Jan./Feb. 1986, No. 56, $3.75

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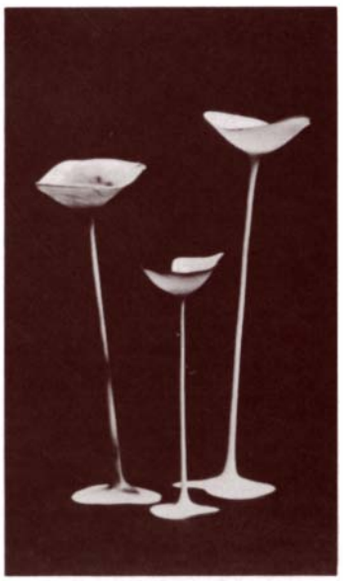
Fine WoodWorking

January/February 1986, No. 56

Cover: Along with brass, wood was a favorite material of early American clockmaker's. On p. 30, Wayne Westphale begins a two-part series on how to design and build a contemporary wooden clock movement.



These delicate goblets by Del Stubbs were among work shown at last October's woodturning conference at Arrowmont School of Arts and Crafts. More photos and a report appear on p. 64.

Stenciling may be a forgotten art but it isn't lost, as Beau Belajonas explains on p. 43.

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Departments

Articles

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Thank you *Fine Woodworking* for a thoughtful issue No. 55. I can't help but write down some thoughts myself on where we've come from and where we're going, especially after reading Glenn Gordon's great article on Jim Krenov.

Gordon mentions Soetsu Yanagi's *Unknown Craftsman.* The industrial revolution turned the spotlights on and focused them at us craftsmen saying: justify yourselves. . . you can no longer work from sheer necessity because you have been undersold. Maybe the industrialists were hoping we would be blinded to the essential fact of craftsmanship: the quality is real. No piece of manufactured furniture could ever hold a candle to my simplest piece. And no matter how much hype industry lavishes upon its output, even the most uneducated can tell the difference instantly.

So for now, I will continue to build what I most enjoy: primarily 18th-century American furniture of the highest quality. I build it for those who value antiques, but couldn't dream of owning a real John Goddard or John Seymour piece. If my pieces are twice as expensive as the manufactured alternative, my clients are getting a hell of a deal. Those people are worth starving for. *—William Thomas, Hillsboro, N.H.*

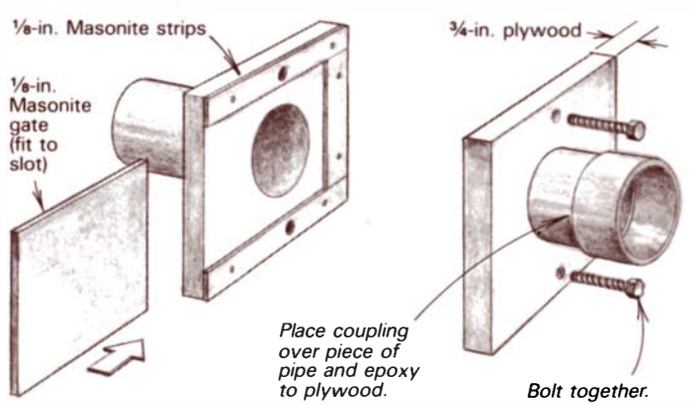
Re Gordon on Krenov: I know there must be a place for combining the thoughts of woodworkers, Mao Tse-tung, Sun Yatsen, Madonna, *The Police Gazette* and the now defunct *Berkeley Barb.* But give us a break. *—Bill Stankus, Bayside, Wisc.*

In reference to the moisture meter article in *FWW* #53, the availability of U1 (LM308N OP AMP) did not exist in our area. I substituted using SK9167/938M recommended by a local electronics parts store. Also, capacitor C2 caused oscillations in the circuit, possibly because of the OP AMP substitution used. I moved C2 across the probe connections instead, which no longer allows an oscillation path.

My meter works great and I hope these clues will help other readers with this project. *—Paul Stoffel, Madison, Wisc.*

The biggest problem with the mositure meter is getting the probe out of hardwood without bending the pins. An improved probe can be made by fitting a slide-hammer-type automobile dent puller to the Plexiglas rod. The rod can be drilled and tapped to take the threaded end of a lightweight dent puller, available from most auto supply stores for less than $10. *—H.C. Yoke, New Haven, Conn.*

In reference to William Harrison's article on dust collection in *FWW* #52, here's another idea. The system I installed in my shop has a collector rated at 450 CFM at 7-in. static pressure. The ductwork is PVC drain pipe, available at home building retail stores. I found the various fittings (couplings, Ys, elbows, etc.) adequate to complete the system. The drawing below shows the shut-off gates I designed to close branch ducts when not in use. *—Frank Rotella, Somerville, N.J.*



I can answer Paul Sasso's puzzlement at the "why wood, why not plastic?" question (Letters, *FWW* #53). When you paint wood, it no longer looks like wood. It becomes a surface to receive paint, like plaster, or clay, or plastic. Most of us who work in wood do so because we like the looks of wood. It shows an interesting surface all on its own. Plastic is made to look like wood in our culture because people without aesthetic sense think it "looks nice." Plastic can't look nice as it is; it has to look like something else. Painted wood looks like something else. Hence the question ". . . why not plastic?"

My assumption is that in older times, when everything was wood, paint was used for visual variety. Today the situation is different. Wood's natural appearance is appreciated because it is different from plastic and paint. Painting on wood may be a part of our craft's heritage, but it's only a part of it.

—John Lucke, Timberville, Virginia

In the article about wood stains by George Mustoe (*FWW* #55) the pitch is a familiar one: running down pigmented oil stains. Who has the ax to grind, you or the author? You say the aniline dyes are transparent and fade-resistant. But what about blotchy results? I've tried these dyes on many occasions and have always been disappointed. In my latest attempt, I made about 30 tries on a desk and finally gave up. The dyes seem to give a mottled effect, even after sanding with 600-grit sandpaper.

After trying the dyes, I returned to a two-coat system of Benjamin Moore light oak stain followed by a coat of Pennsylvania cherry. The light cherry result is far superior to anything I achieved with aniline dyes. *—W. Sheard, Freeport, N.Y.*

Your magazine is the only high-quality, mass-circulation periodical that represents the innovative and independent woodworking trade. As such, I would like to see the staff exercise greater caution in presenting photographs of people without safety glasses, barefoot or sandaled, wearing loose clothing or jewelry, or any other imaginable safety infraction. Whether a technique is new or old, there is a common thread running throughout any woodworking procedure: safety. Safety first, safety second, safety last.

—Lee Grindinger, Salt Lake City, Utah

I have to wonder how many letters you'll get commenting on Carl Swensson's sandals in his article on the Japanese bench in the September issue. Perhaps he's careful enough around the shop so that he never drops anything; for my part, I'd prefer to have the protection of a sturdy pair of shoes.

—Robert Marcotte, Penfield, N.Y.

CARL SWENSSON REPLIES: I'm very careful not to drop anything or let a chisel roll off the bench. The sandals are worn so that I might quickly slip out of them, should I wish to hold the material with my foot without pressing grit into the wood, which could later cause a nick in a plane blade. I would also like to correct a couple of errors in the article. The head of the screw dog is not flattened as drawn, but sharpened to bite into the wood. Second, for the final finish cuts and most flattening, the plane is moved in one continuous pass starting at the far end, opposite the dogged end of the board, rather than the sequence illustrated. High spots or twists can be addressed separately as with a western plane, except on the pull.

Dick Burrows' article (*FWW* #53) on Carlyle Lynch's measuring techniques missed an important element. Mr. Lynch is far more than just a skillful measurer. He is a teacher who through his extremely accurate drawings, usually with one sheet for method of construction and one sheet for bill of materials, provides a classic textbook for the spare-time dabbler in woodworking.

I believe I can lump myself with many more thousands of your readers who fit into the above category. Retired now, with

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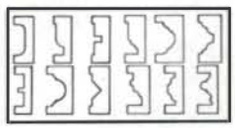

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a fair number of basic shop tools, I still hesitated to tackle the finer projects until last winter when I carefully studied Lynch's drawing of a lady's desk. I discovered that which had seemed so esoteric was becoming clear. This spring, resolved to discipline myself against carelessness and impatience, I jumped in with the saw buzzing. The result: my happy granddaughter received her very own desk. —*W. B. Whitlock, New Kent, Va.*

Mark Berry's "Quilted Mahogany" (*FWW* #54) was a real stopper! This is the kind of article that justifies your conversion to color. Two points, however. Why wasn't Fritz Hoddick's full-length photo of the dresser on the cover? Also, my wife and I would like to express our concern as to Mr. Novak's bounty. If these rare trees can be located, care should be taken to be certain that they are propagated, rather than exterminated.

—*Thomas E. Zumdzinski, Oxon Hill, Md.*

The report in *FWW* #51 on the quality of chisels was intriguing and raised quite a few comments from customers in my second-hand tool store here in England. When I started selling second-hand, and older, tools as a sideline to my furniture-making, I was naive about some older tools. My personal range of chisels included new Footprint and Marples and one old family heirloom—an American paring chisel. The older one kept a better edge, which I assumed was because it was American. Tool customers then started coming back saying, "You know, that cheap old chisel I bought stays sharp much longer than my good new ones, I'll have a few more sizes."

I started trying out older chisels and have tried a lot of them now, having disposed of my new ones. Generally they do keep better edges, often considerably better than any of the new ones. Yes, they can take a bit of minor reconditioning, but it seems worth it.

I don't know what the difference in the steel actually is, though it was made by different techniques from those used now. It could also be primarily in the hardening and tempering process that was formerly used. The same edge-holding ability seems to apply to all the cutting tools.

—*Charles Stirling, Bristol, England*

Over the years that I've been getting your magazine, I've read many suggestions to improve belt sander tracking. These have always been of special interest to me because my Stanley 4x24 sander is one of the poorest tracking machines I've ever used. It constantly needs adjustment. But now if I follow three simple rules, my belt sander tracks like a dream and my belt costs have been reduced by 75%.

Rule 1. I now use resin-over-resin, open-coat, polyester belts, exclusively. They are less affected by heat and humidity, and, therefore, hold their shape better.

Rule 2. I use an abrasive belt cleaning stick frequently, before the belt loads up (and heats up!).

Rule 3. I always remove the belt from the sander immediately when I'm done. I've found that if I leave a belt on my sander for even a short time when it's not in actual use, the belt will never track properly again.

—*Mark W. Smith, Vershire, Vt.*

When cutting small incised letters in wood, I find it's often quicker and more accurate—particularly for jobs where layout is critical—to seal the surface to be cut with shellac or lacquer, and then apply Letraset letters. After shielding the rest of the work and then spraying around the letters with several very light coats of a paint that contrasts with the wood, I remove the letters. I then proceed to carve up to the sharp outline of the paint. Afterwards, a careful cleaning of the surface using fresh sandpaper will finish the job. This method gives woodworkers a wide variety of typestyles and sizes from which to choose, as well as allowing almost all of the time spent to be concentrated where it matters—on the carving.

—*Chris Yonge, Edinburgh, Scotland*

One unique feature of the Joint-Matic was overlooked in your article on new joinery machines (*FWW* #54). In making a tenon, the author cut one face and shoulder and then flipped the board over to cut the opposite face, adjusting the height of the bit several times to "fit" the tenon to the mortise. On the Joint-Matic, you can use the crank to achieve a perfect fit on the first try, not by flipping the stock, but rather by cutting one face and then cranking down twice the diameter of the bit to cut the other face. —*John Rocus, Ann Arbor, Mich.*

Your recent review of the MorTen Jig (*FWW* #54) was of special interest to us. We share your enthusiasm for the product and have concluded negotiations with the inventor for the purchase of manufacturing and sales rights. An improved version of the MorTen Jig will be available from Porter-Cable through our network of professional distributors beginning October 1985. All inquiries will be given the location of their nearest dealer stocking the jig.

—*Rene J. Donars, Porter-Cable Corp., Jackson, Tenn.*

After reading the article "Tight Quarters" in *FWW* #54, you can't imagine how hurt I was in not being called upon as a technical advisor. I consider myself one of the world's leading authorities on the subject. My 1954 Travelo, a 33-ft. travel trailer, has got Mr. Clay beat hands down. Look at the headroom he's got! I had to turn up the sheet metal corners on my fluorescent light fixtures to keep from scalping myself. My overarm router has a knee pedal instead of a foot pedal because it sits on a wheel well. The drill press had to be located under a ceiling vent. My 17 machines and I are quite comfy, but I have to go outside to end-over-end stock more than 8 ft. long. A woodstove? Come on. Even cramped woodworking is better than no woodworking. —*Steve Borgatti, Hornbrook, Calif.*

I enjoyed Richard Walker's drill chuck reconditioning article in the July/August issue. I recondition several hundred Jacobs chucks each year and I still got some good pointers from him.

My reworking operation includes sanding out major dents and scratches, removing oil and grease, rust removal and plating to prevent future rust. Light grease is used for lubrication rather than oil. The five-piece sets of jaws and split nuts are not interchangeable with other sets. If your readers decide to rework two or more of this type of chuck at the same time, the jaw/nut sets must be kept together and separate from others throughout reconditioning. I would be willing to bet other makes are the same way. If these parts are mixed, prepare to spend your next vacation trying to get your chucks together again. —*J. Tom Tilson, Lima, Ohio*

Re Dick Boak's answer about gluing guitar bridges in *FWW* #53. His answer is misleading in two respects. The question is what glue is best, not what glue is used in the factory. The factory has its own production and labor problems and must do things that will benefit its work. Factory methods may very well produce acceptable results, but this is not to say that factory methods produce the best results.

The glue between a bridge and soundboard must transfer sound or vibrations between the two, be it a piano or guitar. The glue must be a hard, or even brittle, material such as hot hide glue, resorcinol or urea-formaldehyde resin. If you use a glue like Titebond, it would, in effect, be like putting a rubber washer between the critical bridge-soundboard joint. You

would be killing the transferal of sound. Also, and just as important, a smooth joint will glue much better and be stronger than one that is roughed up as Boak suggests. I think his tests on roughed-up surfaces are misleading and open to much debate. The best mating of two surfaces is flatness, to allow the surfaces to be brought together without excessive pressure. Hand plane or machine with very sharp tools—dull knives pound, beat, and glaze wood cells. Also, remember that surfaces to be glued should be freshly machined, otherwise the wood will oxidize and impair bonding.

—Bob Russell, Mayfield Heights, Ohio

In the July/August issue, Yosh Sugiyama attempts to distinguish mechanic from artificer from artist-designer from operative from artisan. He wonders who cares, as a woodworker does it all.

Sometimes it makes a difference. When in Japan about ten years ago, I ordered a Buddha carved in American walnut and received it several months later. The United States Customs Service insisted on charging duty because it had been made by an artisan, not an artist. I wrote to the sculptor and obtained his written confirmation that he was indeed an artist, that he had displayed at various shows and won awards, etc. Thereupon, the Customs Service refunded the entire duty charged. Who cares? The Customs Service cares. And I care.

—Franklin Drucker, Santa Monica, Calif

If you want to, you can add another to your collection of means for "artificer". In the horse cavalry, it was the official term for horseshoer and the Army pronounced the word with the accent on the second syllable. An artificer drew more pay than a corporal, maybe $2.50 a day. Before moving on to be Secretary of State in the 1920s and Secretary of War in World War II, the late Henry L. Stimson was an artificer in the New York National Guard, and proud of it.

—John Fountain, Riverside, Conn.

I would be most grateful if your readers could advise me as to any products that can be created from oak staves of whiskey barrels. As a hobby, I produce furniture and recently a local whiskey distillery asked me if I could create any products from their barrels. There has been a recession in the Scotch whiskey industry and, as one result, there is an immense stockpile of barrels.

—Peter Byrne, Inverness, Scotland

To preserve paint and protect it from scum formation, clean most of the paint out of the can's rim with a brush. Seat the lid and with a short piece of 4x4 across it, tap it with a rubber mallet to seal it more firmly. Turn the can upside-down and allow it to sit for 15 minutes, then turn it rightside-up for storage. That brief exposure to the limited amount of air in the can will solidify enough paint to form a bond between the lid and can. The air remaining isn't enough to form a scum.

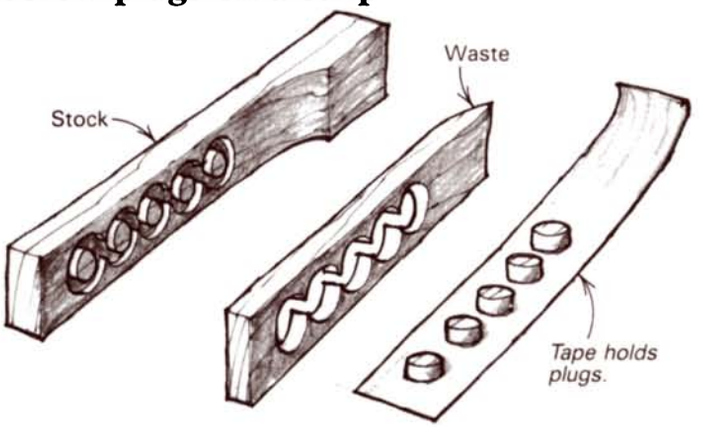
—Carrol D. Kilgore, Nashville, Tenn.

I operate a small furniture design and construction business. I would like to tap into other subscribers' collective expertise on the use of teak in fabricating outdoor furniture for year-round use. Specifically, I need tips about the best type of glue, and how to use it to make furniture that will withstand the rain, snow, sun, heat, and cold of Minnesota.

—Van Cline, St. Paul, Minn.

edited and drawn by Jim Richey

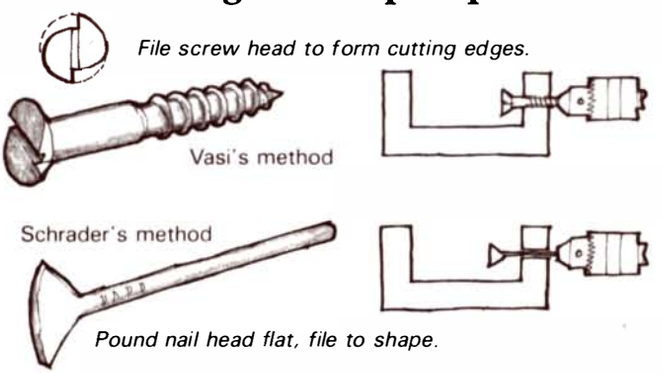
Screw plugs on a strip



After using the plug cutter to cut a row of shallow plugs for screw hole covers, tape the row with masking tape and rip as required with the bandsaw. The result, as shown in the sketch above, is a neat strip of shallow plugs, all with the same grain direction, ready for installation right off the tape.

—Robert M. Vaughan, Roanoke, Va.

Countersinking in cramped quarters



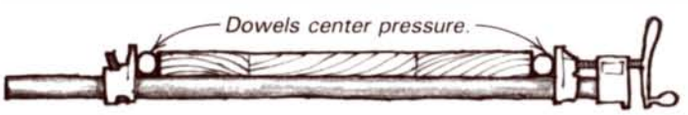
Here's a way to countersink a screw hole on the inside of a small drawer or other cramped space that you can't get a drill into. File both sides of a screw head to produce cutting edges, as shown in the top sketch, above. Insert the screw in the hole from the inside and chuck the screw's threads in a portable drill. A few revolutions will produce a perfect countersink.

—James Vasi, Williamsville, N.Y.

To countersink holes for wood screws when you don't have enough clearance for a drill, flatten and spread the head on a 10-d common nail. File the flat to the proper angle and cut the point off the nail. Poke the nail through the hole from the inside and chuck the shaft in an electric drill.

—Robert H. Schrader, Carrollton, Ohio

Preventing panel clamp-up buckle

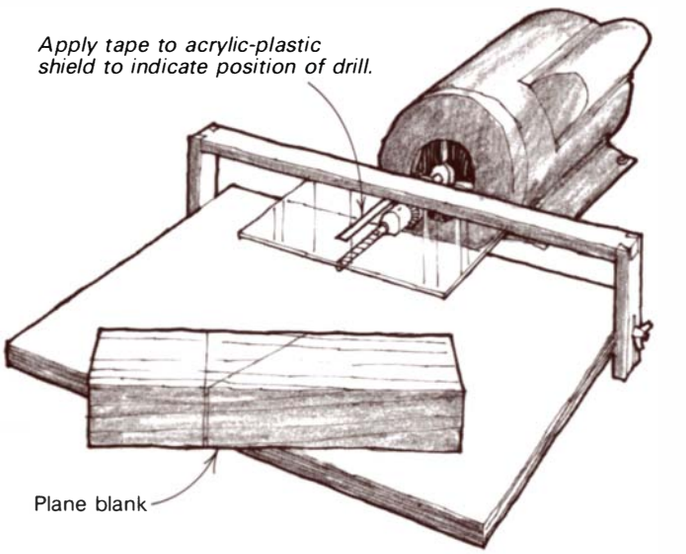


When clamping up boards to make a panel, pipe clamps can ride up on the fixed jaw causing the pressure to be uneven and the panel to buckle. This is caused by the angle of the jaw changing as the pressure comes on. If this bothers you, take a dowel having the same diameter as the thickness of the panel and lay it between the jaws and the work. Now the pressure will be applied on the center of the panel edge just where it should be. The dowel will likely dent the edge, so you may want to add a piece of scrap as a buffer.

—Henry T. Kramer, Somerville, N.J.

Mortising the throat in wooden planes

Although I started woodworking in the usual way—feeding wood to sophisticated machines, sanding, polishing and spraying—after a few years I was really fed up with the dust and dullness of it. Around that time, I chanced on Krenov's *A Cabinetmaker's Notebook.* Needless to say the part on planing caught on with me. From then on the stroke of the plane has been the finish of my work.



I like to make my planes from one chunk of wood. It is an unfounded habit of mine, something akin to an instinct, not to make a glueline where it can be avoided. It is certainly quicker to slice the plane body into three sections, cut the cavity in the middle section and glue everything together again. I have done it but do not like it. Instead I use a horizontal mortiser and the following method to cut the throat into my planes.

First I draw the lines showing the cavity location on all four sides of the plane blank. I remove the bulk of the material from the cavity with a ⅜-in. drill. For this purpose I have made an acrylic-plastic shield that I fit to my shop-made horizontal mortiser. The shield sets parallel to the table just ⅛-in. or so above the plane body. I apply tape to the plastic, directly above the drill, which allows me to "see" the position of the drill within the wood. By aligning the taped outline with the pencil marks on the plane body, I can drill the required holes quite accurately and quickly.

To make the plane's throat, I first drill around the edges of the cavity. Then I waste out the rest, always taking care not to drill too deep. I open the mouth of the plane carefully from the sole with a ⅛-in. drill. Then I clean up the cavity with a chisel and level the plane-iron bed with a float.

—Stefan During, Texel, Holland

Quick tip: Our shaper used to be our main bottleneck, with setup time taking twice as long as cutting time. To solve the backup, I bought six ball bearings—from ¾-in. to 3½-in.—all with a center hole to fit the arbor. The bearings control depth of cut as does a router bit's pilot bearing. By combining the pilot bearings with various cutters and collars, we can now quickly set up for many cuts that used to require interminable fiddling around. *—Craig L. Graybar, West Allis, Wisc.*

Truing muslin polishing wheels

To true the perimeter of stitched-muslin polishing wheels after they get raggedy and misshapen, chuck a Surform sanding disc in your electric drill. With both the sanding disc and the wheel running, carefully bring the disc into contact with the

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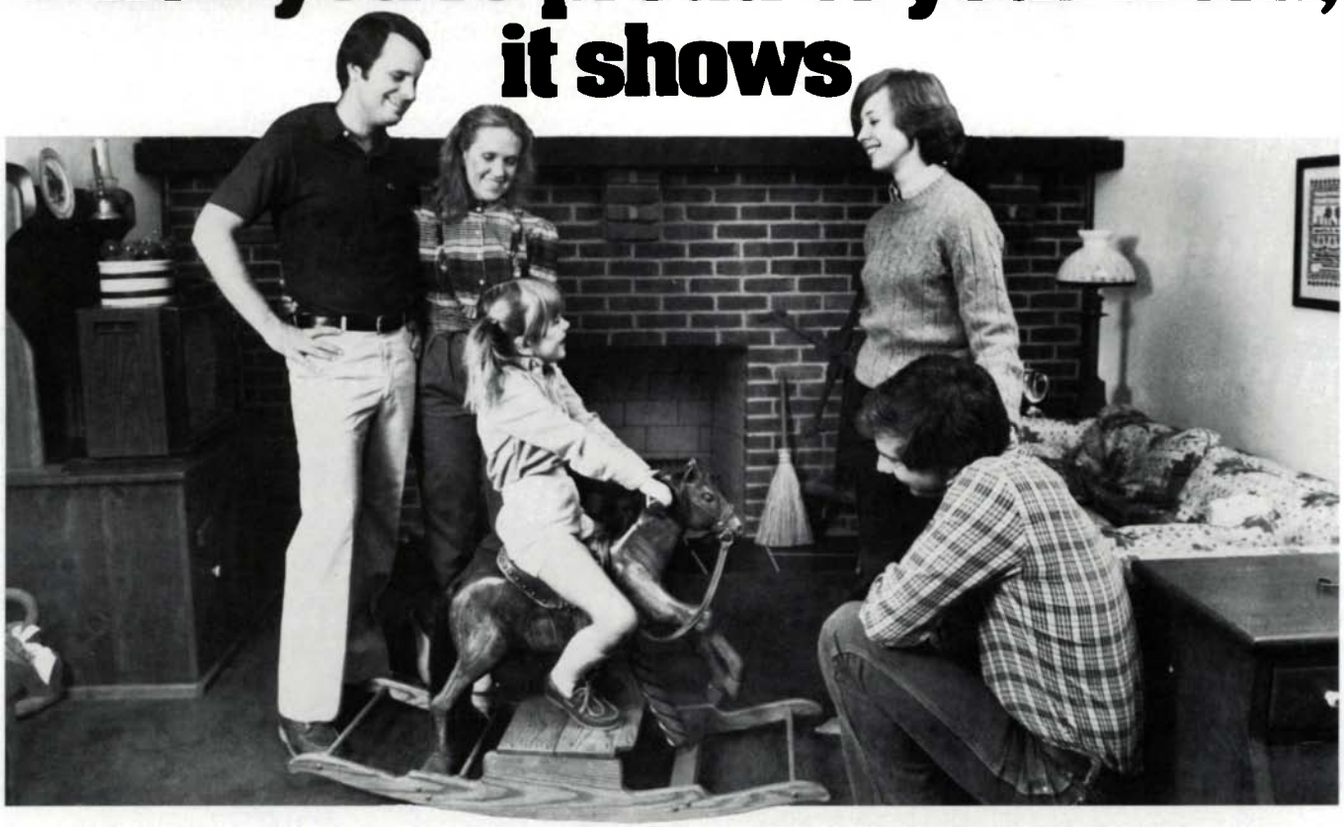

If you're like a lot of people, you seek out hobbies and leisure activities that reflect your personality and creativity. That's why many have found woodworking to be the perfect outlet. It lets you express your creativity from the first time you pick up a piece of wood. From the simplest knickknacks and toys to elaborate wall units and bookcases, it's a hobby where a project's completion is only the start of the rewards.

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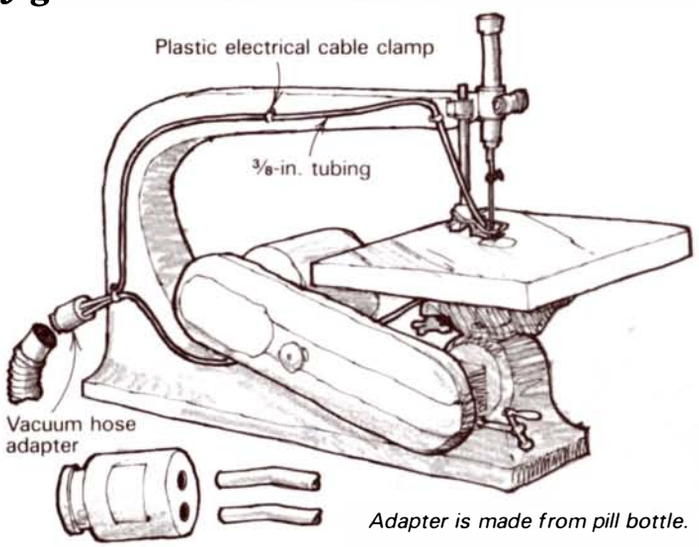
wheel. The Surform's rotation should be opposite to that of the muslin wheel. Apply the Surform in short bursts so that it doesn't overheat. —*W.H. Fowler, Anchorage, Alaska*

Jigsaw vacuum attachment



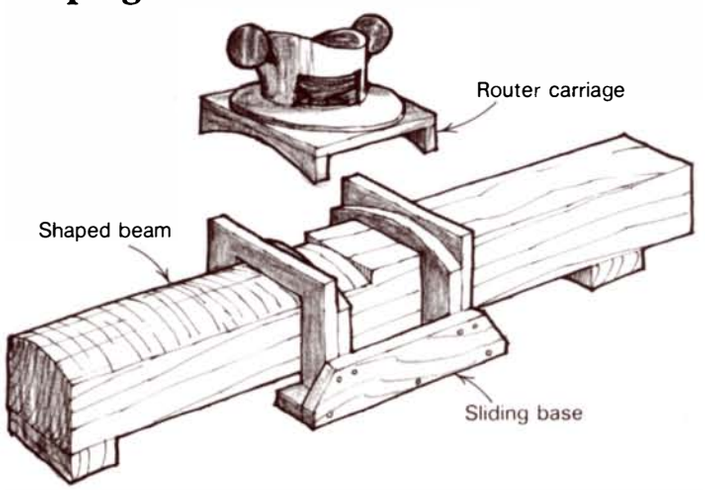
Adapter is made from pill bottle.

In past Methods of Work columns I have noticed a couple of ideas for blowing sawdust away from the cutting line on scroll saws or jigsaws. These methods seem to me to be contrary to the usual thinking about dust collection. On other machines dust is vacuumed, not blown around the shop to light in eyes, noses and motor bearings.

I've solved this problem with a few feet of ⅜-in. flexible plastic tubing, plastic electrical cable clamps, an empty plastic aspirin bottle and my shop vacuum. The aspirin bottle just happens to fit the adapter on the end of my vacuum hose. I attached the tubing to the aspirin bottle with clear silicone sealer. You can form the end of the plastic tubing to point it right where it is needed: Dip the tubing in boiling water for a few seconds and hold it in the shape you want while it cools. This simple arrangement works quite effectively to pull dust away from the work and out of my environment. I plug the saw and vacuum into a foot switch so they operate together.

—*R. J. West, Kansas City, Mo.*

Shaping beams with a router

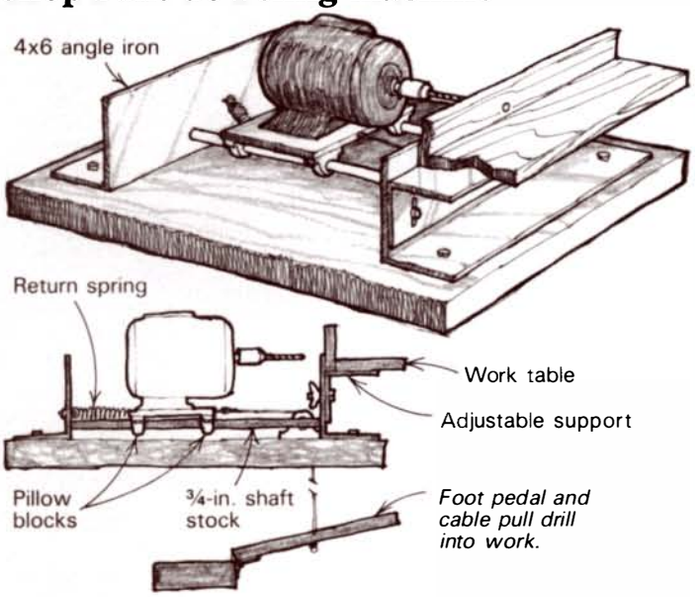


Four years ago my eight-year-old daughter, an aspiring gymnast, pleaded for a balance beam of her own to practice on. Her request required me to find a way to shape the sides of a 16-ft. beam into uniform arcs, so that the finished beam would be as near regulation size and shape as possible. My solution was a sliding jig that guided a router with a 1-in. bit. The jig consists of two parts: the sliding base and the router carriage. Curved rails on these parts guide the router in the proper arc. In laying out the jig you must increase the radius of the curved rails by the amount that the bit protrudes from the router base so that the end of the bit follows the desired finished radius. I recommend you lay out the plan of the jig full-size to verify the correct juxtaposition of beam, cutter and jig.

To use the device, start at one end of the beam and arc the router to and fro as you slide the jig along. The router will let you know how much of a bite to take. The process is slow but accurate. To finish up the very ends of the beam, where the bit can't reach, you can rig up some additional bearing surface or simply use a chisel and plane. —*Burt Babkes, Eugene, Ore.*

Quick tip: When stripping furniture, instead of spending a fortune on sandpaper and steel wool, fold up some old aluminum window screen. —*Richard Tolzman, Excelsior, Minn.*

Shop-built doweling machine



In my one-man cabinet shop I used a doweling jig to drill holes for dowel joints in cabinet door frames and the like. Although I found this procedure too slow, when I went shopping for horizontal boring machines I found them too expensive. Basing my design on a few sketches I made on my shopping trip, I built the machine shown above for about $260, which included $120 of machine shop expense.

The machine consists of two opposed 4x6 steel angle iron sections bridged by two ¾-in.-dia. steel shaft-stock rails. Boring is accomplished by a ½-HP, 1725-RPM motor that slides down the rails on pillow blocks. The sliding action is provided by a low-tech (but effective) pulley, cable and foot-pedal arrangement. A strong coil spring attached to the back of the motor base pulls the motor back out of the hole when the foot-pedal is released. The work table is adjustable vertically, as shown in the sketch, to accommodate different stock thicknesses.

Since the rails must be perfectly parallel I had a machine shop drill the critical rail holes in the angle iron pieces. The machine shop also threaded the rail ends and reworked the motor shaft to accept a chuck.

—*Hjardar Bruun, Ferndale, Wash.*

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

Using plywood for stove wood

One of the many benefits of being a woodworker is the pile of shop scraps I end up with for my woodstove. Alas, the realities of modern cabinetry have made my scraps predominately plywood, particleboard, and fiberboard. What are the health hazards of burning these materials? I know that you should never burn pressure-treated lumber.

—John Fuchs, Ithaca, N.Y.

Michael McCann replies: I advise you not to burn plywood, particleboard, and fiberboard in your woodstove. These materials are made with glues containing formaldehyde, which is released into the air when the materials burn. Formaldehyde is a strong lung irritant and sensitizer which may cause asthma. It also causes nasal cancer in animals and, therefore, is a suspected human carcinogen.

As you mentioned, pressure-treated lumber should never be burned. Burning of wood that has been pressure treated with arsenic compounds was blamed by medical authorities for the poisoning of one family in rural Wisconscin during a recent winter. Burning of other types of treated wood could also be hazardous. For example, much lumber is preserved with pentachlorophenol or its salt, which is applied by brush or dipping. Pentachlorophenol is very toxic both in a single exposure and in repeated exposures, partly due to the presence of *extremely dangerous* dioxin contaminants. It may cause cancer and reproductive damage. Burning pentachlorophenol would also result in the formation of even more of the extremely toxic dioxins.

[Michael McCann is executive director for the Center for Occupational Hazards in New York City.]

Turning sharks into tool handles

Sharkskin is the premium material in Japan for covering chisel handles, and was sometimes used on tool handles on American merchant ships. While full-size sharks may be a litte hard to come by, most saltwater fishermen around here have no trouble catching small dogfish sharks, and their sandpaper-like skins would be good for non-slip handles. Apparently the Japanese tanning methods are quite secret, and I haven't found any method for curing the sharkskin and leaving the rough surface intact. Any ideas?

—Bruce M. Lane, Bedford, Mass.

Gregg Blomberg replies: Dogfish sharkskin is probably just about the right thickness for covering tool handles; I expect the skin of larger sharks would be too thick, so don't worry about not being able to find one. Leaving the rough surface on the outside is no problem (Northwest Coast Indians often used the hide to smooth their carvings), but getting the flesh off the inside of the skin can be tough. Any fisherman can tell you dogfish are hard to skin. The hide of these critters is very well put on and comes off reluctantly.

From the work I've done with sharkskin and other hides, I'd say it really isn't necessary to tan the sharkskin before using it on a tool handle, if you scrape off all the flesh with a knife, or adze-like scraper. After fleshing, the skin will be quite resistant to rot. It will be rawhide, like a drum skin. If you feel better curing the skin before using it, a simple salt soak should do it. Soak the hide in a heavy salt brine for a few days, then rinse it in plenty of fresh water.

Next, I'd experiment with dampening the hide, stretching it around the tool handle and gluing it down with cement or epoxy. If the hide is too oily to glue down, try working it in soapy water. If that doesn't work, try white gas. It won't hurt the skin. Never use heat or hot water, though, or you will cook the hide.

While we have a dogfish in hand, you might also like to try rendering its liver for oil, which is excellent for protecting carvings and handles. The oil never seems to get rancid or gummy, it is light in weight and penetrates well into wood. During World War II it was used by the military for gun oil. To render the liver, place it in a shallow pan in an oven set at low heat, and leave the door open. You will see oil slowly seep out of the flesh. Leave the liver there until you don't see any more oil seeping out. The oil does have a slight, inoffensive fish odor, but it does not seem to get stronger with age.

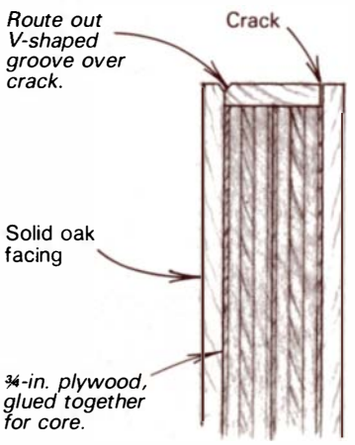
[Gregg Blomberg is a tool maker and owner of the Kestrel Tool Co. in Lopez, Wash.]

Gluing solid wood to plywood

I made a set of exterior doors for a customer last winter. I used two layers of ¾-in. plywood as a core, then covered both faces of the plywood with solid oak, leaving the plywood exposed only on the edges. I covered the edges with a ¾-in. by 1½-in. oak strip tapered to fit snugly between the solid-oak facing. The glue joint looked fine when I released the clamps, but after a few hours I heard a series of pops and cracks. The glue joint on both sides of the strip had let go. What happened and what should I do now?

—Vic Germaniuk, Kaministiquia, Ontario.

Simon Watts replies: You were setting yourself up for trouble when you glued an unstable material, oak, to a stable, rigid core, plywood. The wood wants to move, but the plywood won't let it, and something has to give. Remember that solid wood is always on the move, as it absorbs moisture or dries out with changes in the humidity of its environment. Oak moves more than most species of hardwood, and exterior doors are particularly vulnerable to changes in humidity. In general, you should not try to combine solid wood and plywood in frame-and-panel constructions like this, where you glue one material to another.



Now, what to do? If you can't beat them, join them. Take a router with a pointed V-bit, set up a fence and rout a groove all around the door. This way, what was a crack will appear as a deliberate detail, not as a mistake.

[Simon Watts is a cabinetmaker, teacher, and boatbuilder in San Francisco and Nova Scotia.]

Making a new paint job look old

I am making reproduction candle holders, checkerboards, childrens toys, and the like. How do you make the new finishes on these projects look old? *—E.S. Johnson, Rye, N.Y.*

Robert Mussey replies: You can artificially age paints or lacquers in two ways. The first, sometimes used by manufacturers to produce novelty finishes, is called crackle lacquer. One extremly thick, wet coat of lacquer, either clear or tinted, is brushed on, allowed to air dry, then force dried or baked in a 150°F oven for one to two hours (drying conditions vary from manufacturer to manufacturer). During force drying, the heat sets up stresses in the thick coat, causing wrinkles and a craquelure pattern. Since this process can't be closely controlled, the patterns formed can vary considerably.

The small valleys and cracks formed during the forced drying are accentuated by covering the entire surface with darker glazes (glazes for lacquer are available from Mohawk Finishing Products, Route 30 N., Amsterdam, N.Y. 12010, and Star Chemical Co., Inc., 360 Shore Drive, Hinsdale, Ill. 60521). When the glaze begins to set, wipe the bulk of it off, leaving

the darker color only in the recesses and crackles. The colored glaze is then sealed in with a coat of clear lacquer.

The second way to age paint, lacquer or another coating material, such as shellac, is more complicated and takes a more sophisticated touch. This method, which is closely akin to false graining, uses a colored ground coat, which is then covered with various layers of glaze applied by brush, rag, sponge, feather, airbrush, or spattering, depending on the texture you want. Glazes applied with crumpled paper, rag or sponge produce a finish that resembles leather. Spatters are typically applied by running your thumb over a stiff toothbrush loaded with glaze, but go easy. There's nothing worse that a piece where someone went spatter-happy.

You can apply several colors of glazes, although apply them one at a time, and let each layer dry thoroughly before applying the next layer. While wet, each coat can be partially removed with rags, brushes or feathers to simulate certain effects. Thin glazes on high points of an object show wear, for example, while thick coats indicate dirt accumulation. You can also simulate extra-heavy wear by sanding some areas down to the bare wood. Go easy and sand only those areas where the object would naturally be subject to heavy wear. All the glazes should be sealed with clear lacquer, shellac, or varnish. Usually, a sealer with a satin or flat sheen looks best.

[Robert D. Mussey Jr. is head furniture conservator with the Society for the Preservation of New England Antiquities in Waltham, Mass.]

Beau Belajonas replies: Another way to get a crackled finish is to apply a coat of varnish and wait three to four hours. Then, mix a 1-to-1 solution of shellac and denatured alcohol and apply this mixture over your varnish. As the mixture reacts with the varnish, it will produce uneven cracks and alligator skins. If you want larger cracks, apply the shellac/alcohol mixture sooner. For smaller cracks, apply the mixture later. Needless to say, experiment first on scraps to determine the timing needed to achieve the desired look. It's a quick and simple technique, but it gives satisfactory results.

[Beau Belajonas is a professional wood finisher in Camden, Me.]

Air-dried or kiln-dried for carvers?

I have been carving 8/4 red oak to make 18-in.- to 42-in.-diameter circular medallions for the interior of a local restaurant. The medallions have a raised border and lettering, and a background tooled with concentric circular gouge cuts. My tools are extremly sharp, yet I find it tough going when carving cross-grain on the background. Even a slicing motion as I push the gouge doesn't help. I've been told that air-dried wood is easier to carve than kiln-dried. Should I switch to air-dried wood?

—Robert C. Kinghorn, Excelsior, Minn.

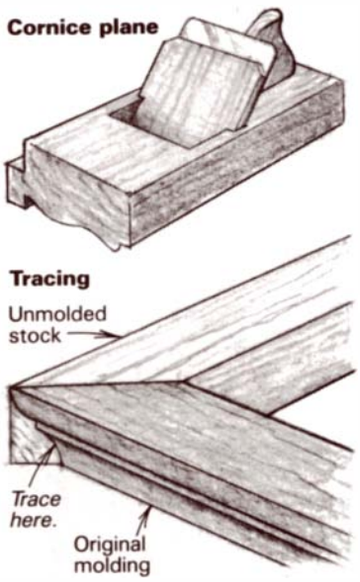
R. Bruce Hoadley replies: Since your medallions will be hung indoors, I recommend you carve kiln-dried stock with about an 8% moisture content. Dry oak, being hard and dense, is understandably a challenge to carve. If you used air-dried wood with a higher (15% to 20%) moisture content, the wood would be slightly weaker and softer, and probably much easier to carve. However, with the air-dried stock, you would run the risk of significant dimensional changes (and probably warping and cracking) after installation, as the moisture content of the medallions dropped to reach equilibrium with the interior environment. For example, a 44-in.-diameter medallion glued up from air-dried flat-grained red oak could shrink as much as 2%. This would mean a ⅞ in. decrease in the perpendicular-to-the-grain diameter. My advice is to continue with the kiln-dried stock and keep your tools sharp.

[R. Bruce Hoadley is professor of wood science at the University of Massachusetts at Amherst.]

Shaping convex moldings

A priest from a local church asked me to reproduce some molding on an old grandfather clock, but I'm a little bit stumped about how to do it. I did the concave section by running the stock at an angle over my tablesaw, but I'm not sure how to get the outside curvature. No doubt the original was cut with some kind of planer or shaper, but I don't have that kind of machinery. Can I do the job with just my 10-in. tablesaw?

—C.L. Ketterer, Zelienople, Pa.



Norm Vandal replies: The molding in your sketch was cut by a cornice plane, which had its sole and iron specifically shaped to cut this style of molding. Repeated passes with the plane removed more and more material until the full molding profile was created. These old planes are scarce collectors' items today. Consequently, only a few craftsmen have been lucky enough to find them at affordable prices.

Making the angled cove cuts on a tablesaw is an effective way to shape the concave portions, as you have discovered. Using different angles, as well as various sizes of sawblades will result in a whole gamut of concave shapes and sizes. Making the convex portion can be equally straightforward. Remove as much material as possible with a series of rip cuts on the tablesaw, then use a block or smoothing plane to bring the shape as close to the finished dimension as possible. After planing, use a scraper to round off the contour, then complete the operation with sandpaper, working progressively from coarse to finer grits.

If you are replacing a portion of molding that abutted a mitered section of an original segment, cut the miter on your new molding stock, then trace the molding shape on the new piece, as shown above, before you try to shape the molding. This trick will prevent you from removing too much material, which will ruin the fit and tempt you to reshape the old molding to fit the new one at the joint. From a conservation ethics point of view, reshaping the old molding should always be avoided.

[Norm Vandal makes period furniture and architectural furnishings in Roxbury, Vt.]

