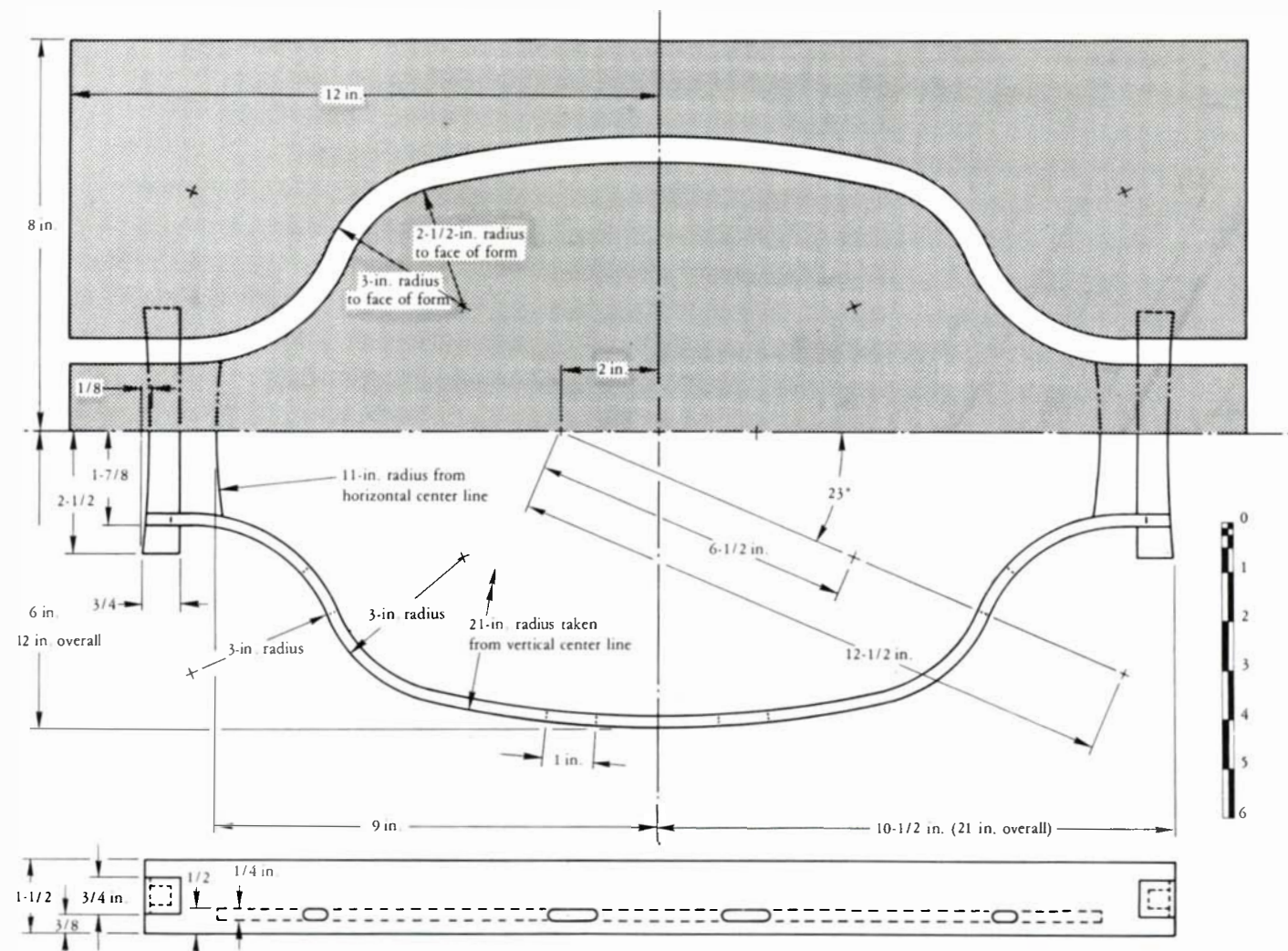


The serving tray described here is designed to introduce the woodworker to bending a simple lamination. The project is small and easily modified to suit your own taste, yet making it will give you the experience you need to apply the process to your own work. It can be made entirely with hand tools and clamps, although a table saw and a band saw or jigsaw are a great help.