Bandsawing a tight radius

I have a Sears 12-in. bandsaw with an ⅛-in. blade, and I can't cut a tight radius in 1½-in.-thick wood. I've seen products with similarly tight curves at craft fairs, so I know it's possible. Do I need a more powerful motor or would you recommend another machine?

—Jamie Jackson, Tampa, Fla.

Rich Preiss replies: Having used a Sears 12-in. bandsaw many times, I suspect your problems don't stem from the machine or its motor, but rather in your blade selection and guide setup. The Craftsman bandsaw is a very adequate tool and its motor (probably ½ HP) may be slow on the feed, but you shouldn't have any problem contour cutting in 1½-in. stock once the machine is properly set up.

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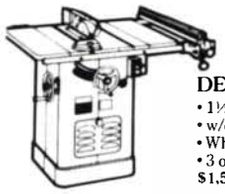

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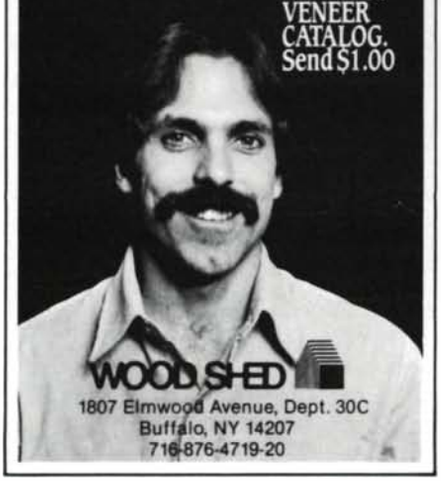

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with 6 teeth per inch. With this blade, you should be able to execute turns with less than a 1-in. radius. Generally, you can cut a radius that's twice the width of the blade or more. Take the time to set all your guides very carefully, as recommended in your owner's manual, and test your setup in scrap stock before beginning work on your project.

Don't force the feed. Let the saw do the cutting, and advance the work at its own rate. For real tight turns, I make a series of relief cuts perpendicular to the contoured line before cutting the curves. This helps release pressure against the blade as you're cutting, instead of letting the wood pinch the blade and retard the cut.

For extremly intricate work, such as marquetry sawing and delicate instrument scrolling, a stationary scrollsaw or jigsaw may be required. These machines are expensive, however, and I would concentrate on tuning up my bandsaw before shelling out the money for an additional machine.

[Rich Preiss is head of the wood program at the University of North Carolina at Charlotte.]

Jim Cummins replies: If you can make the desired tight-radius cut in thin material with your bandsaw, and the problem only shows up in thicker stock, then a more powerful motor will solve the problem. I had the same trouble with my own bandsaw, a 14-in. Rockwell that was equipped with a cheap, non-Rockwell motor when I bought it. I swore at the saw for three years before good advice led me to install an American-made, non-bargain ($180), honest ¾-HP motor. The saw now gobbles up anything I feed it without complaint. The drawback is that I've broken a couple of blades by forcing tight turns, but I'll eventually get used to what can be done.

The Sears bandsaw is a good machine, even with its standard ½-HP motor. I once saw a man use one, with a ¼-in. blade, to cut 8/4 hard maple into a shape with ¼-in.-radius inside curves. How? He pre-drilled the stock with a ½-in. bit to shape the tight turns, then used the bandsaw to lead in and out of the holes. Maybe that's the trick you need for your project.

[Jim Cummins is an associate editor of *Fine Woodworking*.]

Making end grain look great

I am planning to make a small-scale production run of backgammon boards. So far I've found it impossible to sand a really clear, even appearance into the end grain of the Philippine mahogany I am using. Is there any way I can make this endgrain "look like a million bucks?"

—Raymond Frances, Pelham, N.Y.

Tage Frid replies: Your best bet would be to size the end-grain with hot hide glue before applying the finish. I have used this method with good results, and it does not change the color of the wood. You may have to experiment a little to get the knack of mixing the glue to the proper consistency. I mix the glue so that it drops from the brush like honey, then make a more dilute solution by mixing one part glue with two parts of hot water. Sand the end grain as smooth as you can, then brush the glue sizing on hot, say at about 180°F. After the sizing dries for about 24 hours, sand it with fine sandpaper and apply the finish.

[Tage Frid is retired professor emeritus at the Rhode Island School of Design.]

Shellac won't harden

I mix my own shellac for finishing. I begin by making up a 5-lb.-cut solution, then dilute that mixture 50% with alcohol. I apply five-to-six coats, letting each coat dry about 24 hours before sanding and applying the next. The final coat is rubbed out after 72 hours, and waxed a week later. After finishing a tabletop this way recently, I found that brass candlesticks and vases still leave marks on the surface finish, even though it has been several months since the finish was applied. Could the finish still be setting up?

—Mike Santino, Riverside, N.J.

Don Newell replies: The reasons for your finish remaining soft aren't self-evident, but there are a couple of possible answers. First, the dry shellac you're using may be too old to harden completely. Some finishers believe you only have to worry about the shelf life of mixed shellac, but even flake or button shellac in solid form is known to dry soft when it has aged too long on the shelf. Your problem is certainly more than just a matter of leaving enough time for "setting up." That process would be finished when all the alcohol has evaporated from the film, and that certainly doesn't take months, or even weeks, especially if your films are relatively thin.

I would retry my finishing procedure using a new batch of raw shellac. Mix and apply it as before. If this batch dries hard, you will know the original shellac was bad. Another possibility is that your five-to-six coats may produce such a heavy layer of film that the finish can't dry completely. This depends, of course, on how thick you leave each coat after sanding. You might also try applying only three or, at most, four coats, each coat well-sanded, and see if the thinner finish hardens.

Finally, your problem may have nothing to do with the shellac, but rather with the wax you're applying over the shellac. Test your finish without the wax and see what happens.

[Don Newell is a finishes chemist and consultant living in Farmington, Mich.]

Mysterious splotches on ash

I recently made a roll-top desk from some ash lumber I had. The piece looked fine until I applied the finish, then some ugly splotches appeared on the wood. I have never worked with ash, nor had this problem before, and I don't know if I did something wrong, or if it's just a common problem with ash. Any ideas? ***—Earl E. Price, Jr., Monroe, La.***

Jon Arno replies: I have worked with a lot of ash, but have never encountered the kind of problem you describe, so I don't think the species is the blame. I have frequently had similar problems with various species of poplar, such as aspen and cottonwood, and once with a very uneven-grained piece of elm.

I suspect your splotching may be caused by changes in the wood's porosity caused by micro-organisms. One thing that ash, elm and poplar all have in common is that they are not durable when exposed to moisture and are quickly invaded by fungus. A second possibility is reaction wood. When a tree has been bent or otherwise disoriented from its source of light, it will attempt to straighten itself by producing cells that are different in density on one side of the trunk. Boards cut from these sections are difficult to finish and often splotchy when stained. The poplars are notorious for this, but ash is not. The only other possible explanation I can think of is that someone spilled glue or varnish on the wood, sealing the surface and creating a splotchy look when the finish was applied. It seems unlikely that you wouldn't have noticed this type of spill before finishing, though.

All things considered, I favor the the micro-organism theory, especially in light of Louisiana's climate. In your humid area, it is likely that the wood absorbed enough moisture to allow it to be infected by some organism, which changed the wood's porosity. I certainly hope this incident won't cause you to ban ash from your shop. Buy it fresh from the kiln, keep it dry and give it another chance. It's a fine cabinetwood.

[Jon Arno is an amateur wood technologist and woodworker in Brookfield, Wis.]

Send queries, comments and sources of supply to Q&A, Fine Woodworking, *Box 355, Newtown, Conn. 06470.*

RYOBI TOOLS

		List	Sale
S500A	3x5½ Finish Sander	70	41
SU6200	Finishing Sand. ½ Sheet	142	88
B7075	3x21" dustless Belt Sand.	179	116
B7100	3x24" dustless Belt Sand.	208	140
B7200A	4x24" dustless Belt Sand.	269	165
D100VR	3/8" VSR 0-1200 rpm drill	91	49
W640	7¼" 13 amp circular saw	158	99
W740	8¼" 13 amp circular saw	171	109
JS60	Jig Saw-Single Speed	172	99
JSE60	Jig Saw-electronic v/speed	198	123
R150	1 H.P. Plunge Router	138	86
R330	2 H.P. Router	220	138
R500	3 H.P. Router	265	163
E3800	Drywall screwdriver 0-4000	126	79
L120U	3 5/8" Planer	142	89
BD1020R	3/8" 2-spd Cordless Drill w/free holster-Xtra special buy	148	95
TS251U	10" Mitre Box	300	169
SG1150C	4½" H.D. Mini-Grinder	99	59

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0244-1	1/2 drill 4.5A magnum	159	115
0222-1	3/8 drill 3.3A 0-100 rpm	146	99
0228-1	3/8 drill 3.3A 0-1000 rpm	129	95
0375-1	3/8 close quarter drill – NEW – 3.5 amp	175	118
0210-1	3/8 cordless drill – NEW – 2 speed	154	114
6539-1	cordless screwdriver – NEW – 190 RPM	84	64
1007-1	½" drill 4.5A D-Hdle	199	145
1107-1	½" drill 4.5A D-Hdle	204	145
3300-1	magnum rt angle drive kit	249	170
3102-1	Plmbrs rt angle drill kit	263	180
1676-1	HD Hole Hawg w/cse 2 sp	333	235
5395	3/8 sgle sp hammer drill kt	203	150
5397	3/8 var sp hammer drill kit	208	155
5371-1	HD mag. hammer drill ½"	287	207
5373	HD mag. ham. drill 3/8"	240	175
6511	2 speed Sawzall w/case	181	123
6226	port band saw 2 sp w/case	382	280
6234	TSC band saw port w/case	382	280
6385	7¼" circ. saw 13 amp.	159	109
6405	8¼" circ. saw 13 amp.	179	127
6460	10¼ " " 15 amp w/case	349	245
6377	7¼ HD worm saw 13 amp	235	155
6378	8¼ HD worm saw 13 amp	249	185
6165	12" Chop Saw 15 amp 4200 R.P.M.	287	199
6170	14" Chop Saw 15 amp 3600 R.P.M.	289	209
6255	v/sp Jig Saw 3.8 amp	199	140
6245	sgle sp Jig Saw 3.8 amp	175	125
6012	½ sheet HD Orb. sander.	159	110
6014	½ sheet HD Orb. sander.	169	115
5935	4" by 24" belt sander w/bag 10 amp	319	215
5660	1½ HP router 10 amp	256	175
5680	2 HP router 12 amp	314	220
8950	Wet/Dry 8 gal vac 6 amp	145	110

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4901	¼ HP 2.6 amp 24#	159	110
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5041	¾ HP 8.2 amp 58#	379	270

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Item No.	Description	Diam.	Teeth	List	Sale
PS203	Gen'l Purp.	7¼"	24	27.24	17.50
PS303	fine cutting	7¼"	40	32.97	20.50

5/8" Bore — Industrial Grade
CARBIDE TIPPED SAWBLADES

Item No.	Description	Diam.	Teeth	List	Sale
LU72M010	Gen'l Purp.	10"	40	88.58	34
LU81M010	Gen'l Purp.	10"	40	69.30	35
LU73M010	Cut-Off	10"	80	79.65	36
LU82M010	Cut-Off	10"	80	86.40	44
LU84M010	Combination	10"	40	70.99	36
LU84M011	Combination	10"	50	74.51	37
LU85M010	Super Cut-Off	10"	80	110.88	52
LM72M010	Ripping	10"	24	84.85	34
DS 306	6" Dado			139.00	92
DS 308	8" Dado			170.00	105
TR 100	3 blades & Dado set			398.00	255

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Model	Size	List	Sale
2121	1/4	6.40	4.00
2122	3/8	7.00	4.50
2123	1/2	7.80	5.00
2124	5/8	10.35	6.50
2125	3/4	10.95	7.00
2126	7/8	11.40	7.25
2127	1	12.25	7.75
2128	1-1/8	12.75	8.00
2129	1-1/4	13.85	8.75
2130	1-3/8	16.45	10.50
2131	1-1/2	18.15	11.00
2132	1-5/8	21.25	14.50
2133	1-3/4	23.95	16.50
2134	1-7/8	25.50	17.50
2135	2	26.25	18.25
2136	2-1/8	30.50	20.50

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		List	Sale
B04510	Sander	79	43
9900B	3"x 21" belt sander	198	119
9924B	3"x 24" belt sander	188	135
9924DB	3"x 24" b/sand. w/bag	214	130
9035	½ sheet finish sander	79	48
9045B	½ sheet finish sander	158	90
9045N	½ " " " w/bag	158	105
4200N	4-3/8 circ. saw 7.5 amp	152	95
5008NB	8¼ circ. saw 13 amp	178	105
5201NA	10¼ circ. saw 12 amp	348	215
4300BV	v/sp jig saw 3.5 amp	192	120
4301BV	orb v/sp jig saw 3.5 amp	208	125
2401BW	10" mitre saw	329	185
2400BW	10" mitre saw (for vice)	369	248
JR3000WL	2 sp reclp saw w/cse	188	120
JR3000V	vs reclp saw w/case	178	120
6010DWK	3/8 cordless drill w/case	152	89
5081DW	3-3/8 cordless saw kit	195	109
1900BW	3¼" planer w/case	154	82
1100HD	3¼" planer w/case	279	160
3608BK	¾ hp router w/case	132	85
3601B	1-3/8 hp router	188	115
3700B	½ hp trimmer 28,000 rpm	124	82
B04530	8" Round Sander	84	55
8710DW	Cordless Screwdriver	148	105
DA3000	3/8" angle drill	158	105
DP4700	½ v/sp w/rev " 4.8 amp	154	92
HP1030W	3/8 v.s.r. hammer drill w/case	145	99
8300LR	½" angle drill w/rev	229	152
8419BB-2W	½" 2 sp. hammer drill w/case	238	150
GV5000	Disc Sander	79	53
6800DB	2500 rpm 3.5 amp	123	79
6800DBV	0-2500 rpm 3.5 amp	133	88
6801DB	4000 rpm 3.5 amp	123	78
6801DBV	0-4000 rpm 3.5	133	88
2030n	12" planer/jointer	1980	1350
2040	15-5/8" planer	1780	1195
1805B	6-1/8" planer kit w/case	418	265
LS1400	14" Mitre Box	578	410

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9820-2	Blade Sharpener	235	160
6802DWK	3/8" 2-spc/less drill kit	154	94
6010SDW	3/8" cordless drill rev	82	46
DA3000DW	3/8" c/less angle drill	172	105
JV1800	var. speed jig saw	146	99
JV2000	var. speed orb. jig saw	195	100
4300DW	cordless jig saw	158	102
5005BA	5½" circular saw 8 amp. with brake	154	99
5600DW	8¼ c/less circ/saw	224	139
9207SPC	7" var/speed elecronic sander/polisher	289	130
9303BH	4½" sander-grinder kit	148	95
9035DW	c/less finishing sander	128	78
4014NV	var/speed blower	128	78

DELTA

		List	Sale
34-821	9" contr. saw w/o motor	500	395
34-410	10" contr. saw w/o motor	871	650
34-710	super 10" motorized saw	578	450
15-091	15" floor model D/press	467	375
15-090	15" bench model "	467	375
37-207	Saw/Jointer Combination	1018	810
37-609	6" Motorized Jointer	413	335
37-290	4" deluxe Joiner w/o motor	348	275
22-651	RC-33 — 13" Planer	1943	1450
43-122	Wood Shaper w/stand and 1 HP Motor	699	495
46-140	11" lathe, gap bed model w/stand w/o motor	407	335
52-483	1 hp motor for #34-821	170	130
62-042	1½ hp motor for #34-410	230	170
62-144	½ hp motor for #37-290	138	105
62-142	½ hp motor for #28-243 and #46-140	121	95

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#315-1	7¼" Top Hdle	List 189 ..... SALE 103
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1950	3/8" High Torque	165	110
5930	Reversible Hammer	179	120
1970	3/8 rev/hi torque screwdriver	179	120
1980	Rev/ adj. clutch Scrudrill	179	120

BRAND NEW! SUPER SPECIALS from MILWAUKEE

		List	Sale
0214-1	3/8" c/less driver/drill	154	109
8975	H.D. Heat Gun, 11.6A Low 570°F - High 1000°F	69	49
5920	belt sander 3x24 w/o bag	289	199
5925	belt sander 3x24 w/bag	309	215
5930	belt sander 4x24 w/o bag	299	209
5935	belt sander 4x24 w/bag	319	225

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690	1½ H.P. 8 amp	189	125
691	1½ H.P. D-Hdle 8 amp	213	135
536	1½ H.P. Speedmatic Double Handle	295	185
537	1½ H.P. Speedmatic Double Handle	310	210
520	3 H.P. Production	435	275
518	3 H.P. Micropressor 5-sp	475	310

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319	tilt-base laminate trim	205	135

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6010DL	C/less Drill w/flashlight charger & case	182	90
DP3720	3/8 drill Rev. 0-1800 rpm	90	47
6510LVR	3/8 drill Rev. 0-1050 rpm	118	67
6013BR	1/2" Drill Rev. 6 amp.	174	100
5402A	16" Circular Saw-12 amp	468	315
2414	14" Cut Off Saw-13 amp	282	189
3612BR	3 HP Plunge Router	286	175
9401	4x24 belt Sander w/bag	248	160

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		List	Sale
696	H.D. Shaper Table	150	105
695	H.D. 1½ hp Router/Shaper	278	190
399	Drywall Cut-Out Unit	100	70
736	V/Speed *Speedtronic* Band Saw	450	330
7564	½" X.H.D. Drill 8 amp	205	145

BOSCH TOOLS

		List	Sale
1581VS	Top Handle Jig Saw	225	128
1582VS	Barrel Grip Jig Saw	126	118
1604	1¾ H.P. Router	199	110
1942	Heat Gun 650° — 900°	98	85
1272	3x24" Belt Sander	258	159
1272D	3x24" Belt Sander w/bag	274	189
1273	4x24" Belt Sander	274	189
1273D	4x24" belt sander w/bag	289	178

DELTA

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#4/0	5"	2½"	12.45	8.19	43.75
#3/0	6"	3"	13.35	8.59	45.95
#2/0	7"	3½"	14.35	8.95	48.35
#0	8"	4½"	15.97	9.95	53.75
#1	10"	6"	18.25	11.35	61.25
#2	12"	8½"	28.94	13.59	72.95
#3	14"	10"	29.98	18.75	91.35
#4	16"	12"	34.55	23.75	128.25

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Model	Jaw Length	List	Sale	Lots of 6
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#3712	12"	8.73	5.95	32.13
#3718	18"	9.84	6.95	37.53
#3724	24"	10.84	7.35	39.80
#3730	30"	11.76	8.25	44.55
#3736	36"	12.86	8.95	48.33

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3052	8¼" 13 amp - 4300 rpm	247	169
	SUPER SAWCATS		
3047-09	7¼" w/brake - 12.5 amp	226	149
3048-09	8¼" w/brake - 13 amp	240	155
	BUILDERS SAW CAT		
3030	7¼" 13 amp - 5800 rpm	155	100
3035	8¼" 13 amp - 5800 rpm	175	125
3034	7¼" 13 amp - 5800 rpm	162	115
3033	6½" 13 amp - 5800 rpm	162	115
	JIG SAWS		
3157-10	var/sp orb action d/hdle	174	115
3153-10	var/speed 4.5A 0-3100	158	105
3159-10	2/sp orb action barrel grip	178	120
	CUT SAW KITS		
3103	2 sp 6 amp-2400 strokes	163	100
3105	V/Sp 6 amp-2300 strokes	170	110
3107	V/Sp orb 6A 0-2300 strokes	183	119
4300	Drill Bit Sharpener	299	205
1321	½" drill 450 rpm 6 amp	175	115
4010	Palm Sander	80	48
4015	½ Sheet Finish Sander	160	105
	DRYWALL GUNS		
2034	v.s.r. 0-4000 rpm	121	79
2037	v.s.r. 0-4000 rpm	139	99

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9501B	4" Grinder Kit	119	55
6012HDW	Cordless Drill w/Battery & Case	178	98
5007NB	7¼" Circ. Saw	158	94

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Buy Each Piece Separately		$260.80
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648	HD s/s bayonet saw 3 amp	255	189
9627	2 sp. tiger saw kit 8 amp	183	118
505	H.D. 1/2 sheet finish/sander	186	103
330	spd bloc sander ¼ sheet sz	87	54
304	Professional 7" disc sander	180	105
305	Professional 7" polisher	160	105
7511	3/8" xtra hvy v/s drill 5.2 amp	154	100
7554	½" xtra heavy drill 8 amp	205	135
309	3.8 amp laminate trimmer	120	80
310	3.8 amp laminate trimmer	180	130
312	offset base laminate trim.	195	135
319	tilt base laminate trimmer	205	140
187	block plane 2.5 amp	129	88
9652	Versa-Plane Kit	418	285
9118	Porta Plane Kit	289	195
97860	½" dual range var/speed hammer/drill kit w/case	201	130
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7544	5.2 amp — 2500 r.p.m.	154	100
7545	5.2 amp — 0-2500 r.p.m.	154	100
7548	5.2 amp — 4000 r.p.m.	148	100

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PHE 18RL	3.8 amp 5/8" capacity in concrete	289	175
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PHE 20	Same as above — except var/sp 0-750	418	270
PHD 26	8.3 amp-1" capacity in concrete	495	320
PH 38	7.5 amp-1½" capacity in concrete	549	355

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77	7¼" Worm Saw	240	139
367	6½" Worm Saw	239	149
825	8¼" Worm Saw	270	185
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2016-02	3/8" Cordless Drill complete W/Charger Case & 2 batteries	199	99

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33-425	PL-425	1" x 25' Rule	18.95	8.95
33-430	PL 430	1" x 30' Rule	20.95	8.95

Management Workbooks for Self-Employed People by Gerard R. Dodd and Friends of the Maine Idea. *Dodd-Blair and Associates, P.O. Box 644, Rangeley, Me. 04970, 1984. $18.00, five paperback workbooks; 256 pp.*

The product of five years work with self-employed Down Easters in Maine, these workbooks offer a dirt-simple business primer for the eager, but innocent, would-be business person.

Often more useful for the points raised than the questions answered, the workbooks, nonetheless, present a coherent framework on which to begin the building of a new business. This is a starter set; nothing is covered in depth, and some areas, like pricing, are inadequate. You'll soon need more information than is contained here, but the workbooks should get you off on the right foot—or keep you from starting on an ill-fated journey in the first place. *—Roger Holmes*

Computers & Crafts: A Practical Guide by Marc Goldring, with Pat Doran and Thomas Wolf. *American Council for the Arts, 570 Seventh Ave., New York City, N.Y. 10018. $7.95, paperback; 120 pp.*

Goldring's book is really two booklets within the same cover. The first deals with the problems and questions facing a craftsperson or organization considering adding a computer to their operation; the second is a discussion of Craftnet, a computerized information gathering and sharing system proposed by the National Crafts Planning Board. While Craftnet is still in the proposal stage (and thus of less immediate interest), the first section of the book is a good jumping-off point for a craftsperson interested in what new computer technology has to offer.

The microcomputers on the market today can do almost unlimited tasks, and Goldring wisely makes the distinction between what is practical and what is possible. In limiting himself to the most practical of applications, he provides a method for analyzing the benefits of replacing existing systems with computerized ones. Unfortunately, this leaves out the whole range of new systems made possible by the computer's unique abilities. Thus, he discusses at some length, the use of computers to manage mailing lists, but mentions only very briefly the possibility of improved business management and planning by using the computer to analyze the data contained in that mailing list. Similarly, the ability to combine available data in new ways—like using data from estimating sheets to produce shop schedules and cash flow forecasts—doesn't receive the treatment I think it deserves. The problem is that the computer doesn't just do old things better; it also does new things, and these possibilities are not adequately covered in the book.

Playing "What if...?" is an inevitable part of almost any decision in running a business, and the computer's ability to do thousands of calculations accurately, and almost instantly, opens up this area tremendously. While Goldring mentions some of the more straightforward applications of this potential—"What will this piece cost if I raise my profit figure to 15%?"—he gives no hint of the more powerful possibilities. "If I start working Saturday mornings, when will I accumulate enough to pay for a new jointer?. . . What is the cost-per-piece of a direct mail package in lots of 500, 5000, or 10,000, allowing for the various quantity discounts available for printing, labels, etc.?" Questions like these often don't get asked (or adequately answered) in a non-computerized system, just because of the tremendous amount of recalculation necessary each time a new variable is plugged in. This is especially true in the more sophisticated systems that utilize computer graphics as a design tool. Having a perspective drawing completely revised each time an element of the piece is lengthened or shortened is enough to make a draftsman cry. Being able to play "What if...?" quickly and easily is an invaluable asset, and Goldring simply does not give it the emphasis it deserves.

On the other hand, the book does provide the good basic information needed by someone first venturing into the world of computers. His definitions are clear and complete, and his outline of the general process of buying a computer, including what questions to ask and when to ask them, is good. By itself, the book is not enough to enable a person to decide whether or not to buy a computer, but it is a very good place to start the decision-making process. *—Mac Campbell*

Table Saw Techniques by Roger W. Cliffe. *Sterling Publishing Co., Inc., Two Park Ave., New York, N.Y. 10016. $14.95, paperback; 352 pp.*

This is a thorough-going treatise on the tablesaw, with a firm emphasis on safety. In addition to everything you would expect, it contains several furniture projects that look to be a cut above average. Cliffe's writing style is dry and plain, which makes reading the book a little like eating your weight in cream of wheat, but, as Mom always told me, in the long run it will be good for you. *—Jim Cummins*

Tropical Timbers of the World by Martin Chudnoff. *Forest Products Lab., 1984. $16.00, paperback; 464 pp. Available from Superintendent of Documents, U.S. Government Printing Office, 710 N. Capitol St., Washington, D.C. 20402.*

As the official wood identification arm of the federal government, the Forest Products Laboratory in Madison, Wisc., has been researching native American timber for over 70 years. In recent years they've been fielding an increasing number of questions about imported tropical woods. This book, compiled from many foreign sources, covers 370 species and generic groupings, and enables woodworkers to answer many of those questions themselves. Entries are confined to one page, comprising a few sentences on each of about ten categories, including general characteristics, mechanical properties, drying and shrinking, and working properties. *—Roger Holmes*

Making Wood Boxes With a Bandsaw by Tom Crabb. *Sterling Publishing Co., Inc., Two Park Ave., New York, N.Y. 10016. $8.95, paperback; 126 pp.*

Making a bandsawn box entails cutting a series of slices and plugs from a solid block, throwing away what will be the empty spaces, then gluing the rest of the pieces back together. There are about a zillion ways this can be done, and Crabb explores a few dozen basic variations. I wouldn't make any of these projects myself, not without trying to improve on the author's designs and workmanship, but, for the price, the book is an affordable springboard for imaginative woodworkers—you could pay a lot more trying to dig up all this information from other sources. *—Jim Cummins*

Waterfowl Carving with J.D. Sprankle by Roger Schroeder and James D. Sprankle, with foreword by Kenneth Basile. *Stackpole Books, Cameron & Keller Streets, P.O. Box 1831, Harrisburg, Penn. 17105. $39.95 ($53.95 in Canada), hardcover; 224 pp.*

Roger Schroeder's latest book studies the techniques of J.D. Sprankle, as he bandsaws, grinds, drills, carves, fills, textures, burns, and paints a gadwall. There are hundreds of photos of what are, by now, pretty well-known techniques. I'm not sure who the intended audience is—the book doesn't have the inspirational fervor of Schroeder's previous one (*How to Carve*

Wildfowl, reviewed in *FWW* #51), and I found it slow reading. The book is worth a glance if you can find it in the library or at the local bookstore, but be sure to look at what else is available at the same time. *—Jim Cummins*

Strike While the Iron Is Hot by Guy Lautard. *1983; 173 pp., softcover. Available from the author at 2570 Rosebery Ave., West Vancouver, B.C., Canada V7V 2Z9 for $8.88 (U.S. postpaid).*

This book is a good yarn about a fictional machinist, John Kelly, and his adventures in the North Country of British Columbia. The story focuses on a mysterious railway disaster cunningly solved, but the constant thread of a romantic subplot is the real interest. The incidents and anecdotes are interspersed with nuggets of machinists' lore—many of them a bit over my head, but fascinating nevertheless. I recommend this novel highly to anyone who grew up on the *Saturday Evening Post* fiction of the late '40s and early '50s. As a passing thought, it occurred to me that this book could have been a very early, unpublished work by the late Nevil Shute. That might be too much praise, but I do hope that Lautard writes a sequel soon. *—Jim Cummins*

Craft Fair Primer by Michael Scott, with Marliene Froke and Carol Sedestrom. *The Pennsylvania State University, Department of Independent Learning, University Park, Pa. 16802. $16.90 ppd., paperback (spiral bound); 117 pp.*

In recent years the craft fair has become a viable way to reach a large market of both wholesale and retail buyers of craft objects. The *Craft Fair Primer* attempts to offer practical advice about preparing for and exhibiting at a fair. The book is organized as a study guide, containing eight chapters which take you through the steps of applying for and exhibiting at a fair. Along the way there is practical information on photographing your work, slide presentation, booth display, promotion, and sales work.

The book is written by Michael Scott, Carol Sedestrom, and Marliene Froke, with contributions from a number of professional craftspeople. Mr. Scott is the editor of *The Crafts Report,* a monthly newsletter devoted to marketing crafts. Ms. Sedestrom and Ms. Froke have been instrumental in developing the fairs sponsored by American Craft Enterprises. These are people with vast experience in marketing crafts and the *Craft Fair Primer* would be a worthwhile investment for anyone contemplating exhibiting at a fair. *—Silas Kopf*

Tool Grinding & Sharpening Handbook by Glenn D. Davidson. *Sterling Publishing Co., Inc., Two Park Ave., New York, N.Y. 10016. $6.95, paperback; 128 pp.*

The author mentions, toward the end of this short book, that he will never again use the grinder on an electric can opener to sharpen a fine knife. Enough said? This isn't a bad book, but chances are you don't need it. If you know someone you think does need it, chances are it wouldn't hold his/her interest. I'll pass on this one. *—Jim Cummins*

Mac Campbell designs and builds cabinets and furniture in Harvey Station, N.B. His article about computers appears on p. 62. Silas Kopf is a professional furnituremaker in Northhampton, Mass. Roger Holmes and Jim Cummins are associate editors of Fine Woodworking.

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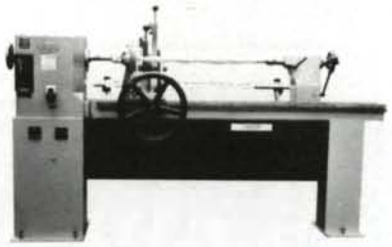

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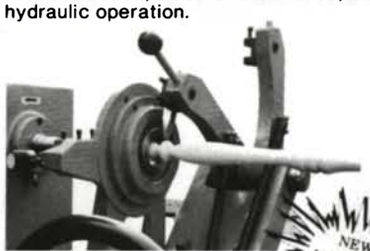

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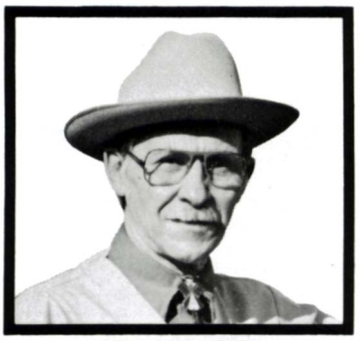

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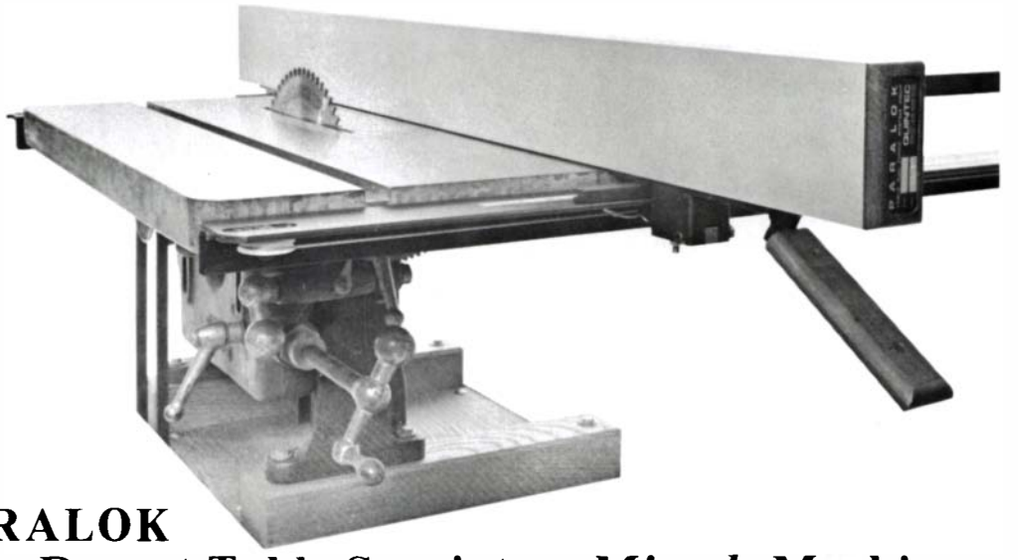

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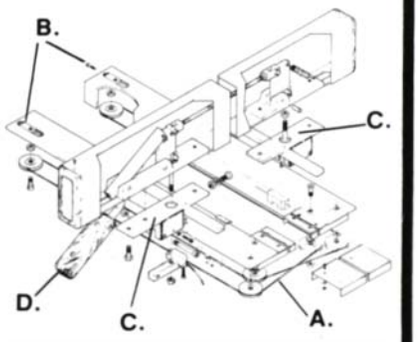

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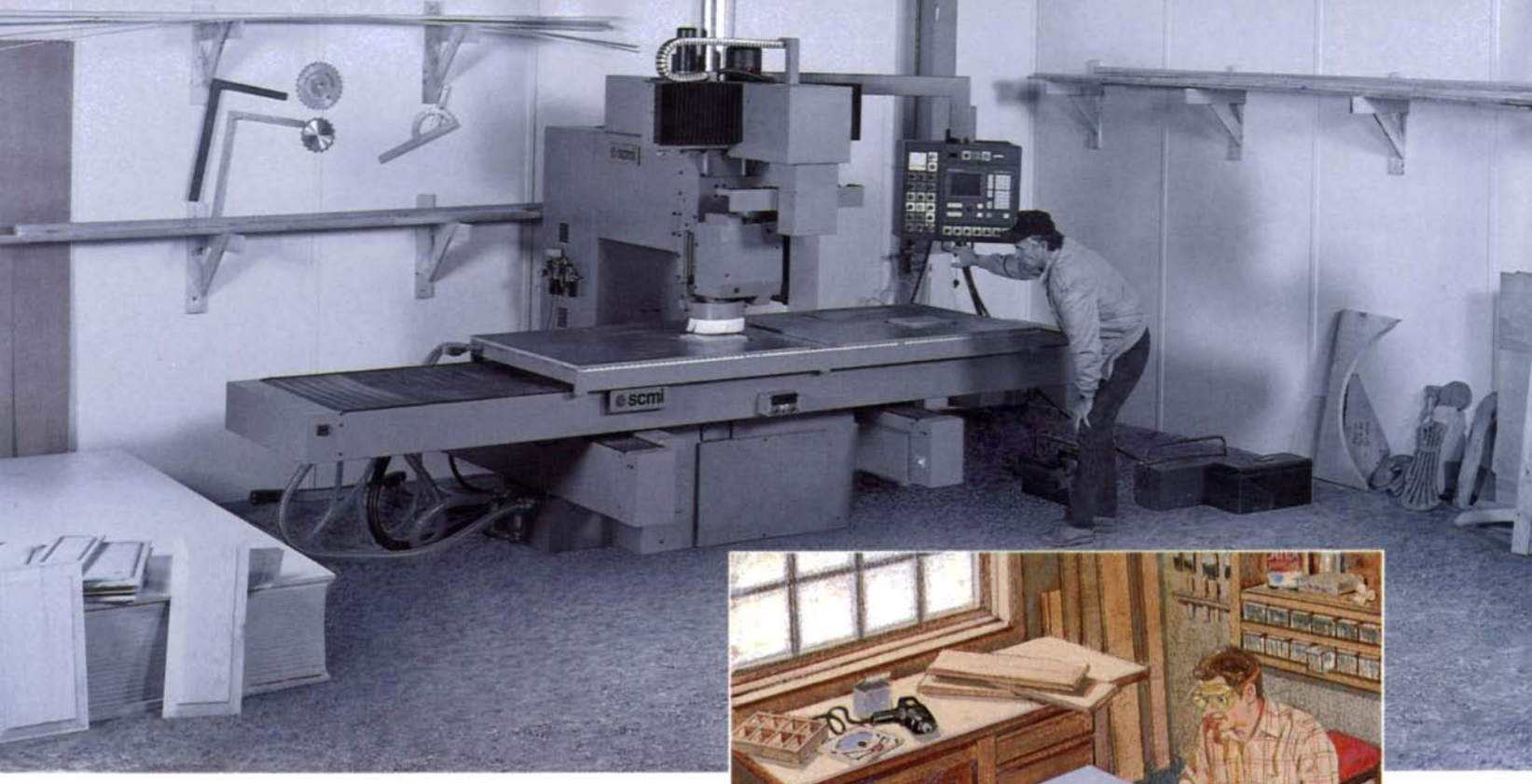

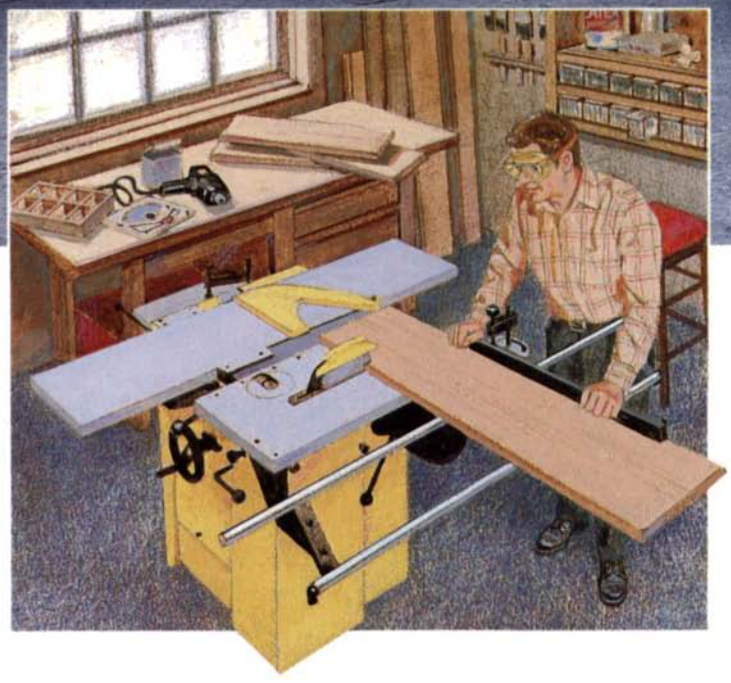

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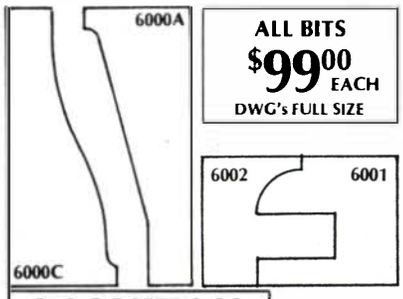

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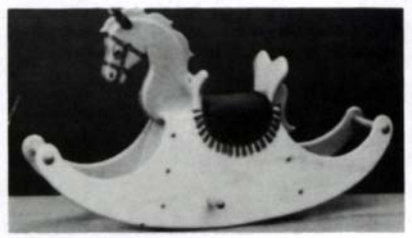

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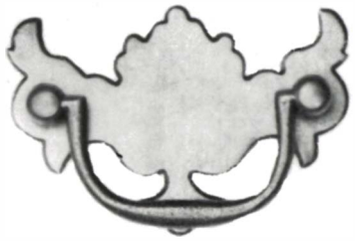

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Fine WoodWorking January/February 1986

Designing Wooden Clockworks

Movements and how they work

by Wayne Westphale

I suppose I am only one of many readers of *Fine Woodworking* intrigued by an early article about wooden-works clocks (*FWW* #10). My first efforts were only nominally successful (in large measure because I can be impatient—I wanted to build the whole clockworks and sit back and watch it run). Well, it ran, but it had so much internal friction that it required 12 lb. of drive weight. Beyond that, its tick-tock was not as consistent as even a novice clockmaker would like. Although it won a best-in-show in one woodworking exhibition, it did not satisfy me. In fact, a couple tried to buy it at a show in Philadelphia, but luckily—for them as well as for my reputation—I was able to persuade them to wait a few weeks for the improved model.

Clock construction is a study in perseverance, patience and forethought. Dad charges, "Boy, you're in too much of a hurry. You've never got enough time to do a job right the first time, but you've always got time to do it over." Like most fathers, mine proves to be right with uncanny, and sometimes irritating, frequency. Nevertheless, I have to wonder if "doing it right the first time" is even possible with clocks—mine seem to work better with each one I build. The grandfather clock described in this article runs two days on a winding and carries two 3-lb. drive weights. It is accurate to about a half-minute per day.

One of my latest clocks, which I call the Oval, ran in the workshop on an astonishing 1¾ lb. of weight. I am hoping to get my next generation of grandfather clocks to run five or six days on 6 lb. of weight. This kind of performance requires great precision. Are setups and measurements with a machinists' dial caliper going too far? Perhaps, I can't say for sure—I only know I feel better for doing the best I know how. Doing less would reduce the pleasure of the craft and result in something other than the heirloom timepieces I intend my work to become.

What is a clock?—In the strict definition, a clock is a timepiece that signals the hours by striking a bell. But in broader terms a clock is a mechanical device designed to release stored energy in small, equal increments over a period of time.

The energy in purely mechanical clocks is typically stored in one of two ways, either in a coiled spring or in a falling weight or weights. In a spring-driven clock, a fully-wound mainspring delivers maximum drive energy, but this force decreases constantly as the clock runs down. Spring-driven clocks, therefore, require special compensating mechanisms that are beyond the scope of this article.

The most practical power source for mechanical clocks is the energy provided by a falling weight, which remains constant for the duration of the weight fall. It is a simple matter to compensate for the internal friction of the clock movement by increasing the drive weight. Of course, too much weight will accelerate wear, deform bearings and possibly even bend the weight arbor.

As shown in the drawing on p. 33, the weights in my clock are wound around a drum 1 in. in diameter, which acts as a lever—the larger it is, the more force it will transmit, but the faster the weights will fall and the sooner the clock will have to be rewound. The less internal friction in a clock (and the more efficient it is in general), the smaller the drum can be, and the longer the clock will run with any given weight.

Converting weight into time—At first glance, a clock seems a confusingly complex mechanism, but a few minutes' study will prove that a basic timepiece such as this one is surprisingly straightforward. The clock turns energy into time by means of two gear trains, a *drive train* (or going train) and a *dial train*, which moves the hands. An *escapement* mechanism controls the rate at which the energy stored in the weights is released. The escapement mechanism consists of an escape wheel, an escape lever, a pendulum and a crutch.

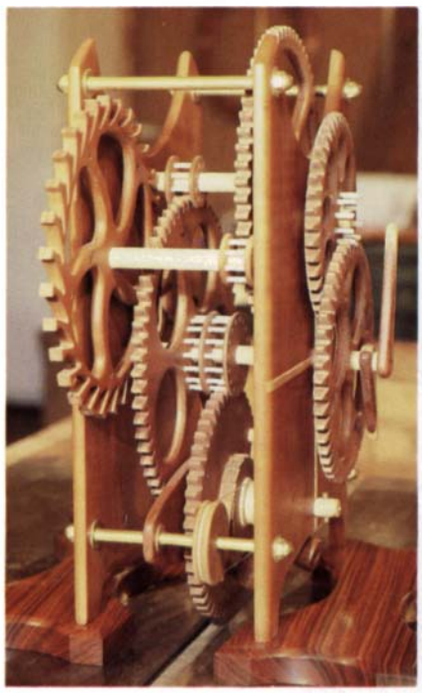
The weights connect to a weight arbor at the beginning of the drive train, and from there a series of gears increases the speed at which each successive arbor turns (the arbor is the shaft the gears are mounted on). This sort of gear-up drive, where large wheels are driving smaller pinions, is unique to horological applications. In most other gear trains, pinions (the small gears) turn wheels (the large gears) in order to convert the fast, low-power revolutions of a motor shaft to an output shaft that turns slower but has more torque. Because the drive train of a clock is a gear-up train, the tooth profiles on its wheels and pinions are not the same as those in most other gear trains, a consideration discussed in the box on p. 34.

The speed of the drive train triples from the 48-tooth wheel on the weight arbor to the first pinion, then increases by eight, then by eight again. The result is that the escape wheel wants to turn 192 times faster than the weight-arbor wheel. Ignoring all internal friction for the moment, this means that the clock's 6 lb. of weight (or 96 ounces) can be stopped by a ½-ounce force applied to the pinion on the escape-wheel arbor.

If we apply the force to the escape wheel itself, which is much larger than the pinion, the stopping force decreases to about 1/16 ounce. And when we introduce the power losses due to the clock's internal friction, which occurs not only at the bearings but also between the pairs of teeth as they engage and disengage, we see that it takes very little force to prevent the escape wheel from turning.

Thus the escape wheel is a good place in the drive train to

James Canfield



Westphale's first clock, above, ran but required 12 lb. of drive weight. He has since refined the designs—the contemporary grandfather clock, at right and on the facing page, will run on 4 lb. (the less weight, the less stress on the bearings) and is accurate to a half-minute per day. It sells for $6,000.

Photo left: White Light

regulate the rate of release of the energy stored in the clock's weights—because little force is involved, the acting parts can be light in weight and, further, they will be subjected to little wear.

The escapement mechanism—The drawing on the facing page traces the path of the drive force of a clock by starting at the weights. But in designing a clock, the escapement is where you would start, because all clocks depend on the following interrelationship: the internal gearing determines the length of the pendulum; the length of the pendulum suggests the internal gearing. For those interested, I've included a mathematical discussion of gear ratios and pendulum lengths (at right).

The pendulum regulator developed around 1675. It superseded the verge escapement, the earliest escapement known, which dates from the 13th century. Verge escapements required a large oscillation of about 100° of arc and were, therefore, not very accurate. With the development of the recoil escapement, the pendulum oscillation was reduced to between 5° and 10° of arc. Within this range, the period of a pendulum (the length of time it takes to swing from right to left or from left to right) is constant, or nearly so. It is this principle upon which all pendulum regulators are built.

The exact period of a pendulum can be calculated mathematically, at least in theory. In the real world, theory and actuality do not quite correspond, but it remains true that to lengthen a pendulum's period, you lengthen the pendulum; to shorten the period, you shorten the pendulum. In my grandfather clock, the bob—the weight on the end of the pendulum shaft—is adjustable up and down. By moving the bob, the pendulum can be adjusted to swing faster or slower, thus speeding or slowing the clock.

With each oscillation of the pendulum, one tooth of the escape wheel is released and the entire gear train of the clock is allowed to advance proportionally. More specifically, the escape wheel and escape lever constitute the release/relock mechanism. As shown in the drawings below, the pendulum, working through the crutch, rocks the escape-lever arbor back and forth, so that the escape lever will stop and release each tooth on the escape wheel according to how fast the pendulum is adjusted to swing. It is important to keep in mind that though the pendulum controls the movement of the crutch and, therefore, of the escape lever, it would stop without the impulse it receives from the escape wheel and the escape lever through the crutch. This push is essential, because it is the force that keeps the pendulum swinging. There are at least a dozen major clock escapements, all designed to solve one problem or another, but only two—the

Clock math

The internal gearing of a clock must relate to the length of its pendulum. The period of a pendulum of small oscillation is mathematically defined as:

$t = \pi\sqrt{p/g}$ or $p = t^2g/\pi^2$, where:

t = one oscillation in seconds

$\pi = 3.14$

p = length of pendulum in feet

g = acceleration of gravity (32.17 ft./sec.^{2})

If $t = 1$ second, then, p equals $(1^2 \times 32.17) \div$ by 3.14^2, which equals: $32.17 \div 9.86$, which equals: 3.26 ft. (or 39.12 in.). Therefore, a "seconds" pendulum is one meter long, at least in theory.

The mathematics of the internal gearing (the drive train gearing) is equally straightforward. Horologists call the large gears wheels, and the small ones pinions. The number of beats per hour is equal to the product of all the wheel teeth divided by the product of all the pinion leaves. The number of teeth on the escape wheel must be counted twice because each acts twice on the escape lever—once on the entrance pallet, once on the exit pallet.

For a seconds pendulum, any combination of wheels and pinions may be used that yields 3,600 beats per hour. A typical grandfather clock with a seconds pendulum might employ a 30-tooth escape wheel, 60-tooth second and 64-tooth center wheels, with two 8-leaf pinions:

$$2 \times 30 \times 60 \times 64 \div 8 \times 8 = 3{,}600$$

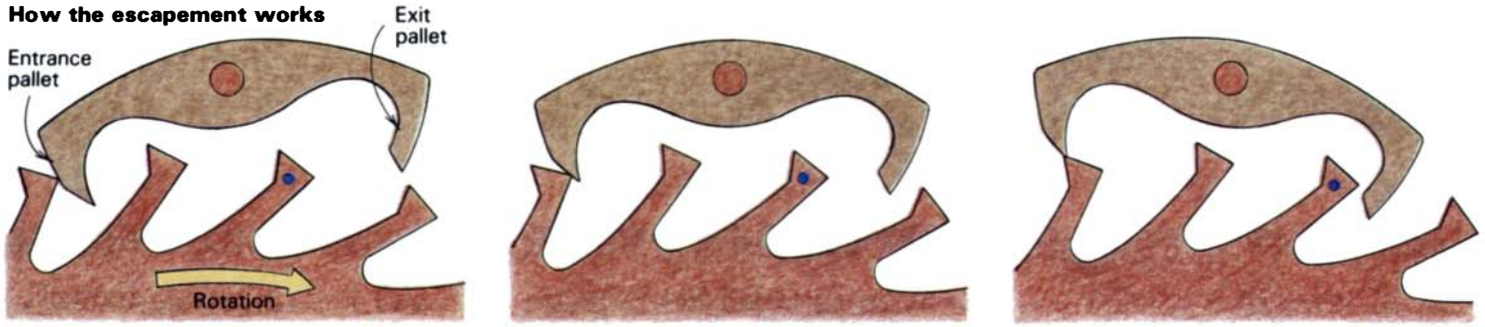
A design parameter of my grandfather clock was a 3-ft. pendulum. A slight modification in the drive train gearing was all that was necessary to accomplish this.

I've also designed a mantel clock with a pendulum just over 12 in. long. It beats 6,400 times per hour. This clock required an extra wheel and pinion to absorb the additional beats of this much shorter pendulum. Consequently, its escape wheel rotates counterclockwise.

My general rule in designing a gear train is to use pinions of 8, 10 and 12 leaves whenever possible. Pinions having fewer than 8 leaves are troublesome. Pinions having more than 12 leaves yield smooth engagement patterns but become inefficient because the mating wheels must be so much larger to maintain the 8:1 wheel-to-pinion ratio common to clocks. Much higher ratios are not desirable; lower ratios require more wheels and pinions in the train, introducing more friction. Whatever their size, good pinions are critical.

—*W.W.*

How the escapement works



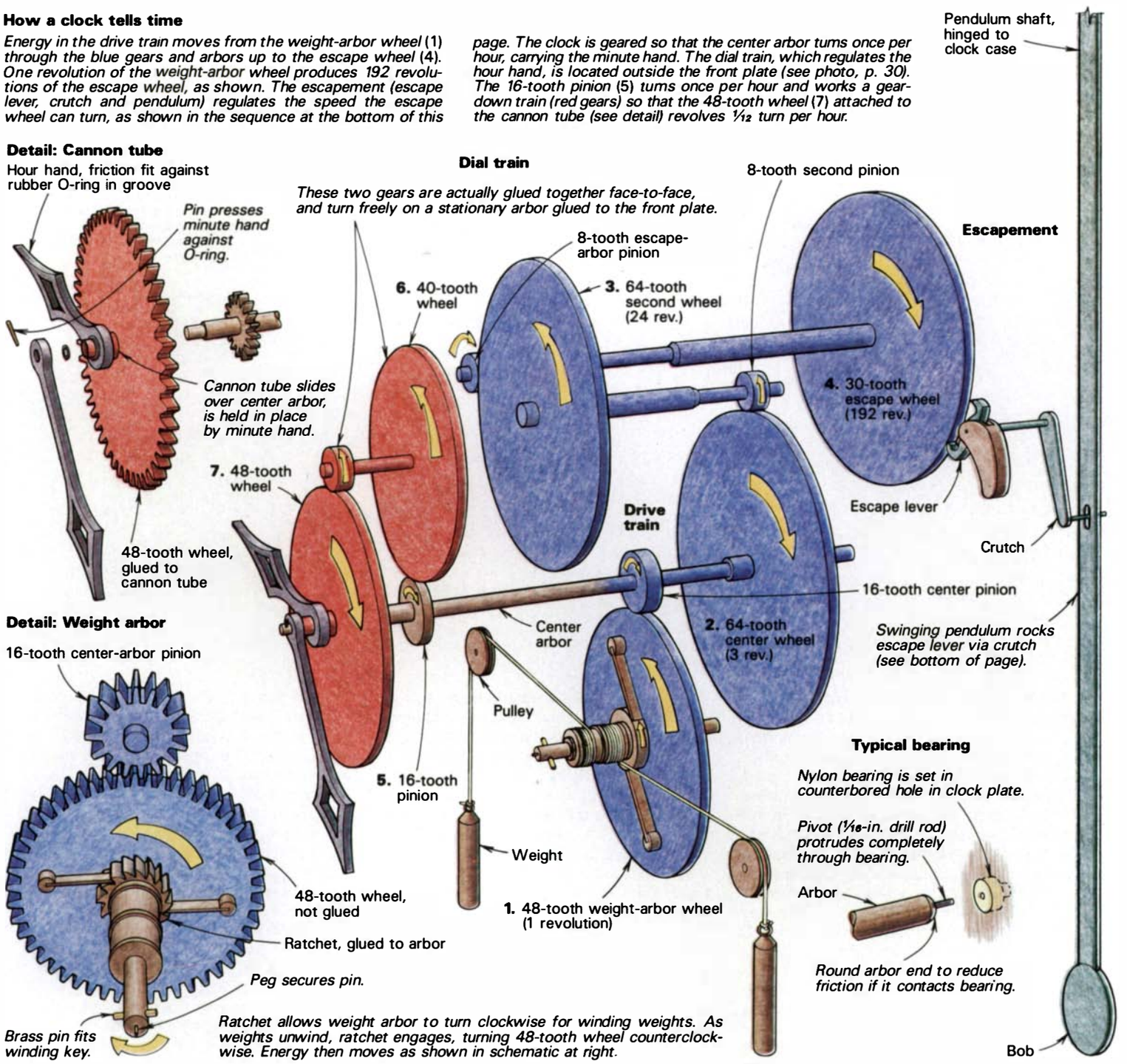
1. "TICK." The escape wheel advances freely until stopped (producing the sound) by the entrance pallet on the escape lever. The pendulum's arc is at its maximum point to the right; as it swings back to the left, it rocks the escape lever toward the position shown in 2.

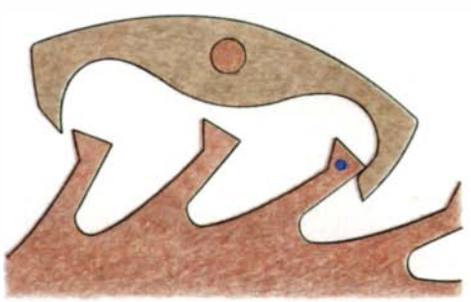
2. As the pendulum continues to swing left, the impulse plane of the escape wheel, powered by the clock's weights, advances across the escape lever. This motion gives a small impulse to the pendulum, just enough force to keep it swinging.

3. The escape wheel eventually advances far enough so that a tooth can drop freely onto the exit pallet. The opposing planes between the wheel and the lever must be designed so that they never become parallel; otherwise there would be too much friction.

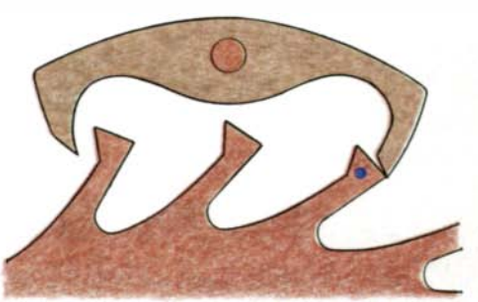
How a clock tells time

Energy in the drive train moves from the weight-arbor wheel (1) through the blue gears and arbors up to the escape wheel (4). One revolution of the weight-arbor wheel produces 192 revolutions of the escape wheel, as shown. The escapement (escape lever, crutch and pendulum) regulates the speed the escape wheel can turn, as shown in the sequence at the bottom of this page. The clock is geared so that the center arbor turns once per hour, carrying the minute hand. The dial train, which regulates the hour hand, is located outside the front plate (see photo, p. 30). The 16-tooth pinion (5) turns once per hour and works a gear-down train (red gears) so that the 48-tooth wheel (7) attached to the cannon tube (see detail) revolves 1/12 turn per hour.

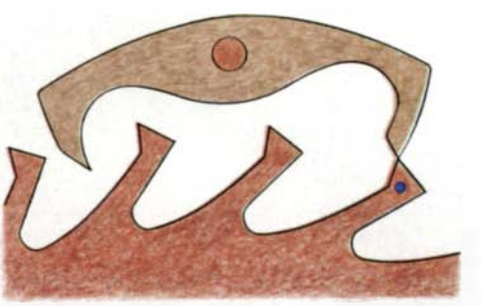




4. "TOCK" sounds when the escape wheel's free advance is stopped by the exit pallet. The pendulum is at the far left of its arc and begins to drop back to the right, rocking the escape lever so the wheel can move to the position shown in the next drawing.



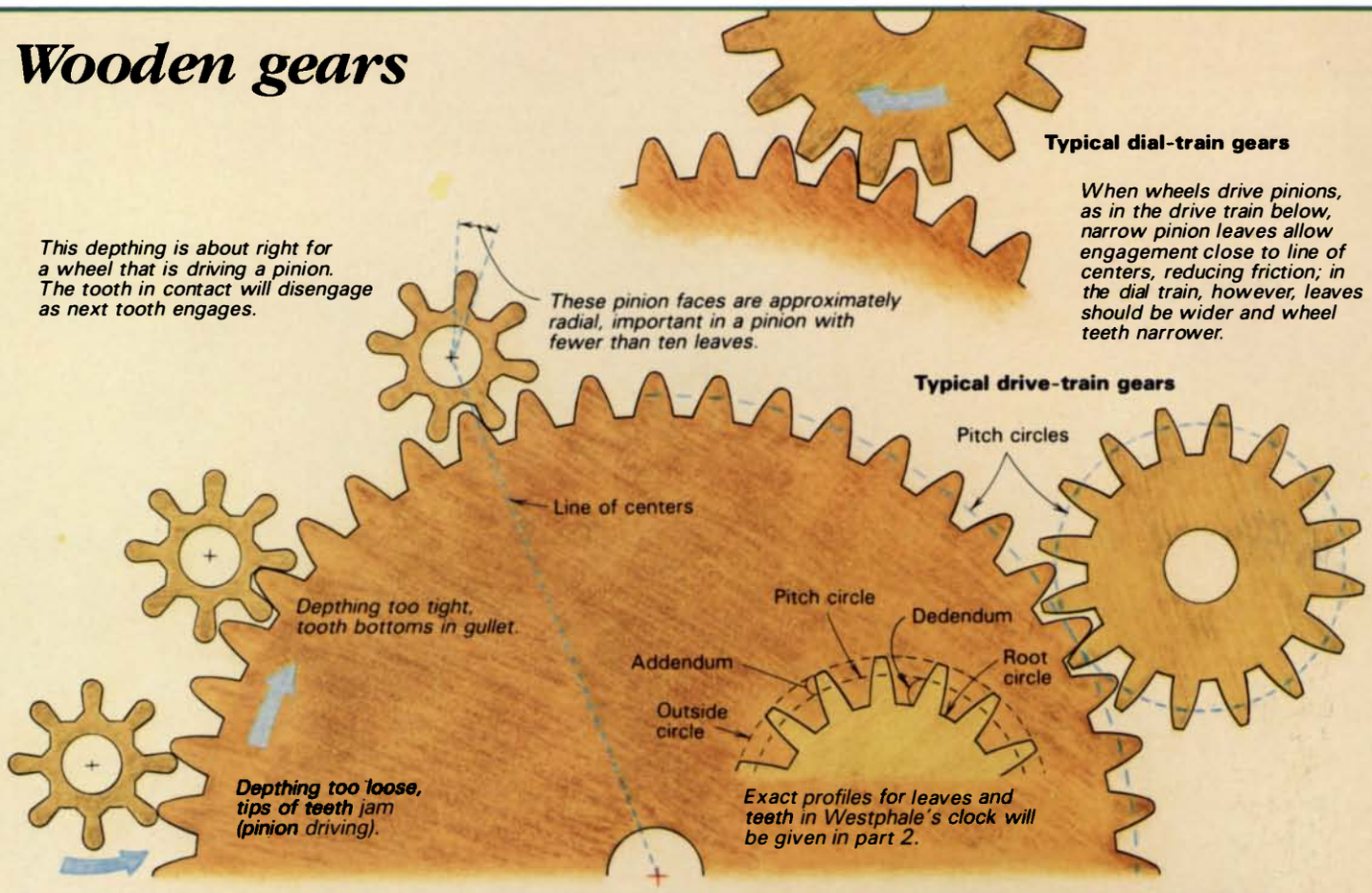
5. The process continues much as in step 2. The right-moving pendulum rocks the lever, allowing the escape wheel to advance. Again the escape wheel contributes a small impulse to the pendulum as the opposing, non-parallel planes traverse each other.



6. Here the pendulum has swung almost to the farthest right, and the escape wheel is poised to advance freely onto the entrance pallet. This will sound the next tick and start the cycle over again. The time each cycle takes is determined by the length of the pendulum.

Drawings: Lee Hov

Wooden gears



Much of what will be covered here pertains specifically to clocks, but the principles can be applied to any set of wooden gears, including kinetic sculptures, models for teaching and demonstration, and an infinite variety of whimsical mechanisms.

I use eight different tooth shapes in my grandfather clock. This discussion will explain why. In part 2, I'll describe exactly how I make the gears and adjust their fit.

There are several rules that pertain to gear cutting in horological application: For wheels and pinions to mesh smoothly, they must have the same diametral pitch, that is, the same number of teeth per inch of diameter of the pitch circle (approximately the circle of initial tooth contact, as shown in the drawing). D.P. = Number of teeth divided by the pitch diameter in inches. The smaller the D.P., the larger each tooth will be. It is convenient, though not necessary, to use the same pitch throughout. Mine are 10 D.P.

Also, the wheels must be adequately spaced (or depthed) so that the tooth of one does not bottom in the gullet of the mating gear, but they must not be too widely spaced or the tips will contact point to point rather than engage, as shown above. There must also be a small amount of backlash—play between the teeth.

Beyond this, the object is to achieve constant rotational velocity and, as much as possible, avoid engagement before the line of centers (an imaginary line through the pivots of mating gears). The friction of engagement, approach friction, is greater than the friction of disengagement, recess friction. The principal means of reducing friction within a clock is to minimize approach friction by designing appropriate tooth profiles. Historically, this has been accomplished in a variety of ways.

The most common tooth profiles are derivations of involute and cycloidal curves. These are mathematically defined curves capable of providing constant rotational velocity. Each profile has its advantages and disadvantages.

Involute profiles are what you will typically find in mechanical equipment. Their primary advantages are (1) milling cutters are available in a variety of tooth sizes; (2) constant rotational velocity is relatively insensitive to depthing.

The primary disadvantage of involute gearing when used in a gear-up drive train is that there is considerable engagement friction. Involute gearing was designed for bi-directional running with minimal backlash to reduce noise at high RPMs. Engagement friction is not a concern under these high-power conditions.

The primary disadvantages of cycloidal profiles are (1) cutters are not generally available in the sizes we need for a wooden clock and (2) constant rotational velocity of mating gears is depth sensitive.

The considerable advantage of cycloidal profiles in drive trains is that approach friction can be eliminated or substantially minimized. Further, it is not unreasonably difficult to create cutters to produce approximate cycloidal profiles, as I'll explain in part 2. For these reasons I recommend cycloidal tooth profiles in the drive train. Involute profiles are acceptable in the dial train, but cycloidal profiles work well there too.

A very usable tooth profile is shown in the drawing: these teeth do not correspond exactly to what the theory calls for, but they have the advantage of being fairly forgiving. They are less depth-sensitive than "ideal" teeth, and their width can be varied a little both ways to accommodate the different requirements of both the drive train and the dial train.

For best results, pinions in the drive train should have leaves about one-third the circular pitch—where the pinion is driven, the leaf must be narrower to minimize engagement friction. In the dial train, where wheels and pinions both drive, ideally the wheel teeth should be a bit thinner and the pinion leaves a bit thicker, because both wheels and pinions contribute to circumferential clearance (i.e. backlash).

In spite of what has been said so far, involute profiles can be used in the drive train if mated with lantern pinions instead of involute pinions (which are uncommon below 12 leaves). I used lantern pinions in my first clock, and they are visible in the photo on p. 31. Lantern pinions have no appreciable dedendum and so engagement friction is substantially reduced. But don't use them in the dial train. Even though I got away with it in my first clock, it really isn't good practice. —*W.W.*

recoil and the dead beat—seemed practical for me to construct in wood. The recoil (the escapement analyzed in *FWW* #10) is so named because there is a small counter-rotational movement of the escape wheel for each swing of the pendulum.

The dead beat escapement, a significant refinement, was invented by George Graham about 1730. In a weight-driven clock with a long pendulum, it is probably the best escapement to use. It gives a steady, constant beat—and with no recoil, the drive train moves in only one direction. My version of the dead beat uses a "club foot" escape wheel—it is a bit more difficult to construct than the standard recoil, but it offers larger wear surfaces that should allow a wooden mechanism a long life.

The dial train—With this much accomplished, we have a mechanism that will keep time, in the sense that the pendulum will swing at a steady rate until the weights have fully unwound. It remains for us to translate the mechanism's rate of time to our own, by gearing the clock to indicate hours and minutes.

The typical arrangement, which I use in the grandfather clock, is to design the escapement and gearing so that the center wheel of the drive train rotates once each hour. Then the minute hand can simply be mounted on the end of the center wheel arbor.

To turn the hour hand, we need a train of gears called the dial train, shown on p. 33. This is simply a four-gear 12-to-1 reduction system that takes its power from the center arbor and causes the hour hand to rotate once for each 12 rotations of the minute hand. In other words, as the minute hand cycles through 12 hours, the hour hand moves from midnight to 12 noon.

In order that the hour hand and the minute hand can both be centered on the clock face, the dial-train gearing is "folded back" upon itself, and the hour hand is mounted on a short hollow arbor, called the cannon tube, concentric with the minute-hand arbor. The hands are friction-fit against rubber O-rings on the center arbor and the cannon tube, so that the hands can be set without turning the clock's gears.

Holding it all together—The clock's moving parts must be held in precise alignment with each other. Wheels and pinions are mounted on wooden shafts called arbors. In general terms, arbors turn in bearings set into the front plate and the rear plate. Wooden clocks in the past have successfully used bearing materials such as brass, ivory and bone. Ivory and bone make particularly handsome bearings, but I am shifting away from them to nylon, which I find superior. Materials such as Teflon are too soft.

My arrangement is to bore the clock plate to accept a ⅜-in.-dia. plug of nylon, which has 1/16-in.-dia. hole through its center. A pivot, a steel pin on the end of the arbor, fits the bearing hole and runs with little friction. The pivot must be perfectly centered in the end of the arbor or the wheels will turn eccentrically.

The clock's plates are held rigidly in relation to each other by concealed threaded rod, making a unit of most of the moving parts. The plate assembly is supported by a case or a frame tall enough to contain the pendulum and allow room for the weights to drop. In my grandfather clock the pendulum is attached directly to the frame, not to the clock's rear plate.

Wood for clocks—Anything made of solid wood will change size or shape across the grain as the humidity of its environment changes. For this reason I use laminated wood wherever possible. Since solid-core plywood of the quality I need is not commercially available, I make my own of ⅛-in.-thick layers, alternating each ply at 90°. For parts that will be subject to wear, I choose dense, tight-grained rosewoods that contain a high degree of natural oil. For parts not subject to wear, such as clock plates, I laminate various domestic and imported hardwoods, choosing these as much for beauty as anything else.

Be sure the wood is dried to a moisture content compatible with the intended environment. Select good, flat, preferably straight-grained wood, joint one face and edge, then thickness so that the stock is absolutely uniform. Proceed to make your own sawn veneer substantially as described in *FWW* #51.

I have found epoxy to be the best adhesive. Since it cures chemically, it has no effect on the moisture content of the wood. It adheres well to all the woods I've used, and it's an excellent gap filler, if needed as such. I use T-88 two-part epoxy (from Chem Tech, Inc., Chagrin Falls, Ohio). I apply it evenly, using a serrated applicator that I made from a hacksaw blade. I make sure all surfaces are covered evenly—no lumps and no voids. I've found that coating one side of each ply is adequate. I press the parts together by hand with a slight circular motion to assist glue transfer, then clamp between cauls overnight.

The woods I use are heavy, so I lighten the wheels by cutting away as much unnecessary wood as possible. This provides me with an opportunity to add to the clockwork's visual appeal. I try to design spoke patterns that are interesting in themselves and that also allow a viewer to look through into the clock's interior to watch everything in motion. I'll describe my methods of cutting spokes in part 2.

More to come—This first article has provided an overview of how a clock works and some of the theoretical considerations. In the next part I'll give exact sizes and relationships and I'll cover the methods I use to achieve the necessary precision. I'll also talk about problem-solving and fine-tuning. I hope I've tempted you so far to try to build a clock of your own. But hold off for just a while longer—I may be able to help you steer clear of dead ends, backtracking and trouble spots. I've been there once already, and believe me, trial-and-error is the long way to get through the maze. □

Wayne Westphale designs and builds a variety of limited-edition and custom clocks at his shop, Contemporary Time, in Steamboat Springs, Colo.

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Coopering

Curved panels from solid wood

by Skip Sven Hanson

Coopered panels are a useful solid-wood alternative to laminated panels for curved work. They can be mounted directly, or they can be framed, as Hanson did for this chest lid.

Coopering, the creation of part or all of a cylinder from flat wooden staves with beveled edges, is most often associated with the art of barrel making. But for centuries, the techniques of the cooper have been used for the construction of lids, doors, and curved panels in fine furniture.

There are other methods for making curved panels. Thick timber can be carved to shape, but this method is wasteful, limits the choice of woods, and yields a potentially unstable panel. Laminating veneers over a curved form is a great improvement, offering precision, stability and repeatable results. But, what if the panel edge is to be molded? What if you prefer (as I do) to work in solid wood? Now the first choice is coopering.

Coopered panels, framed and unframed, make fine chest lids and cabinet doors. The simple chest with framed, coopered lid, shown at right, is a good coopering project for the novice. It is built from the coopered panel out, because of the unpredictability of the finished panel's radius. A small error in the bevel, repeated in each of the 20 or so strips, can result in a panel wildly different from the original drawing.

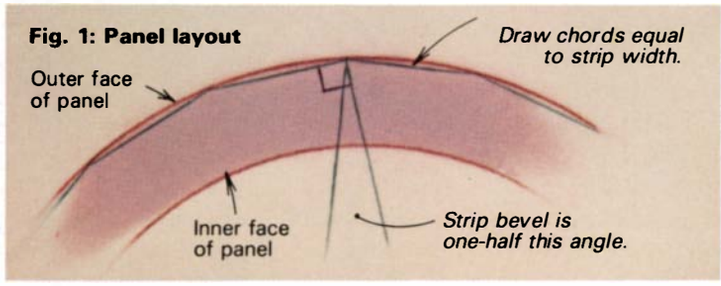
Because of the many glue joints, a grainy wood, like oak or ash, is a good choice for the first-time cooper. The labor-to-materials ratio is very high, so save your motorcycle crates for another project and use the finest piece of wood you can afford for this panel. A lid is such a prominent feature of a chest that you should also consider bookmatching boards resawed from a thick plank. Coopering can be safely done with stock as thin as ⅝ in.

Begin by drawing a full-scale section, showing the panel's arc and finished thickness. When selecting wood, add 25% to the panel height and 50% to the width, measured on the arc, for waste. Lay out the stock for the best match of grain and figure, then cut the boards to length and joint all edges. Reassemble the pieces and draw a large triangle that bridges all the pieces. This serves as a witness mark for keeping the pieces in order. Check again to be sure the stock is still at least 25% wider than the finished arc.

The width of the strips should be between 1 in. and 1½ in. The exact width should be chosen to maximize use of the boards and, this is very important, so the grain matches at the edges. Strips less than 1 in. wide are more work, more waste and more dangerous to machine. Strips much wider than 1½ in. require removal of a lot of stock to create a true arc. Draw chords equal to the strip width onto the panel section (figure 1), to make sure the width you've chosen gives you a panel approximately the size you want; if not, adjust the width accordingly. Remember that the actual panel will probably vary somewhat from your drawing.

Rip the strips to the chosen width plus 1/16 in. allowance for jointing, then place each in order on a workboard. With a soft pencil, number the ends of the strips and draw a line below each number to indicate the inside surface of the panel. At this point, it's best to sticker the strips for one or two weeks in a warm, dry spot, to let the wood's moisture content equalize with the atmosphere. If you skip this step, I recommend that you move like a bat out of Hell all the way through the glueup.

Fig. 1: Panel layout

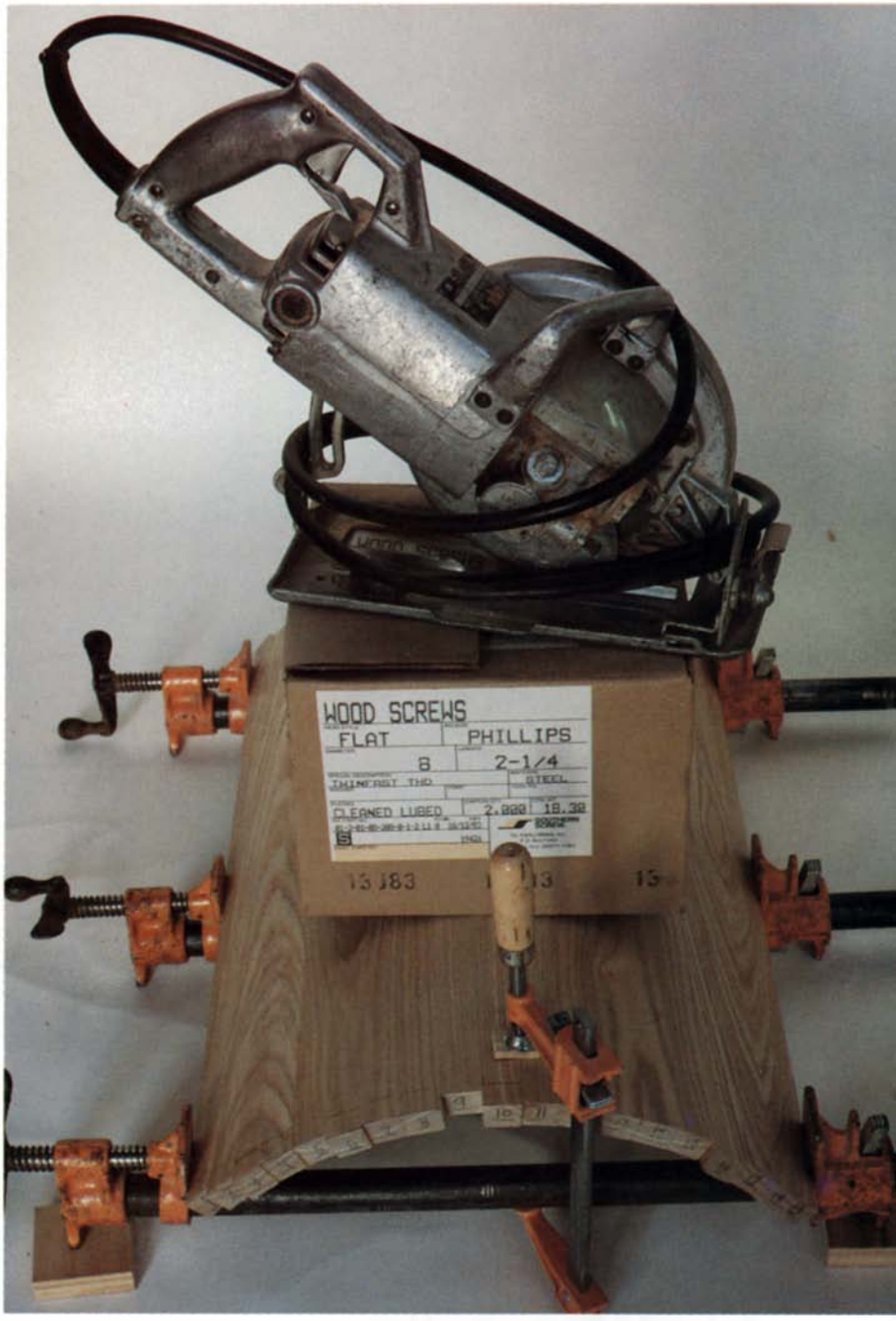


After stickering, reassemble the strips on the workboard, then joint a face of each and surface them to the same thickness. Do this one-at-a-time off the workboard and you won't waste a lot of time finding the pattern again. Then redraw the triangle on the face.

Next, at the intersection of two chords on the drawing, draw two lines, one perpendicular to each chord, as shown in figure 1. Measure the angle between the perpendiculars, as carefully as you can, with a protractor. Divide this angle by two to get the bevel angle.

To bevel the strips, set the jointer fence tilting into, not away from, the tables. Tilting the fence in permits you to joint strips already glued-up by running the outer, convex face against the

Staff photo



Tilting the jointer fence in toward the tables to bevel the strips allows you to joint glued-up segments (top left). When jointing narrow single strips, brad awls make good push sticks. After beveling, glue up pairs of strips, then pairs of pairs, and so on. As the glued-up segments get larger, use larger clamps to assemble them, as shown at bottom left. Dark strips are clamping cauls, which protect the strip edges. The final glue joint is on the panel's centerline. A combination of clamps and weight is usually necessary to draw the joint tight on both the inner and outer faces of the panel (right).

fence, as shown above, left. Bevel both edges of each strip, as well as about eight clamping cauls, 1-in. by 1-in. strips of scrap, the length of the strips. For safety, I push single strips across the jointer using two brad awls, one in each hand, as push sticks. Check the fit of each pair of strips, pairing them either side of the centerline.

The strips are glued in pairs, then groups of four (two pairs), and so on, with the final assembly on the center joint. Apply yellow glue to the edges of a pair of strips and clamp with C-clamps. Protect the edges with cauls, then clamp evenly, carefully, and with medium pressure. Scrape off squeezed-out glue and inspect the joint immediately, altering pressure as needed to eliminate gaps on either face. When the glue has set, place the pairs in order on the workboard. Glue any odd strips onto an already glued-up adjacent pair.

Next, glue pairs into fours and, after the glue has set, glue the fours into eights. Rejoint the edges if a dry fit shows a gapped joint. When C-clamps won't fit, use bar or pipe clamps, as shown above, bottom left, scraping squeeze-out, inspecting and adjusting pressure as necessary. With a highly arched group of eight or more, you may need to weight the pieces in the middle or stretch a band clamp across, anchored to the center bar clamp, to get a tight joint. As you proceed, avoid gluing a small unit onto a larger group—say, a pair onto eight—so glue on odd segments as soon as the even segments have set up.

To glue the center joint, I use bar clamps, quick-action or C-clamps and weights if necessary. First check the fit dry, rejointing and adjusting the clamps until the two halves are positioned perfectly. Use a mirror and flashlight to see that the joint is tight, both inside and out. If it's not perfect now, it won't be later.

I roll a medium coat of glue onto both edges with an engravers' brayer. I put the halves back in position on the clamps, pin the ends with 2-in. C-clamps if necessary, add the smallest amount of pressure on the bar clamps, and place the other clamps or weights in a way that will still allow me to inspect the joint, as shown above, right.

Photos by author except where noted

Plane panel edges, then use a squared-up piece of flexible material to scribe a line on the panel end square to the good edge.

Getting the joint tight on the outside is easy. If you want the inside perfect, too, you've got to remove dripping glue with a gooseneck scraper, inspect with the flashlight and possibly the mirror, and adjust the clamps until the joint is closed nicely along its whole length. When the joint is just as you want it, let it set up overnight; 30 minutes is not enough for a joint held under such light pressure. The next day, early, scrape off the glue with the gooseneck scraper.

Shape the inside surface with a gooseneck scraper and a shaped sandpaper block. Pencil lines drawn across the width, spaced every inch from top to bottom, help keep you aware of where you've removed wood, and keep you from removing too much. I remove glue and rough out the shape with the scraper, then move to a 2-in. by 2-in. by 6-in. sanding block, shaped to the radius of the inside curve. Start with 100-grit paper, sand until tear out and pencil lines are gone. Redraw the pencil lines, move to 150-grit paper and repeat the process. I use an orbital sander with a foam base to work fine sanding grits, say 220 and up for oak.

On the exterior face, plane the joints down with a sharp, finely-set plane to a fair curve, or shape with 100-grit sandpaper on a flat sanding block. As on the inside face, pencil in 1-in. spaced lines across the grain, and move through the grits again, backing the paper with a flat block.

To square-up the panel, place it concave-side-down on a flat surface and mark the high corners. Plane the edges until the panel no longer rocks. To square an end, cut a piece of flexible sheet material (thin plywood, plastic laminate, posterboard) perfectly square. Attach one edge of the sheet flush with the best edge of the panel and wrap the sheet over the surface, as shown above. Scribe the end, bandsaw and plane to the line. Reverse the sheet to do the other end of the panel. If the panel is slightly wider than you'd like, joint the waste off an edge. If it's considerably wider, bandsaw the waste then plane, making sure the panel doesn't rock on a flat surface.

Measuring from the completed panel, you can construct the box or cabinet to suit the actual curve. Sometimes I field the panel and mount it directly; sometimes I enclose a fielded panel in a frame, as for the chest lid. I field a curved panel with a router, a piloted bit and a router sub-base shaped to match the curve of the panel (see figure 2). The sub-base provides a stable bearing surface for routing the edges, as well as the ends. It should be 2 in. wider and 7 in. longer than the router base. Remove most of the waste from the sub-base blank with multiple tablesaw cuts,

Fig. 2: Router sub-base

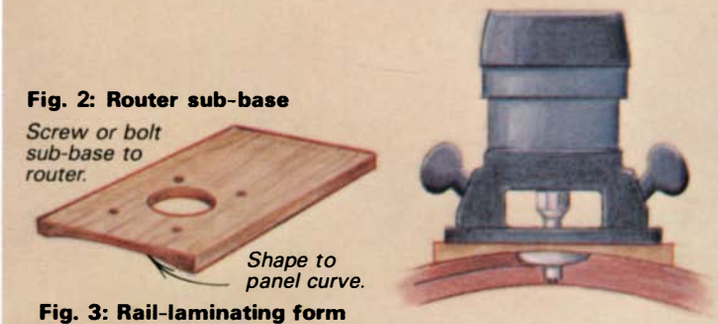
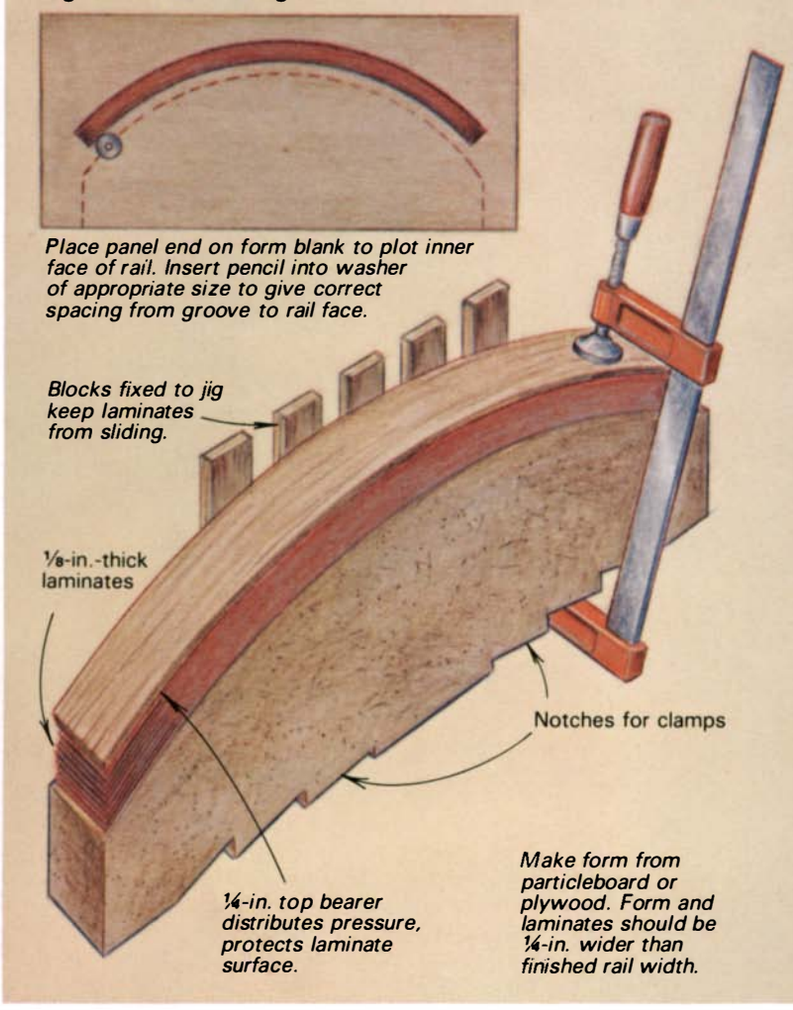


Fig. 3: Rail-laminating form

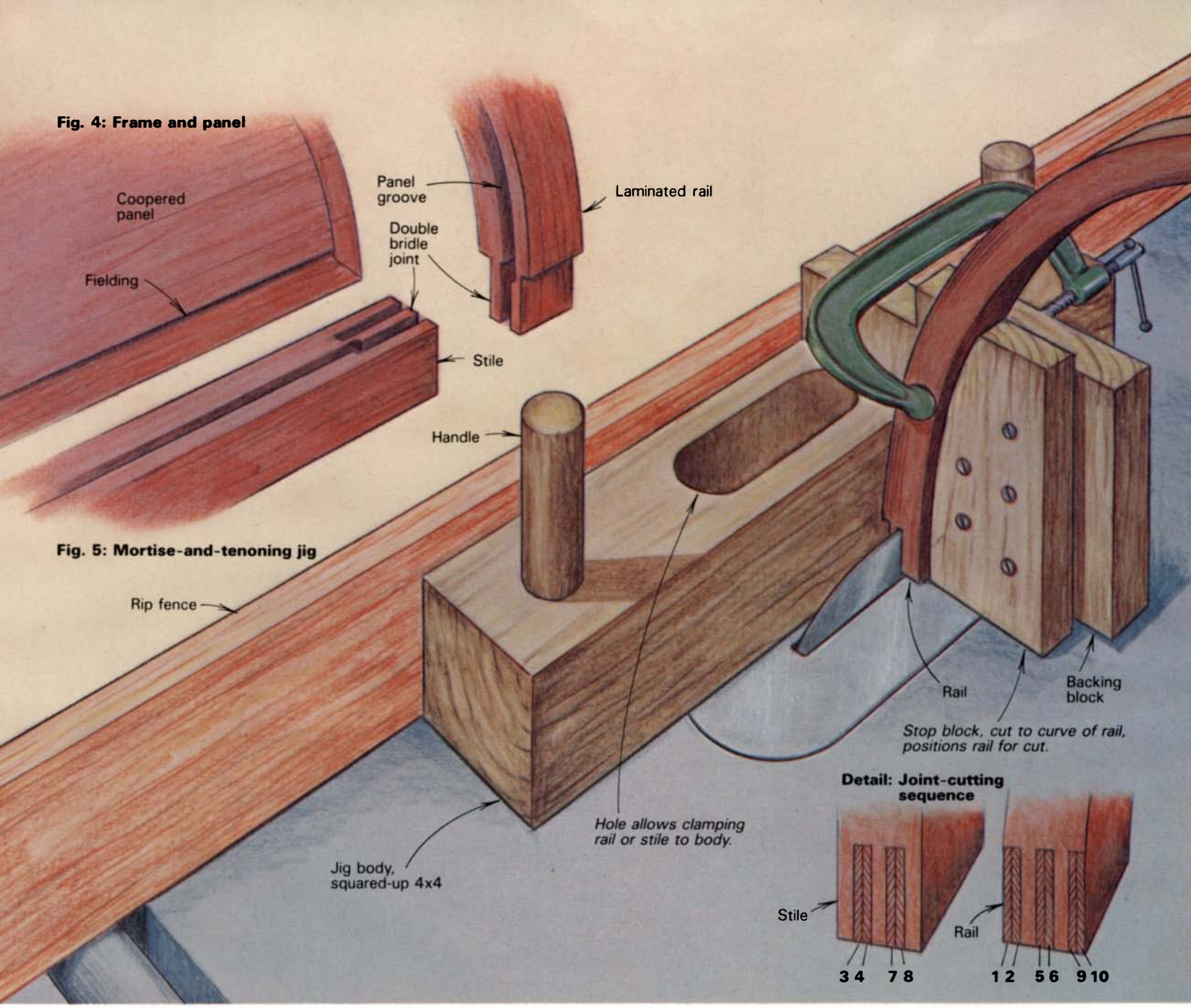


scrape and sand to match the panel curve. In use, keep a steady hand and take several shallow cuts rather than one deep one.

In addition to considerations of appearance, framing the panel has definite structural advantages. Like any piece of solid wood, a coopered panel will expand and contract with the seasons. A frame will help keep the radius of the panel's curve from altering with seasonal movement, as well as concealing from view changes in the panel's width due to movement. The straight members, or stiles, are identical to those of a flat frame. The other pieces, the rails, must be curved; I laminate mine on a form, like the one shown in figure 3. When making the form, remember to add the length of the tenons and a generous allowance for waste. (For more information on form lamination, see *FWW* #54, p. 40.)

I join rails and stiles with a double open mortise and tenon (also called a double bridle joint), and house the panel in a groove, as shown in figure 4. After you square-up the rails and stiles, cut them to length. Figure length just as you would for a flat-panel frame, remembering to allow for panel movement across the grain.

I cut the double bridle joint on the tablesaw with a flat-top,



chisel-tooth carbide rip blade and a simple jig (figure 5), made of a squared-up 4x4, a support for the curved rail and two handles. I make the tenons and mortises of equal thickness, about one-fifth the thickness of the rails and stiles, and cut the tenons on the rails. With a marking gauge, set-out the joint on two pieces of scrap the thickness of the rails and stiles, and use these to set the saw.