The tray is symmetrical and combines a plan view of the work with the form layout. The curve is constructed by swinging a series of arcs with the centers and radii shown below. The important thing in making any two-part form is taking accurate account of the full thickness of the laminates and form liners (*Fine Woodworking*, Spring '77). Because the curve of this project need not be absolutely precise, I have simplified the drawing process by using the outside line of the

bent side as the face line of the concave half of the form. This means accounting for the total thickness of the liners on the convex half of the form. Where you need precision, you would construct the form drawing by dividing the total thickness of the liners, half on each side of the piece itself. In any case, you need a full-size shop drawing from which to make the form.

The bottom panel of the tray, shown in the photo at the top of the next page, does not lend itself to solid wood construction and is best made of good-quality plywood; I used 1/4-in. birch ply. The handles are of walnut and the sides are four laminations of 1/16-in. mahogany. This thickness turns the 3-in. radius well and the four layers are enough to minimize springback. Commercial veneers of 1/28 in., 1/30 in. or 1/40 in. could be used, but they are not the best because they



often acquire lumps and bumps during glue-up. If you can't find thicker veneer, you can saw it from an 8/4 board on the table saw, using a hollow-ground planer blade or a carbide-tipped blade. Resawn stock might require five thinner layers to produce the 1/4-in. thickness, because it does not always bend as easily as sliced veneer.

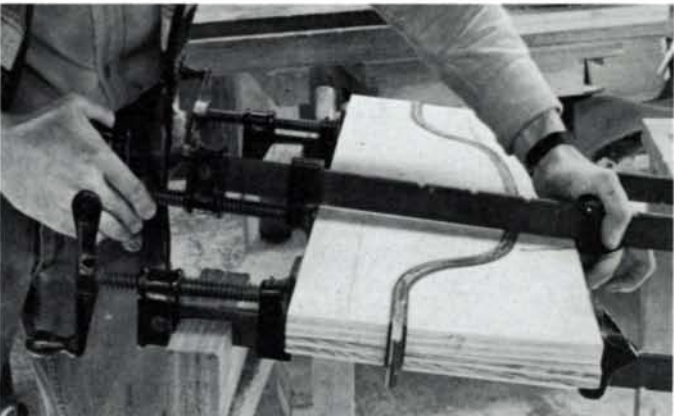
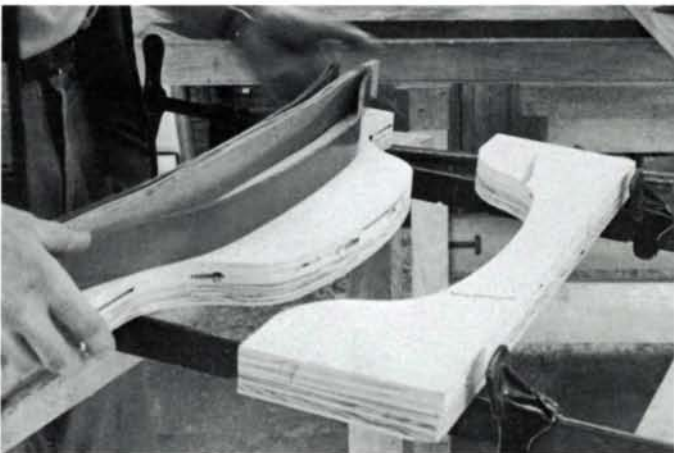
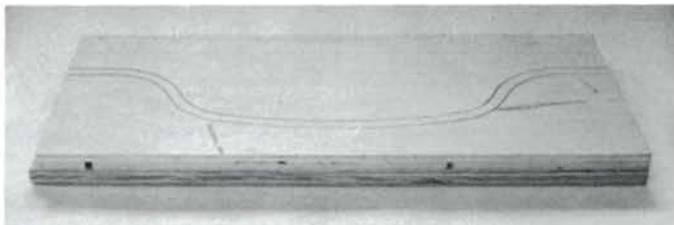
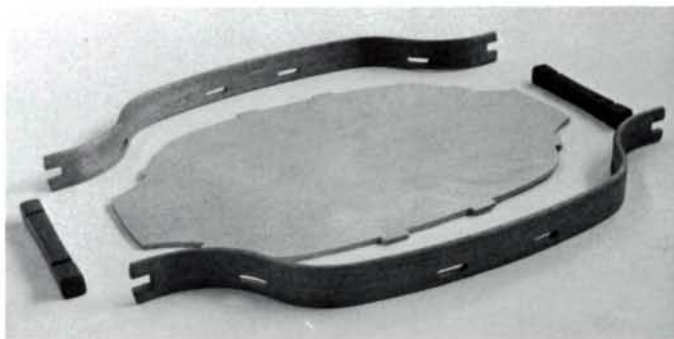
To line the form I used four layers of 1/16-in. Formica, two on each side of the laminates, and the package totaled 1/2 in. You need to prepare your stock and form liners and measure the package before you can draw the line for the second half of the mold. Instead of plastic laminate liners, you can use an extra layer of veneers, springy metal, or, for shallow bends, Masonite. But if the material is bondable remember to insert paper or to wax the liners, or the whole business might just stick together.