The sequence of cuts for making the joints is shown in figure 5. I use the scrap to establish and check the rip fence position before each new cut, then cut all four ends before resetting the fence for the next cut. The first cut is made on the outer faces of the curved rails, the rip fence positioned so the blade just skims, but doesn't cut, the face of the jig. After completing cuts 1 and 2 on the first tenon, move the rip fence away from the blade by the thickness of a saw kerf, to make the first mortise cut on the straight stiles (cut 3). Be sure to check against the scribe marks on the scrap before cutting the stiles. Remember to work from the outside face of the stiles, as well as the outside face of the rails. Continue to alternate from tenons to mortises, as shown, until the joints are finished.

Clear the waste and clean up the shoulders with a chisel if necessary, assembling the joints to check the fit. Clamp a simple wooden fence, cut to the panel curve, to a router to make the panel grooves. Remember to make the grooves deep enough to allow for panel movement. Plunge the bit into the rails and stiles in the area of the mortise or tenon so that any tear-out at the beginning or end of the stopped cut will be hidden. If you prefer to be able to remove the panel, you can rabbet the frame parts with a piloted bit; the panel is held in place by thin fillets screwed to the frame. Fillets can be glued-up on the rail-making mold as a single, wide ¼-in.-thick piece, then bandsawed to width.

Finish-sanding the rails and stiles, and finishing the panel before gluing up, helps minimize clean-up problems. I glue up the frame first in two L-shaped sections, let them cure, then complete the assembly. Make sure that the panel slides easily in the grooves before the final glue-up. A little candlewax in the grooves near the joints will keep squeezed-out glue from adhering the panel to the frame. When the framed panel is complete, you can make the box to fit its size and curves exactly. □

Skip Sven Hanson, founder of the Albuquerque Woodworkers Association, builds custom furniture in Albuquerque, N. Mex.

Vermont Turning School

Russ Zimmerman's three principles for clean cuts

by Dick Burrows

Like many woodworkers, I learned turning with a book in one hand and a gouge in the other. Whenever I read about a slick technique, I'd imitate it, seeking those satisfying cascades of shavings and mirror-smooth finishes. Most often I'd catch the tip of the tool and brutally slash the wood. One night, while holding an ice pack to my jaw, pondering how a shattered bowl could hit so hard, I decided to temper my quest for world-class cutting technique. When things got risky, I'd put the skew and gouge away, grind a burr on my ½-in. roundnose and scrape.

My turning gradually improved anyway, largely because I repeatedly practiced what Dale Nish and Peter Child had written. No matter how good the finished pieces looked, though, I didn't like the hit-and-miss combination of cutting and scraping I used to hack them out, or the pieces I broke trying. Something was wrong, but there weren't any good turning teachers nearby to help. Wouldn't it be great, I thought, to attend one of those intensive seminars, like the ones Child conducted at his home in England, and learn a better way?

Unfortunately, Child retired from teaching before I could visit him, but I recently spent a couple of days with one of his students, Russ Zimmerman, who runs a turning workshop in Westminster, Vt. Zimmerman modeled his school after Child's, but has modified many of the methods he saw Child use in the mid-70s, because of his subsequent experience and his contacts with other turners. As Child did, Zimmerman limits each class to two students, who usually move in with his family for 2½ days and spend most of their waking hours turning. My fellow student, Nils Agrell, a New York City stock investor, and I each had our own Myford lathe to work on in Zimmerman's compact and efficient basement shop.

One of the first things I noticed about Zimmerman's turning is that it's much more relaxed than my mish-mash of techniques. Where I would strangle the tool, jam it in and hang on, Zimmerman stresses control more than brute force. Steadying the tool against his leg or hip, he uses his whole body to move the tool, adjusting the cutting edge with light hand and finger pressure, taking full advantage of the tool's bevel and cutting edge.

Zimmerman bases his turning on three general principles—the cutting edge should be about 45° to the direction in which the work is rotating, the tool's bevel should be rubbing on the wood, and finishing cuts should be made across, not against, the wood fibers. These principles are presented as guidelines for developing a feel for tools and an understanding of what they are doing. Zimmerman urges students to build on this understanding, and to ask themselves what he thinks is the most important question: "Does it feel right?" His only iron-clad *must* is sharpening. The grinder, shown on p. 42, is one of the most used tools in the shop.

Zimmerman demonstrated his principles by hollowing a small walnut bowl using a long-handled, ¼-in. deep-fluted gouge. With the bevel riding lightly against the wood, but not cutting, he moved the tool forward and shifted the tool handle slightly until the gouge began to cut, then moved his body to continue the cut across the wood's surface. He steadied the handle with his side and kept the bevel rubbing while manipulating the angle of the cutting edge. Since I manipulated turning tools with just my arms and hands, I initially thought Zimmerman's style of work was more like dancing than turning, but I soon found that by bracing the 15-in. handle against my leg or hip and moving my body and tool together, the tool's cutting edge was much more stable and easier to control.

After stressing the importance of body movement and bevel contact, Zimmerman urges his students to play with the techniques. He convinced me that I needn't worry about the edge digging in, as long as the bevel was in contact with the wood. Being overly cautious, I practiced for a while with the lathe motor off, turning the wood into the tool by hand. Even with the lathe on, I was surprised at how easy it was to adjust the tool angle and cutting edge, as long as I kept the bevel riding on the wood.

The recommended 45° angle of the cutting edge to the work makes sense if you consider that when the edge is at 0°, just about parallel to the direction of rotation, no cutting takes place. Adjusting the handle slightly to a 15° edge angle produces a light cut and a fine finish, because the bevel is able to polish the surface behind the cut. As the angle increases to 90°, as shown on the facing page, more of the edge contacts the wood, and the cut becomes heavier and more likely to tear the endgrain. The 45° angle compromise produces a good surface and a reasonably fast cut without requiring excessive force. Once the position of the cutting edge is set, Zimmerman describes the angle of the gouge's flute in terms of how a clock face would look with a gouge cross section superimposed in the center of the dial. A straight-up flute would be 12 o'clock; one parallel to the tool rest would be 3 or 9 o'clock. As the flute orientation changes, note how a different part of the edge begins cutting.

The hardest thing about manipulating the bevel is developing a light enough touch to skim the bevel across the wood, instead of rubbing it so hard that it burnishes the wood, heating and dulling the tool. It takes time to develop a feel for moving the handle and cutting edge simultaneously at the same rate. If you shift the handle without moving the tool forward to keep the

Fig. 1: Flute angle

Flute angle is described with a clock face. 12 o'clock is good for roughing out; 3 o'clock better for starting a hollow cut.

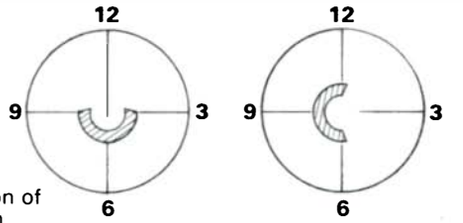
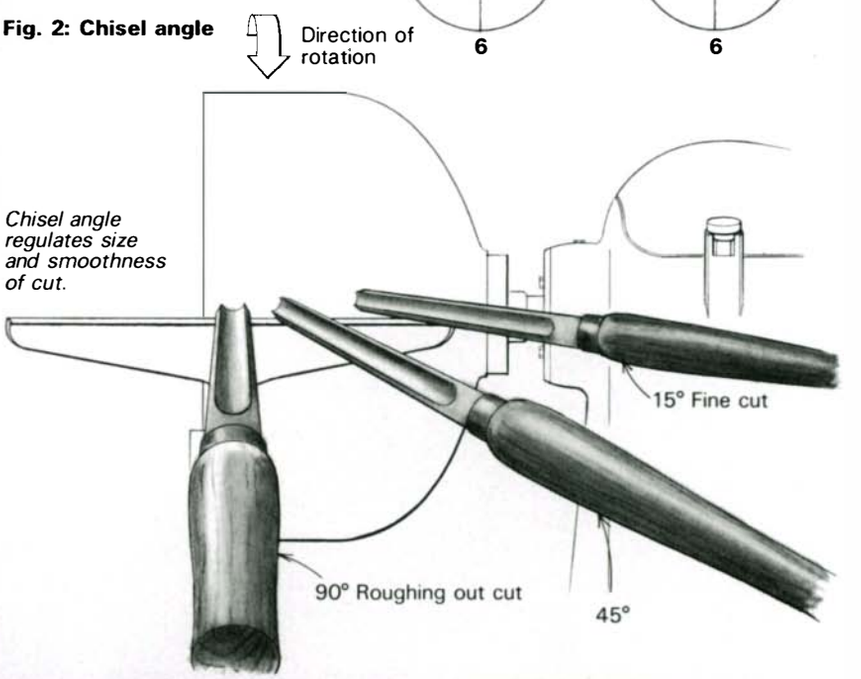


Fig. 2: Chisel angle



Turning student Nils Agrell, above, braces the tool handle against his hip to steady the cutting edge, while he manipulates the bevel and flute angles with his hands held high on the tool. To hollow a bowl on the lathe's outboard rest, right, adjust the flute to the 9 to 10 o'clock range and skim the tool bevel along the cut surface as you arch the chisel deeper into the blank. A fingernail gouge rides its bevel up the outside of a bowl, far right, smoothly cutting across the wood fibers. Keeping the bevel against the wood at all times prevents the cutting edge from digging into the stock.

bevel skimming the wood, you will either lift the edge off the wood, stopping the cut, or the edge will dig in and the cut will be rough and difficult to control. A rough cut creates a bump, on which the bevel bumps again next time around, cutting another bump, and the bumps will reproduce quickly. Stop, go back to the last smooth area, set the bevel and recut.

Agrell and I had our choice of doing spindle or bowl turning, or both, and each of us elected to spend most of our time on bowls. We began by making a small walnut bowl. We each worked a 4-in.-thick bandsawn blank screwed to a faceplate on the outboard spindle, first turning the outside shape, then flattening the bottom with a ½-in. deep-fluted gouge. Flattening the bottom was a good chance to practice body movements, since the straightness of the bottom depends on the handle moving at the same rate as the cutting edge. Begin the cut with the bevel parallel to the bottom of the bowl and the flute facing 10:30. Then, brace the end of the handle on your leg, set the bevel, and use your leg to push the tool across to the center.

During each cut, Zimmerman makes his students watch the emerging shape on the bowl in the area opposite the actual cut. If you concentrate on the cutting edge, you'll instinctively try to keep the tool cutting and never notice the character or flow of the shape you are cutting. I found it hard not to focus on the tool, so Zimmerman repeatedly put his hand in front of my bowl, blocking my vision. It's uncomfortable not being able to see the business end of the tool, but he was right—the shape was more flowing and elegant when I didn't just stare at the tool.

Before removing the bowl from the faceplate, we held a second faceplate against the rotating wood, centered it by eye, and held a pencil to the wood at the faceplate's rim. The drawn circle is the guide for remounting the blank. It's a surprisingly accurate method. Instead of screwing the faceplate to the now flat bottom of the blank, we attached it with Permacel double-faced cloth tape. Cover the faceplate with tape, peel off the

Grinding turning tools

Zimmerman uses a sliding tool support to steady a long-handled gouge as he grinds the cutting edge on a 6-in. aluminum oxide wheel. Note how the tool's cutting edge rides directly on the blade and doesn't touch the grinder's tool rest, which is set for grinding skews and other straight tools.

Zimmerman insists that a key part of turning is continually sharp tools. He uses a Sears' bench grinder, right, fitted with custom-made tool rests and guides. The two tool rests are 3-in. by 4-in. by ¾-in. pieces of plywood bolted to the grinder's original metal rests. The right-side rest, which is used for skews and parting tools, is angled to produce a 30° to 35° bevel on the tool. Scrapers are ground on the left-hand rest, which Zimmerman sets to produce an 80° bevel.

The third bench-grinder modification is an adjustable tool-handle support for grinding square-edge and fingernail gouges. The ⅝-in. by 1¼-in. arm slides in a small box mounted to the table under the wheel. A thumbscrew locks the arm in position. The tricky part is setting the height of the rest to fit your tools. Clamp an 8-in.-high rest to the arm and put your longest gouge in the support notch. Adjust the rest height and arm length so the wheel contacts the middle of the bevel. Now try your shortest gouge. You may have to compromise on the height to be able to work on both tools satisfactorily. When you have worked out the height, cut the rabbet and assemble the support. Note that when the handle is properly adjusted, the tool rides directly on the wheel and doesn't touch the grinder's tool rest at all. To grind square-edged gouges, first rotate the tool on its bevel. For a fingernail grind, you also have to push the tool up the wheel slightly as you roll the tool onto its side. After grinding, Zimmerman hones the tool with a medium India stone or soft Arkansas stone. —D.B.

backing paper and squeeze the blank to the faceplate for a few minutes with a handscrew.

Most of the hollowing was done with a deep-fluted gouge ground to a fingernail shape (*FWW* #53, p. 75). A ⅜-in. fingernail gouge was more maneuverable than a square-edge gouge for the deeply hollowed bowl shape I was working on. On the outside of the bowl, I found I could easily cut across the fibers of the wood and get a smooth surface by cutting from the bowl's small diameter to its large diameter. The flute is held at about 10 o'clock, orientating the cutting edge at 45°. Again, remember to use your body, not your hands, to move the tool. Make a notch to begin the cut, then lower the handle and twist it around, adjusting the flute in the 9 to 12 o'clock range. The swinging motion of your body will arc the cutting edge to follow the curve of the bowl. For deep hollows, you can let the tool's shaft rub against the rim, using it as a fulcrum to cut deeper into the bowl. At first, I expected the edge to catch despite the rubbing bevel, but I kept adjusting the flute orientation and the shavings kept spewing out. I got so carried away that I cut through the bottom.

Zimmerman gets a remarkably clean finishing cut inside the bowl using one side of a ¼-in. deep-fluted, square-edged gouge with the edge held at about a 10° to 20° angle. During this operation, he held one hand lightly on the outside of the bowl to dampen vibration. You can also finish up with a scraper—scraping isn't a bad word in Zimmerman's shop. He feels it's important to enjoy and to feel comfortable with turning, and some people are just more comfortable with scraping. Zimmerman makes what he calls the slicing scrape with a roundnose scraper, which produces a fine shaving, not sawdust. To avoid the torn endgrain commonly associated with scraping, he cuts with the tool edge held at 45° to the wood's motion, so only one corner of the scraper contacts the tool rest.

Since I hadn't turned much in recent years, I think I went to the seminar with a fairly open mind and unpracticed hands, eager to develop new skills and perhaps to rekindle my interest in turning. Zimmerman's hands-on instruction helped me make sense of many things I had half-learned. Since the seminar I've been turning regularly again, and am finding that I'm cutting much faster and with greater accuracy than before, and producing crisper, more delicate pieces. And it's been fun. I couldn't ask for much more from any teacher. □

Dick Burrows is an associate editor of Fine Woodworking. *Russ Zimmerman's school is in Westminster, Vt., a small community in the southeastern part of the state. His address is RFD #3, Box 242, Putney, Vt. 05346. In addition to Myford lathes, he sells Permacel double-faced tape and Sorby tools, and publishes a chatty technical journal,* The Zimmerman Woodturning Letter.

Stenciling a Boston Rocker

Color with powdered metals

by Beau Belajonas

Few early-American classics can compare with the function, comfort and beauty of the Boston rocker, with its graceful, smooth-flowing lines and colorful painted finish. Chairmakers in the early 1800s built the chairs from whatever hard or soft woods they had, rubbed on layers of red and black paint to make the chair look like mahogany or rosewood, then decorated this painted finish with colorful striping and stenciling. Many chairs were stenciled by sprinkling metallic powders on a tacky varnish base, which is the technique I'll describe here.

Most of the chairs I see as a finisher and restorer in Camden, Me., are basket cases, faded and worn and just hinting of the brilliance of their original finish. Antique buffs or museum curators wouldn't think of restoring these pieces. Their antiquity, and value, is obvious. But if you're more concerned with enjoying the original beauty of the chair, or if you'd like to try stenciling on your own work, the process isn't hard to learn.

In restoration, the first step is to clean the chair, trace the original stencils, and make notes and sketches about everything you want to re-create in the repaired chair—color, measurements, graining, and so on. As a memory check, take a few color photos. Repair structural problems, then strip away the old finish and repaint the chair before reapplying the stenciling and other decorative touches.

Water and paper towels will take off enough dirt and grime to let you clearly see the artwork. You can also use mineral spirits, but be careful not to remove the worn stencil. Set the chair on its back under a bright lamp. Place a piece of Supersee Acetate (available from most large art supply shops), matte side up, over the stenciling and trace it. You may not be able to see all of the stencil clearly, but work with whatever you have. Most patterns are symmetrical, so you can take segments from both sides of the centerline to come up with one complete half-pattern. If you can only make out half a melon, sketch in the other half. Don't be afraid to add your own creative touch—the stencil doesn't have to be an exact copy. After tracing one half of the stencil, fold the acetate in half and trace the pattern onto the blank half. When you unfold the acetate, you will have a complete pattern. If you don't have an original, you can scale-up the patterns shown on p. 47, which I used for the chair shown at right.

Stripping is the messiest part of restoration. Spread newspaper on the floor, wear rubber gloves, and make sure you have good ventilation. Stripper fumes can be hazardous. Cover the chair with a semi-paste remover (I use Zip Strip Paint and Varnish remover made by Star Bronze Co., Alliance, Oh.) and let it set for 10 minutes. Then, dip a half-pad of 0 steel wool into a bowl of lacquer thinner and scrub the softened finish. Wipe the chair clean with

A subtle interplay of red and black paints, brilliant yellow striping, golden turnings, and an ornate vine-and-fruit arrangement stenciled onto the crest rail with metallic powders, enhances the comfort and graceful lines of this traditional Boston rocker. Stenciling requires careful preparation and a steady hand, but isn't a difficult process to learn.

Photos: Kip Brundage

paper towels, then go over it again with paper towels dipped in clean lacquer thinner. Finally, sand with 180-grit paper.

Now you're ready to paint. The trick is to streak on several thin layers of different colors, so that the interplay of colors creates the impression of grain, wear or age. For an undercoat, I like oil paint because of its toughness, and I prefer the deep earth-tone reds used on the original chairs. The color is important because the undercoat will show through on parts of the chair. I've had good results with the brick-red "Old Village" enamels (Salem Brick or the New England Red). You can also tint any red paint with raw umber and yellow ochre artists' oil colors.

Thin the paint with mineral spirits so it'll brush on easily and be a little streaky. I sometimes leave a little wood showing, or rub off color with steel wool, especially on the arms, back spindles and other heavy-wear areas. If you like the aged feeling created by this light coat, apply a coat of black. If you want more red, then apply another thin coat after the first coat dries.

I put a fairly opaque coat of black on the crest rail to set off the gold stencil, but I streak it over the red on the chair rungs and legs to make tiger-striped grain patterns. After thinning two parts flat black paint (I like Benjamin Moore's Flat Black Satin Impervo Enamel) with one part mineral spirits, I begin at the bottom of the chair, with a 2-in.-wide brush, and work my way up. By the time I get to seat level, my technique is in high gear.

Before you begin painting the rockers, legs and rungs, make a graining comb, as shown on the facing page, top right, by cutting notches in a stiff piece of belt leather. After painting the undercarriage, remove the paint from your brush with paper towels. Then, dry-brush the pieces you've just painted to give the paint a thin, worn look. Dry your brush often. As the paint begins to set, drag the notched graining comb up-and-down on the runners, and back-and-forth on the legs, as shown on the facing page, center right. If your graining runs, you have not dry-brushed the black paint enough.

Instead of graining the back spindles, crest, arms and seat, I dry-brush these parts without revealing too much red. The arms and the middles of the back spindles can be rubbed with paper towels or crumpled newspapers to give the illusion of wear. Another variation is to wait until the paint dries a little and scratch it with steel wool. Periodically stand back and look at your work. If you think more red would look better, rub off more black. If too much red shows, add some black. When you're satisfied, let the graining dry overnight before sealing it with 3-lb. shellac cut 1-to-1 with alcohol. Finally, apply a coat of satin varnish over the dry shellac to protect your work. Don't varnish before sealing the chair—the varnish will pull off some of the black paint.

To duplicate the yellow seats traditionally found on Boston rockers, draw in the seat with a white China marker (sometimes called a grease pencil). An ordinary yardstick, which is about an inch wide, is a good guide. Place the yardstick along the inner edge of the arm spindles and draw a line along the stick's inside edge. You can just paint over the line—the China marker doesn't interfere with paint adhesion. Many of the seats are scooped, so you can follow the curved line along the back without a yardstick. Generally, the line is ½ in. to 1 in. behind the last arm spindle. The front edge should be 2 in. (the width of two yardsticks) before the front arm spindles.

After drawing in the seat, mix some flat yellow paint (I like Benjamin Moore) with white oil color to make a straw yellow. Thin this soft yellow with mineral spirits and paint in the seat. You'll probably need two coats. With a 1-in. brush, carefully paint along the line, working a section at a time using your other hand as a guide (facing page, bottom left). If you go over the line, wipe the paint toward the seat with your little finger. The edge isn't critical because you will be putting a stripe around it later. If you don't want to risk doing the job freehand, block out the seat with masking tape. Brush away from the tape to avoid forcing paint under it. If paint seeps under the tape, scrape it away with an X-acto blade. If you scratch through the black to the red, it'll just add to the "aging." After the yellow has dried, seal it with white shellac cut 1-to-1 with alcohol.

In about an hour, make a glaze of yellow ochre and raw or burnt umber, mixed with a solution of equal parts varnish and mineral spirits, and brush it over the yellow seat. Streak the glaze with a paper towel or dry brush (facing page, bottom right). Let the glaze dry overnight, then seal it with satin varnish.

Next, take your acetate tracing of the old stenciling and recopy it onto tracing paper. It's better to work from tracings because you must make individual stencils for various parts and colors of the design and don't want to destroy the original. Besides, I think my patterns get better each time I trace them. Tracing is easier on a light table, which you can make by mounting two fluorescent bulbs in a frame supporting a piece of translucent white Plexiglas.

You'll need the five separate stencils shown in figure 1, a master stencil for the end scrolls and grapes, which provides a layout guide for the other stencils, and stencils of the two leaves with veins (left and right), melons (left and right), pineapple and basket lattice work. You'll also need an outline tracing of the basket, which will be painted red. To help you align the small stencils with the master, look for places where you can put in keys or reference marks. On the basket, for example, I used a couple of grapes, as shown. You can line up the leaves, melons and pineapple by eye, so no keys are needed.

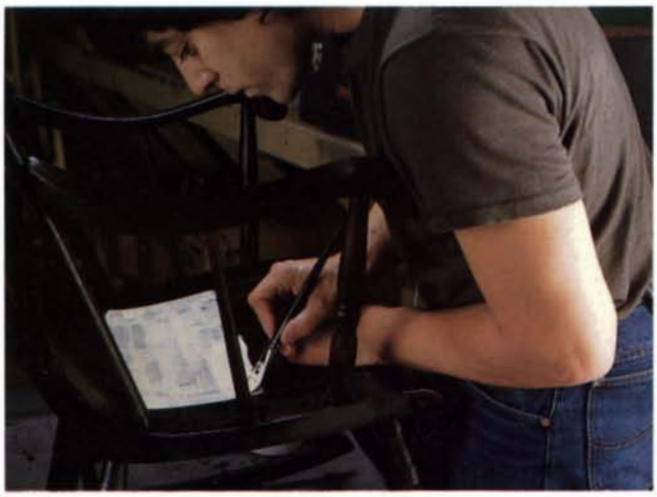
After transferring the tracings onto stencil paper (available from art supply shops), cut out each design with a #11 X-acto knife. A piece of glass, 18 in. by 24 in., placed on a light table makes a good roomy work surface. The extra light will help you see better and cut much finer details. Cutting a stencil is a two-handed job. If you're right-handed and cutting a circle, for example, hold the knife with your right hand and slowly turn the stencil paper with your left hand. If you're left-handed, turn the paper with your right. This motion will give you a smooth, accurate cut. Cut the master stencil first, just the grapes and the end scrolls. Next cut the basket lattice and trace the basket outline onto another piece of paper. Then cut the remaining stencils.

Once all the stencils are cut, tape the basket outline to the center of the crest rail. Using white carbon paper, trace the outline onto the rail. Paint the basket red and let it dry. The next day varnish the crest rail and the roll at the front edge of the seat. The varnish acts as an adhesive for the metallic powders, non-precious metals in a range of colors (see p. 47 for sources of supply). Just lay on a thin coat, lightly pulling it out in one direction.

While the varnish is drying, tap about a half-teaspoon of each metallic powder you plan to use onto small pieces of velvet. Silver or copper powders can be used along with the gold. For example, grapes done in silver, flowers in copper, leaves in gold. Use clean pieces of velvet for each color. After 20 to 30 minutes, check the varnish by lightly touching it with your fingertip. When the varnish feels tacky, but you don't leave fingerprints, you can stick the master stencil on it, centered, as shown on p. 46, bottom left.

Wrap a clean strip of velvet around your fingers to make an applicator for spreading the powder. I do the lighter colors first, then apply golds and other darker colors. Use the nap of the velvet to pick up some powder from the piles you previously laid

Belajonas paints a thin, brick-red undercoat on the chair, above, which has already had its old finish stripped off. Before adding a coat of black paint, he makes a graining comb by cutting different-sized notches into the edge of a 3-in. long piece of belt leather, above right. By gently dragging the comb up-and-down through the still-wet black paint on the rungs, right, he removes enough of the black to let the red show through as a tiger-stripe grain pattern.



Belajonas uses his hand as a brace, above, to support his brush as he paints the center part of the seat yellow. For a mellow, aged effect, he adds a brownish-yellow glaze over the yellow, then streaks it across the width of the yellow seat with a crushed paper towel, right. He lets the glaze dry overnight, then seals it with satin varnish.

Five stencils are used to apply the metallic powders to create this traditional floral scene on the black crest rail. After applying varnish as an adhesive for the powders, Belajonas locates the master stencil by holding the pattern at the end of the rail, above left, as he centers it over the painted basket. To apply the powders, he wraps velvet around his fingers to make an applicator and dabs the powders onto the tacky varnish under the stencil, above center. A light touch is needed to shade in the powder for a lifelike three-dimensional look. After picking up powder with his applicator, right, he removes the excess from the velvet by tapping it on his arm. He stripes the spindles freehand, far right, by using one hand as a steady rest.

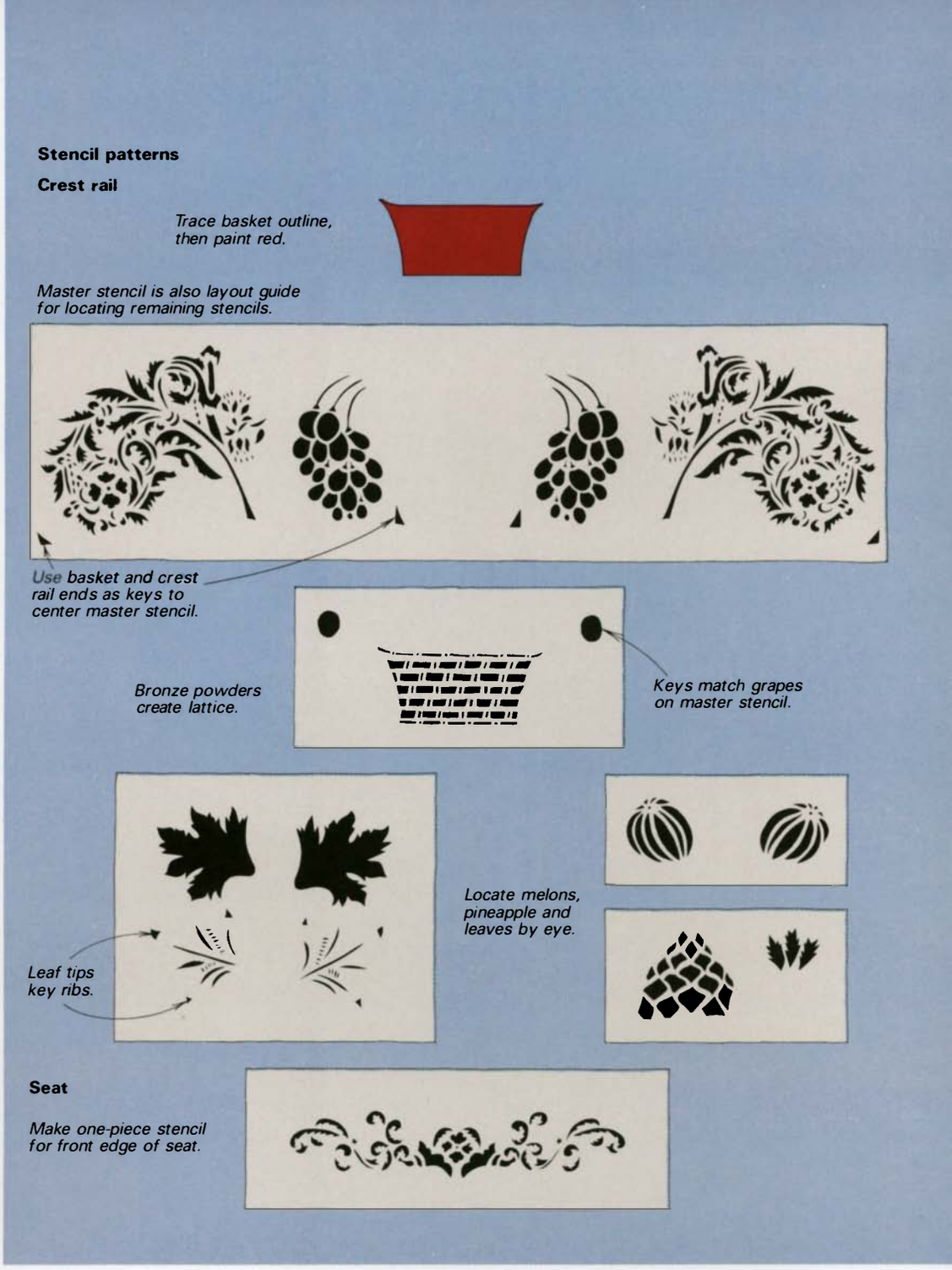
out on the velvet pieces, then rub the velvet applicator on the back of your hand or forearm, to remove the excess. Start rubbing lightly over the stencil to gradually shade on the powder. Work in from the edges so the powder won't get underneath the stencil. It's okay to let a little black show through. If you are doing a leaf, make the tips strong, then fade them out toward the middle. Similarly, a peach or melon should have dense edges that fade in the middle. The black showing through creates a nice soft, three-dimensional look—delicate and aged.

After applying the powder, take a soft cloth and very gently wipe any excess powder before lifting one end of the stencil and carefully peeling it away. If you don't like the result, immediately wipe off the gold powder and tack varnish with mineral spirits and try again. If it looks good, let it dry a day, then gently wash the stenciled areas with water to remove any excess powder. Powder stuck in the wrong place can be rubbed off with 000 steel wool. Finally, varnish over your work and let it dry. Repeat the process for the roll of the seat.

The final decorative touch is to add horizontal stripes around the back and arm spindles, where you feel a touch of color is needed. To stripe the back spindles, measure 1½ in. to 2 in. down from the rail and mark with a China marker. Pour some yellow paint in a little tin (clean cat food cans are great) and thin with turpentine, which makes a smoother mixture for striping than mineral spirits. Soften the yellow with white and raw umber, if you wish. Apply an opaque stripe with a #2 quill brush. Two coats are usually needed, but you can dab on the second coat 15 minutes after the first. After the yellow has dried, put a green stripe next to it. You can soften the green enamel with raw umber.

Now put a stripe around the yellow seat. The seat outline is usually guide enough, but you can mark it out with a China marker. This time add raw sienna to your thinned yellow to make a brown yellow. Run a stripe along the edge of the yellow seat with a 0 or 00 sword-striper brush. Use long strokes—the quicker the stroke, the straighter your line. Wipe off mistakes with your finger.

You may want to put gold on the ball-like turnings of the chair.



The easiest way is to paint on Decorator's Enamel Antique Gold Paint, but the color won't exactly match your stenciling. You also can mix varnish, turpentine and just enough chrome yellow to make a semi-opaque color. Apply this with a #12 flat brush or #6 quill. When tacky, apply gold powder with velvet or a soft brush. You may also want to put a green or yellow stripe on the chair rungs. After the stripes and gold paint have dried, I protect the entire chair with a coat of satin varnish, which I usually tone down with raw umber, then wax the chair.

When American artists did these chairs 100 years ago, they added their own personality and style to their work. Don't be afraid to continue the tradition by expressing yourself a little, unless you are trying to do an exact reproduction. As art continues to move into new eras, it keeps many of the old techniques, but the personalities of the new artists can create new traditions. □

Beau Belajonas is a stenciler, grainer and furniture restorer in Camden, Maine.

Sources of supply

Metallic powders are available by mail order from Lambert Company, 920 Commonwealth Avenue, Boston, Mass. 02215, and Woodfinishing Enterprises, 1729 North 68th Street, Wauwatosa, Wis. 53213.

Finishing supplies are available from Behlen, Route 30 North, Amsterdam, N.Y. 12010.

Beaute Satin Creme Furniture Wax may be ordered from Roger A. Reed Inc., 165 Pleasant Street, PO Box 508, Reading, Mass. 01867

Stenciling supplies are available from Crafts Manufacturing Company, 72 Massachusetts Avenue, Lunenburg, Mass. 01462, and S. Sleeper Company, Route 107-A, East Kingston, N.H. 03827

Console Table

A three-way tenoned miter holds it together

by John Kriegshauser

When I received the drawing for this otherwise simple console table, my reaction was to propose alternatives to the three-way miter. A mortise-and-tenon joining the apron to the legs would, I argued, be easier and strong enough to stiffen the long legs. But the designer, Roger Kraft, an architect who is a fanatic about detail, would hear none of it. He suggested a Chinese-style three-way tenoned miter.

I couldn't imagine hand cutting these joints to the tight tolerances required, so, after much thought, I developed this method of machining three-way miters with concealed tenons. The process may appear complicated, but it really isn't. The challenge lies in the need for patience and accuracy.

First, adjust your tablesaw to cut square and without heel. The stock must be straight, square and uniform. I set the miter gauge with a machinists' combination square, then verify the setting by mitering two scraps. As the process proceeds, I cut scrap material to check each saw setting. If the legs and aprons are the same dimension, then each angle will be 45° and each joint will be cut exactly alike. There will be no right- or left-hand parts. Kraft's table, for comparison, joined a 3-in. apron into a 2½-in. leg, so the miter angles were 39.8°/50.2°. Odd miter angles can be calculated with trigonometry or measured off a scale drawing. For clarity's sake, these drawings show the same size apron and leg.

The key to the process is establishing a reference surface that guides the parts through the saw to form the tenons. To allow material for this reference surface, the parts must be rough cut over length, the legs longer by their own width, the aprons by twice their own width. Now draw the miters, mortises and tenons directly on the stock. Only one joint needs to be laid out to set up the saw since each of the three pieces being joined will be exactly alike; to avoid confusion, you might want to mark them all.

After all the parts are mortised (I use a hollow-chisel mortiser), the reference miters are cut so that the toe of the reference miter is located one stock width beyond the finished leg or apron tip. This mitered reference surface is used as a guide to run along the saw fence when the tenons are shouldered, and as a guide to run on the saw table when the tenon cheeks are faced, as shown in the drawing.

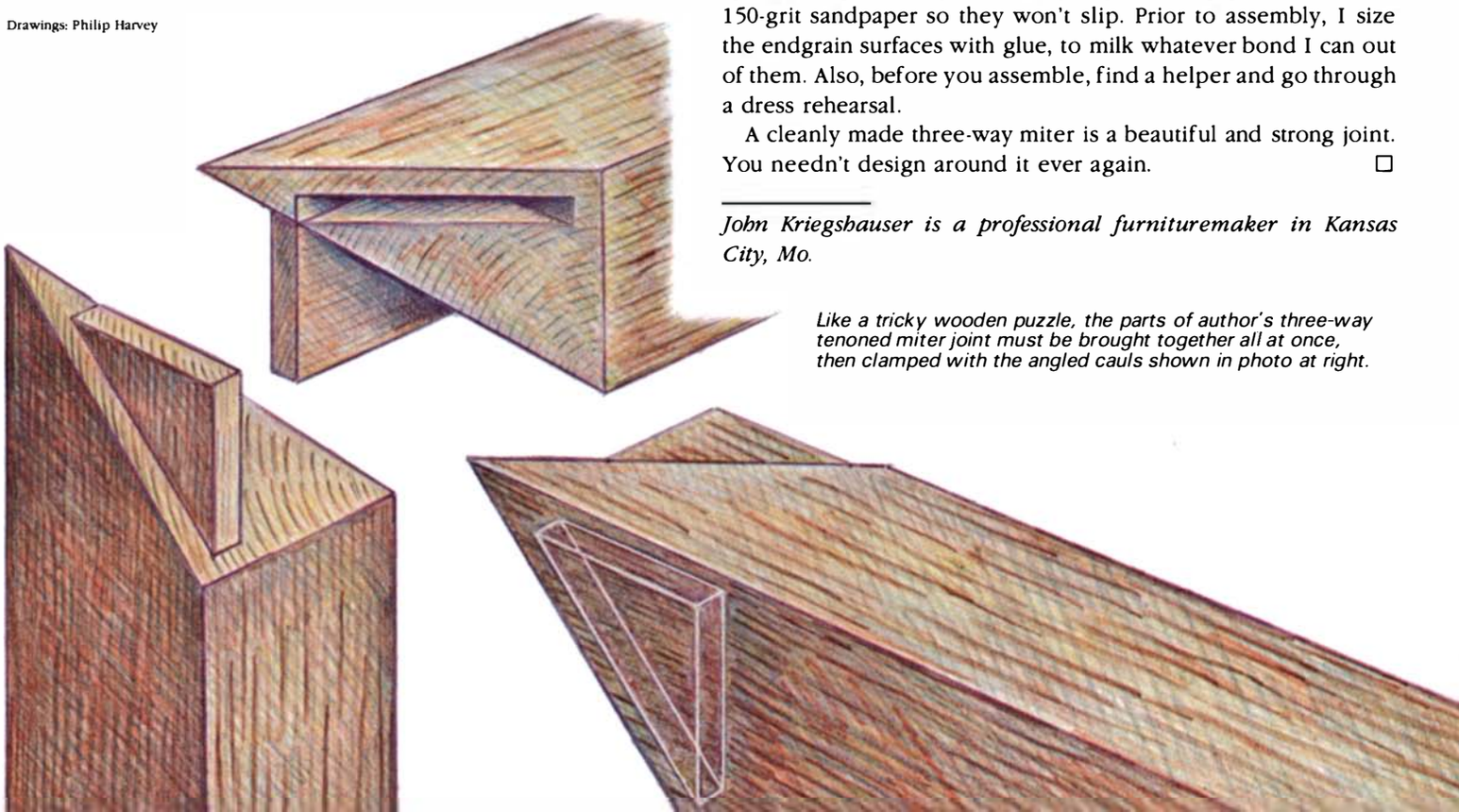
Next, the mortised side of the joint is mitered. This cut will leave an angled tip on the tenon, which must be squared with the tablesaw. Also, at this point, I like to shoulder the bottom of the tenon to eliminate any chance that it will be seen. Both of these saw operations will leave debris that will have to be removed with a chisel. Apart from this, no hand fitting should be required.

The table is assembled upside down on a workbench. The aprons are pulled together using angled clamp pads faced with 150-grit sandpaper so they won't slip. Prior to assembly, I size the endgrain surfaces with glue, to milk whatever bond I can out of them. Also, before you assemble, find a helper and go through a dress rehearsal.

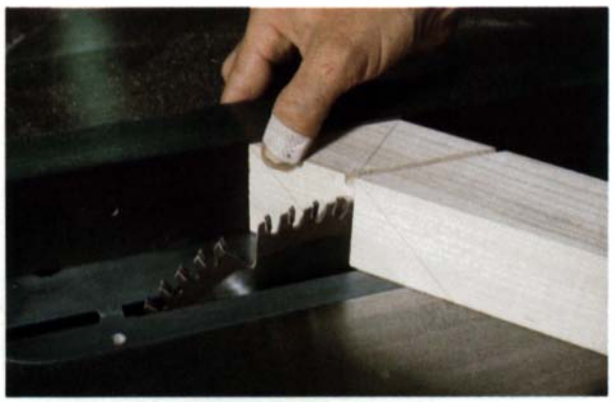
A cleanly made three-way miter is a beautiful and strong joint. You needn't design around it ever again. □

John Kriegshauser is a professional furnituremaker in Kansas City, Mo.

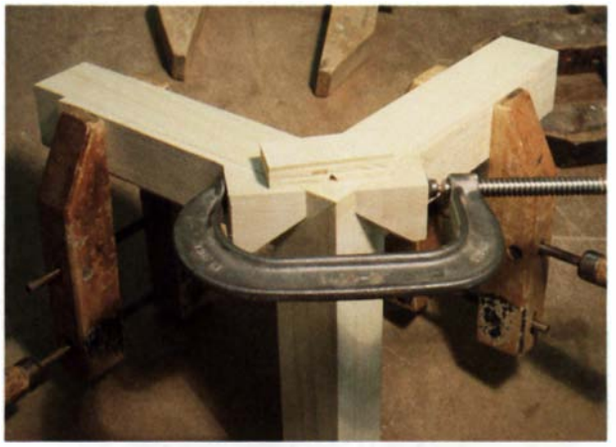
Drawings: Philip Harvey



Like a tricky wooden puzzle, the parts of author's three-way tenoned miter joint must be brought together all at once, then clamped with the angled cauls shown in photo at right.



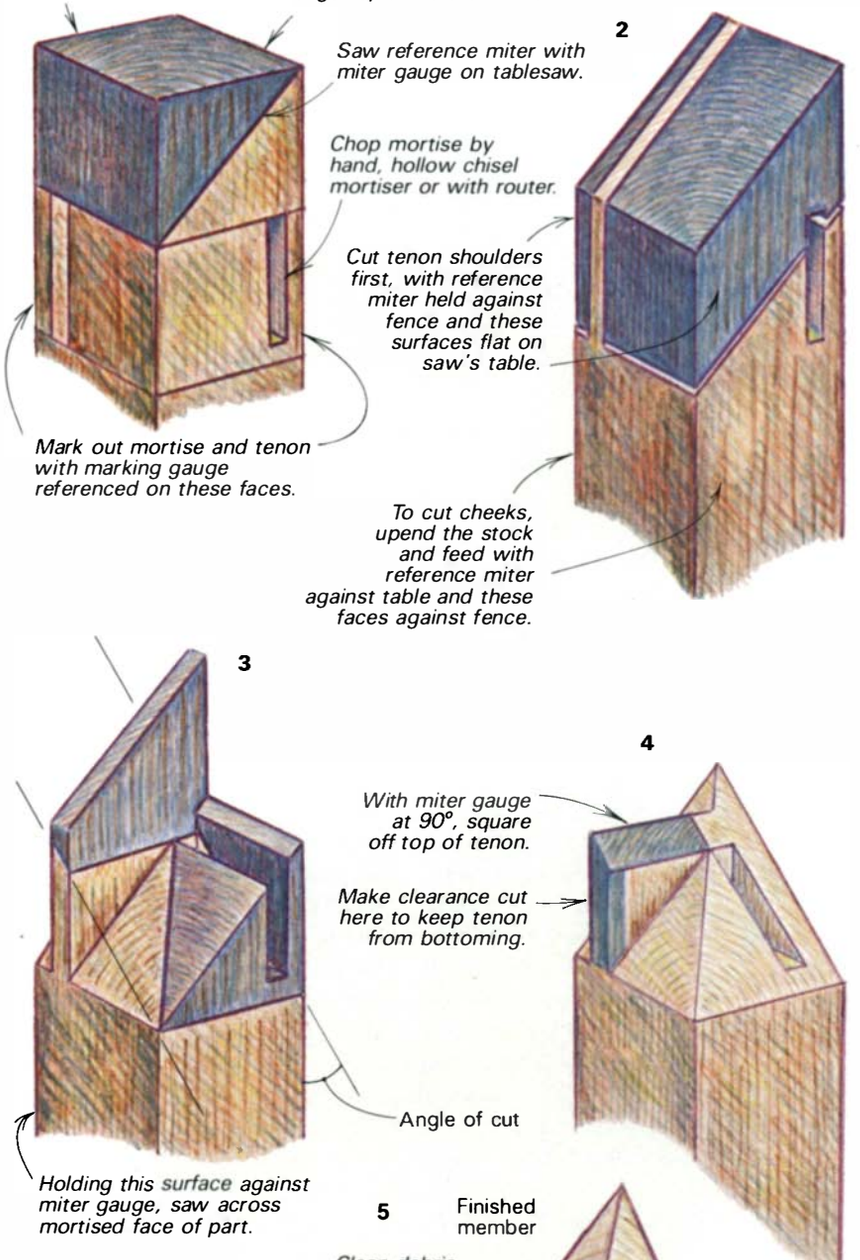
The tenon's shoulders are sawn first, by referencing the cut against the fence. Then it's upended and fed vertically to cut the cheeks. A shallow rabbet, cut into a scrap of plywood screwed to the fence, keeps the waste from binding between the blade and fence.



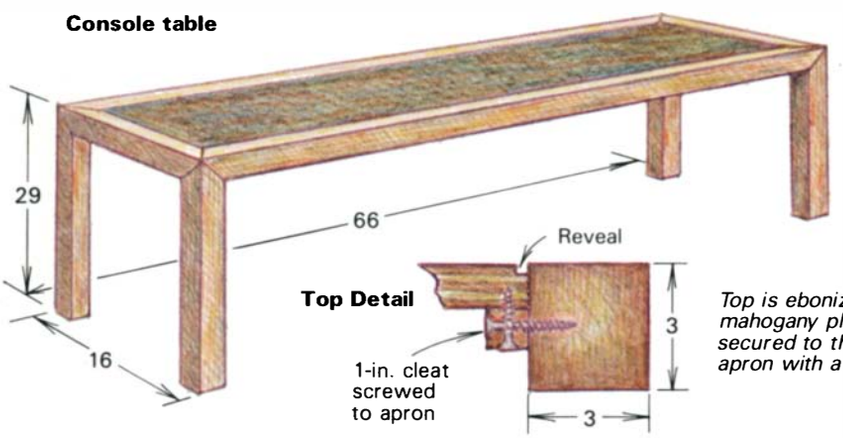
Cauls with angled faces allow miters to be C-clamped across the corners. Handscrews hold the cauls in place while the C-clamp is tightened; sandpaper glued to the inside of the cauls keeps them from slipping.

Cutting the joint

To provide reference surface for cutting tenon, make legs longer than finished size by amount equal to their width. Aprons get joints at both ends so make them longer by twice their width.



Console table



Top is ebonized mahogany plywood secured to the apron with a cleat.

Choosing a Tablesaw

How to find the one that fits your needs

by Rich Preiss

I have pushed wood over a lot of tablesaws during my years as student, furnituremaker and teacher, and one thing I've learned is that there is no single "best" tablesaw. Nor do you need the finest machine money can buy to accomplish the highest level of workmanship. The goal in choosing a tablesaw should be to first decide what you really need for your work (this is not to be confused with what you merely want) then to select the most appropriate tool and use it to your maximum ability. A machine larger and more expensive than you need will, at best, wind up as inappropriate in your shop and could rob the resources necessary to purchase other needed equipment.

In support of this, I would like to relate a short tale. After graduating from school, I was faced with the furnituremakers' nightmare—I no longer had access to a shop. My landlord was doing some remodeling and had brought in an older-style 10-in. Sears tablesaw to help with the work. I was taken by the simple, rugged design that had enabled it to survive for so many years.

I decided to try making a run of small, decorative boxes completely on what had been, up to now, a rough-use contractors' saw. With the help of a sharp sawblade, I was able to resaw the boxes' 5-in.-wide boards with over/under cuts. I next devised a mini sliding-table jig for crosscutting, and ultimately machined delicate splined miters for the corners. By the end of the project my illusions of dependency on ever-fancier machine tools were shattered. True, if I'd had a better saw I would have used it, but the final solution wasn't in the machine, it was in me.

Types of tablesaws—As I see it, there are four categories of saws: the fully-enclosed stationary saw, the open-based contractors' saw, the specialty saw, and the benchtop saw, which is often "motorized" (direct drive) and frequently has only a ½-in.-dia. arbor. Stationary saws weigh-in at upwards of 300 lb., contractors' saws (designed to be moved around a lot) might be 50 lb. to 100 lb. lighter, and benchtop saws can be hauled around easily by one person. Specialty saws, as we shall see, can be anything.

Though all saws are expected to do roughly the same tasks, their performance varies greatly depending on their construction, power, and features. Tablesaws rip, crosscut, resaw, mold, miter, rabbet and dado, and they are often called upon to cut many types of joints. Many saws have add-ons such as extension tables for handling full plywood sheets, extension rails and dust-collection gear. These accessories are standard on some saws and optional on others. This article won't attempt to evaluate accessories, but rather the basic tablesaw.

A series of boxes specifically describes and compares three very different machines—the Unisaw, Inca and Sears—that I've been testing in my own shop. I'll talk briefy about specialty saws, and on p. 56 there's a chart listing the sorts of saws available from as many manufacturers and importers as I could find. The job of comparing each tablesaw head-to-head with its competition is not something I can attempt, mostly because everyone expects different things from machines. But this article should get you on the way to being able to pick and compare for yourself. To keep the chart reasonable in size, I've set the cut-off point at saws that will accept a 12-in.-dia. blade. It is common to run 10-in. blades on such saws, though some saw models have arbors larger than ⅝ in. and won't take the usual blade.

Start by considering just what type of woodworker you are. Do you need a saw for rough work only, or is accuracy most important? Many professionals need a light-industrial tablesaw that will work all day, every day, often under adverse conditions of repetition and dust. Other shops may be able to get by with an open-base contractors' saw, which will saw a lot of 4/4 lumber satisfactorily, while still allowing for heavier jobs from time to time.

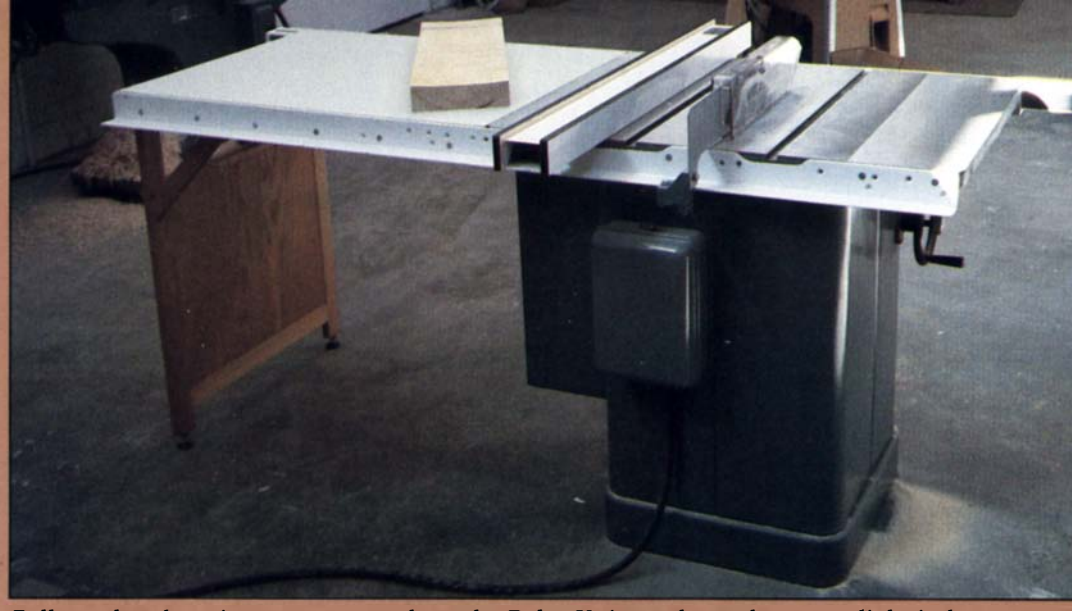
If you are a hobbyist, you don't need what the professional needs, and probably don't want to pay for it. By this I don't mean that a hobbyist's woodworking is necessarily inferior, in fact the opposite may well be true. But if you're an amateur, you're not under the same pressures of production as a professional. You can buy a lighter-duty saw entirely adequate for your needs and have money left over to invest in some decent sawblades.

When you begin shopping for a tablesaw, you should be familiar with its basic operation. The heart is a sawblade mounted to a rigid arbor rotating at a precise speed. The arbor might be the motor shaft itself, or power can be transferred from a separate motor by means of belts and pulleys, or even a flexible shaft, as in the Sears saw I tested (see p. 55). In general, better saws have more than one belt, and the shorter the belts are, the better. Once locked to the arbor, the blade should adjust vertically, and its angle to a flat table should be variable through 45°. Most machines today accomplish the adjustment by tilting the motor and arbor, while some older ones (and the Inca) have a tilting table.

A tablesaw requires an adjustable fence that can be locked parallel to the blade for ripping, and a means to direct a guide perpendicular to the blade for crosscutting and mitering. The whole system must be rigid, as free of vibration as possible and sturdy enough to be banged about by materials and mishaps alike.

Blade sizes and arbors—A saw will initially be rated by the diameter of its maximum sawblade, which bears directly on the depth of cut, both at 90° and at 45°. Be sure that the 45° depth of cut is sufficient to cut through the thickest stock you want to

Unisaw



Fully-enclosed stationary saws, such as the Delta Unisaw shown here, are light-industrial machines that won't complain when asked to do hard work at a steady pace. The extension table, an optional accessory that most tablesaw manufacturers allow for, is great for handling plywood sheets. But if you don't work a lot of plywood, such a setup may be a mixed blessing, taking up more room in your shop than you have to spare.

The Delta Unisaw is probably the most popular tablesaw of all time. With its fully-enclosed base and predominance of cast-iron parts, it has been standard in small commercial, vocational and private shops since it was first introduced in 1939. The particular Unisaw I tested was 3-HP, 220-volt, single-phase model #34-756 with the standard "see thru" splitter-mounted blade guard. My saw was bought in 1982, just before the Rockwell name became Delta again, but is the same as the machines currently sold.

Uncrating and assembly were quick and easy. The two cast-iron table extensions had to be bolted on and aligned, and the one-piece splitter/anti-kickback safety shield had to be mounted and aligned. All that remained was to screw on the fence bars, mount the magnetic on/off switch, clean off the table and plug it in.

The construction of the Unisaw is mostly cast iron, with the base enclosure being folded heavy-gauge sheet steel. The table surfaces still show the swirl marks left by a Blanchard grinder, though they are good and flat, and showed no eroded edges top or bottom. The T-slot table grooves were cut clean and square, though the table did require minor adjustment to bring the grooves parallel with the blade.

The arbor on the Unisaw tilts to the right, and is securely supported by a cast-iron bracket and 2½-in. O.D. sealed ball bearings. Power is transferred to the arbor by three short V-belts, from a motor specially bracketed for this machine. The whole arrangement sits firmly on a four-part series of cast-iron brackets and trunnions. Arbor runout measured 0.0015 in., which is perfectly acceptable and half that of the Sears saw I tested.

I like the straightforward operation of the Unisaw. The control handles for raising and inclining the blade are 7-in.-dia. cast-iron wheels with threaded locking pins in the center. Both the tilt and elevation shafts function by means of a short, fixed worm gear section that must be kept clean for the system to work smoothly. It takes 31 turns of the wheel to reach 45°, and only 13 quick cranks from minimum to maximum elevation. Factory-set limit stops required no adjustment to work perfectly. The system is comfortable and functional, although if you overtighten the locking pins or crank hard past the fixed stops, the controls will lock up and can be difficult to free.

Changing the blade and other common maintenance procedures are very simple. With a little pressure on the far end, the metal throat plate pops right up to expose the arbor nut and also provide enough access for general lubrication of the ways. The throat plate is sturdy enough and ribbed so that it doesn't flex, and its height is adjustable with four Allen set screws. I wish they would provide better wrenches and an arbor lock button for changing blades, to make a good system even better.

Turning the machine on requires groping under the table for the control or actually stooping to locate the switch. Once running, however, performance is strong and vibration free, and other functions are convenient to control. The 3-HP motor feels like a middle-of-the-road selection for this machine. I think 1.5 HP would not be enough and 5 HP would be even more to my liking. When ripping 2-in.-thick oak and maple, the machine had to work, but it never bogged down or required an unusually slow feed rate. There are no particular provisions for dust collection, other than a covered 3-in. by 5-in. opening in the base ring of the saw. A motor cover, to cut down dramatically on dust, can be purchased from Delta or made up of plywood and fastened through the pre-drilled holes.

The rip fence and miter gauge that come standard with the Unisaw work adequately. It's difficult to say anything too good or too bad about either. The rip fence locks to the bars simultaneously with an eccentric cam on the near side and a J-shaped hook on the other. After a time, drift can become a problem. In the shop at school, we've broken at least two of the flimsy levers that activate the J-hook. The tubular bars remind you when they need waxing by grabbing the fence when you release the lock or causing it to rack instead of glide smoothly between settings. The miter gauge has a single locking knob (no hold-down), is very sturdy and designed to support a bolt-on wooden fence extension. It has adjustable limit stops (with a screw and lock nut) at 45° and 90°, and a solid 18-in.-long guide bar that fits the T-slots in the table just right.

With 3 HP, the Unisaw effortlessly gobbles up 8/4 stock. Preiss replaced the standard fence with a Biesemeyer.

Basic safety features on this Unisaw are minimal and awkward. Alignment of the metal splitting plate never seems completely right, and it blocks your line of sight almost completely after the cut. The standard blade guard does not encourage even the creative user. The plastic blade cover jiggles around a lot and can't sustain itself perched up and out of the way if you want to measure for a cut. The built-in electrical motor brake, however, is a real plus that takes no time at all to get used to.

I wouldn't rush out to buy a 3-HP Unisaw at its "suggested list price" of $1,871. But if you are more than a casual user and can deal your way down $300 and use this savings for optional attachments, the Unisaw is a good buy. It's a durable, consistent, light-industrial machine with quality components that can be replaced readily, if need be. I believe it's worthwhile to upgrade to a "Uniguard." When equipped with one of the optional 50-in. fences, the Unisaw's realm increases greatly and, having come this far, it's worth it to convert a good machine into a great one.

Delta's Contractors' saw is also worth mention. This saw intends to be a lightweight version of the Unisaw, with open stand, 1½-HP motor, plastic control wheels, stamped-steel table extensions and a steel-tube trunnion. It has many of the Unisaw's features at about half the price. This type of saw would be good for somebody who didn't expect to push it too hard. Compare it with other models of about the same power and weight in the chart. A saw in this category might be just what a hobbiest needs. —*R.P.*

The Inca, conservatively rated at 1½ HP, passed all the precision tests with ease, but this unusual machine has what many consider to be three main drawbacks: The arbor is non-standard size, a 10-in. blade won't fully retract beneath the table surface, and the table has to be tilted for angled cuts, as shown.

Inca Major

The Inca Major is a specialty circular saw manufactured in Switzerland by the INCA Injecta Company. It's sold in this country through numerous regional distributors for about $1,400 when fitted with the mortising attachment, base and standard 1½-HP motor. This design is most notable for its tilting table, pressure die-cast aluminum parts, and unflagging accuracy.

The Inca is an accurate, carefully made tool that is an enjoyable machine to own. It could not possibly function as the only tablesaw in any production woodshop, but that's not what this machine was designed to do. The Inca seems geared especially to the small cabinetmaker, instrument builder, or any hobbiest doing fine furniture woodworking. Its lightweight, compact design (the base is about as heavy as the saw itself) and versatile operation make it possible to take this saw to a jobsite for furniture-quality finishing work, or easily move it out of the way in a small workshop.

It doesn't take very long to assemble. The first thing you discover is that this is a tilting-table, and not a tilting-arbor saw. By fixing the arbor, a lot of the bulk and potential vibrations inherent in tilting-arbor saws are eliminated. By combining this concept with precision components, the Inca is able to perform smoothly and accurately without great mass. The trade-off for this apparent windfall comes when mitering wide, long pieces, such as cabinet sides and tops. They want to fall off the table and can cause the miter gauge to bind and sometimes bow. It takes longer to set angles, and I have yet to comfortably adapt to working on an inclined surface.

Precision is evident throughout this machine, even including the base. The table, though small, is finished smooth and flat, and the closely-ribbed undersurface is also extremely clean. The pressure die-cast aluminum has a dark gray color throughout and appears very unlike the slightly harder surfaces of cast iron. Deep scratches tend to stand out as silver streaks. The miter gauge grooves are not T-slotted, though the fit of the guide bar is so exact it doesn't seem to matter. So, too, is the fit of the assorted throat plates that screw into perfect position in their opening. Optional extension tables lock securely and level via a sliding dovetail arrangement and can increase the work surface as much as you want. The base is very sturdy, thanks to a snug fit between its metal legs and particleboard sides. There is even a built-in dust chute that really helps channel dust and chips.

Though parts can quickly be mail ordered, I have found, in six years of use, maintenance on the Inca Major has been

miter in one pass. If you decide that ripping 3-in.-thick boards is integral to your work, then a 10-in. saw will be the minimum size needed. In contrast, an 8-in. saw will average a 2⅜-in. depth of cut. This won't preclude ripping thicker lumber—you can cut halfway through from one side, then flip the work over to finish the cut—but the saw will probably be underpowered if it has to do this job often. I have included a number of small-blade saws in the chart. I won't tell you never to buy such a saw—it might be just what you need—but I will tell you that in builders' and contractors' slang, any saw that draws less than 10 amps is considered a "throwaway."

The blade arbor should have at least a ⅝-in. diameter to minimize the chances of wobble and to accept most commonly available blades, and you'll probably want an arbor length that can take a ¾-in. stacked dado. Many foreign machines, such as the Inca, have a metric-scaled arbor and require special sawblades.

The nominal arbor size is only part of the story. Many ⅝-in. arbors are ⅝ in. clear through the bearings. The Inca, however is stepped up to about 30 mm (about 1¼ in.) through the bearings, making it a true heavy-duty saw despite its light weight and small size. If you need beef, this is the sort of thing to look for.

What about the motor?—As the cutting capacity increases, so too should the horsepower. I would always opt for the largest motor possible, with 1.5 HP being the minimum for any saw with an 8-in. blade capacity or larger. For a 10-in. saw, 3 HP is appropriate, and for a 12-in. machine, 5 HP or 7 HP will be required.

These figures may at first seem like overkill, but think about it. With less power you won't be able to make rip cuts in thick stock without severely straining the motor. If your current saw is underpowered, you know already that one way around burning out the motor is to rip in a series of 1-in.-high increments, but it's nasty and frustrating work to pass a piece of wood over the saw three times when once should do the job.

Be aware of inflated peak horsepower ratings. Many motors can supply spurts of peak horsepower, but it's the continuous-load performance that will endure, especially under heavy daily use. One way to judge whether the rated horsepower of a motor is honest is to check the motor plate for the amperage that the motor draws—an honest, continuous 1.5 HP motor should draw about 14 amps at 115 volts, or half that at 230 volts. By extension, a 3-HP motor run at 230 volts should draw 14 or 15 amps.

A totally enclosed fan-cooled (TEFC) induction motor is the best. All-ball bearings and self-contained overload protections are not luxuries, but necessities for a healthy motor life. Don't assume that all motors are thermally protected or equipped with all-ball bearings. Check the motor plate carefully and ask your distributor to spell out these features.

Despite the recent introduction of small but powerful universal motors on many imported machines, I still favor the proven endurance and quieter operation of the induction motor.

Look carefully at the motor mount setup. Are the mounts accessible with a wrench and ratchet? Universal mounts, though arguably less rigid than integral housing mounts, are much more versatile. If your motor dies, integral mounts require you to replace the motor with a "factory only" replacement, at a "factory only" price. The same holds true for belt drive versus direct drive. Look for a multiple, short belt drive system for maximum performance, safety and maintenance flexibility.

Be sure that your electrical system can supply enough current. Low fluctuations in current can greatly reduce your motor's efficiency and shorten its life. Low voltage conditions can occur for

minimal. The arbor runs on two good-sized sealed ball bearings and is driven by a single V-belt and pulley arrangement. I feel my saw to be slightly underpowered at 1.5 HP, and could bolt on a larger 3,450-RPM motor with little difficulty. (There's an optional 2-HP motor.) Little lubrication is required as long as the tilting-table ways are kept clean. It has been a few years since my saw was new, but even so, when I measured for this review, arbor runout was still an almost non-existent 0.0005 in., one-third that of my Unisaw.

Like any machine, the Inca takes a little bit of getting used to. The table raises and lowers on vertical dovetail ways by means of a pivoting bracket, screw, and 3-in. handwheel. This is very slow, but accurate. The table locks function well, though the lever handles on my saw no longer fit as positively, and in some positions will conflict with other controls. Space under the table can get very close for big hands. When fitted with a 10-in. blade, there will always be at least ½ in. of blade projecting above the table, so I use 8-in. blades on the machine almost all of the time. Cutting 2-in.-thick hardwoods in any direction requires a really slow feed rate, but the saw doesn't hesitate and the belt has never slipped.

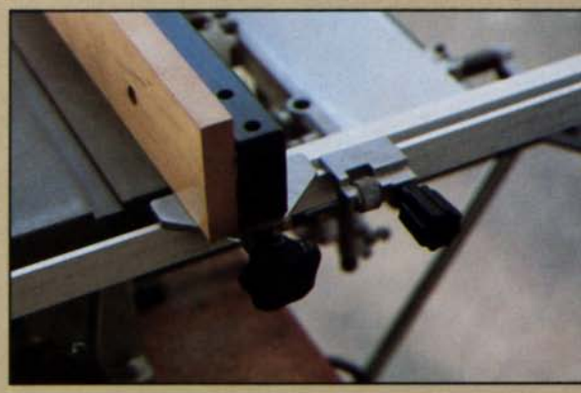
I like the accessories for this machine very much and rely on their accuracy, especially for small work. The rip fence only locks on one end, so I have had to add a maple extension to be able to guarantee rigidity. When used in conjunction with the vernier adjustment device, it's possible to make micro-fine adjustments or even find your way back to a previous exact position.

The miter gauge can be purchased with a choice of optional aluminum extensions in various lengths, but comes standard with a 16-in. fence and a locking tailstop. Missing are any pre-set limits, even at 45° and 90°. The long, 22-in. bar really comes in handy and offsets some of the short crosscutting distance in front of the blade. Most other accessories, especially the tenoning jig, are equally well considered and extremely easy to use. I have also tried Inca's optional sliding table, which is well made, though I consider such an addition somewhat contrary to the machine's compact nature.

The arbor size is 20 mm, about ⅛ in. larger than the ⅝-in. arbors most of us are used to. If you buy an Inca, your old sawblades won't be compatible with it unless you have them bored out. Inca does sell a wide range of blades at reasonable prices, though, carbide as well as steel.

The Inca's optional built-in mortising table is at the right side of the saw. If you don't have a horizontal mortiser, it will do the job, but I don't find that I use mine very much—it's too slow.

I have found that the safety devices on the Inca get left in place more than on other tablesaws. Because the blade always remains in one position and because the splitter is independent of the saw guard, it seems to stay in line very well. The blade guard is suspended from a mostly unobtrusive and retractable U-shaped bar. Though not transparent (it is made of aluminum) the guard can be positioned to hover over any thickness of cut, thereby leaving the line of sight open at all times.



Precisely machined parts and fine adjustments remind the author of Swiss watches.

Like Swiss watches and German cars, the Inca may seem relatively costly for it's size, but in the long run I think it returns every bit of what you pay for it. —*R.P.*

a variety of reasons—one common mistake is to run a saw at the end of a long extension cord, another is to have two heavy machines running on the same circuit. The total amperage of machines in operation at any one time should not exceed 80% of your system's maximum load capacity.

No matter what type of motor you run, and on what type of current, without a good magnetic on/off control, the risk still exists for damaging your motor. A magnetic control (*FWW* #24, p. 59, and *FWW on Machines*) will automatically disconnect if the fluctuation approaches a significant danger level. Like any good insurance, it's worth the additional cost. All the stationary tools in my shop are equipped with magnetic controls.

Rip fence—A woodworker who expects to handle 4x8 panels regularly needs a minimum rip capacity of 24 in. If the lowest edge of the rip fence does not kiss the table surface and you need to cut Formica or thin stock, be sure to allow for the thickness of an auxiliary fence plate and refigure the maximum rip. As mentioned earlier, 50-in. extension bars (and longer) are readily available for many 10-in. saws and can be simply bolted on at any time. But don't let your "wish list" run away with you. Though sliding extension tables and extended rip bars are nice options, they take up a lot of shop room—a smaller capacity tablesaw, in combination with a hand-held circular saw and a good straightedge, might be your best bet. For professional use or daily cutting, upright panel saws offer another alternative to purchasing oversized attachments solely for sizing 4x8s.

A precise, hassle-free rip fence is a must. If the fence cannot be brought smoothly into position, lock itself automatically square, and hold that setting without flex or drift, then it will drive you crazy every time you use it. A fence should move without jerking or racking and reasonable amounts of chips and dust shouldn't cause it to bind. The lower edge should ride close and parallel to the table surface. A fence that locks on both the inboard and outboard ends, whether simultaneously with a single lever or with a screw lock, will be less apt to deviate under feed pressure. Whatever type of mechanism is used, the fence should be easily adjustable for both locking pressure and parallel alignment. For two years I have been working with a Biesemeyer fence on my Unisaw, and despite the fact that it has no lock on the far end, it is mounted to a bracket that is rigid enough and triangulated over a large enough area that it overcomes the need for a second lock. The same is true for the Delta Unifence.

On the tablesaw, I prefer a full-length fence to the European-style half fence for the support it provides larger work after the cut. If the rip fence happens not to be 100% in alignment, or your work is pulling slightly away, it's an advantage to have the full fence to help keep the cut going straight. My Inca came with a short fence that locks square and feels sturdy, yet even so I have added a full-length maple extension that allows me to clamp the fence outboard for production work.

Miter gauge—The length of table in front of the sawblade will determine the maximum width of stock that can be crosscut with the miter gauge. This capacity is somewhat variable, however, depending on the length of the miter gauge bar, and, more important, whether the table groove is T-slot or rectangular. Though marginally more awkward to insert and remove, a T-slot will enable you to draw the miter gauge ahead and off the table surface, thereby extending the range for crosscuts beyond mere table limits. It is common practice to do this with rectangular-bar gauges as well, but it really isn't safe—better to insert the gauge

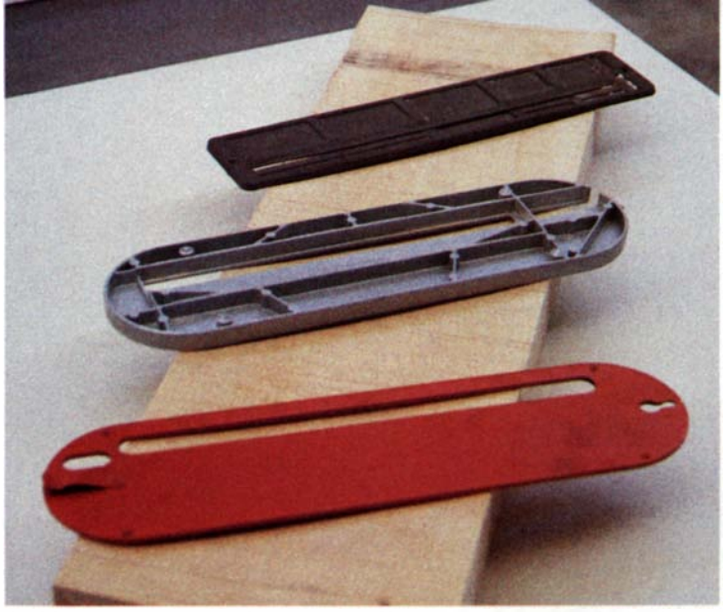


Table inserts give a clue to overall saw quality. The Sears insert (front) is unribbed and flexes under load. The Unisaw's (center), a drop-in type, is well ribbed and has height-adjustment screws. The Inca's (rear) is stiff, and screws rigidly to the table.

facing backwards, so that the leading edge of the work can bear against it to start the cut. If necessary, you can then stop the saw in the middle of the cut and transfer the gauge to its normal position to finish up. Shorter distances in front of the blade can also be overcome by constructing a sliding-table jig.

The miter gauge itself needs to be constructed of sturdy materials to endure typical mishaps such as dropping. This is especially true for the locking mechanism and the pre-set angle stops. Small plastic handles and parts are insufficient, as are stamped metal guide bars, and bodies whose faces are too thin to sustain shopmade extensions. A built-in hold-down is handy if the gauge itself is up to par. My own gauges have shopmade wooden fence extensions with movable tail stops.

Heavy metal—The best stationary machines I've seen are constructed primarily of cast iron. A well-designed casting, with careful ribbing that has been adequately destressed and accurately machined, provides guaranteed trueness and long life. The inherent mass endows the tool with vibration dampening and maximum stability. The more good cast-iron components that are incorporated into a saw, right on down to control wheels, fence parts, etc., the more likely it will interest me. Cast-iron trunnions and arbor-support housing with rack-and-worm-gear elevation and tilting mechanisms score well with me. Look out for lightweight sheet metal at any stress points, especially under the table in the arbor-tilting and height mechanisms.

Check with a straightedge that the table and wings are flat and true. Reputable manufacturers allow a delay between casting and final machining. This "destressing" can take a year before internal stresses neutralize. If a rough casting doesn't get sufficient time in the "bone yard," distortions such as twists in what were intended to be flat surfaces can appear later. As a consumer, it's impossible to know the history of a machine's components until it is too late—you have to trust the manufacturer's reputation.

Die-cast aluminum has become a more common and competitive material, making possible lightweight machines that are also rustproof. Although tables require a denser ribbing system to ensure flatness, they are still a lot lighter than cast iron. The traditional mass value of cast iron has been seemingly offset by sound overall designs that minimize vibration in the first place, and by the sort of advances in processing and casting aluminum that now allow it to be used for such highly stressed (and precise) parts as automobile engine blocks.

Safety—All exposed moving parts should be guarded. The blade guard should be as rigid and unobtrusive as possible, so as to interfere minimally with the work and provide maximum visibility. The blade guard, splitter, and anti-kickback assembly should be easy to remove and install so as to encourage use—a guard is no good at all if you've removed it to get it out of the way. Unfortunately, no saw combines all these criteria into one system.

Most guards are variations of two basic ideas: One mounts behind the blade—either to the splitter or behind the table—then pivots up and down. This type of guard must be removed for certain molding and ripping cuts where the fence must be very close to the blade; then it must be reinstalled before going on to other work. The temptation is not to reinstall it. The other type of guard pivots on a long arm mounted off to the side. It takes only a moment to position it over the blade, but this type of guard sometimes does not have anti-kickback protection.

Controls, especially the "off" button, need to be readily accessible and housed in such a way as to prevent accidental start-up. Switches that have different height on/off buttons, or isolate the "on" switch with a specific enclosure, accomplish this very well. Lockable controls, such as on the Sears saws, or wall-mounted disconnects are the sure way to child-proof your machines. As further operator protection, many new machines come standard with a motor brake—either automatic or activated by foot pressure—to stop a free-spinning blade quickly. You can add a motor brake to an existing 3-phase tablesaw to accomplish the same thing, though the $200 cost is high for the small shop. Blade height and tilt controls should have enough clearance around them to leave the skin on your knuckles intact and should lock firmly.

Before purchasing a particular tablesaw, take careful account of available shop area—you have to have enough room so you won't be bumping into or tripping over one machine while working on another. Optimum use of the stationary machine would have it fixed in place and surrounded by carefully positioned outfeed and side tables. For extra versatility, an old hospital gurney or rolling bed table with a plywood top makes an excellent, adjustable-height support table.

Specialty saws—There are some unusual tablesaws worth considering. For example, Delta makes a 10-in. Scoring Saw, actually a 12-in.-capacity saw with an extra arbor in front of the main blade. The front arbor carries a small scoring blade that pre-kerfs the surface of the stock to eliminate chipping on hard-to-cut panels such as plastics and brittle veneers.

The Vega tablesaw features a rolling table to the left of the blade. This is not to be confused with the extension tables for handling plywood. In the Vega saw the entire table surface to the left of the blade moves. A crosscut fence attached to the rolling table holds the work, then the table is pushed past the blade. All ripping is done to the right of the blade, on the stationary part of the table. Ulmia makes a true sliding-table saw as well.

I'd compare the Erika and the Henniker to upside-down radial-arm saws. Unwieldy work is simply clamped to the table, then the motor and blade are pulled through to make the cut.

I don't have enough work experience with any of these machines to say much about them, although I can imagine that they would be very attractive for certain jobs. I would be interested to hear from readers about the subject.

The chart—The chart is not the dizzying, spec-heavy compilation I first set up. In the process of listing every dimension and feature of more than 50 tablesaws, it became apparent that saws

Sears

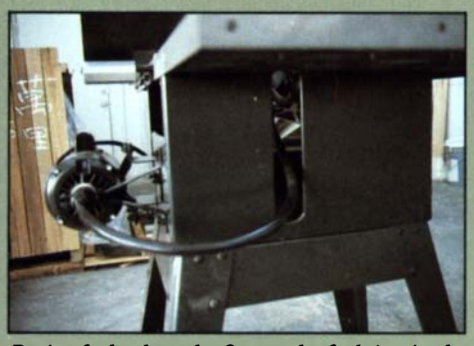
A study in patience: The Sears flexible shaft drive tablesaw will rip 8/4 stock, but at a pace that tends to put the operator to sleep. Preiss prefers the older, belt-drive models.

If you have a tight budget, then you'll need to look at the Sears Craftsman 10-in. tablesaws, which come in several versions. The one that I tested was the 10-in. Deluxe Flex Drive tilting-arbor saw, priced in the catalog at $590. It is not as ruggedly constructed as many of the older model Craftsman saws that I have tried, but it does aspire to the same concept of functional simplicity at an affordable price. This saw should not be purchased for any heavy-duty work, as it is in no way a light-industrial machine. With some modification, however, this Craftsman saw could be elevated to an operating level sufficient to satisfy most sawing chores encountered in the home workshop.

The cast-iron tables are good and flat, amply large, and hefty. As on many contractors' saws, the extension wings are cast in an open grid, which helps to save on weight. Slots for the miter gauge are squarely milled, and there is even a special plastic spot set into the table to mark the exact location of the saw cut (but the kerf width is likely to be different with each blade change, so the gauge line won't always be accurate). Two cleverly concealed Allen screws, for easy adjustment of the tilt-angle stops, are also set into the table. Unfortunately, the throat plate is awkward to remove and will deflect under pressure.

The most unusual component of this machine is the flex shaft drive. Because there are no exposed belts or pulleys, the system seems very safe. In practical terms, however, the power transmission is insufficient, especially when the saw comes with only a 1 1/16-HP motor. (Specs say the motor will develop a peak of 2 1/8 HP). When the arbor is tilted to 45°, the resulting compound bend in the shaft causes the blade to jerk when started and stopped, and the shaft itself heats up considerably. Whether caused by inadequate power or design problems with the drive, the net result is that feed rates, even through 1-in. hardwoods, are distinctly slow, and I was able to virtually stop the rotation with any 8/4 material.

Time and again I was bugged by a missing sense of positive control while working with this Craftsman saw. The open base is bolted to four legs that seemed to want to twist and rack no matter how much I tried to stablize the saw. The blade-raising and tilting controls feel very mushy, and the arbor-lock handle wants to tighten forever. It's tucked *right* up under the table and the handle has to be constantly repositioned on the screw head to get the job accomplished (and if you don't set the lock, the blade creeps). When resetting the blade angle, it tends to lock in a position slightly different than where you set the crank, which can get frustrating after a very short while. The 5-in. plastic control wheels for the arbor settings both require 45 turns to go from lock to lock, enough to try anyone's patience. The arbor runout on the machine I tested registered at a loose 0.003 in.



Preiss feels that the Sears shaft drive is the saw's Achilles Heel—it gets uncomfortably hot to touch and if the blade is tilted, the saw starts and stops with a jerk.

I like the miter gauge design very much, though the rip fence seems neither sturdy enough nor rigid enough to guarantee continued reliable performance. The miter gauge has a large, comfortable handle with a quick-action hold-down that makes quick and accurate crosscuts a breeze. However, its pre-set stops are controlled by a spring-loaded pin that is not adjustable. The rip fence is supposed to lock on both ends when you tighten the single control lever, but it requires perfectly aligned support bars if it is to do so along its entire length, and it's difficult to accomplish this. Also, there is enough play in the fence so that if the bars are not perfect and there happens to be some dirt on the table, the fence will rack its way from one setting to another. Despite being able to see the Metric/English scale easily, I could not rely on it for consistent or accurate settings.

The safety features are very similar to those of the Unisaw, with a few small differences. Unlike the Delta, the see-thru blade guard can be pivoted up and out of the way, although it balances very precariously and tends to crash down at inopportune moments. Aligning the splitter takes some doing, and even after you get it right, it flexes out of position when the saw is tilted because it is forced to support the angled weight of the blade guard.

The on/off switch is easy to operate and is located perfectly, right up near the table. It is a simple switch without magnetic protection, but it does have one nice feature that might be a real asset to some woodworkers—there's a built-in key for childproofing. Dust collection is not accounted for at all, though a bag or sheet metal chute set under the base would probably work.

The Craftsman Flex Drive tablesaw appears to have all the capacities associated with any 10-in. machine, without the necessary power or beef to back it up. By upgrading to a larger motor, or even adding an aftermarket rip fence, it might be possible to substantially increase this machine's performance, though it could add as much as $350 to the cost. Before I purchased this machine new, I would look around for a used, older style Craftsman—the older the better—with a belt and pulley drive. Many of these saws appear able to last forever. In a friend's home shop, I checked out a Craftsman 10-in. saw that had been purchased by his grandfather and had been used in family workshops for three generations. The basic design is similar to today's models, but part for part everything has more meat, is cast iron instead of aluminum or plastic, and, above all, all the original parts are still functioning. The fence never locks parallel, I was told, but that's not hard to explain after so many years of service.

I also visted an architectural model shop that employs both a Craftsman belt-driven saw and one of the newer 9-in. "motorized" saws. Everyone I spoke with preferred the 9-in. saw for its quieter direct drive and more manageable size. It retails for $290.

There's a saying that people on a low budget usually have to buy everything twice. Of course, you can get a Craftsman saw on credit, and you don't have to shell out a thousand dollars for one tool. But for twice the money you can get lots more than twice the saw. —*R.P.*

Manufacturer/ Distributor		Andreou	Black & Decker	Bratton	Delta	Erika	Foley-Belsaw	General	Grizzly	Henniker	Hitachi
Number of models		6	6	2	6	1	1	1	2	1	1
Country of origin		Taiwan	U.S.A.	Taiwan	U.S.A.	Germany	U.S.A.	Canada	Taiwan	U.S.A.	Japan
Blade diameter	8		●								
	9				●						
	10	●	●	●	●	11	●	●	●		
	12	●		●	●					●	●
Weight in pounds	Benchtop		●		●	●					
	100+		●		●	●					
	200+	●			●				●	●	
	300+	●			●		●				●
	400+	●		●	●			●	●		
Continuous horsepower (estimated according to amperage)	1 HP (+ or −)		●		●						
	1.5 HP				●		●	●	●		●
	2 HP	●			●	●				●	●
	3 HP	●		●	●			●	●	●	●
	5 HP +	●		●	●			●			
Tilt table											
Rolling table											
Traveling arbor						●				●	
Price range–rounded off		$325–$1400	$150–$525	$900–$3000	$150–$3000	$975–$1125	$700–$1000	$1200–$1400	$325–$800	$2000–$2500	$1850–$2150

with similar power and weight were similar in most other respects as well. As I compared a long string of numbers about one saw with a long string of numbers about another, I realized how little such information really meant. For example, once past a certain weight, almost all trunnions, tables and wings are cast iron, and that's all a chart can tell you, not the quality. Even weight can be deceptive: one casting might outweigh another one but it could warp, have an ugly surface and even be flawed with air bubbles and voids. You have to look for yourself. I check for thin spots and for cracks, and I'm suspicious of any castings with heavy, possibly fault-concealing, coats of paint. Yet my impressions are subjective, and I admit to being slightly spoiled by having had lots of work time on machines of excellent quality. The guy standing next to me might feel happy with a machine I wouldn't let into my shop.

Prices are somewhat deceptive as well, so I deliberately made them approximate. Suggested retail isn't meaningful in the first place, and you can get all the better saws with a variety of options that will swing the price many hundreds of dollars. Consider shipping costs and other factors that may influence price. Some manufacturers give a trade-in allowance, for example. Ask.

The best advice I can give is to make up your mind about what you need, then write for brochures. If possible, visit a showroom—read the motor plate and work the fence and the controls, try all the adjustments, push on the throat plate. Better yet, find somebody in your neighborhood who owns the machine and get an evaluation of what it's really like. There's nothing like living with a saw for a while to show up its pros and cons. But keep in mind that owner loyalty can have its blind spots.

The tests—I'm not intending the tests to be an endorsement of any particular brand of tablesaw, but rather a sampling of what you can expect from a saw in the various categories. I know people, for example, who prefer Powermatic to the Unisaw, but when you get into this class of tablesaw, I don't think there are really any differences worth arguing about seriously.

For some woodworkers, even the range of saws described here won't be enough. I know of a custom-door and window maker who regularly has to rip 8/4 oak, and a lot of it. He ended up with a used Beech tablesaw—18-in. blade capacity, 5-HP, 3-PH motor (direct drive, no belts), and an arbor the size of your arm. For him, it's just the right saw. If you think you could use a piece of equipment in this category, just be sure your shop floor will be able to support its weight.

Conversely, lots of people build furniture with a Sears saw and swear by it. In the long run, what you need from your tablesaw and what you expect of yourself are the two main parts of the woodworking equation. When these factors are in pleasant balance, all is well. □

Rich Preiss supervises the architectural woodworking shop at the University of North Carolina at Charlotte.

	Inca	Jet	Makita	Davis & Wells	Power-matic	Sears	Ulmia	Vega	Wilke	AMT	Skil	Fine Tool Shops
	1	5	1	1	4	6	3	1	1	4	1	3
	Switzerland	Taiwan	Japan	U.S.A.	U.S.A.	U.S.A.	Germany	U.S.A.	Taiwan	U.S.A.	U.S.A.	Taiwan
			●							●	●	
						●						
	●	●			●	●	●					●
		●		●	●	●	●	●	●			●
			●			●				●	●	●
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		●		●	●		●	●				
		●		●	●		●	●				
	●											
							●	●				
	$1100–$1600	$475–$2500	$325	$3000–$3400	$1700–$3500	$300–$700	$3350–$5950	$2425–$2700	$300–$450	$50–$125	$184	$190–$1100

Sources of supply

American Machine & Tool, Fourth and Spring Sts., Royersford, PA 19468, (215) 948-0400.

Andreou Industries, 22-69 23rd St., Astoria, NY 11105, (718) 278-9528.

Black & Decker U.S. Inc., 626 Hanover Pike, Hampstead, MD 21074, (301) 239-5122.

Grizzly Imports, Box 2069, Bellingham, WA 98227 (206) 647-0801.

Davis & Wells: PAL Industries, 11090 S. Alameda St., Lynwood, CA 90262, (213) 636-0621.

Delta International Machinery, 246 Alpha Drive, Pittsburgh, PA 15238, (412) 963-2400, (800) 438-2486, (800) 438-2487 (PA).

Erika: MaFell North America, Box 363, Lockport, NY 14094, (716) 434-5574.

Fine Tool Shops, Inc., 20 Backus Ave., Box 1262, Danbury, CT 06810, (203) 797-0772, (800) 243-1037.

Foley-Belsaw, 6301 Equitable Rd., Kansas City, MO 64120, (816) 483-4200, (800) 468-4449, (800) 892-8789 (MO).

General: J. Philip Humfrey Ltd., 3241 Kennedy Rd., Unit 7, Scarborough, Ontario, Canada M1V 2J9, (416) 293-8624, (800) 387-9789.

Bratton Machinery, 1015 Commercial St., Box 20408, Tallahassee, FL 32316, (904) 222-4842, (800) 874-8160, (800) 342-2641 (FL).

Henniker: The Versatile Saw Corp., Box 716, Henniker, NH 03242, (603) 428-3258.

Hitachi Power Tools USA Ltd., 7490 Lampson Ave, Garden Grove, CA 92641, (714) 891-5330.

Inca: Garrett Wade Co., 161 Avenue of the Americas, New York, NY 10013, (212) 807-1155.

Jet Equipment and Tools, Box 1477, Tacoma, WA 98401, (206) 572-5000.

Makita USA Inc., 12590 E. Alondra Blvd., Cerritos, CA 90701, (213) 926-8775.

Powermatic Corporation, McMinnville, TN 37110, (800) 821-2750.

Sears Roebuck and Co., Michael Mangan, Dept. 703, 40th Floor, Sears Tower, Chicago, IL 60684.

Skil Corporation, 4801 W. Peterson, Chicago, IL 60646.

Ulmia, Mahogany Masterpieces, Suncook, NH 03275, (603) 736-8227.

Vega Enterprises Inc., Box 300 B, Rt. 3, Decatur, IL 62526, (217) 963-2232.

Wilke Machinery Co./Bridgewood, 120 Derry Ct., York, PA 17402, (717) 846-2800.

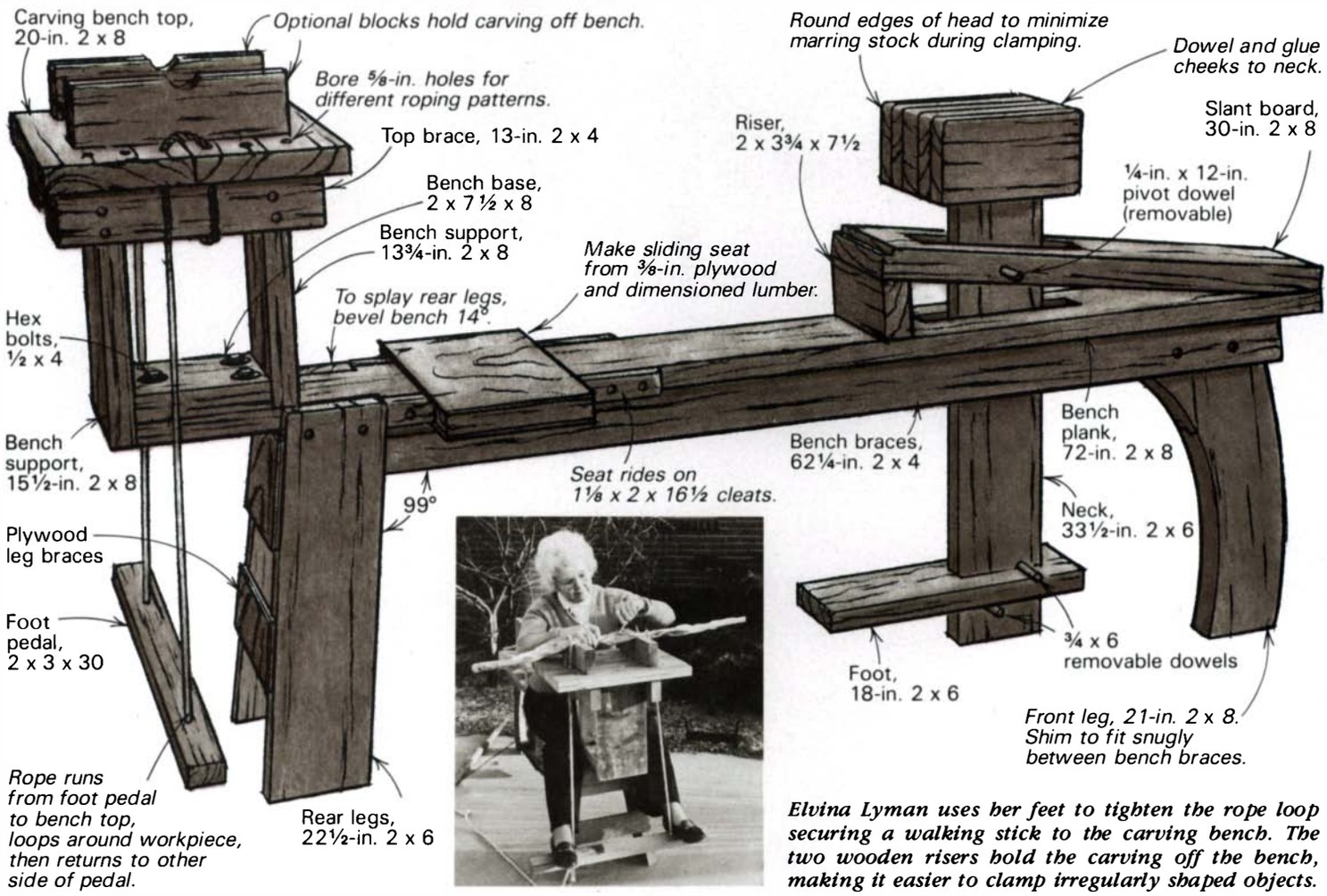
Carving Benches

Woodcarving benches are as idiosyncratic as the carvers who use them. Carvers who work on pieces that are small enough to be handheld don't need much more than a table to hold their tools. Relief-panel carvers need solid, flat surfaces to anchor their work. Sculptors who work in-the-round not only need to secure their work, but must also be able to rotate the piece, or at least have space to work around it as they carve. And, depending on the person's height and the type of work being done, each carver tends to feel most comfortable working on pieces held at a certain angle or height.