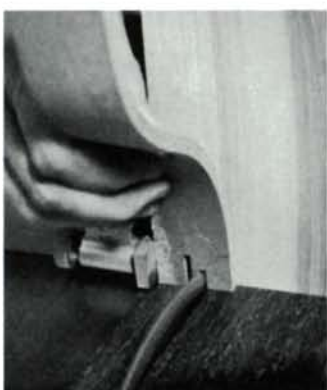
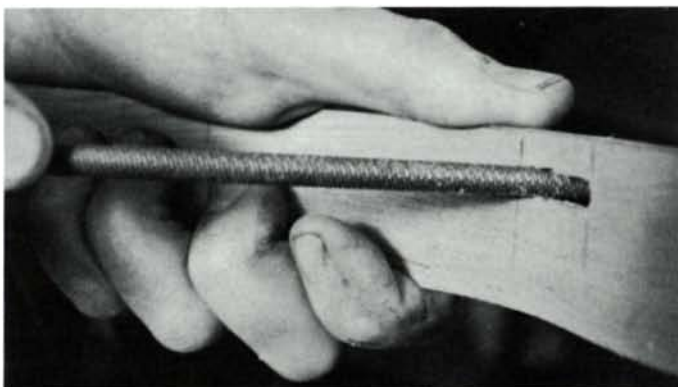
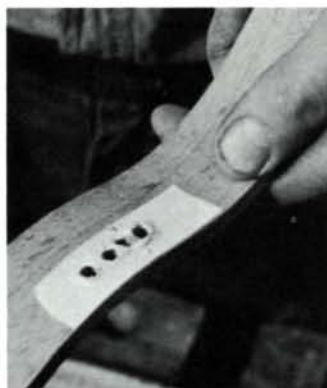
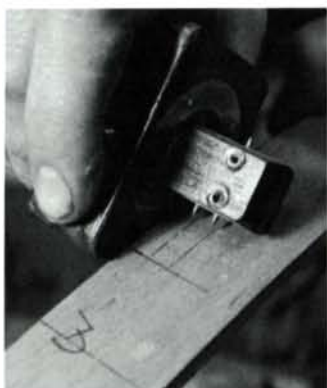
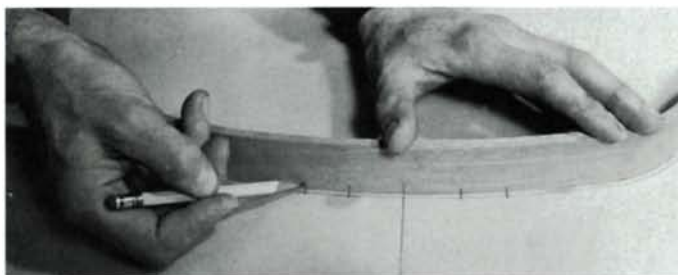
The form shown at right, bandsawn but with the waste left in place for the photograph, is made of two layers of 3/4-in. veneer-core plywood. You could use particle board, a stack of Masonite, or even 2x10 lumber. But it is better to avoid solid wood with a strong grain pattern because the band-saw blade will track off the pencil line with variations in the density of the wood. Make the form as thick as the finished height of the bent sides, in this case 1-1/2 in., and make the stock to be bent a little oversize, perhaps 1-3/4 in., to allow for misalignment in gluing.