It's no wonder that few carvers are satisfied with commercially available benches, and either customize their store-bought models or start from scratch and build specialized benches and clamping systems to solve their individual problems. Here are two such solutions—a heavy-duty sculptor's bench, which would also be good for many cabinetmaking operations, and a versatile shaving horse that combines a traditional design with a Chinese carving bench.

A carving/shaving bench

by E. D. Lyman



Elvina Lyman uses her feet to tighten the rope loop securing a walking stick to the carving bench. The two wooden risers hold the carving off the bench, making it easier to clamp irregularly shaped objects.

As a hobby, I make walking sticks from diamond willow and sumac. I needed a way to hold the stock securely while I shape it with a drawknife, as well as a place to carve the shaped sticks. To save space, and concentrate the messiest parts of my hobby in a single spot, I decided to build a bench combining the powerful clamping and quick release capabilities of two traditional designs—a dumbhead shaving horse and a Chinese carving bench.

In addition to creating a functional, attractive bench, I found the extra weight of the combination bench makes each of the devices more stable. I made the whole thing from scrap: oak for the head, neck and foot; pine for the rest of the horse and the carving bench. The head end of the horse is about 2 in. higher than the rear, which makes for easier, nearly horizontal shaving. The sliding seat provides great comfort, and I sometimes mount on a tractor seat for long stints. I also added more holes on the carving bench, so I could vary the roping patterns, and two notched risers, 2x4s with dowels that fit into the bench holes, to raise the work off the bench surface and give me more room for carving. □

E.D. Lyman is a physician and woodworker in Lincoln, Neb.

Photo: E.D. Lyman

Cloutier secures the carving with a carvers' screw, above, then tips the bench, raising the piece to a comfortable work height, below.

Articulated sculptor's bench

by Richard Starr

The Canadian town of St.-Jean Port Joli is home to at least 100 professional carvers. One of the most accomplished is Pierre Cloutier, whose work appears in numerous big-city galleries under the name Pier Clout.

Cloutier works both in-the-round and in bas-relief. He specializes in life-size human forms and is widely recognized for his extraordinary ability to portray living flesh. His studio is clean, roomy and efficient. Huge windows provide west light that can be softened with white drapes. Storage cabinets are hidden behind large white panels. His tool rack, which is adjustable in height, can be moved anywhere in the room, as can his solid and versatile bench.

The bench's heavy T-shaped base is fastened with a threaded rod to one of the several keyed sockets that are cast in the shop's concrete floor. Once the base is attached to the socket, the bench can be rotated a full 360°, to take advantage of the natural lighting. Fitting over the base unit are two slotted tabs, which are, in turn, mortised into the benchtop.

A large Acme-thread vise screw pulls the tabs tightly against the base of the bench, and allows Cloutier to adjust the angle and height of his work surface. Cloutier grinds slight hollows on the inside surfaces of the tabs, so they'll grip the base better when the screw is tightened. Work can be held on the bench with a carvers' screw or bench dogs, or be clamped directly in the Record vise mounted at the end of the benchtop. □

Richard Starr teaches woodworking at Richmond Middle School in Hanover, N.H., and is the author of the book Woodworking with Kids *(The Taunton Press, 1982).*

Photos: Richard Starr

Planning for Profit

Basic cost analysis for woodworkers

by Tim Nash-Jones

A couple of years ago, I had a plum commission for a suspended wall unit of Lucite and walnut, with plate glass shelves. The thing called for about $800 in materials, was about 6 ft. high and weighed a ton. It was to be hung from a concrete wall, and I did all the shear calculations on the suspension screws and applied a safety factor of three. No way was this going to fall down. The fact that the client was into Ming porcelain and other goodies made me double-check my calculations: I figured that 25 lead anchors into the concrete would be more than adequate to hold it up.

They say that if everything seems to be coming your way, then you're probably in the wrong lane. Since I lived, at that time, some 150 miles from the Toronto waterfront apartment that was to house the beast, I naturally wanted to go there only once. I thus planned everything with military precision, even down to carrying two brand-new tungsten carbide drills for the concrete wall, in case I broke one.

To cut a long and painful story short, the wall, finished in $100/yd. covering, turned out to be good old Gyproc, nailed to 2x4 studs on 16-in. centers. The vital concrete wall lay beyond, unquestionably out of reach, at least not for anything like the price the client and I had agreed on. There was no way to jury-rig a solution, either. The cabinet's own verticals were conveniently spaced, according to Murphy's Law, at 29 inches. I was fortunate that the client was on vacation.

Luckily I had not asked for money up front—which one *should* always do, by the way. Had I done so, I would have been contractually obliged to somehow recess the wall back to the concrete, install the piece and make good the interior finish. And quietly go broke. Instead I retreated, took my financial lumps, and regrouped for another day.

What I'm stressing is the need for meticulous planning and its associated cost analysis. One can assume nothing. I had assumed the friend who helped me tote and lift would do it because he liked me (in fact, he does like me, but he charged $120). I had also assumed that the interior designer who gave me the job knew what he was talking about structurally.

Few of my cabinetmaking assignments have been this harrowing, but I use this example to illustrate how important hidden costs can be when you're trying to make a living in the game.

With a less complex assignment, a trestle table for example, the hidden costs are different, but, nevertheless, still there. You don't actually use all the purchased board feet for a piece; a fair amount ends up as sawdust, offcuts, and the occasional mistake or, worse, shrapnel from a misadjusted shaper. The small amount of sealer you needed for that stubborn end grain would have, had you measured it, amounted to one-eighth of a can. Then there's all that up-front design work, perhaps even a jig or a fixture to make, and the time spent running over to the hardware store for the little odds and ends that nobody ever remembers to charge for. All these bits and pieces tend to be overlooked if you're in a hurry to deliver. Last, but not least, who pays for the shop electric bill, the rent, or that super new gizmo that's been high on your wish list for as long as you can remember?

Let's start at the beginning. Over the next 12 months you need X dollars to survive as a human being; forget the shop at this point. Being human, you may feel that 40 hours in the shop is enough for anyone with a rudimentary commitment to spouse and family. You also need an annual vacation; be generous and allow four weeks, spread whenever. This means you actually work 48 × 40 hours per year, a paltry 1,920 hours. If you divide this into the above value of X, you end up with your hourly rate, H. If you are some sort of masochist, you could stretch this to 60 × 48 = 2,880 hours a year, or 60 × 52 = 3,120 without a holiday—it's up to you.

The above exercise results in an hourly rate that's just part of the price you ask for your pieces. It covers your own private money for clothes, food and other delights, but has nothing whatever to do with your business. The way you take care of your shop is tied up in the following formula: $(Mw + Lb)\,P = S$ where: M = cost of material; w = wastage factor; L = cost of labor; b = burden, or overhead factor; P = profit multiplier; and S = selling price.

Cost of material *(M)*—This is the total amount you pay for all the different materials you use to make one of your pieces. Wood, adhesives and finishing materials should all be included in the tally. Stock consumables, such as glue and stain, are best estimated by monitoring use over several pieces. A $5 bottle of glue that makes 20 pieces, for example, has a material cost contribution of 25¢ per piece; 19½-ft. of pine at 90¢/ft. contributes $17.55. And so on. Adding all these individual costs gives the total *(M)*, which should be what it costs you, in materials only, to make one piece.

Wastage factor *(w)*—This factor inflates the value of M you just calculated so that you will not lose money through wastage or damage to your materials.

Cabinetmaking entails a large quantity of deliberate and accidental waste; deliberate in such tasks as selecting stock for grain match or sizing and jointing stock, accidental in such unplanned events as what we, in Canada, aptly term "cock-ups." Waste var-

Pricing for the art market

by David Ellsworth

The price for each piece I make cannot be determined by any mathematical formula. In the one-of-a-kind market, ultimate value depends on the entire body of a person's work—in my case, on my history as an artist, craftsman and teacher, and on how one particular piece relates to every other I've made.

I don't price a piece down because it is less than a good piece. Instead, I may price a piece up when I feel that it is a great one. Before I can establish a value for any object I make, it must be photographed and critically reviewed. With the aid of the camera, I can observe six to ten pieces in a group and remove the weak ones. On the average, I throw away one out of four finished pieces. There are no "seconds" in this type of work.

The redwood piece shown here is one of a series of tall, figured shapes with ⅛-in.-thick walls. I wanted to make a piece with a natural bark rim and a full line of sapwood figure running like a flame down the side. To get these effects, I required a burl with a proper outside curvature and sufficient mass—the one I finally chose weighed six tons. If I had erred in selecting the species, or if the piece had come out in any way inferior in balance, form, delicacy of technique or expression of grain and figure, I would have discarded it.

If establishing the value of an object is a subjective process, marketing that object is certainly one that requires great objectivity and a lot of luck. I began in the mountain craft fairs in Colorado in the early 70s selling hi-tech production pieces: sugar shakers, salt-and-peppers, and the like. The response to my work was immediate—often painfully honest—and helped me form the marketing techniques I employ today. In the years since, I've seen craft fairs grow into big-business, "hype-and-flash" arenas, but I believe the key to sales is still the same: Keep the client at your booth with a clear, accurate method of display.

Production work can be displayed in quantity to suggest that it will sell at low or moderate prices. One-of-a-kind pieces should be displayed to emphasize their unique nature and individuality. The two don't mix, and a craftsman displaying both takes the chance of losing a client out of confusion rather than a simple "like" or "dislike" for the work itself.

I have learned to display work at full retail price, even to wholesalers, so that they will have a true sense of how the work will appear on their gallery shelves. Galleries are in the same business as I am, except that they can reach a much broader market, so wholesaling work to them is an important part of my survival. When I retail a piece from my studio, clients sometimes ask me to discount my prices because they know I won't have to pay a gallery commission. This practice is very short-sighted, because the price of a piece sold today has an impact on the price of a piece sold tomorrow. Word gets around, and craftspeople who undercut their galleries soon find that their own studios are their only outlets. However, any gallery that refers a client to me will receive a 15% commission on the sale price out of my studio. These galleries are secure in the knowledge that if I sell a piece on my own, I will be upholding the prices that they have helped me reach.

To some, the prices of one-of-a-kind work may seem inordinately high. But when an artist sells such a piece, he is not only realizing cash-in-hand for the hours spent making it, but also for the years of development and professional training, the risk that made it all possible. Most of all, he is creating a value for the history of his work—past, present and future. □

David Ellsworth lives in Bucks County near Quakertown, Pa.

Redwood Lace Burl, *1984, 7½ in. by 21 in., $3,500. In order to get the bark edges, the sapwood figure and the height he sought, Ellsworth needed to begin with a six-ton burl.*

ies widely depending on the type of woodworking involved, but it will have to be averaged out over a number of pieces. Depending on the nature of your product, w can be anything from 1.1 to 1.35. So, we multiply M by factor w to account for this loss.

Cost of labor *(L)*—In the formula, this is the hourly rate you want multiplied by the time it takes to make one piece. In other words, $H \times$ time to produce. As mentioned earlier, this part ends up in your pocket, ready for the IRS.

Burden, or overhead factor *(b)*—Industry calls this little number "burden," which is a nice way of saying you have to live with it. Getting a handle on this factor is extremely important to the success of your shop, so the calculation should be done with great care.

Overhead is what you have to spend in order to stay in business. This includes rent, equipment, bank interest, coffee, telephone, heating, insurance, and so on. Make a detailed list of all your projected expenditures for the year and divide the total by your value of H discussed earlier. The following simplified example illustrates the point:

Shop rental	$4,800
Telephone	600
Insurance	150
Heating	500
3-yr. loan (equipment)	1,000
Total	$7,050

Hours planned for year = 1,920, therefore overhead/hr. = 7,050 ÷ 1,920 = $3.67.

If you work out of your basement, most of this goes away, or is substantially reduced by apportionment from your home expenditures. There will still be craft-specific items, however, that cannot be shared. If you are not sure what can be included as overhead, simply log all your expenditures for a couple of months, then spend some time with an accountant. This professional will

Photo: David Ellsworth

COST ANALYSIS

item	MATERIAL	cost/ batch	cost/ unit

(M) Total material cost (1)
Multiply (1) by (w) = (2)

step	LABOUR	time/ batch	cost/ batch	cost/ unit

(L) Total labour cost /unit (3)
Selling Price(S) = profit factor(p) x (5)
Multiply (3) by burden(b) = (4)
=
Add (2) and (4) = (5)

Nash-Jones' costing form, reproduced here from his book, can be enlarged and printed for use in your own business.

clarify all the costs that can legally be classed as overhead for the essential running of your shop. There are also numerous booklets about the subject available from your nearest IRS office.

Based on the above example, you now have an hourly overhead figure. This means that every hour you work, or had planned to work, you spend $3.67 just keeping your operation going without even lifting a mallet. With this sobering thought in mind, b can be calculated as the ratio of your hourly rate (H) plus the hourly overhead, divided by your hourly rate. Thus, if you wanted to earn $15/hr. clear, $b = (15 + 3.67) \div 15 = 1.25$ (rounded off). This makes Lb in the formula $15 $\times$ 1.25, which equals $18.75; just as we inflated M by w, labor has now been inflated to cover overhead.

Factor b changes if your overhead increases or you decide you need more dollars per hour. In that case, calculate a new value.

Profit multiplier (P)—If this multiplier is not greater than 1.0, all you will do is break even, having covered your overhead, material and labor. You must make a profit, not only so that your business can grow, but also so that in the event of an emergency or a drop in sales, you will have funds to weather the storm. You need profit to buy new tools and materials for speculative projects, or for the impulsive acquisition of bargains. Since your material and overhead per piece are separately covered by the formula, you should aim for a profit of 30% to 50%. In other words, P should be between 1.3 and 1.5.

Selling price (S)—This is the magic number! If you have used the formula correctly, then the answer is a price you can be confident with, and one that you can later reduce for special sales and still make a profit.

Let's use the formula to analyze a typical woodshop with an overhead of $5,000 and a wastage factor (w) of 1.3. Artisan Y, who works 2,000 hours, wants only $10/hr., but decides to make

Try a computer

by Mac Campbell

I have run a one-man shop in Harvey Station, New Brunswick, for the last eight years. It is not a big shop—I made 24 major pieces in 1983 and grossed around $36,000. I suspect that many professional woodworkers will find themselves in a comparable range. Yet, even in a shop this size, I have found that a computer can make a great deal of both sense and cents.

Four or five years after I started the shop, business was so good that the myriad details of estimating, planning, billing and customer relations began to cut into my shop time. So I sat down and devised a system for keeping track of things. The heart of the system is a file card. It contains the name and address of the client, and the dates an estimate, a visit and a delivery were requested. I also note on the card where the client heard of me; this proves useful in evaluating the worth of going to a particular show, for example. I update the cards as things actually happen and keep them stored in two vertical racks—one for jobs I'm preparing estimates for, the other for confirmed orders. The oldest cards go at the top, and as work is completed they are removed and filed, and all the rest move up a notch. This allows me to see at a glance where things stand.

I adapted supplementary paperwork from regular business forms, then had a printer run off 100 copies each. They include contract forms, a cutting-list form (which I use to help make the estimate), and a time sheet for noting how long each step of a job actually takes. Estimates for materials and labor, which I used to do on paper, are now computerized. I use my wristwatch's built-in stopwatch to fill in the time sheet as I work, and I've found that real-world time can be very different from ideal time. When preparing an estimate, I may imagine that I can dovetail a drawer in two hours, but when I refer to past time sheets, I may find that drawers always take me two and a half hours. The time I spend keeping accurate time sheets is the essential first step for future estimates.

I knew nothing about computers when I set out to buy mine. I was looking for something that, in addition to looking after all my business needs, would take care of the family's needs for word processing, games, and whatever else might come up. The system I wound up with consists of a Kaypro II, a portable computer with built-in screen, two disc drives, and a Brother printer. The complete setup cost about $3,500 in Canada, and comparable systems are under $2,000 today. Within a month I had it keeping track of some shop records, and I've since discovered that it's a tool of tremendous promise. For example, using a standard spreadsheet program (I use PerfectCalc, but there are many others that will do the same job), I can enter time and materials and have all the addi-

a profit of 50%. Here's how the selling price *(S)* shapes up on a hanging pine mirror that needs $20 in materials *(M)* and takes 2¼ hours to make:

(Mw + Lb) P = S is the costing formula
Mw = $20 × 1.3
= $26 is the applied wastage factor
Overhead/hr. = $5,000/2,000 hr. = $2.50/hr.
b = ($10 + $2.50) ÷ $10
= 1.25 is the overhead factor
Lb = ($10 × 2.25 hr.) × 1.25
= $28.13 (rounded off) is the inflated labor cost
(Mw + Lb) = $26 + $28.13
= $54.13 is the "break-even" selling price

This is your rock-bottom selling price. Let's multiply this by *P* to arrive at a selling price *(S)* with a built-in profit of 50%:

S = (Mw + Lb) P
= $54.13 × 1.5 is the times profit multiplier
= $81.20 (rounded off)

which is a normal sort of price for a well-made mirror. Actual dollar gross profit can be calculated by subtracting *(Mw + Lb)* from *S*. In the above example, this equates to $27.07; a margin that gives plenty of room for haggling or later price reduction in a special "clearance sale."

The facing page shows a convenient form that I developed for use in my own shop. Notice that the labor part has several lines in which to itemize the time spent on various operations, such as jointing, assembly and finishing. Time each discrete step. If you are running a batch, average the time each step takes.

Once you have computed a price using the formula, all bases should be covered and you can confidently look the client in the eye and say, "This is the price I need for this piece." Or is it? What do you do about covering a bad debt? Unfortunately, they do crop up now and again. Or what about that piece that ran way over your quoted price, but that you proudly finished with your usual care? No problem. You can build such inevitable losses into your regular costing formula, as the following tale shows.

Four years ago, I had a commission to build an entrance door within a large apartment (yes, here we go again; I'm a sucker for high-rise views). This time, the subject was Honduras mahogany with etched, beveled-glass panes double-hung in a lighted, fixed frame—seven windows in all. Brass hardware. The thing oozed wealth. Unfortunately, I had a tight deadline and was forced to buy some stock that turned out to be not quite dead. One of the door stiles warped, so I had to make another. I also cracked one of the beveled-glass panes; I forgot that glass doesn't bend. The replacement added another $96 to my growing sense of doom. By the time I collected, by check, from my delighted client, I was $450 out of pocket. Luckily, I was costing to formula by then and running a *b* factor of 1.27. By adding the $450 to my $9200 overhead for 12 months (I thought that a fair write-off period), the following happened: My overhead rose by 4.9%, but my *b* factor went up only to 1.28. You can check this by feeding in 1,920 hours at $18/hr. into the earlier part of this article.

The next piece I made was a hutch for a restaurant. It took 22½ hours. Instead of my *Lb* being $514.34, the new *b* factor made it $518.40—hardly noticeable, but after 12 months, that entrance door became a fond memory instead of a recurring horror show in my subconscious. You can do the same with a bad debt. Write it off over time. Also, when you want to put that little extra bit into a piece and you know it's outside the client's budget, if you're on top of your costing, do it anyway; you'll feel great for indulging your artistic license and the client will become the best piece of word-of-mouth advertising you ever created. □

Tim Nash-Jones now lives in Wales. His book, Making It—A Guide to Successful Craft Retailing, *which also analyzes consignment sales, is available from Gelcyn Ltd., 2 Longlenelen, Abererch, Pwllheli, Gwynedd, N. Wales LL536BX, U.K.; postpaid.*

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tion done almost instantly, without error. I can also easily change the figures for hourly rate, mark-up percentage, waste allowance and other factors to see how they affect price—something that's very useful when I'm estimating a job that I think is right on the edge of what a customer is willing to pay.

This isn't so different from what I once did on paper, though it's much faster and more detailed. I've found that the business-form system I was using could be adapted very well to the computer. A total of about six hours per month keeps track of all bookkeeping, as well as two of the biggest boons of using a computer, scheduling and forecasting.

Customers always ask when a job will be done. In about half an hour I can enter data from the file cards into the computer and, using a project-management program (I use Milestone), come up with a complete schedule of working days for the next several months. Revisions to cope with rush jobs and other changes are equally quick. For once, I know what I'll be doing weeks ahead, day by day, and can promise a delivery date with confidence. It's worth noting that if my time estimates are way off, my schedule will be too, but that's where the time spent keeping accurate time sheets pays good dividends.

Another use is in long-range planning, particularly cash flow. In a small business like mine, which deals with fairly large pieces, cash flow is usually nonexistent for a while, then a large lump sum comes in. This is instantly gobbled up by accumulated debts. Using the project-management program, I can predict when materials will have to be ordered (and when they will have to be paid for), and when I can expect payment for each job. Combining these figures with average monthly expense figures, I use a spreadsheet to predict cash flow, and get a printed forecast of how many dollars will be traveling where, and when they will have to do it. Gaps show up very quickly, and it's fairly easy to see what juggling can be done to ease the crunch. If this juggling doesn't smooth things out, I've found that my local banker is much more amenable to granting a short-term loan if I go to him, spreadsheet in hand, ***before*** I need the loan, than if I wait until I'm neck-deep in unpaid bills.

Right now I'm working on finding trends—what sort of furniture carries the highest profit margins, which shows bring the best responses, and so on. I'm also using the computer to keep track of all accounting records, and to print all written materials like invoices, proposals, purchase orders, and drafts of articles like this one. A direct-mail advertising plan is also in the works.

I would hesitate to say that my computer is indispensable, but I would hate to get along without it. It extends my horizons and abilities, saves me time, and increases accuracy in a number of ways. That combination would be very hard to part with. □

Mac Campbell, in addition to keeping up furniture production, is preparing a pamphlet about how other woodworkers can get a computer working in their own businesses.

Arrowmont Turning Conference

New work, new guild

by David Sloan

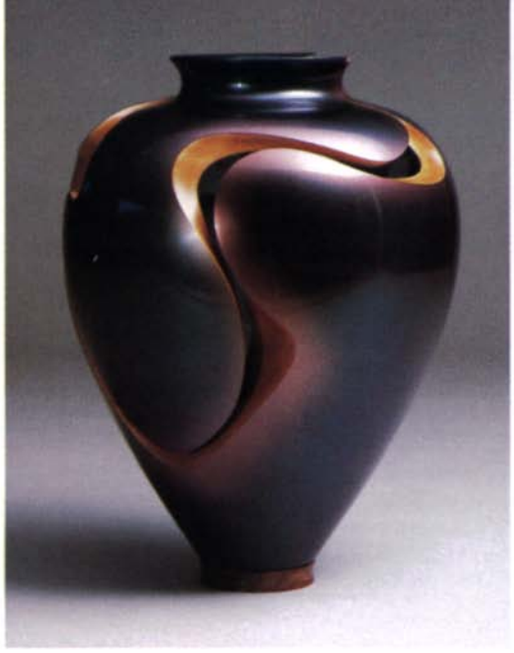
Last October, I attended the 1985 National Woodturning Conference and Exhibition at the Arrowmont School of Arts and Crafts in Gatlinburg, Tenn. In the works for over two years, it was the first national-scale woodturning event since the last of Albert LeCoff's Philadelphia turning symposiums back in 1981 (see *FWW* #32, pp. 54-61).

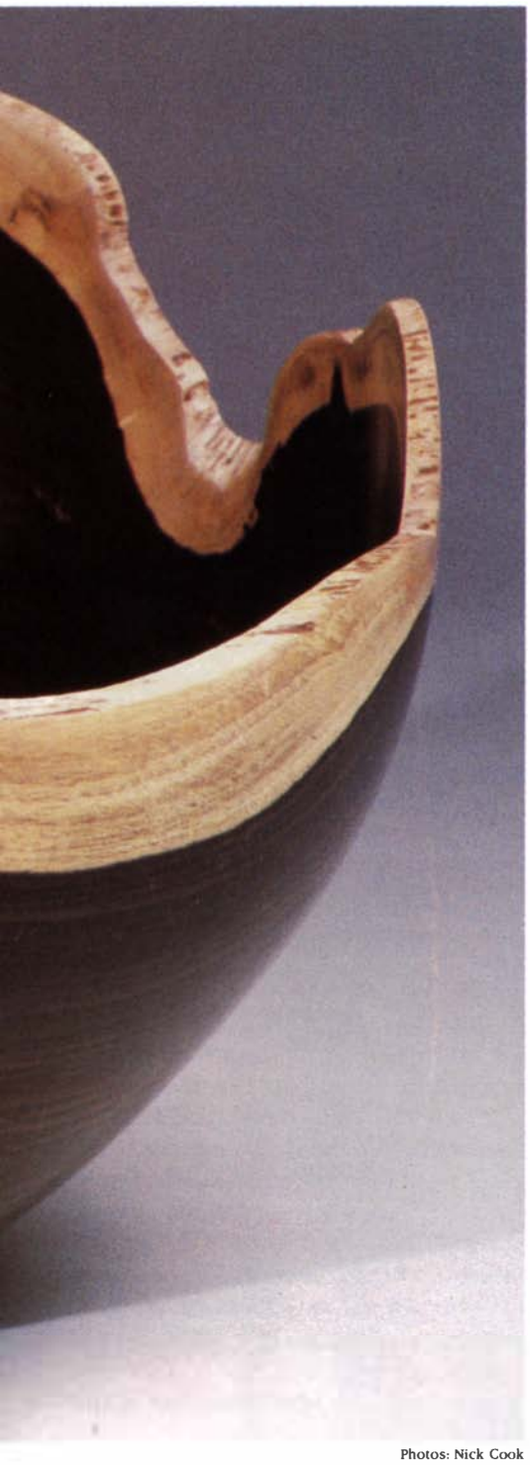
Stylistically, the work of woodturning's innovators has evolved somewhat since the Turned Objects Exhibition at the 1981 symposium. Current work by many of these innovators was on display at Arrowmont. With technique finally mastered, avant-garde turners are in hot pursuit of form, concentrating on shape and surface without concern for function, or even the illusion of function. Wood, once viewed as the sacred material, has become almost incidental in the work of some turners, like Giles Gilson, whose pearlescent-lacquered forms seem to be made of clay or glass, until you lift one.

The exhibit was juried by turners David Ellsworth and Mark Lindquist, along with Michael Monroe, curator at the Smithsonian Institution's Renwick Gallery. There were a few functional bowls on display, and familiar shapes by a few old-guard notables whose work hasn't changed much lately, but the exhibit leaned toward the novel in an attempt, perhaps, to look away from woodturning's functional past.

I walked alone through the moodily lit gallery-like setting, hefting the pieces I could, and peering at those that were enshrined in little glass cases. Much of the work was outstanding, but something bothered me. The display of these flawless wooden pieces as *objets d'art* seemed inappropriate at a turning conference. I preferred the informality of the display tables downstairs, where you could pick things up and examine them, without feeling as if you should glance over your

The exhibition at the Arrowmont Woodturning Conference last October showcased the cream of contemporary woodturning, exemplified by the work pictured here. Below, natural-top bowl (dia. 8½ in.) in African blackwood by Ray Key, Worcestershire, England. Clockwise from right, "Black Ribbon Vase" (height: 9 in.) in lacquered birch by Giles Gilson, Schenectady, N.Y.; vessel (dia: 9½ in.) in wormy ash by Dale Nish, Provo, Utah; "Drop Bop Footed Vessel" (dia: 14 in.) in zebrawood, inlaid with plugs of maple, mahogany and purpleheart, by Fletcher Cox of Tougaloo, Miss.





Photos: Nick Cook

shoulder first. Later, when 225 turners crowded into the exhibit, drinking punch, chatting away, rubbing their noses against the glass cases, and popping flash bulbs at everything in sight, the arty aura that had bothered me came down to earth with a delightful crash. Everyone was excited about the work on display, but most people were talking technique, not concept. The rank-and-file turner had come to Arrowmont to learn about turning, not to worship at the shrine of art. I found the irreverence refreshing. It set the tone for the rest of a very lively conference.

For the next three days, there was a contagious energy in the air. Each day, David Ellsworth, Rude Osolnik, Alan Stirt and Del Stubbs turned and explained, and turned some more. Stirt concentrated on bowls, Ellsworth on his trademark hollow forms, and Stubbs on paper-thin bowls and gossamer goblets with long delicate stems. Osolnik, probably the best production turner in the country, ran through the gamut of turning techniques—he even did some metal spinning. People circulated between demonstrators as they wished. Mark Lindquist hauled a huge lathe up from his Florida shop and drew a large crowd as he demonstrated the chainsaw turning techniques he has developed for his sculptural pieces.

In the middle of the conference, a new piece mysteriously appeared in the exhibit. It was sort of an assemblage of rough-turned shapes nestled on a bed of shavings with a sharpened steel pipe driven into the top, and a sensitively applied

"Ceremony" (height: 11 in.) in elm by Michael Hosaluk of Saskatoon, Sask. Hosaluk drilled tiny holes around the opening of the form and stitched down a necklace of porcupine quills with black linen thread. Below, a fluted butternut bowl (dia: 19⅛ in) by Alan Stirt, Enosburg, Vt.

flesh-colored Band-Aid. As comic relief, it stole the show. The pipe bore a strong resemblance to Del Stubbs's first homemade turning tool. The piece turned out to be the result of a spontaneous, late-night collaboration between Stubbs, Al Stirt and Mick O'Donnell, who'd come all the way from Scotland. As Australian turner Richard Raffan has said, there's something about turning that "gratifies the vandal in us all."

In addition to demonstrations, there were slide shows of work, past and present, a panel discussion on the future of woodturning as a movement, and awards to old-guard turners Mel Lindquist, Dale Nish, Rude Osolnik and Ed Moulthrop, along with Bob Stocksdale and James Prestini, neither of whom showed up. At the big barbecue (complete with bluegrass band) the last night, a special award, a turned disc signed by hundreds of turners, was presented to Albert LeCoff, for his efforts in first organizing turners back in 1976.

Arrowmont was an ideal site for the conference. Gatlinburg is a gaudy tourist mecca on the edge of the Great Smoky Mountains National Park, but the school is set on a pretty park-like campus away from the tourist strip. Credit for the smooth running of the conference goes to the Arrowmont staff, veterans at this sort of thing.

Arrowmont worked because it provided turners, no matter what their level of skill or creativity, with an opportunity to share what they know, and to learn from others. With an eye to the future, Albert LeCoff, David Ellsworth, Dale Nish and a handful of others met to lay the groundwork for a national woodturners' guild. By the end of the conference, a committee was assigned to draw up a charter and elect officers. The guild will organize future turning shows and conferences, keep members posted on turning workshops across the country, and promote woodturning to the general public. If you are interested in becoming a member write to: Robert Rubel, Rt. 2, Box 295, San Marcos, Tex. 78666. □

David Sloan is an associate editor of Fine Woodworking.

A 17th-Century Chest

Scooping curves with a scrub plane

by Peter Schuerch

This 17th-century travelers' chest looks coopered, but it's actually carved from three planks. Handforged hardware, above, accents the chest's dovetails, adding to its French flavor. You can antique commercial hardware by hammering it, then blackening it with linseed oil ignited with a propane torch.

When I began woodworking, I never guessed it would lead me back to Samuel de Champlain's search for the Northwest Passage in the 1600s. But for the last several summers I've played the role of Charles Boivin, master carpenter, at the restored mission of Saint Marie de Gannentaha, near Syracuse, N.Y. Champlain's voyages led to the founding of this French mission, the first European settlement in upstate New York, which was rebuilt in 1932 as a living museum where costumed workers portray historical characters.

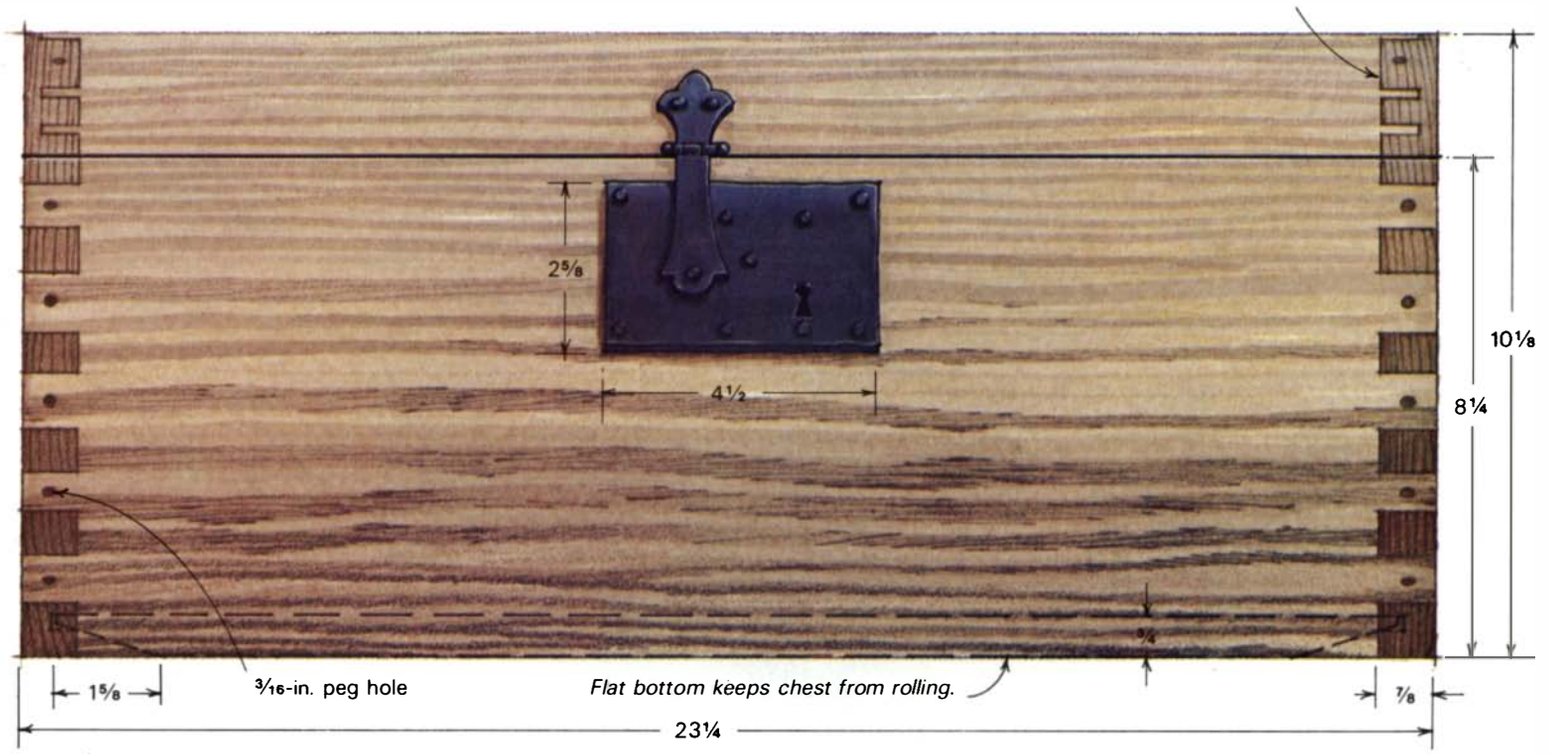
My job was to build 17th-century furnishings, like the dovetailed travelers' chest shown here, "by hand." The light chest is compact enough to tuck under a person's arm, yet sufficiently sturdy to be bounced around in a canoe or small boat. Although the chest appears to be coopered like a barrel, it's actually a square box that is carved to look round.

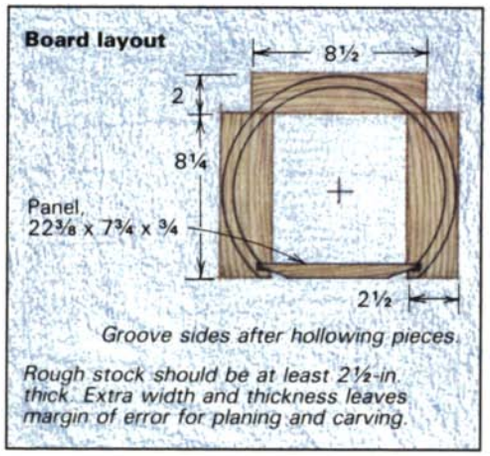
I based my design on illustrations in Jean Pallardy's book, *The Early Furniture of French Canada.* Building the chest with handtools is pleasant, but you might prefer power tools for some operations. I hollowed out the three 2½-in.-thick planks for the sides and lid with a scrub plane, for example, but you could remove most of the waste with a tablesaw, then clean up the surface with a handplane. Begin by cutting all the stock slightly larger than the dimensions shown in the drawing, and lay out all the parts. Select straight-grained, easily worked lumber. I used American chestnut, but pine or butternut also work well. Small knots are okay, but can be hard to plane.

Lay out the ends with a compass, then use the same compass settings to draw patterns for the sides and top. Make sure you locate the compass at the same centerpoint on each face of each end—you'll need accurate lines on both faces later when you cut

Photos this page: Author

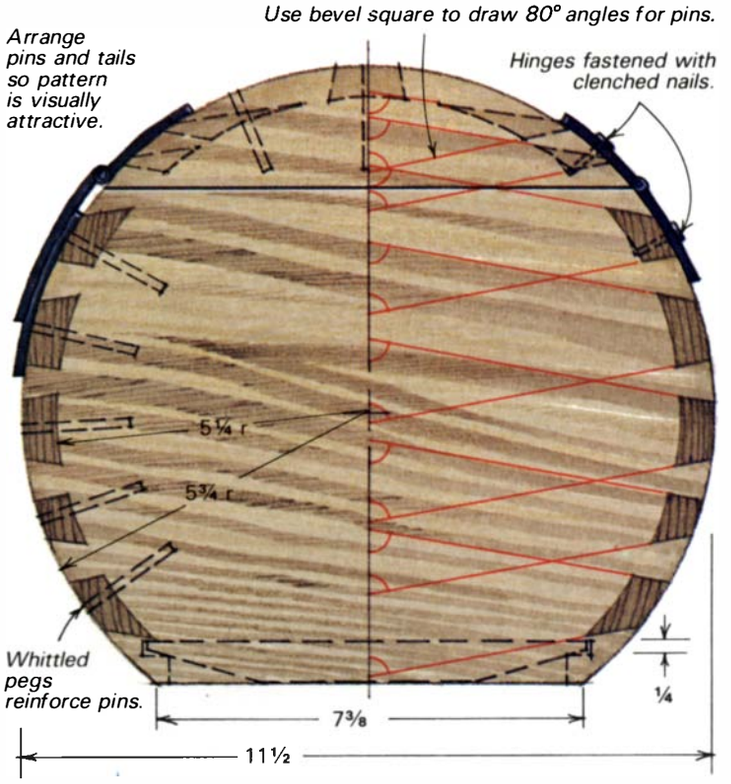
17th-century round chest





To set the curvature of the sides and top, trace wedge-shaped patterns, above center, for the chest's outer radius and its inner radius on each piece. Then, hollow each piece with a scrub plane, above right. Plane along the full length of the board. After removing most of the outside waste with the scrub plane, switch to a jack plane, bottom left, and plane right down to the line. Then lay out the dovetails in three steps. Sketch in the tails on the circular ends with a bevel square set for 80°, bottom center. Use any arrangement of tails that looks good—accuracy isn't that important. Next, hold a side board against each end and scribe the pin locations onto the side. After using the bevel gauge to mark the pins on the end grain, bottom right, saw and chop the pins. Then, hold the side against the end and scribe accurate tails from the completed pins. Cutting the tails completes the job. Scrap bandsawn to fit the chest's inner radius steadies the side during layout and makes a good cutting board for chopping the pins.

Drawings: Joel Katzowitz



the dovetails. To locate the centerpoints, square up the ends and mark a centerpoint on one face. Place a try square on the edge of the stock and draw a line to the centerpoint, then use the square to carry the line across the edge and down the other face. Repeat the process with the square on the adjacent edge. The two lines intersect at the centerpoint.

Set your compass for the chest's 5¾-in. outer radius and scribe circles on both sides of each end. Before resetting the compass, draw the same radius on a piece of cardboard and cut a 120° wedge-shaped pattern. Repeat the whole procedure, including making the pattern, for the 5¼-in. inner radius. Next, hold the 5¾-in. pattern on the end grain of a side board, with the top of the curve about 1/16 in. below the edge. Mark the pattern where it intersects the bottom edge, and trace it onto the end grain. Turn the board end-for-end and repeat the tracing, using the guide marks on the pattern to align it so both curves are in the same plane. Do the same thing with the 5¼-in. radius, aligning the pattern ½ in. inside, and concentric to, the outside radius. Trace the patterns on the other side piece and the top. Saw the round ends with a bowsaw or bandsaw.

I first scooped out the inside radius with a scrub plane, which has a round-nose plane iron that cuts through wood like a gouge. Cabinetmakers traditionally pushed the plane across the grain when they wanted to reduce a board's thickness, but the tool works fine with the grain. The depth of cut depends on how hard you like to push the plane and how easily your plane clogs. Experiment with different settings. I found that mine worked best when I set the iron for a 1/16-in. cut. When you near the scribed curve, retract the iron until it cuts a curve that matches the inner radius. You will be taking thinner shavings, but the plane sole will guide the iron to cut a curve matching the one scribed on the end grain.

To remove the waste with a tablesaw, set the blade to cut to within 1/8-in. of the curve in the center of the board. After cutting the centerline, move the fence about a saw kerf closer to the blade and make another cut. Without changing the fence, flip the piece end-for-end and make the same cut on the other side of the centerline. Repeat the cuts, lowering the blade as needed, until you hollow the side. Clean up with a scrub plane.

After hollowing the insides, turn the boards over, butt each against a bench stop and use your scrub plane to remove most of the outside waste. When you get near the line, switch from the scrub plane to a jack plane, and plane right down to the mark. With a fine-tooth backsaw, crosscut all three boards about 1/8 in. longer than the chest's finished dimension. Use a marking gauge shouldered on the end grain to draw the cut-off lines.

I mark out the through dovetails on the ends in three steps. First, pencil the tails on the outer face, but don't cut them. Instead, hold the hollowed-out pieces between the two radii scribed on the end and use your penciled-in tails to mark the pins on the sides and lid. After cutting the pins, go back to the end, hold the side in the same place as before and re-mark the tails to fit the cut pins. I mark out the joint from each end's central axis, using a bevel square set for an 80° angle, which seems to make a strong joint. The major factor in deciding the number of pins and tails is appearance, as long as the pins and tails are large enough to be strong. I recommend you start with the arrangement shown in the plan, then modify the pins until you like the look.

The dovetails on the lid and sides are sawn and chopped in the conventional manner (*FWW on Boxes, Carcases, and Drawers*, pp. 14-18), except you'll need a curved chopping block that fits under the hollowed sides to support the wood while you're chopping the pins. When chiseling the ends, you can maintain the shoulder curve of the smaller radius at the shoulder by making numerous narrow paring cuts with a 1/16-in. or 1/8-in. chisel.

After cutting the joints, draw a line defining the semi-circular lid end, as shown, and carefully separate the lid section from the rest of the end with a thin-blade saw. I use a beveled panel for the bottom. It's easy to fit the ends of the panel into the hollowed sides, and you still have a good, flat surface to keep the chest from rolling on the floor. I grooved the sides with a plow plane, and the ends with a scratch stock. I clamped each hollowed side to my bench, then balanced the plane and cut the groove by eye. I didn't groove the sides before hollowing them because it would have made the carving more difficult to align.

Now put the chest parts together halfway to make sure everything fits—you don't want to loosen the joints with trial fittings. If everything fits, put one end on your bench, tap in the pins of the sides, slide in the bottom and tap down the second end. Assemble the top the same way. Next, drill 3/16-in. holes through the pins and about 1¼ in. into the ends. Split out small sticks and whittle one end to make a 1¼-in. peg to fit the hole. Drive in the peg, saw it off, and whittle another.

After assembling the lid, you may have to plane around the lid and base to level the pieces. Don't take off too much, or you'll spoil the fit between the lid and sides. Finally, clean up the exterior with a block plane to make everything smooth and flowing. I attached the handmade hinges, which add to the French flavor of the chest, with nails, clenched over on the inside. For the lock, you could probably substitute a regular keyhole lock, then cover it with a curved plate or just hammer a commercial hasp to match the curve of the chest. The outside of the chest is coated with linseed oil, but the inside is unfinished—even 17th-century travelers didn't want oil bleeding onto their clothes. □

Peter Schuerch designs furniture and works for Warren Platner Associates, an architectural firm in New Haven, Conn.

Vacuum Veneering

Build a bag press

by Greg Elder

Veneering opens up new horizons in design. No longer limited to solid wood, you can cover stable, man-made panels with a choice of veneers in a wide variety of species, widths and grain patterns. Veneering can be done by at least three methods: with a veneer hammer, in a mechanical press, or in a vacuum press. The first requires muscle and skill, the second requires a large, heavy and often expensive piece of equipment, while the third needs only a thin bag and the weight of the air above it. With the air pumped out of the bag, the atmosphere bears on the bag's contents like one huge clamp (2,117 lb. per square foot!), its pressure perfectly distributed. Simple, inexpensive, easy to store, a vacuum press yields consistently excellent results.

My vacuum press consists of a flexible, 16-gauge vinyl bag, a 4-ft. by 8-ft. sheet of particleboard and a second-hand, ⅛-HP vacuum pump. The procedure is simple: After applying the glue, the substrate and veneer, along with a Masonite caul and protective sheet of plastic, are slid into the bag on top of the particleboard press platform. The bag is sealed, the air pumped out and the now-pressed panel is left to cure.

The bag can be any size you wish. Mine takes panels up to 64 in. by 120 in. To get that size, I had to join three pieces of vinyl—two 54 in. wide, one 27 in. wide, all 11 ft. long—to form a tube. The simple, 2-in.-wide lap joints run the full length and are glued with vinyl adhesive. (Vinyl and adhesive can be ordered from Minute-Man, 375 Beacham St., Chelsea, Mass. 02150.)

After applying the adhesive, make the seam, without wrinkles, pressing with a small, firm roller to get a good seal. I found the adhesive joins best when tacky. An extra pair of hands is very useful here, and I suggest wearing a respirator when working with the adhesive. Let the seams set for about 10 minutes, then seal one end of the tube with another 2-in. seam, to form a bag. Wood battens and clamps help seal the end seam while the adhesive sets. Avoid placing the lengthwise seams along the edges of the bag—they would make sealing the end corners difficult.

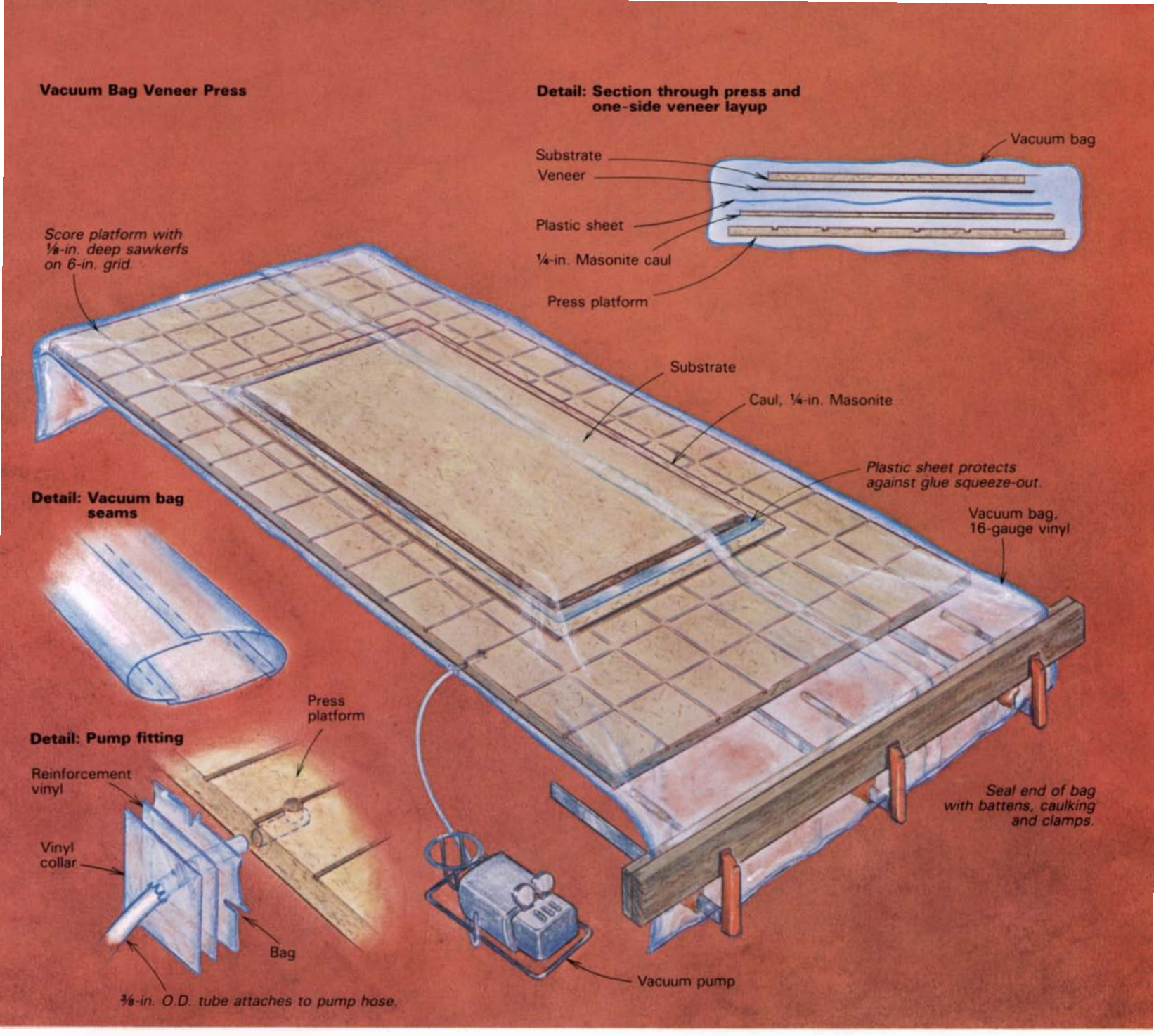
The press platform is a sheet of particleboard, scored with a 6-in. grid of ⅛-in.-deep sawkerfs to aid the evacuation of the air. A fitting for the pump hose plugs into a ⅜-in. hole bored in the platform edge, aligned with the end of a groove, as shown on the facing page. The hole should be about 1 in. deep and located 18 in. to 24 in. from a corner. A ¼-in. hole, about ¾ in. from the edge, connects the groove and the fitting hole.

The pump-hose fitting is glued to the bag, positioned to align with the fitting hole in the platform. I use a piece of ⅜-in. outside diameter clear vinyl tubing about 10 in. long for the fitting. A flanged, vinyl collar and vinyl reinforcement layer connect the fitting to the bag. Punch a hole slightly smaller than the tubing through the bag and reinforcement layer. I made a punch by grinding a sharp edge on the end of a length of metal tubing. To make the collar, punch a smaller hole in another piece of vinyl, then cut the flanges with a knife. I glued the collar and reinforcement to the outside of the bag; hand pressure will make the bond.

Brooke Beaird

Elder's vacuum bag veneer press consists of a lightweight, homemade vinyl bag, a particleboard platform and a secondhand vacuum pump. It will handle large, flat panels easily, and can be broken down and stored in a small space.

Vacuum pumps vary in capacity, measured in the number of cubic feet of air they move per minute (CFM) and the vacuum they'll create, measured in inches of mercury. A perfect vacuum will permit the maximum air pressure (14.7 pounds per square inch—PSI—at sea level) to bear on the work. I bought my second-hand pump from a hospital for $50. It moves 2 CFM and attains 22 in. of mercury, which translates to 11 PSI—not perfect, but it's still 1,584 lb. per square foot. Similar pumps are available from scientific catalogs, such as the Sargent-Welch Scientific Co. biology catalog (7300 North Linder Ave., Skokie, Ill. 60077). An air compressor can also be converted (*FWW on Bending Wood*, pp. 92-97). If the system is well-sealed, there should be no problem maintaining a vacuum with a low-volume pump.



To use the press, you'll need cauls to cover the veneered surfaces. Mine are ¼-in. Masonite, one 4 ft. by 8 ft., one 3 ft. by 5 ft. A sheet of cheap 2-mil or 3-mil plastic prevents the caul from sticking to the veneer. After preparing the substrate and veneer, I spread a thin, even layer of glue on the substrate—not on the veneer—with a notched trowel, then position the veneer. To keep larger pieces of veneer from shifting during the process, I staple or tape the waste at the midpoint of each end. Lay the plastic sheet on the caul, turn the veneered substrate over onto it, then slide this assembly into the bag. Make sure the caul is smooth and the sheet unwrinkled—bumps on these surfaces can make depressions in the veneer.

Placing the veneer face-down on the caul allows me to press panels in a variety of sizes without making a separate, exact-sized caul for each panel. Under pressure, an oversized caul placed on top of the veneer might bow over the substrate edges, keeping pressure from the veneer near the edges. For large panels that are difficult to turn over, cut the caul exactly the same size as the substrate and slide the assembly into the bag, caul-side up. To veneer both surfaces of a panel at once, use a caul and plastic sheet top and bottom. Before sliding any assembly into the bag, make sure to ease sharp edges that may damage the bag under pressure. As the vacuum forms, push the bag into the corners formed by the substrate and the caul/platform so that the bag won't bridge these areas and be vulnerable to tears.

I clear the bulk of the air out of the bag with a vacuum cleaner—my low-volume pump would take forever. When the bag is collapsed, remove the nozzle and seal the end of the bag completely with battens and clamps. A sealer strip of Mortite caulking cord (available in most hardware stores) eliminates leaks, which are fairly easy to hear with the pump turned off.

I've found that for a 40-in. by 60-in. panel it takes 8 to 10 minutes from pouring the glue onto the substrate to achieving full pressure. The vacuum cleaner is the key to keeping the time that short. I leave panels glued with Titebond under pressure for an hour, but let the glue cure fully before working the panel. □

Greg Elder makes furniture in Woodstock, Vt.

Working Wood Without Electricity

It's quite easy to take electric tools for granted. You just grab a plug and stick it into the wall without much thought about where the power comes from. It's hard to argue with the convenience of electricity when it comes to woodworking tools. It's clean, reliable, and, if the machine happens to be in the wrong place for a job, there is no problem in moving it; a couple of wires transports the power anywhere you want.

Could you run your shop without electricity? At one time, everyone did, and many people still do. Some live in isolated areas beyond the power lines, some forego electricity because of religious conviction, some just like the slower, quieter pace of working wood without screaming motors. On the pages that follow, we'll look at some alternatives to plugging in.

Diesel Power for Production Shops

Amish woodworkers convert modern machines

by David Sloan

At the big woodworking tool show in Louisville four years ago, a friend of mine was surprised to see a couple of Amishmen poring over the latest in expensive multiple-spindle boring machines and fancy edgebanders. He was vaguely aware that the Amish don't use electricity, yet the machines these men were sizing up were electric with a capitol E, and about as far removed from hand tools as you can get. His curiosity piqued, my friend broached the subject, "I thought you guys didn't use electricity?" "We don't," came the frank reply. "We take off the electric motors and run the machines on a lineshaft powered by a diesel." My friend's idyllic image of the Amish as "old-fashioned" woodworkers went up in smoke, like yesterday's cigar.

I had to admit (only to myself, of course) that this diesel engine business was news to me too, even though I'd lived for years in Lancaster County, Pa., home of the oldest Amish community in the country. I'd met Amish woodworkers at auctions, but they were carpenters and kept to themselves, so we never talked much. Now, ten years later, I decided to see, first hand, what a diesel-powered shop was like. I arranged to visit Amish shops in Pennsylvania and also in Ohio, home of the men my friend met at Louisville.

From an outsider's perspective, Amish woodworkers go to great lengths (and expense) to avoid using electric power. In addition to the cost of the machines, there's the enormous additional expense of diesel engines, fuel tanks, shafts and installation. Some shops have replaced the lineshaft with a hydraulic system that requires pumps, hydraulic motors and extensive plumbing.

It's hard for outsiders to understand why the Amish go to all this trouble for a point of principle. A definitive explanation is elusive, since the Amish don't feel compelled to justify their behavior to outsiders. Indeed, they don't welcome attention at all, one reason why there aren't any photographs of Amish woodworkers in this article. These devout people believe that they should remain "separate" from the rest of the world. Keeping separate means, among other things, that an Amish household must not be linked to non-Amish households through a network of electric wires. A diesel engine's storage battery and self-contained 12-volt electrical system, however, are permitted. A self-contained 110-volt generator might be used temporarily by someone saving for an expensive air tool, but long-term use would meet with community disapproval. The *Ordnung*, rules for living that vary according to the community, specify what is and is not permitted. They aren't written down, so the fine points are understood only by the Amish.

The July sun was bright, and it took a minute for my eyes to adjust to the low light inside Alvin Mast's cabinet shop. When they did, the natural light from the windows and skylight proved adequate, though less than I am accustomed to for working. The one-story 5,000-sq.-ft. building is fairly new, and built—walls and roof alike—of corrugated-steel garage-door panels.

Mast's shop, in central Ohio, is the largest I visited, and like most other Amish shops I saw, it's well-equipped for production work. The first machine that caught my eye was a big Ramco wide-belt sander—a sophisticated, expensive abrasive surfacing machine. Next to the door was a multi-spindle horizontal boring machine. The only vintage tool in sight was a grand old turn-of-the-century bandsaw. Mast turns out well-built hardwood furniture in production lots, for customers like motels and nursery schools, or to fill wholesale orders from furniture stores. There's nothing superfluous or contrived about his furniture.

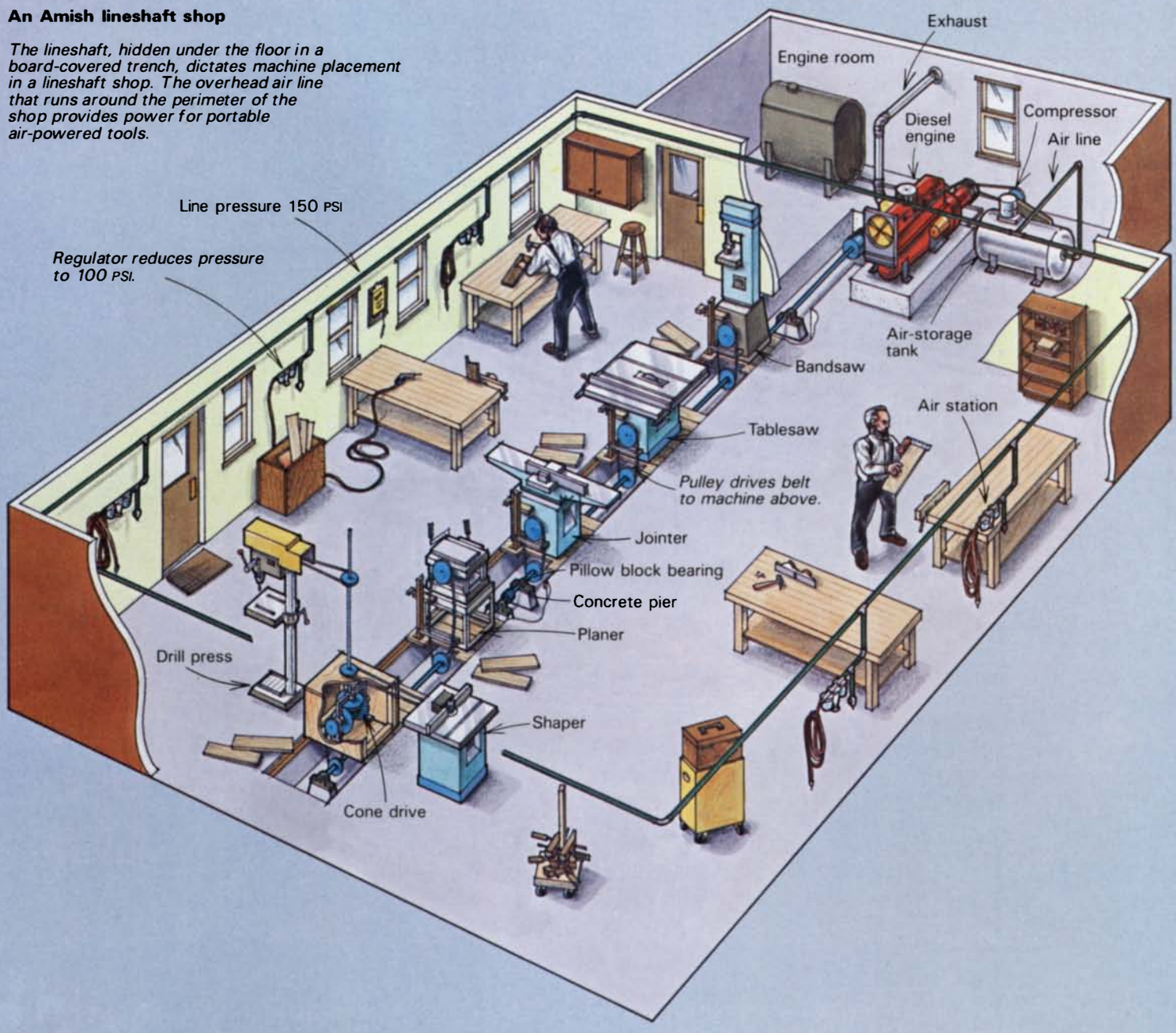
Mast's shop, like most Amish shops, uses an air compressor powered by the diesel to provide an auxilliary source of power for portable tools and spraying equipment. There's a wide range of portable air-powered tools on the market, so the Amish don't want for routers, sanders or drills. An overhead air line runs around Mast's shop and into the adjacent finishing room where he sprays lacquer. He uses the loop system, shown on the facing page, which allows operation of several air tools at once, without pressure drops farther down the line. Regulators at individual air stations drop the 150-PSI line pressure to 100 PSI.

The shop wasn't bustling the morning I visited, but nobody was idle. One of Mast's four employees was trimming some boards with an air-powered cut off saw. The sound was different—higher, sharper, like a chorus of dentist's drills—but the saw cut through that oak as fast as any electric saw. A nearby Rockwell lathe was also fitted with an air motor. Unobtrusive, but hard to ignore, was the deep drone of the diesel coming from the back of the shop, the source of power for Mast's entire shop.

In a way, Mast's shop is a modern-day version of the steam-

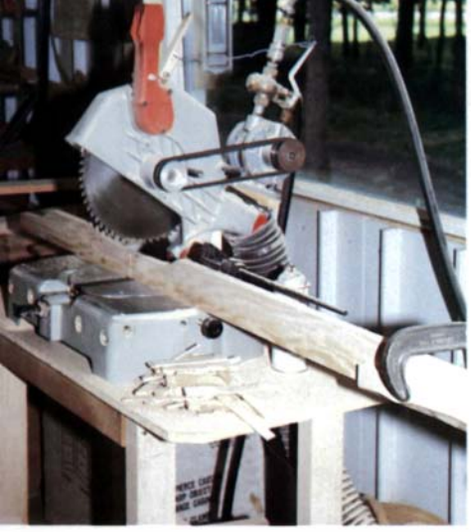
An Amish lineshaft shop

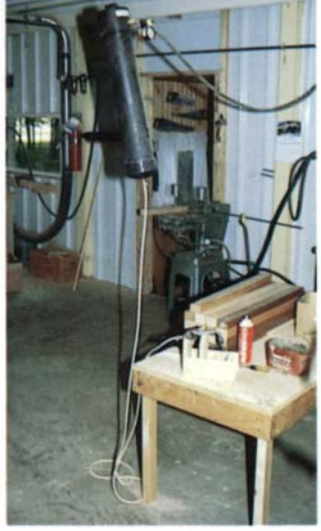
The lineshaft, hidden under the floor in a board-covered trench, dictates machine placement in a lineshaft shop. The overhead air line that runs around the perimeter of the shop provides power for portable air-powered tools.



The idler pulley setup is easy to see on Alvin Mast's vintage bandsaw (left). The bottom end of the belt slips loosely around a pulley on the line shaft under the floor. Pulling the lever forward to its lock position, as shown, moves the idler pulley to tighten the belt and start the saw. To drive vertical-arbor machines, Mast uses a friction cone drive (right) to convert the lineshaft's horizontal rotation to vertical rotation. A belt off the lineshaft turns a short shaft with a rubber cone that drives the cone on the vertical shaft by friction. Another cone on the right end of the shaft would permit reversing the rotation of the vertical shaft by driving on the left or right cone.

Drawing: David Dann





Air motors work well on tools that don't require large amounts of torque, like this cutoff saw. Mast capped the ends of a section of plastic drainpipe, equipped it with a nozzle and filled the pipe with glue. Result? An air-powered glue dispenser.

driven central power plants that powered factories throughout the 19th century. The Amish have simply replaced steam with diesel, which is cheaper, more reliable, and less of a fire hazard. They've updated the drive system with V-belts, modern bearings and clutches. Mast runs two lineshafts, an air compressor, a dust-collection system and an exhaust fan with a 50-HP, 3-cylinder, air-cooled Murphy diesel. Through a multiple V-belt and pulley arrangement, the engine is connected to $1^{15}/_{16}$-in.-dia. steel lineshafts, hidden below the floor in a board-covered concrete trench that runs the width of the shop. The shafts turn in pillow-block bearings bolted to concrete piers on the trench floor.

Mast's set-up is quite a contrast to vintage overhead lineshafts with wide leather belts flapping and slapping noisily as they transferred power to pulleys on the machines. His lineshaft spins quietly under the floor at a steady 600 RPM, except at lunchtime when the diesel is shut down for half an hour. Each machine draws power from the shaft through a V-belt that connects the shaft to the tool's arbor. The belt slips loosely around the spinning lineshaft pulley until the machine is needed, when a wooden lever moves an idler pulley to put tension on the belt. Mast pulled the lever to start up the bandsaw, which hummed quietly.

Tools with horizontal arbors—planers, jointers, bandsaws, lathes—are the easiest to convert to lineshaft drive. The Amish just mount the proper size V-pulley on the arbor and hook up the belt with an idler or clutch. Vertical arbor machines, such as drill presses or shapers, require converting the lineshaft's horizontal rotary motion to vertical rotary motion by means of a bevel gear or a friction cone drive.

Machine dealers catering to the special needs of the Amish often assist with the conversion of sophisticated machines. The dealer who sold Mast his wide-belt sander helped him convert it. The sanding belt now runs off the shaft, while an air motor powers the rubber belt that feeds stock through the machine. An electric eye that keeps the sanding belt tracking properly has been replaced with a device that activates the adjusting mechanism when the belt breaks a stream of air instead of a light beam.

Lineshaft drive seems, to me, a perfectly practical way to power machines in the absence of electricity. Though elaborate, it uses engine power efficiently, and it's very reliable. However, Mast says the biggest disadvantage is that once a machine is hooked up to the shaft, it stays put, limiting shop flexibility. Because of this, some Amish shops have done away with lineshaft drive in favor of centralized hydraulic systems that use a diesel-driven pump to push hydraulic fluid (a lightweight oil) through pipes and hoses to hydraulic motors on each machine. Because the pipes can run all around the shop, tools can be placed where they're most convenient. Hydraulic systems are handier for tool mobility, but they require more engine power than a lineshaft system.

It's easy to convert machines to hydraulic power because the hydraulic motor will often bolt on in place of the electric motor. There are several types of hydraulic motors, but, basically, they consist of a cylindrical steel case with input, output and drain connections. Inside is an impeller which spins when hydraulic fluid flows past the vanes under pressure. The impeller is connected to an arbor, which, in turn, connects to the machine arbor either directly or by means of a V-belt. An hydraulic motor will operate in any position, so it doesn't matter whether the machine arbor is horizontal or vertical.

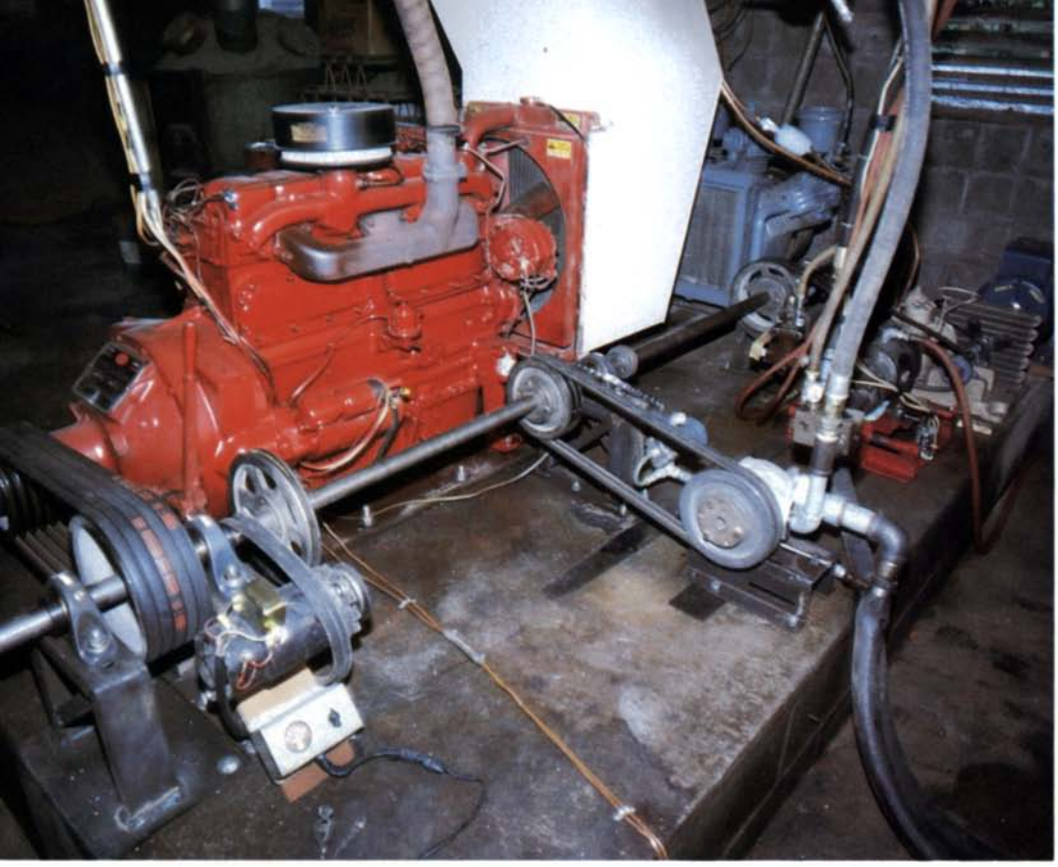
Elam Fisher's shop runs on hydraulic power. Kitchen cabinets are the mainstay of Fisher's Pennsylvania shop, but he also makes wooden toys which he wholesales to gift shops, a business he'd like to expand. Fisher's shop is in a fairly new building with a display room for an attractive sample kitchen, a basement finishing room, and lumber storage in the attic. The engine room, also in the basement of the shop, houses an enormous 6-cylinder, water-cooled, 110-HP diesel connected by a short lineshaft to two hydraulic pumps and an air compressor, as shown in the top left photo on the facing page.

Fisher's shop looks just like any other well-equipped shop at first glance. When I looked closely, I noticed the short black hoses snaking down from the machines and disappearing into the floor where they tap into the main hydraulic line. On-off valves, instead of switches, were the only other evidence of the hydraulic system. I imagined disasterous leaks and ruptured hoses spurting oil all over the shop, but Fisher pointed to an old stain and said that he'd had only one serious leak. Seals, fittings and valves need to be replaced from time to time but leakage, he says, isn't a problem.

Fisher's hydraulic system is more sophisticated than most, with two hydraulic pumps and two separate plumbing systems. The main pump powers most of the machines in the shop. The second pump, a smaller one that was once the only pump for an earlier, smaller system, now powers the planer and the dust-collection system. The pumps push hydraulic fluid under pressure through 1-in.-ID black steel pipe that runs underneath the shop floor and up through high-pressure hoses to each machine. There's an on/off valve and a flow-control needle valve at each machine. The flow-control valve allows the operator to infinitely vary the speed of the hydraulic motor, to keep arbor speeds within a safe range. Not all hydraulic systems require this valve, but with his high-volume pump, Fisher's system has the power to exceed safe arbor speeds. To demonstrate, he cranked up the speed on his tablesaw until it screamed like a banshee.

I wondered, considering the enormous cost of setting up shop, how Amish woodworkers manage to make ends meet financially. Just setting up a shop with electric machines is a major investment for most of us, let alone the cost of converting them. Pulleys are cheap, but hydraulic pumps and motors cost from $100 to $300 each. A new diesel engine alone can easily cost $5,000 and repairs aren't free. Add to this the labor involved in lineshaft installation or plumbing for an hydraulic system and you nearly double your set-up costs. Top-of-the-line air tools are unbelievably expensive: a major dealer quoted me a price of $1,059 for a D-handled Delta router with a ½-in. collet and $901 for a 3-in. by 24-in. Delta belt sander.

The day-to-day operating expenses of a diesel-powered pro-



Elam Fisher's hydraulic system gets its power from a 6-cylinder, 110-HP, water-cooled diesel that drives two hydraulic pumps and an air compressor (above, left). The generator in the left foreground recharges the diesel's 12-volt storage battery. The pumps (the belt driven units with hoses) circulate hydraulic fluid around the shop through steel pipes under the floor and up through hoses to motors on each machine, like the radial-arm saw and planer, top and bottom, right.

Abner Miller runs a small shop with a 3-cylinder, air-cooled diesel (above). Miller runs his smaller machines off a secondary wall-mounted shaft. The main shaft crosses under the shop floor perpendicular to the wall-mounted shaft. A V-belt with a 90° twist transfers power from the main shaft to the wall shaft.

duction shop appear comparable to one powered by electricity. At a steady 1,800 RPM, for instance, fuel consumption on Mast's 3-cylinder diesel is about 1 gallon per hour, which works out to less than $200 a month for a six-day week—a little more than the cost of electricity for a shop this size. But, during the winter, a belt-driven fan in the wall blows the heated air from the engine room into the shop, so heating costs are reduced. Mast said that he rarely needed to fire up the shop's heating stove last winter.

All this adds up to a high overhead for the Amish woodworker who still manages, somehow, to compete successfully with electrified, non-Amish shops. I can only attribute this to their down-to-earth approach to woodworking as a business. Unlike many of the rest of us who pretend we're in business then turn around and make what we want to make (tying up countless hours of expensive labor in a precious one-of-a kind piece that may not sell for months, if ever), Amish woodworkers make what people want to buy. If economics dictates machines instead of hand-tools, and oak instead of paduak, so be it. It's not that these men aren't interested in more creative, non-production woodworking. Many are, but they indulge their creative urges after hours, in their spare time. □

David Sloan is an associate editor of Fine Woodworking. *Hydraulic-system components and books on hydraulic power are available from Northern Hydraulics, 801 E. Cliff Rd., Burnsville, Minn. 55337, and Surplus Center, 1015 W. "O" St., P.O. Box 82209, Lincoln, Neb. 68501. Air tools are available from Air-Way Mfg., R. 4, 4766 T.R. 352, Millersburg, Oh. 44654.*

A Child's Pole Lathe

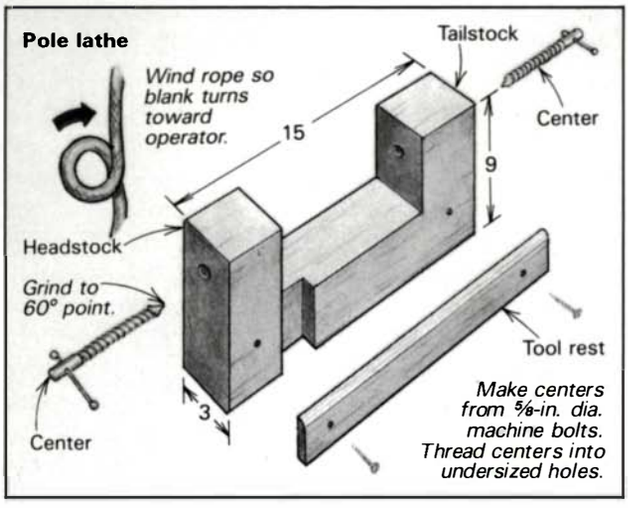
Foot-powered way to teach woodturning

by John and Jon Leeke

The flying chips and smooth round shapes of lathe work in my shop sparked my then 9-year-old son Jon's interest in woodworking. He wanted to get started on the lathe right away. I wanted to say yes, but I thought he was too inexperienced to handle the hazards of power equipment. I knew I had to act fast, before his interest waned, so I built this simple foot-powered pole lathe and had Jon set up and turning in half a day.

Like all lathes, the pole lathe holds the turning blank between two metal points called centers. The stock is turned by a rope that passes from a foot treadle below, up and around the blank, and on up to the end of a springy pole. The pole keeps tension on the rope so it grips the wood. Pressing down on the treadle with your foot rotates the wood, which goes around several times and then stops when the treadle hits the ground. Lift your foot, and the pole pulls the rope back up, the blank goes backwards, and you're set for another down stroke. Since the turning action is intermittent, it takes some coordination to cut only on the down stroke.

To save time and space in the shop, I built this lathe as an attachment to Jon's workbench. The body of the lathe is gripped by the left vise. The treadle pivots on a bolt in the back leg. To ten-



A pole lathe is a good way to learn turning basics without the speed or danger of a power lathe. Leeke's simple lathe clamps to his son's workbench. To cut, you push down on the treadle to spin the stock, the springy pole spins it back again and lifts up the treadle, ready for another cut. A rope wrapped around the stock makes it spin. On the cutting stroke, the stock rotates into the gouge; when the pole pulls the treadle up, the stock rotates in the other direction.

Photos: John Leeke

sion the rope, we usually clamp a pole to the back of the bench, but we've used a coil spring hooked to the rafters of the shop as an alternative. You could build the lathe as a free-standing unit or even build an adult-size pole lathe. Old pole lathes sometimes had movable tailstocks. A slotted tenon on the bottom of the tailstock extended down between the two wooden ways that formed the lathe bed and locked in place with a wedge through the slot.

On our version there's no sliding tailstock to bring up against the work, but threaded centers let you chuck and remove wood easily and allow some adjustment for length. The centers are made from ⅝-in. machine bolts. I ground the ends to a 60° point on a bench grinder. The points don't have to be perfectly conical, but they should be close. The surface of the cone should be polished with emery cloth to reduce friction between the center and the turning wood.

I bandsawed the body of the lathe from a piece of cherry. Then, I cut a wide notch along the side of the base to make a space for the rope. I drilled holes in the headstock and tailstock for the centers, just slightly smaller in diameter than the ⅝-in. threads. When I wrenched the centers into the holes they formed their own threads in the wood. The maple tool rest screws to the headstock and tailstock, and ties the two uprights firmly together.

Using the Lathe—To chuck the blank, mark the middle of each end with a pencil. Then, twist the rope around the wood once, or twice with wood less than 1 in. dia. Press the center mark on one end of the wood onto the sharp point of a lathe center and hold it there. Go to the other end. Line up the center mark with the other center and tighten both centers until you can't turn them any more. Then, loosen them until the wood swivels freely but not loosely. If the blank catches a little on the tool rest, trim it with a chisel.

Push down on the treadle, the top of the blank should turn toward you. If not, twist the rope around the stock in the other direction. Pump some more and watch the wood spin. At first it might seem awkward, but in a few days you will get used to it. After roughing the square blank into a cylinder, remove it and reverse ends to cut down the rough stock where the rope was.

The slow speed of this lathe made it easy for Jon to see and feel just what was happening at the cutting edge of his chisel, and thereby make corrections in the angle of the chisel before the work was spoiled. He easily learned to make nice paring cuts with the skew chisel that left an even, smooth surface on his turnings.

My son worked on the pole lathe for two years. The lathe gave him an excellent background in the skills of woodturning. He now works on the power lathe and can concentrate on safety and more complex projects. □

John Leeke makes furniture in Sanford, Me. Jon Leeke is a high-school student and writes science fiction.

Industrial-Age Pedal Power

Testing a modern-day Velocipede

by Paul Bertorelli

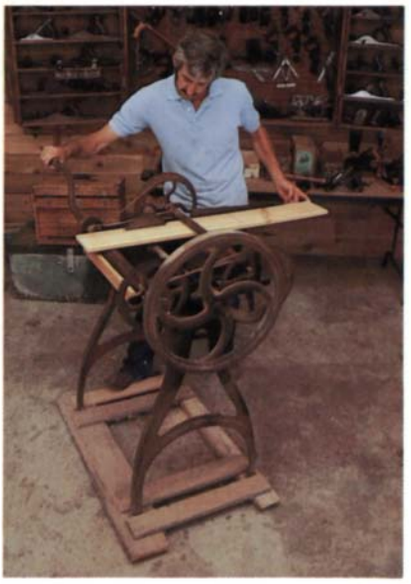
When Isaac Singer finally chased the bugs out of his treadle-powered sewing machine in 1850, he proved that muscle power still had a place in a world increasingly shaped by the industrial revolution. Twenty years later, after Singer had made a fortune selling sewing machines, a handful of American companies were succeeding with similar technology applied to hand- and foot-operated woodworking tools. One of the biggest was the W.F. and John Barnes Co., of Rockford, Ill.

The company was founded by John Barnes, a restless, inventive modelmaker, who devised foot-powered machines to speed up his own work, only to find his customers more interested in his tools than his models. It's easy to understand why human-powered tools had such appeal. By 1868, when Barnes went into full-scale manufacture, a cabinetmaker who couldn't keep pace with accelerating automation faced eventual ruin. Yet the very powered machines that promised salvation were beyond reach, chiefly because the complicated water or steam power plants that drove them were enormously expensive.

Barnes and his competitors offered a less expensive way to mechanize until electricity became affordable in the 1920s. At its zenith, the Barnes Co. made eleven kinds of foot-powered or hand-powered machines: three circular saws, three scroll saws, lathes, grinders, mortisers and tenoners, and a former (shaper). Thousands were manufactured, and today, enough survive to sustain a group of Barnes tool collectors. Last summer, I visited one of them, Bob Barnes of Galena, Mo. Barnes, who is no relation to the founder of the company whose name he shares, has an extensive collection of muscle-powered machines and we spent an afternoon tinkering with them.

What impressed me most about the Barnes tools is their remarkable sophistication. The Barnes No. 4 circular saw, for instance, is powered by a pair of cranks (one on each side) helped along by a treadle. For ripping, a gear-driven mechanism feeds the wood into the blade automatically, freeing the operator to cheer on the apprentices who are, presumably, whaling away at the cranks. Like the modern-day Inca saw, the No. 4 featured an optional horizontal boring attachment with a sliding table, good for doweling. After wrestling the saw out of its storage shed and into Barnes' shop, we gave it a brief test by feeding in a piece of ¾-in.-thick pine. With surprisingly little effort applied to one crank, I was able to rip the length of pine board without breaking a sweat on a hot July day. "Oh, it's real easy to run it," said Barnes, "but after 15 minutes of it, you've had your fill."

Barnes believes muscle-powered machines were bought primarily by small cabinet shops, furniture factories and millwork houses. Besides being less expensive, Barnes tools had other advantages over water and steam: early boilers were unreliable and it was not unusual for an entire plant to be shut down for repairs; power was usually transmitted through an intimidating



During the last half of the 19th century, the W.F. and John Barnes Co. manufactured a sophisticated line of hand- and foot-powered machinery. Bob Barnes demonstrates a No.4 crank-operated circular saw (right). The 1985 reproduction of the Barnes Velocipede (above) is virtually identical to the original, but is cast in aluminum instead of iron. It weighs 40 lb. and has a 24-in. throat. A pitman arm (above, right) converts rotary pedal motion to reciprocating sawing motion. A composition belt, whose perforations engage teeth in the pitman wheel, transmits power.

maze of shop-long shafts and leather belts, best described as accidents waiting to happen. A Barnes-equipped shop could peddle, treadle and crank right around such misadventures.

John Barnes' original invention, the foot-powered scroll saw, was light enough to be carried to a building site, where it was ideal for sawing the ornate scrollwork of Carpenter-Gothic-style houses then in vogue. A heavier version of this saw, the pedal-powered No. 2 Velocipede, works so well that Bob Barnes decided, two years ago, to market a reproduction of it.

The reproduction is made by Dwight Check, who operates a small tool manufacturing company in Harrisonville, Mo. Like the original, Check's Velocipede is low-tech direct. It is nothing more than a simple cast aluminum frame (the original was cast iron) housing a 20½-in. flywheel driven by a pair of pedals. A perforated composition belt transmits power from the flywheel to a smaller wheel, where a pitman arm converts the rotary motion into reciprocating motion. A jewelers' blade, held in tension by a pivoting parallel arm arrangement (similar to that of the Hegner and other scroll saws), does the cutting.

Check also makes a line of treadle scroll saw kits, which I had the chance to compare against the Velocipede when I drove over to his place from Bob Barnes' shop. At the outset, I found the Velocipede much easier to use. I haven't much experience with treadle machines, and have never learned the trick of kicking the treadle so it accelerates the flywheel instead of stopping it cold at top dead center. By contrast, the Velocipede is like riding a bicycle, literally. Once you've spun it up to the right cutting speed (about 80 RPM for 1,000 strokes of the blade) you have only to maintain that rate as you feed the wood. The Velocipede vibrates more than its electrified counterparts, but this doesn't seem to affect the cut. I got smooth, accurate results sawing hard and soft woods up to 2-in. thick. It's not exactly effortless, however. After 10 minutes of hard going in 6/4 poplar, I was winded.

Lacking only a tilting table for marquetry (an addition that could be easily devised), the Velocipede ought to do anything an electric scroll saw will do. It has a 24-in. throat capacity and will accept jewelers' blades down to 8/0. At $600, however, it's hardly cheap. Check's treadle-saw kits, which range in price from $130 to $375, are a better choice for a bargain scroll saw.

I see the Velocipede's chief asset as fun, with some healthy excercise thrown in at no extra charge. I borrowed one from Check, tried it in the shop, and then parked it in the office for a few days. No one who has seen it has been able to resist trying it out. □

Paul Bertorelli is editor of Fine Woodworking. *The Velocipede is available from The Tool Co., P.O. Box 629, Harrisonville, Mo. 64701, or from Woodcraft Supply, 41 Atlantic Ave., Box 4000, Woburn, Mass. 01888.*

Pleasures of a Slower Pace

Do the job with hand tools

by Simon Watts

Middle Island, a tiny speck off the south shore of Nova Scotia, has never had electricity. It was part of the charm of the place when I bought two tumbledown houses here 19 years ago. Ever since, I've flirted with the notion of bringing some sort of power here to build the odd lapstrake boat, as well as make furniture for the house.

The single most useful machine, especially for boatbuilding, is the bandsaw. It's more versatile than the circular saw because you can cut curves or straight, resaw thick stock with a wide blade, or do quite delicate work with a narrow one. A medium-size bandsaw runs quite comfortably on ½ HP.

So how best to power one? I ruled out mainland electricity because of the expense, and the need to gouge an unsightly path across the island for the power line. Also, I was well aware that introducing electricity would subtly change the character of the place. Tending the oil lamps, getting water from the stone-lined well and other simple, but necessary, chores would become pointless. Increasing ties to the mainland would gradually erode the isolation and self-sufficiency that makes the place unique.

A portable gasoline unit was an obvious choice. They are compact and reliable, and can put out electricity or direct-shaft power. However, the noise and the fumes are obnoxious, and any gas engine gets temperamental when left untended for six months in the fog and salty air of Nova Scotia. The best bet seemed to be the wind. But a windmill is not something one buys off the shelf in Nova Scotia, so I looked around for a used one. One can use the mechanical power directly or have the fan drive a generator aloft and feed current to banks of storage batteries.

I did find a windmill, but faced with the reality of moving it—all that iron, and by boat—I found I'd lost interest. The whole project had become too complex, costly and even self-defeating. I decided that the last thing needed on Middle Island was a high-maintenance item liable to self-destruct in gales and shred anyone who got too close. Also, the law of sheer cussedness dictated that I'd only need the thing in periods of flat calm.

Convinced, finally, that mechanical power was not the way to go, I stopped fantasizing and began accumulating more hand tools and the skill to use them. Within living memory, boats were built on these islands quite without power, and the tools these hardy people used are still in circulation. So, I got a short-handled hewing axe, some heavy-duty ripsaws, a bowsaw, a shipwright's adze, a new Portugese *enxó* (pronounced iń-chaw, a sort of small adze), as well as augers and some wooden planes. Also some slicks—large chisels—that can be pushed through green wood rather than driven with a mallet.

Hand tools do limit what can be done but, if you match ends with means, they're fast. Setting a machine up for one cut can actually take longer than using hand tools, but I avoid working heavy sections of dry wood by hand. That's slow and boring work. There is a crucial difference between working green or partially-dry softwoods mainly by hand and doing the same with kiln-dried hardwoods. Take a hewing axe to dry maple and you're liable to shatter your arm sooner than the wood. I work green wood whenever possible. For cutting heavy sections to length I use a chainsaw. If the chain is sharp and accurately filed, a chainsaw is a precision tool and will cut to a tolerance of 1/16-in. After a neighbor showed me (uninvited) the stitches up his chest, I decided never to use it when alone on the island. One must always remember that a chainsaw is the most dangerous tool. For lighter work I use a bowsaw. The teeth need plenty of set or the saw binds in the wet wood.

The real chore is surfacing. Planes tend to choke on green wood, and it can't be sanded. I've seen floors surfaced so smoothly with an adze that one could barely see any tool marks. This is far beyond my skills, so I buy surfaced lumber of various dimensions, and keep it on hand for work that requires surfaced boards. Cutting to length is best done with a crosscut saw, bowsaw or chainsaw. Cutting along the length you have more choice. If the grain is straight, you can split off what you want with an axe or wedge. If it's not, and the waste is small (an inch or so), taking the hewing axe to it is fast, but leaves a somewhat ragged edge. The *enxó* does a much better job, once you've learned to use it.