The glue I used was American Cyanamid's Urac 185, which is excellent for laminating but unfortunately is sold only in industrial barrels. You could use Weldwood plastic resin glue or Cascamite, both of which resist water, or even Franklin's Titebond (yellow glue) if you don't mind a little springback when the wood is removed from the form. But avoid white glue as it doesn't resist water and it creeps. Arrange the form on the clamps as shown, and double-spread each glue line with brush or roller. With the stock and liners in place, alternately tighten the center clamp and the two end clamps to bring the two halves together. A little glue should squeeze out all along each glue line. Tap the form with a hammer to keep everything aligned in the same plane. When doing any kind of laminating leave the clamps on overnight, longer if the workshop is chilly.

When both sides are glued and dry, clamp the wood to the convex half of the form, clean off the glue with an old rasp, and use a smooth plane to level one edge, as shown below. Turn it over so the finished edge rests flat on the bench and rasp and plane away whatever sticks up above the form to reach finished width.

Now carefully mark off and cut the sides to length. The tray bottom is held in the sides by four tabs in mortises, and the mortises are a little wider inside than outside. One mortise on each side will have to be pared at assembly in order to





snap the bottom into place. The easiest way to lay them out is to place the side pieces on the shop drawing and transfer the marks, on both the inside and outside, and square them across the wood. The width of the mortise is laid out with a double-pin marking gauge, or a single one set twice; check the thickness of your plywood because commercial stock is noted for being only approximately 1/4 in. thick. The tabs must fit tightly. I used an eggbeater drill with a twist bit to take out the waste, starting with the two end holes and then the ones in between. Use a bit a little smaller than the tab thickness because the holes may wander and it is easy to clean up to size with rattail and straight files. Put masking tape on the back before drilling—it will minimize splitting.

This joint is a through mortise and tenon, and I made the ends of the tenon flush with the outer surface and sanded all the edges slightly round. There are variations. The mortise could be squared off instead of being left round from the drilling, or the plywood tabs could be extra long and pinned with a tiny wedge to emphasize the joint. Or the tabs could be eliminated entirely by fitting the bottom into a shallow groove cut all around the sides with a scratch-stock.

The other joints to be cut in each side are the slots for the handles. I made them 3/8 in. wide and 3/4 in. deep, cutting the sides with the piece held vertically on the table saw and then chopping the ends with a chisel. Then I used a small spokeshave to round the top and bottom edges of the side pieces to a radius of about 1/8 in. It is best to put a radius on an edge like this, to accommodate wear.

I cut the matching dadoes in the handles (bottom photo) while the stock was still square, taking care to get a good fit as there is not much area for long-grain gluing. Then I rasped the handles slightly concave to give a better feel to the hand.

The next step is to lay out and cut the plywood panel. The way to deal with variations in the side curves is to fit the sides and handles together. Place the assembly on the plywood, and carefully trace around both the inside and outside. The plywood piece is 18 in. long and the arc on each end is swung from a center 11 in. away.

Since the tray is small enough to be easily picked up, both the top and bottom should be sanded and finished carefully. Start with 80-grit on the plywood and 50-grit on the solid parts, and sand through 120-grit and 220-grit on all surfaces.

The plywood bottom should be finished with lacquer or polyurethane to resist food and drink, and the sides and handles with oil to resist knocks and chips. I'd recommend putting masking tape on the tenons and finishing the plywood before assembly, and rubbing on the oil after assembly. If you put lacquer or polyurethane on the sides and handles as well as the bottom, do it before assembly. But mask all the spots that will have to accept glue.



Two Meetings

Woodworkers compare notes

by John Kelsey

About 100 woodworkers from the Canadian provinces of Nova Scotia, New Brunswick and Prince Edward Island met in Halifax, N. S., on April 16 and 17 for a workshop. It was a most interesting and informative weekend.

Topics included jigs for power tools, building power tools, turning, finishing, drawing and design, lumbering and kiln drying, and starting a woodworking business. The group saw slides from a forthcoming book about contemporary Canadian furniture and of innovative woodturning by Stephen Hogbin of Caledon, Ont. Except for Hogbin, all the workshop leaders were local craftsmen. A few tips:

—Deryk Jones, a furniture conservator for Parks Canada, says the most reliable moisture meter is the palm of the hand. Crosscut the board in question and place the palm on the end. If it feels cool, it is too wet.

—Wilf Boutilier assumes all his machines are wild animals eager to maim his hands. This makes him very careful—and his hands, after 50 years in the woodworking business, have no scars at all. When using the spindle shaper, he wears a plywood apron against the chance that a three-wing cutter might break apart.

—Oner Kesebi, woodworking teacher at Dartmouth Regional Vocational School, advises ripping on the table saw with the blade protruding only 1/4 in. or so above the surface of the board. But crosscut with the blade as high as possible, so the teeth are moving almost vertically when they enter and leave the board. Thus the teeth spend minimum time inside the board. The result is more accuracy and the least tearing out at the surface.

—Peter Zimmer, the conference organizer, uses welder's vise grips to quickly clamp his large assortment of jigs to the work or to tools. When cutting plywood sheets with a portable circular saw, he clamps an 8-ft. length of 4-in. by 1/4-in. aluminum bar stock to the panel as an edge guide.

The weekend was sponsored by the Nova Scotia Designer Craftsmen and organized by Zimmer, 34, an NSDC vice-president. He started work on the project in February and estimates it took about 100 hours away from his woodworking business in Judique, N. S. The registration fee was \$20 per person and the total cost was about \$3,500, with NSDC making up the difference.

Zimmer found the 100 participants by mailing 350 copies of a brochure to woodworker members of NSDC and to area shop teachers. Everyone seemed to think it had been most worthwhile and another conference is planned for next year. The main changes Zimmer would like to make are the addition of smaller, hands-on workshops and the formation of a committee to help with the work. Boutilier summed it up,



The Rev. Jake Brubaker and some of his work.

saying that in all his half century in business he'd never before met a group of people who shared his interests.

Woodturners from all over the eastern United States met in Newtown, Pa., on the last weekend in March, as they had done a year ago (*Fine Woodworking*, Summer '76). The daytime sessions were taken up with demonstrations by master turners, and the evenings were reserved for hands-on turning in the well-equipped George School shop. The conference was organized by the brothers Albert and Alan LeCoff and by Palmer Sharpless, head of the art department at the school. They had received almost 400 inquiries as a result of last year's conference and they accepted the first 50, charging each person \$50 to attend. This generated enough travel and hotel money to import Stephen Hogbin from Ontario, bowl turner Bob Stocksdale from California and ornamental turner Frank Knox from New York City. Another conference is being held in June for some of those squeezed out in March.

Stocksdale (*Fine Woodworking*, Fall '76) probably knows more about the simple silhouette of a bowl than anybody: he's been making variations on that curve every day for thirty years. Many of the turners were startled to see his entire tool kit: two spindle gouges and one skew scraper.

Stocksdale keeps his long-handled gouges very sharp, with a long bevel and a ladyfinger nose. On the outside of a bowl he works from small diameter to large, or foot to rim, in order to work with the grain as much as possible and shear the fibers cleanly. His touch is very light and sure; he never digs in.

This directly contradicts the advice of Peter Child, the English master turner (*Fine Woodworking*, Winter '76 and page 41), who works the outside with long-and-strong tools ground square across, from large diameter to small, or rim to foot. A dual demonstration by Stocksdale and Russ Zimmerman, a student of Child, made it clear that either method will produce a clean bowl quickly. Stocksdale does less violence to the wood, but Child's method requires less dexterity.

The Rev. Jake Brubaker, 79, of Lancaster, Pa., represents the fourth generation of a six-generation line of woodturners. He learned the craft on a treadle lathe at age 4, from his grandfather. Whenever he needs a new tool, he makes it from whatever steel is handy. Brubaker is a Mennonite preacher who, when demonstrating, spends more time telling stories than putting tools to wood. He specializes in delicate little cups and vases, often with acorn lids or pewter inlay. His favorite finish is Qualatone padding lacquer from H. Behlen Bro., Box 698, Amsterdam, N. Y. 12010. He wipes on one coat, tells a quick story while it dries, then starts the lathe to buff with a wool cloth and to rub on carnauba wax.

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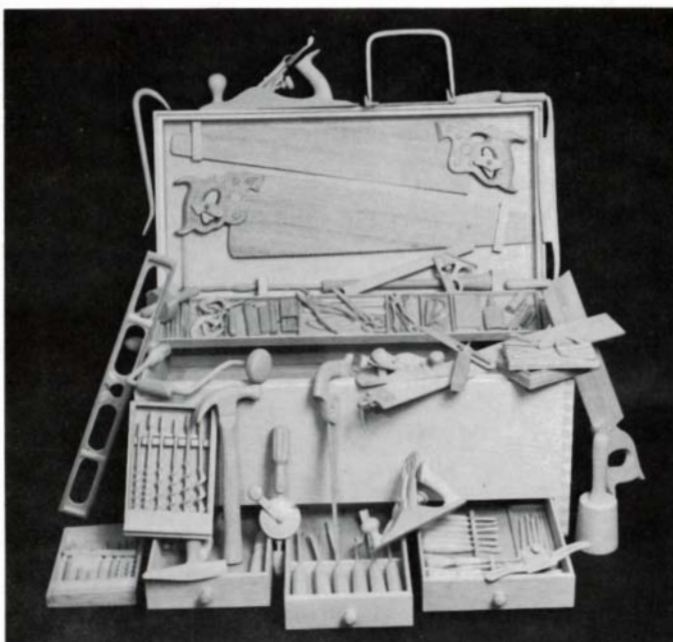
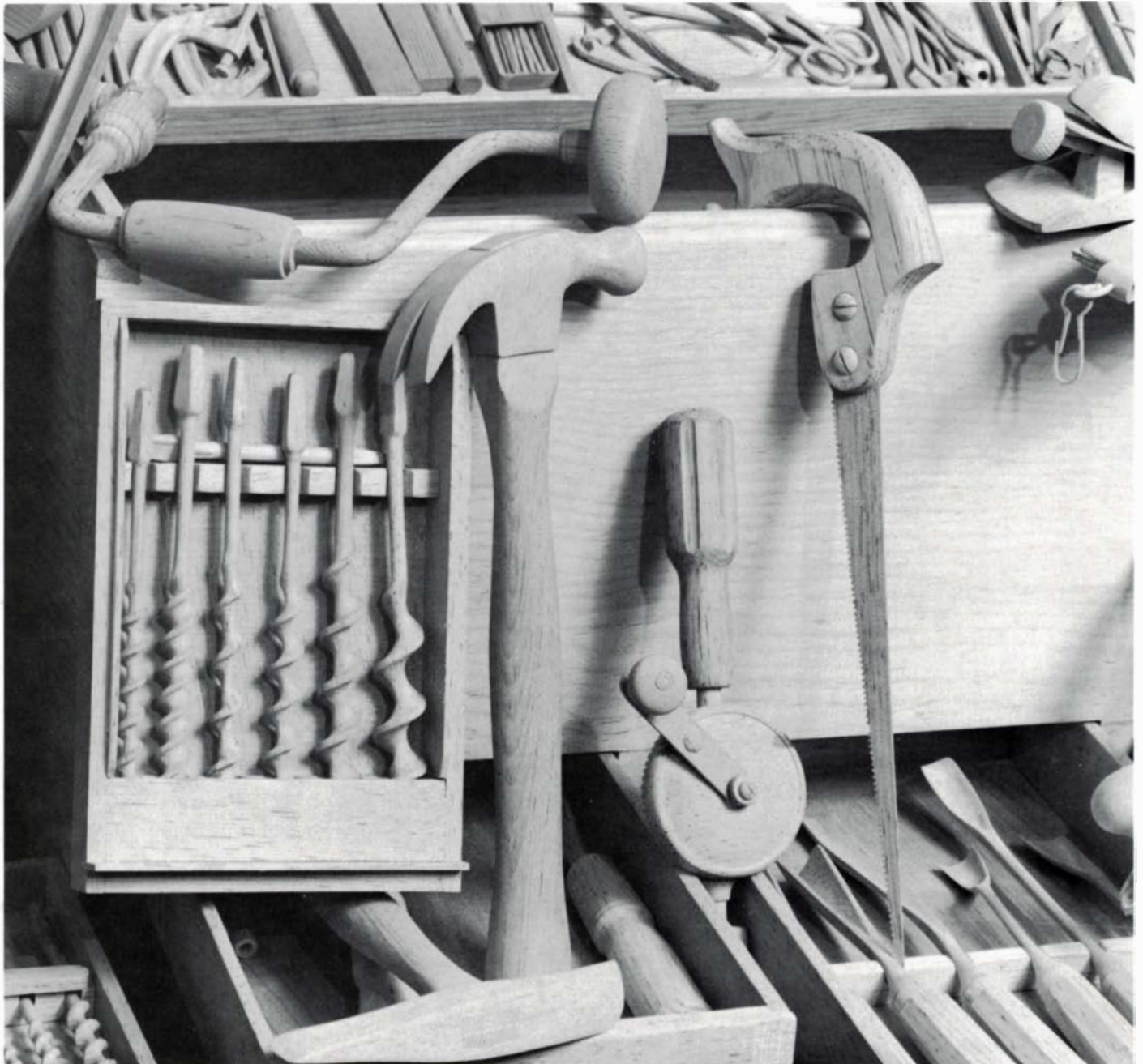
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Carving Tools

The first thing Allan Adams ever whittled was a pocket knife. Then he whittled twigs—he'd find a nice one, and whittle and paint another to match. When he went to the University of California at Davis to be a graduate student in sculpture, he needed a toolbox. So he made one. Then he spent six weeks whittling the tools to fill it. The tools were on display at the recent California Crafts X show in Sacramento.

Adams, 24, works in sugar pine. He bandsaws each piece, trims with his pocket knife, and finishes with rifflers and sandpaper. Now he's reproducing all the tools in his studio—hay forks, axes and adzes, a posthole digger, and his old Rockwell table saw.

The first auger bit took him a whole day to make. The last took 25 minutes. "Each thing has a little trick," he says. "You figure it out and there's nothing to it."

—Alan Marks