When doing a lot of handwork, sturdy sawhorses of the right height are essential. I find 16 in. about right for me. It's easy to kneel comfortably on the board and hold it in place while sawing. Another useful item is a low bench, the same height as the sawhorses, for cross-cutting. When sawing a long board to length, you can rest the longer part on the bench and prop the other end on the horse.

I tend to keep my tools very sharp because it's such hard work when I don't. My neighbor Jim Smith's favorite story concerns a man sawing wood on a Sunday. Along comes the minister and calls out, "My man, do you know what Hell is?" "Yes," comes the reply, "It's three cord of wood and a dull saw."

Saws are no problem to sharpen by hand, but sharpening edge tools without electric grinders takes some ingenuity. I mostly use whetstones, the kind used on scythes and sickles, files and various Arkansas stones for honing. It may sound a bit uncouth in this day of Japanese waterstones and diamond honing, but I quite often take a file to chisels and planes, especially when they are badly nicked. The file leaves a slight burr, which I remove by honing on an oilstone in the usual way.

Good lighting is one convenience I would greatly miss if I were here in the wintertime. However, sea ice makes the place quite inaccessible, so the many steel tools are cleaned with a brass wire brush (not steel), oiled and put away.

So, with a chainsaw to do the brute cutting, and a collection of heavy-duty hand tools, one can accomplish a fair amount without electricity. I'm used to a shop equipped with A to Z woodworking machinery and I've had to change my habits and my thinking. Mostly just slow down—it all takes longer. I've persevered because knowing I can work competently by hand frees me from being dependent on powered machinery. Then, when a tree falls on the line or another nuke approaches melt-down, I'm not quite paralyzed. It's easy to get precious on this subject, but I find I really enjoy working the wood, instead of processing it by machine. The quiet, the absence of dust, and not having to be constantly counting my fingers are other benefits that I appreciate more the older I get. □

Simon Watts is a contributing editor of Fine Woodworking. *Depending on the season, he lives in San Francisco or Nova Scotia.*

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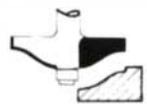

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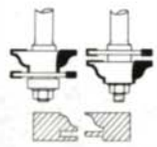

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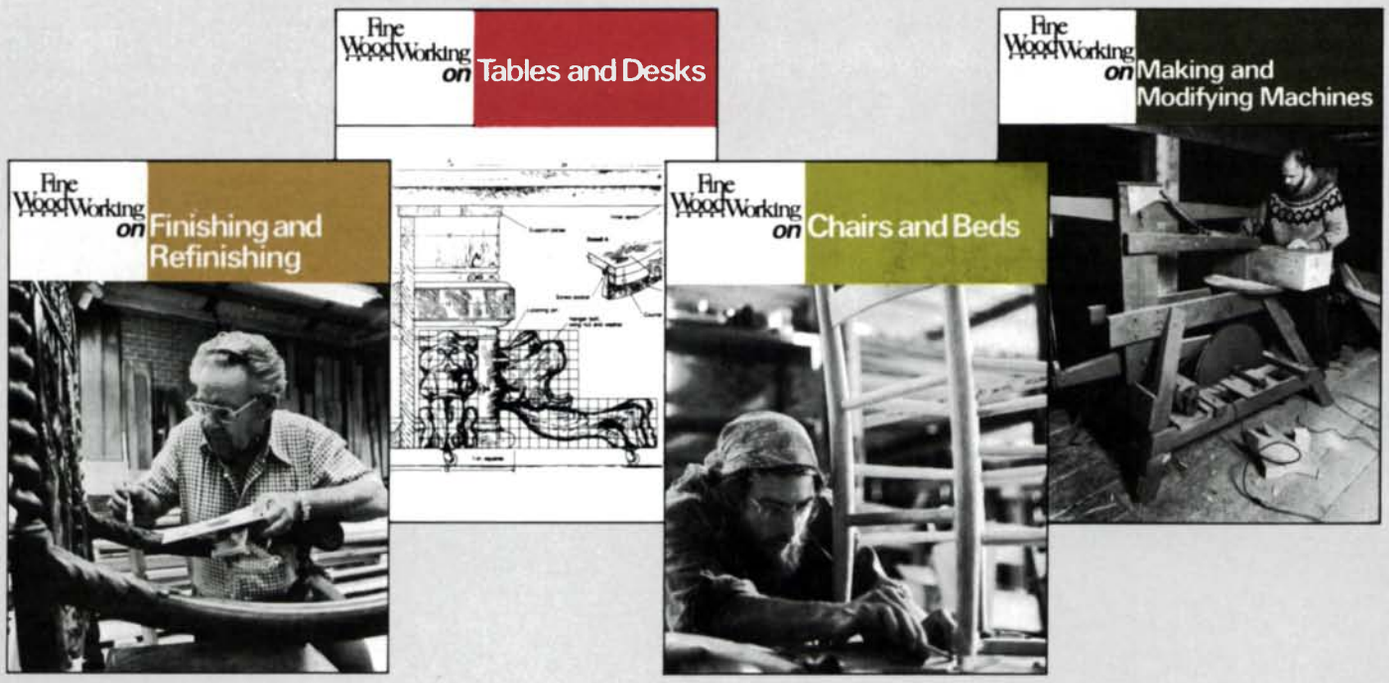

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Chairs are the most exacting and the most challenging kind of furniture to make. And although there are no easy shortcuts to making a good chair—or its horizontal analog, a good bed—there is plenty to learn from craftsmen who have mastered this difficult art. In this collection of 33 articles from *Fine Woodworking* magazine, the experts tell you how they design and make stools, chairs, sofas, cribs and beds. And yes, there are even plans for a rocking chair.
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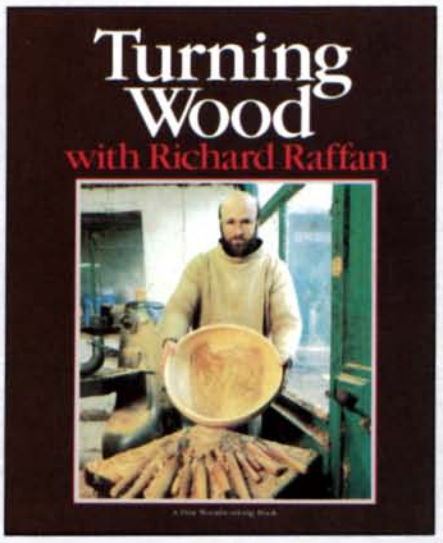


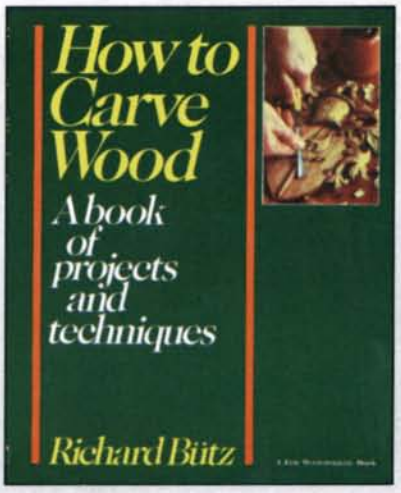
Turning

If you've ever wanted to try your hand at woodturning, or improve the skills you have, ***Turning Wood with Richard Raffan*** is for you.

A skilled professional, Raffan begins with the basics: setting up a safe and efficient work area, getting the most out of your lathe, selecting and sharpening your cutting tools and more.

At the heart of the book are Raffan's chapters on centerwork and facework turning. Using carefully selected exercises, he teaches you different ways to angle a tool to get the cut and surface you want. Detailed photographs and drawings capture every movement of the cutting edge and show how the position and support of your body affect the outcome of the finished piece. Raffan also offers a number of projects to help you develop your skills and a full-color, 16-page gallery of his work that will inspire you to create new designs of your own.

Whether you're a beginner or more experienced woodturner, Raffan's straightforward and encouraging manner will help you approach the lathe with new confidence and skill. *Softcover, 176 pages,* ***$17.95 postpaid***

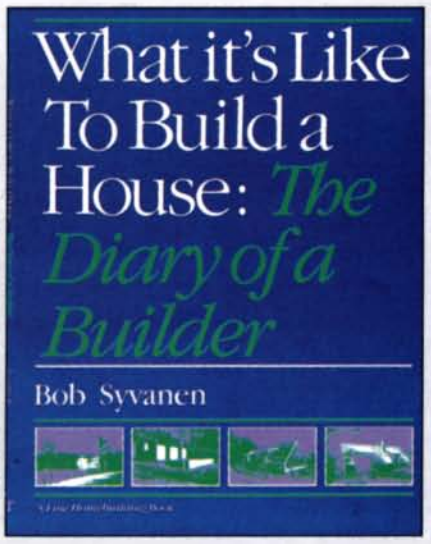


Carving

All you need to start carving are a few simple tools, a piece of wood and some good, clear instruction. That's where Richard Bütz's new book comes in. ***How To Carve Wood*** provides all the information you need to get started—facts and advice about tools, the work space, sharpening, woods and finishes.

Then, chapter by chapter, Bütz teaches you six different woodcarving techniques—whittling, chip carving, wildlife carving, relief carving, lettering and architectural carving. Bütz even gives you scaled patterns for each of the 37 projects he presents.

If you're a beginner, you'll want to start with the basic information in the opening chapters. If you've already done some carving, you'll want to skip ahead to the more advanced projects. Wherever you start, and whatever you decide to make—small figurines, intricate ribbon moldings or realistic birds in flight—Bütz's book will help you develop your skills as you explore the special satisfactions of carving wood. *Softcover, 224 pages,* ***$13.95 postpaid***



Building

It's always good to have a knowledgeable friend around when you're starting a major project. If the project is building your own home, there's no one better to have at your side than carpenter Bob Syvanen. A veteran of numerous homebuilding jobs and the author of some first-rate articles in *Fine Homebuilding* magazine, Syvanen has just written a book that gives you a rare look ahead at ***What It's Like to Build a House.***

Instead of offering a dry, step-by-step course in home building, the new book records Syvanen's day-to-day experiences on one particularly interesting project: the designing and building of a solar-heated, Cape Cod style house. Using drawings and photos, Syvanen offers insights into his own methods of work, carefully noting the highs and lows of the project and sharing practical tips and tricks you can use in your own work.

Whether you're planning to build a house yourself, or are going to have one built for you, Syvanen's detailed account will help you think through your own ideas and generally prepare yourself for the reality ahead. *Softcover, 112 pages,* ***$7.95 postpaid***

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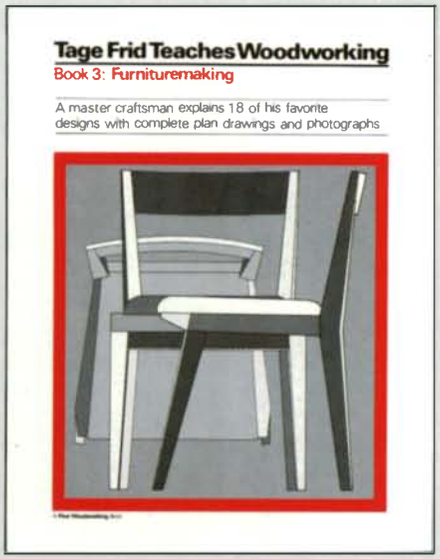
Tage Frid's latest book is here.

Book 3: Furnituremaking



Here is the long-awaited conclusion to Tage Frid's best-selling series on woodworking. Frid's new book on furnituremaking offers photos, instructions and complete working drawings for 18 different projects—everything from his distinctive three-legged stool to a grandmother clock—all designed by Frid and presented in his refreshingly down-to-earth style. The techniques he's covered in his earlier two books are carefully referenced, while especially difficult or interesting steps are illustrated and explained in detail.

Frid also shares his years of experience designing fine furniture. He tells you how to design pieces to meet your own needs, how to improve your efficiency in the workshop and, in the last two projects, how to bring together individual pieces to form a well-designed kitchen or office. There's even a photo gallery of Frid's own work—a sampling of fine craftsmanship spanning more than 30 years that will send you back to the shop with new ideas and fresh enthusiasm.
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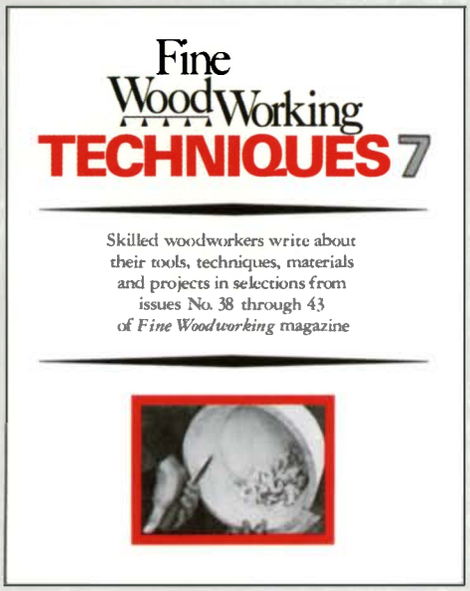

The newest volume in our *Techniques* series is *Fine Woodworking Techniques 7*, a compilation of over 80 articles from the 1983 issues of *Fine Woodworking* (issues 38 through 43). Written by some of today's best craftsmen, these articles offer a wealth of information on everything from backsaws and block planes to cabriole legs and pencil-post beds. There are articles on exotic hardwoods, how to turn a matched set of bowls, the relative merits of five different jointer-planers, outdoor finishes, and much more. And *Techniques 7* also contains a section on woodworking specialties—a compendium of unique projects and specialized techniques to help you improve your skills and broaden your horizons.

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You can still purchase *Techniques 7*, or any of the other *Techniques* books, for just $14.95 each (regularly $17.95 each) postpaid. ***But please remember, this special sale price ends on February 1, 1986.***

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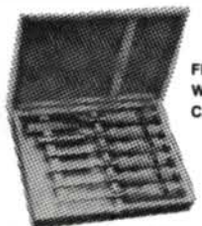

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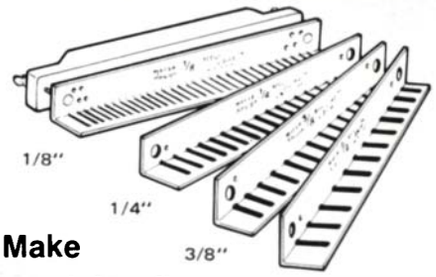

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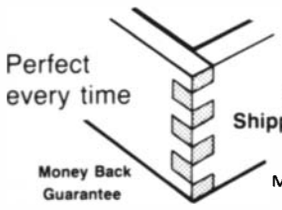

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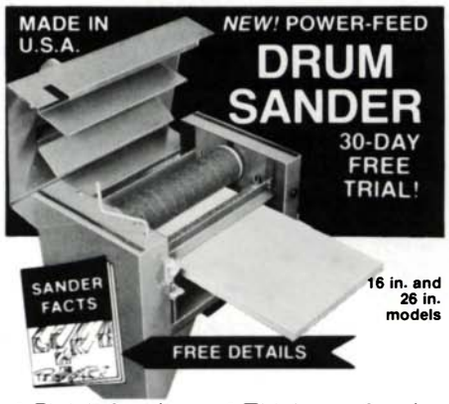

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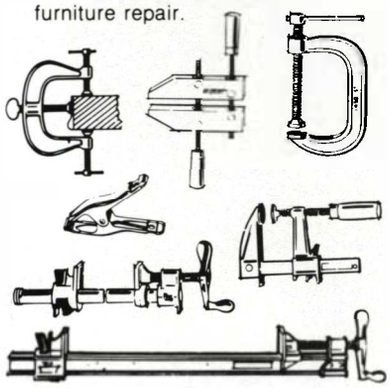

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VS 130	Orbital Sander 20,000 O.P.M. 1/3 sheet	75	49
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VSS 260	Orbital Sander 25,000 O.P.M. 1/2 sheet w/bag	189	119
HBSE 75S	3" x 21" var/speed Belt Sander w/bag	199	119
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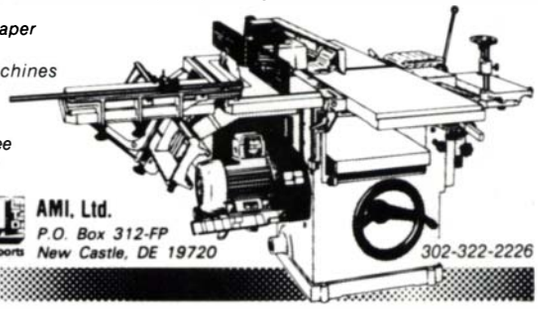

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1a. Title: Fine Woodworking. 1b. Publication no. 105190. 2. Date of filing: October 1, 1985. 3. Frequency of issue: Bimonthly. 3a. No. of issues published annually: 6. 3b. Annual subscription price: $18.00. 4. Location of office of publication: 63 So. Main Street, PO Box 355, Newtown, CT 06470. 5. Location of the headquarters of the publishers: 63 So. Main Street, PO Box 355, Newtown, CT 06470. 6. Publisher: Paul Roman, 63 So. Main Street, PO Box 355, Newtown, CT 06470; Editor: Paul Bertorelli, 63 So. Main Street, PO Box 355, Newtown, CT 06470. 7. Owner: The Taunton Press, Inc., 63 So. Main Street, PO Box 355, Newtown, CT 06470. Stockholders owning or holding 1 percent or more of the total amount of stock: Paul Roman, 63 So. Main Street, PO Box 355, Newtown, CT 06470; Janice A. Roman, 63 So. Main Street, PO Box 355, Newtown, CT 06470. 8. Known bondholders, mortgagees and other security holders owning or holding 1 percent or more of total amount of bonds, mortgages or other securities: None. 9. Not applicable. 10. Extent and nature of circulation:

	Average no. copies each issue during preceding 12 months	Actual no. copies of single issue published nearest to filing date Oct. 1, 1985
A. Total no. copies (net press run)	284,557	301,515
B. Paid circulation		
1. Sales through dealers and carriers, street vendors and counter sales	42,264	48,976
2. Mail subscription	222,186	224,013
C. Total paid circulation	264,450	272,989
D. Free distribution by mail, carrier or other means, samples, complimentary, and other free copies	2,404	3,343
E. Total distribution	266,854	276,332
F. Copies not distributed		
1. Office use, left over, unaccounted, spoiled after printing	8,425	14,432
2. Return from news agents	9,278	10,751
G. Total (sum of E, F1 and 2)	284,557	301,515

11. I certify that the statements made by me above are correct and complete. Signature: Paul Roman, Publisher.

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2040	15 5/8" Planer	1185.00
2708	Table Saw	218.95
3601B	Router	118.95
3612BR	3 HP Router	176.95
4200N	4 3/8" Circular Saw	92.95
4300DW	Cordless Jig Saw	124.50
4301BV	Vr. Sp. Orbital Jig Saw	126.95
5007NB	7 1/4" Circular Saw	97.95
5008NB	8 1/4" Circ. Saw	108.95
5081DW	3 3/8" Cordless Saw	103.95
5402A	16" Circular Saw	314.50
6000R	Uni–Drill	104.95
6010DL	Cordless Drill w/charger light & case	99.95
6010DWK	Cordless Drill w/charger & case	88.95
6010SDW	3/8" Rev. Cordless Drill	44.95
6012HDW	Cordlss Drill Kit 2 Sp	108.95
6510LVR	3/8" Drill–Rev.	68.95
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9900B	3"x21" Belt Sander	122.95
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DP4700	Drill Reversible	94.95
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LS1000	10" Miter Saw w/vise	239..95

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No. 7236	36"	18.70	16.95 Ea.
No. 7248	48"	20.75	18.70 Ea.
No. 7260	60"	22.65	20.55 Ea.
No. 7272	72"	24.55	22.25 Ea.

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No. 3712	12"	5.90	5.35 Ea.
No. 3724	24"	7.30	6.60 Ea.
No. 3730	30"	8.20	7.40 Ea.
No. 3736	36"	8.85	7.95 Ea.

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No. 1	6"	11.30	10.15 Ea.
No. 2	8 1/2"	13.45	12.15 Ea.

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No. 4536	36" Open	22.90	20.60 Ea.

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R–330	2 HP Router	137.95
R–500	3 HP Plunge Router	159.95
TS–251UB	10" Miter Saw w/ Freud LU85M10 Blade	229.95

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6014	1/2 Sheet Sander	124.95
6255	Vr. Sp. Jigsaw	139.95
6287	H.D. Jigsaw	224.50
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3370–10	3 1/4" Planer	129.95
4010	Palm Sander	49.95
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Assortment of	80	1.31 ea	1.15 ea
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LU82M12	12"	72	Cut–off	85.95
LU84M11	10"	50	Comb.	38.50
LU85M10	10"	80	Cut–Off	63.50
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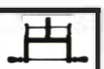

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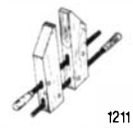

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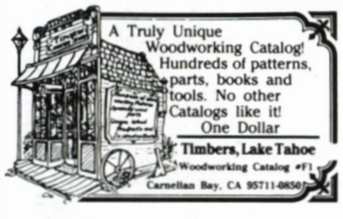

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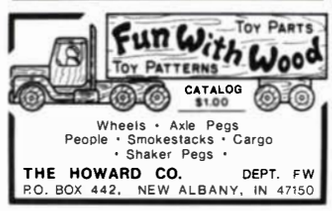

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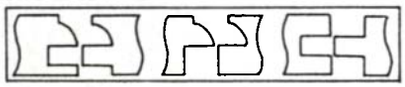

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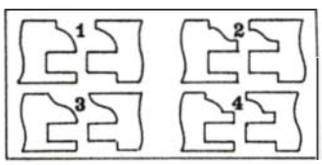

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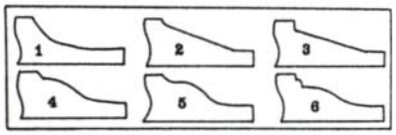

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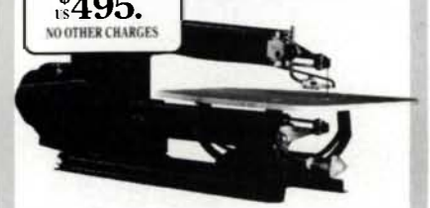

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Listings are free, but restricted to happenings of direct interest to woodworkers. Our Mar./Apr. issue will list events between Feb. 15 and May 15; deadline Jan. 1. Our May/June issue will list events between Apr. 15 and July 15; deadline Mar. 1.

ARIZONA: **Classes**—Construction and repair guitars, three four-month courses, Jan. 6–May 5. Roberto-Venn School of Luthiery, 5445 E. Washington, Phoenix, 85034.

CALIFORNIA: **Workshops/classes**—Numerous subjects. Hands on Wood, Building F, Fort Mason Center, San Francisco. (415) 567-2205.
Workshops/classes/lecture—Beginner and intermediate woodworkers. Liam O'Neil, woodturner, Mar. 4–6. Rosewood Tool Supply, 1836 Fourth St., Berkeley, 94710. (415) 540-6247.
Workshops—Woodworking for women, beginners and advanced, traditional furnituremaking, focus on handtools. Contact Debey Zito, 103 Wool St., San Francisco, 94110. (415) 648-6861.

CONNECTICUT: **Juried exhibition**—Second Annual Members, sponsored by Woodworkers Guild of Connecticut, through Jan. 4. Wethersfield Historical Society, Old Academy Museum, 150 Main St., Wethersfield. Contact Guild, PO Box 7453, Bloomfield, 06002.
Show—Wood vessels by Peter Petrochko, Merryll Saylan, Mar. 5–Apr. 5. The Elements Gallery, 14 Liberty Way, Greenwich, 06830. (203) 661-0014.
Exhibition/workshops—Woodturning, David Ellsworth and many others, Jan. 19. Numerous classes, Jan. 25–Mar. 9. Brookfield Craft Center, Inc., PO Box 122, Brookfield, 06804. (203) 775-4526.
Juried exhibtion—29th Annual Crafts, sponsored by Guilford Handcrafts, Inc., July 17–19. Entry deadline Feb. 21. Contact 29th Annual Guilford Handcrafts Expo, PO Box 221, 411 Church St., Guilford 06437. (203) 453-5947.

FLORIDA: **Demonstrations/classes**—Wood finishing, restoration, veneering, marquetry, Allen E. Fitchett, Jan 15–18. Constantines Wood Center of Florida, Inc. 1040 E. Oakland Park Blvd., Ft. Lauderdale 33334. (305) 561-1716.
Juried show—Boynton's G.A.L.A., Feb. 28–Mar. 2. Civic Center Grounds, 128 East Ocean Ave., Boynton Beach. Contact Eleanor Wollenweber, PO Box 232, Boynton Beach, 33425-0232.

IDAHO: **Classes**—Traditional woodworking and furnituremaking, Jan. 7–Mar. 13. Sun Valley Center for the Arts, PO Box 656, Sun Valley, 83353. (208) 622-9371.

ILLINOIS: **Workshops**—Conservation furniture, fine arts, architectural conservation, Feb. 3–14. Campbell Center, PO Box 66, Mount Carroll, 61053. (815) 244-1173.
Seminars—Table saw, routers, finishing, May 12–17. Woodworking Lab, Still Hall 103, Northern Illinois University, DeKalb, 60115. (815) 753-1457.

LOUISIANA: **Workshops**—12th Annual, Louisiana Crafts Council, wood with Bob Trotman, Feb. 15–16. Nicholls State University, Thibodaux. Contact Louisiana Crafts Council, 720 Terrace Ave., Reddy Cultural Center, Baton Rouge, 70802. (504) 381-9562.

MAINE: **Shows**—Maple Hill Gallery, 367 Fore St., Portland, 04101. Contact Lou Kimball, (207) 775-3822.

MARYLAND: **Juried exhibition**—20th Anniversary Maryland Crafts Council, Jan. 12–Feb. 28. Courtyard Galleries, Baltimore City Hall, Baltimore. $1,000 in awards. Contact Nancy Press, Maryland Crafts Council Biennial, 6206 Lincoln Avenue, Baltimore, 21209. (301) 358-7743.
Exhibition—Artscape '86, juried, outdoor, July 18-20. Mid-Atlantic states. Entry deadline Mar. 31. SASE to Crafts, Artscape '86, c/o MACAC, 21 S. Eutaw St., Baltimore, 21201. (301) 396-4575.

MASSACHUSETTS: **Workshops/seminars**—Numerous events. Contact The Woodworkers' Store, 2154 Massachusetts Ave., Cambridge. (617) 497-1136.
Show—Small Expressions: Two Centuries of Little Furniture, through Jan. 1986. Essex Institute, 132 Essex St., Salem. Contact Sally Miller, NBSS, (617) 227-0155.
Workshop—Wood identification, Jan. 14–17. Univ. of Massachusetts, Holdsworth Hall, Amherst, 01003.
Fair—16th Annual Worcester Craft Center's, May 16–18. Entry deadline Feb. 14. Contact Craft Fair Registrar, Worcester Craft Center, 25 Sagamore Road, Worcester, 01605. (617) 753-8183.
Demonstrations/lectures—Tradeshow, woodworking tools, supplies, Jan. 18; wildfowl carver, Charles Murphy, Feb. 8. Preregistration deadline Jan. 14. Woodcraft Supply Corp., 41 Atlantic Ave., PO Box 4000, Woburn, 01888. (617) 935-5860
Show/exhibition—Furniture and woodturnings by David and Michelle Holzapfel, Jan. 26–Feb. 22. Furniture by Silas Kopf, Wendy Stayman, Bruce Volz, Christina Madsen, Tim Faner, Mar. 2–29. Ten Arrow Gallery, 10 Arrow St., Cambridge, 02138. (617) 876-1117.

MINNESOTA: **Workshops/seminars**—Numerous events. The Woodworkers' Store, 3025 Lyndale Ave. S., Minneapolis. (612) 822-3338.

NEW MEXICO: **Workshops**—Early winter series, through Jan. 11. For locations contact Albuquerque Woodworkers Association, PO Box 40407, Albuquerque, 87196. Contact William Pike, (505) 265-4077.

NEW YORK: **Show**—Master Furniture Makers of the 80's, through Jan. 12. Gallery Henoch, 80 Wooster St., New York, 10012. (212) 966-6360.
Classes/demonstrations/workshops—Wood finishing, furniture restoration, veneering, marquetry, caning, Allen E. Fitchett. For winter schedule contact Constantines of New York, 2050 Eastchester Rd., Bronx, 10461. (212) 792-1600.
Juried exhibition—10th Anniversary American Crafts, June 28–29. Entry deadline Jan. 31. Lincoln Center for the Performing Arts, N.Y.C. Contact Brenda Brigham, American Concern for Artistry and Craftsmanship, PO Box 650, Montclair, N.J. 07030. (201) 798-0220.
Exhibition—"Designed and Made for Use," scheduled for the American Craft Museum, Jan. 1986, has been canceled. For information, contact Susan Harkavy, American Craft Museum, 45 West 45 St., New York, N.Y., 10036. (212) 869-9425.

OHIO: **Show**—Woodworking World, sponsored by Woodworking Association of North America, Feb. 14–16. Veterans Memorial Hall, Columbus. Contact W.A.N.A., PO Box 706, Plymouth, N.H. 03264. (603) 536-3876.

OREGON: **Exhibition**—Vibrant wood, mixed media constructions, Charles Forster, Jan. 16–Feb. 8. Contemporary Crafts, 3934 S.W. Corbett Ave., Portland, 97201. (503) 223-2654.

PENNSYLVANIA: **Exhibition**—Wharton Esherick, sculpture, furniture, utensils, daily. The Wharton Esherick Museum, PO Box 595, Paoli, 19301. (215) 644-5822.

Workshops—Traditional joinery, handtools, with Jasper Brinton, Bob Harrington, Michael Burgoon, Feb. 4–Apr. 10. Brinton Studio, Western Rd., RD 2, Phoenixville, 19460. (215) 935-2851.
Juried show—8th Annual Longs Park Art and Craft Festival, Aug. 30–Sept. 1. Entry deadline Feb. 15. Contact Dick Faulkner, Longs Park Art and Craft Festival, PO Box 5153, Lancaster, 17601.
Juried exhibition—Market House '86, 5th annual, sponsored by Conestoga Valley Chapter, Penn. Guild of Craftsmen, May 4–25. Entry deadline Mar. 1. Market House Craft Center, Queen and Vine Sts., Lancaster, 17604. (717) 295-1500.
Juried show—4th Annual Pennsylvania National Arts and Crafts, early American and contemporary designs, Mar. 28–30. Entry deadline Dec. 30. Penn. State Farm Show Complex, Harrisburg. Contact Pennsylvania National Arts and Crafts Show, PO Box 11469, Harrisburg, 17108-1469. (717) 763-1254.
Exhibition—Hap Sakwa, sculpture; Mark Berman, furniture; Jan. 4–Feb. 2. The Society for Art in Crafts, 719 Allegheny River Blvd., Vernona, 15147. (412) 828-6121.

TENNESSEE: **Juried show**—Political Statements, reflections of social, political, economic and environmental concerns to artists, Jan. 26–Feb. 18. Vanderbilt Univ. Sarratt Gallery, 402 Sarratt, Vanderbilt Univ., Nashville, 37240. Contact Joel Logiudice, (615) 322-2471.
Workshops—Spring program, designing furniture, veneering, marquetry, woodturning and more, Mar. 10–28. Contact Arrowmont School of Arts and Crafts, PO Box 567, Gatlinburg, 37738. (615) 436-5860.

TEXAS: **Show**—Woodworking World, sponsored by Woodworking Association of North America, Jan. 10–12. Shamrock Hilton, Houston (one mile from Astrodome). Contact W.A.N.A., PO Box 706, Plymouth, N.H. 03264. (603) 536-3876.
Exhibition—19th Annual Winedale Spring Festival and 11th Texas Crafts, Apr. 5–6. Early entry advised. The University of Texas Winedale Historical Center, PO Box 11, Round Top, 78954-0111. (409) 278-3530.

VERMONT: **Exhibition**—Rare tools and machines, ongoing exhibit. The American Precision Museum, Windsor. (802) 674-5781.

VIRGINIA: **Exhibition**—11th Annual Mid-Atlantic Wildfowl, sponsored by Back Bay Wildfowl Guild, Mar. 7–9. Virginia Beach Pavilion, Virginia Beach. Contact Archie Johnson, PO Box 1086, Virgina Beach, 23451. (804) 425-1530.

WEST VIRGINIA: **Juried exhibition**—Mid-Atlantic woodworking, functional, sculptural, Jun. 22–Aug. 24. Entry deadline Apr. 1. Oglebay Institute, Stifel Fine Arts Center, 1330 National Rd., Wheeling, 26003. (302) 242-7700.

ONTARIO: **Show**—Woodworking World, sponsored by Woodworking Association of North America, Jan. 24–26. Constellation Hotel and Convention Centre, Expressway 401, Rexdale, Toronto. Contact W.A.N.A., PO Box 706, Plymouth, N.H. 03264. (603) 536-3876.
Classes—Stringed instrument building, Michael Schreiner, beginning Jan. 14. Michael Schreiner, 8164 College St., Toronto, M6G 1C8. (416) 536-3979.

Connections

In Connections we'll publish membership calls for guilds, authors' queries, and appeals from readers who want to share special interests.

Foothill Woodworkers Association is open to professional and amateur woodworkers. Write Dennis Hayes, 10310 Banyon St., Alta Loma, Calif. 91701.

Minnesota Woodworkers Guild is looking for new members. Write the guild at Box 8372, Minneapolis, Minn. 55408.

Topeka woodworkers: Want to join our group? Write Cleo McDonald, c/o Topeka Public Library, 1515 W. 10th St., Topeka, Kan. 66604.

Arkansas Woodworkers Association is open to amateur and professional woodworkers. We meet the first Monday of every month at Hardwoods of Little Rock, 7:00 p.m. Contact Ron Hubbard, Rt. 1, Box 1739, Benton, Ariz. 72015. (501) 847-3056.

Horizons sponsorship of hands-on, craft-oriented trip to England for juniors and seniors in high school and freshmen in college. Students will see Christopher Faulkner, Ashridge Workshops and Judith Hughes, Devon furniture designer/maker. June 22–July 16. Contact Horizons, Jane Sinauer, Director, 374 Old Montague Rd., RD 3, Amherst, Mass. 01002. (413) 549-4841.

Virginia Mountain Crafts Guild is looking for new members. Contact Gary D. Adams, Rt. 1, Box 209C, Hardy, Va. 24101. (703) 721-3845.

San Diego Fine Woodworkers Association meets fourth Wednesday each month. St. Mark's United Methodist Church, 3502 Clairemont Dr., San Diego. Contact Chuck Meechum, PO Box 99656, San Diego, Calif. 92109.

Hawkeye Woodcrafters is interested in new members. Write Dwight Mulch, 2636 South Main St., Burlington, Iowa 52601.

American Craft Council advises there will be no Designed and Made for Use competition scheduled for 1986.

The Society for Art in Crafts has educational services available to the community to acquaint the public with art of crafts. Contact the Society, 719 Allegheny River Blvd., Verona, Pa. 15147. (412) 828-6121.

Wisconsin Woodworkers Guild meets the first Wednesday of each month and invites amateurs and professionals to join an active, interesting group. Write PO Box 137, Milwaukee, Wisc. 53201.

The Green Country Woodworkers Club meets the 4th Thursday of each month, at 7:00 p.m. at the Tulsa County Vo-Tech School, 3420 S. Memorial Drive, Tulsa, Okla. 74145. Interested woodworkers invited to attend.

5th Biennial Crafts Tour to USSR and Scandinavia, June 30–July 21. For details send SASE and $.39 postage to Michael Scott, 3632 Ashworth North, Seattle, Wash. 98103.

East Tennessee Woodworkers Guild holds bimonthly meetings. Contact Grover Floyd, (615) 690-2973, or James Hooper, (615) 573-9752.

Counselors–Maine: First quality residential co-ed camp. Counselors with knowledge of woodworking needed. Contact Ron W. Scott, Browning Road, Hyde Park, N.Y. 12538.

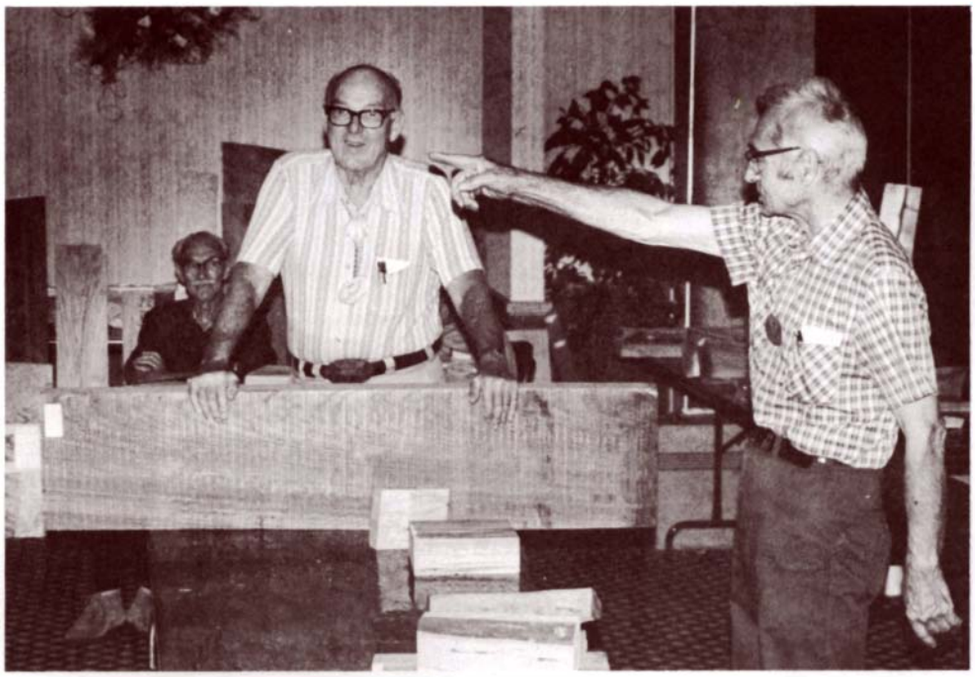
Wood collectors' clambake

The International Wood Collectors Society is thriving, despite the fact that most of its members don't actually collect wood. Let me explain: When the society was founded in 1947, the membership consisted almost entirely of scientists. It was agreed that wood samples should be a standard size—½ in. by 3 in. by 6 in.—and left unfinished. But over the years the membership swelled to include many who weren't much interested in a standard collection but who hoarded wood on their own terms, much the same way you or I do—a chunk of rosewood here, some dogwood tucked under the bench, some elm and ash drying in the basement.

Estimates of the total number of woody plants range up to 70,000 species, though some of them never grow large enough to yield a standard sample. Almost anything is grist for a wood collector's mill. Members harvest wood in their backyards as well as on their vacations. They trade wood back and forth. They write to each other about wood and read about it in their monthy magazine, *World of Wood*. I met Gene Himelick, the magazine's editor, at the IWCS 1985 National meeting in Brattleboro, Vt., last summer. He took over the magazine about three years ago, and has transformed it from a narrowly focused newsletter into a publication of much more general interest. A typical issue has articles on travel, forestry and collecting, news about meetings plus several regular columns.

At this year's four-day meet there was the usual business meeting followed by social visits, an auction and bus tours of the countryside. Himelick and I both noted one of the most unusual woods on display, some beat-up pieces of spruce or tamarack. It wasn't that the *species* was unusual, but that the wood had been carbon-dated as being 13,000 years old, about the time the last ice-age glacier retreated. It had been found at a building site in Poughkeepsie, N.Y., at a spot 70 feet above the current level of the nearby Hudson River. Constant moisture in the soil had protected the wood from the repeated wet and dry cycles that would have rotted it.

A consulting geologist inspecting the site snatched up the wood and had it carbon dated, not because he cared about the wood itself—he wanted it merely as evidence of the age of the sediment around it. The engineer in charge of the project was (you guessed it) an IWCS member, and he sent a sample off to the Forest Products Laboratory in Madison, Wisc., who determined it was either spruce or tamarack. Either species would have been typical of the place and time, but if FPL had had a look at the bark, I think they would have leaned toward tamarack.



Sold! With bigger stuff on-deck, the IWCS auction hammer falls on a tiny alder chunk.

It isn't surprising that a construction engineer might be a wood collector. The backgrounds of the members are varied, and so are their locations. The membership directory lists about 1,600 active members from all over the world. There are three dozen in Australia, a dozen in New Zealand, a handful in Japan. China, Denmark, Greece, Norway, Panama, Poland and the Philippines have one member each. Planning a trip to Tanzania? Yup, there's a wood collector there. Brazil? Belgium? Bahamas? Yup, there too.

It was apparent from the constant banter that most of the 120 members in attendance had known each other for some time. I wouldn't like to guess at the composition of the whole membership from this group alone, but I'll draw one conclusion: the society has its share of vigorous golden-agers, the sort of grand people who haven't changed much in the past ten years and aren't likely to change much in the next ten either. Wood talk was rife, of course, but there was always an overcurrent of plain good cheer. At the banquet dinner on my first night, Red Waggener told the joke about the flock of three-legged chickens. It's a shaggy dog story that a skillful raconteur can extend almost indefinitely. The bare bones are these: a motorist is passed by a flock of three-legged chickens, and he follows their trail of dust to a nearby barnyard, where he learns from the farmer that the birds were bred in order to get an extra drumstick from each. The motorist finally asks: "How do they taste?" and the farmer replies: "Don't know; can't catch 'em."

The same joke had passed through my part of the country two years ago, and was making its second run via Florida, where Waggener had been a professional charter-boat captain all his life (retired, he now makes a steady living carving wildlife for the tourists). His favorite wood is crabwood, which he harvests himself from the steamy jungle around the keys. Crabwood, which I'd never heard of before, has a vigorous and beautiful figure that is so tight it looks plain gray from ten feet away—you have to hold a piece in your hand to appreciate it.

I met many other interesting characters as well. Bill Fyffe, for one, has 450 cowboy boots, each carved from a different wood, with 50 more in the works. He brought a few for exhibition. Rules for exhibitors were few. Someone with something to show had merely to choose some table space and set up. There was a belt-buckle display, a lot of good carvings and turnings, and one impressive show of standard samples, all hand-gathered by president-elect Alan Curtis, a professional forester. Harold Seekins, who writes *World of Wood's* social column, was showing off a machinists' micro lathe by Taig Tools (15048 Proctor Ave., Industry, Calif. 91746). I first thought that Seekins was selling the little machines, but no. He'd brought it along to turn some souvenir pens for fellow members, and because he thought the lathe would interest them.

At the group's wood auction, I held back as well as I could. The day before, I'd bought a 2-in. by 2-in. by 15-in. turning square of pink ivory for $50. I'm going to make a soprano recorder from it, and hope to use the costly "scraps" for some boxes and jewelry. At the auction itself, $30 got me a nice plank of bloodwood, which I

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want to make into a clock. Then I couldn't resist a 4-in. by 16-in. by 46-in. piece of mahogany, a steal at $21—there are four cabriole legs in it, and maybe the best part of a tabletop as well. I wanted it all, of course, and still do. Maybe next time.

As the annual meeting broke up, talk was enthusiastic about the next one, to be held in Indiana. In his report about the coming event, organizer Rex Vaught described one of the highlights, a forest walk into a grove of trees that includes a 5-ft.-dia. sycamore with a gnarly burl that sticks out 5 ft. more on one side. The walk might prove a trial for some of the septuagenarians, but the path will be eased by playful banter and many tales (some sure to be tall ones). In my mind's eye I can clearly see this bunch gathered around the old tree in celebration. But, I can also see that every last one of them, at some time or other, will fall silent, lose touch with the rest of the party, and contemplate that magnificent burl in silent awe for a while. No wood collector would deny the link between human spirit and the spirit of a tree. That link is probably the real reason most of them will be there. If interested, you can write IWCS c/o Robert M. Bartlett, 2913-3rd St., Trenton, Mich. 48183. *—Jim Cummins*

Safety notes

Next time you use paint, epoxy, solvents, or similar products, check to see if they contain glycol ether. According to the National Institute for Occupational Safety and Health (NIOSH), glycol ethers have been reported to cause headaches, fatigue, personality changes, decreased mental ability and may cause reproductive disorders and birth defects.

NIOSH suggests that workers wear gloves and coveralls when spraying or brushing materials containing glycol ethers. When spraying, wear a respirator with an organic vapor cartridge and use a spray-paint prefilter. Glycol ethers appear under some 40 different trade names and synonyms—when in doubt, contact the manufacturer for clarification. For more information, write for NIOSH Intelligence Bulletin #39, free from NIOSH, Division of Standards Development and Technology Transfer, 4676 Columbia Parkway, Cincinnati, Ohio 45226.

A rather more bizarre hazard was noted in a recent Midwest Woodworker's Association newsletter. Seems MWA member Tom Hutchinson was preparing bowl blanks outdoors on his 6⅛-in. Makita planer when he was descended upon by a wave of 13-year cicadas, giddy with the amorous promise in the machine's high-pitched whine. You've been warned. . . .

Woodworker's wife

Beads of perspiration gather along his receding hairline, one glistening drop slipping down his nose and landing on the red-hued mahogany he's preparing to carve.

"Damn." He stops to wipe his wet brow. "It's sweltering in here. Open a door or something, will you?"

"Sure." I reach for the nearest window. The sun has dropped below the building across the street and the approaching evening threatens to be as hot as the day has been.

"You know we have to be there in an hour, Ben," I say, half expecting a response. The radio is playing an oldies tune I'd known as a child. Ben nonchalantly hums along, sharpening his tools on the whetstone next to his workbench. He is a woodworker, a maker of fine furniture. There are two loves in his life, his ability to create something beautiful out of a plank of wood, and the wood itself. I am a woodworker's wife.

I step out of the damp shop into the night air. We have promised his sister we will be at her graduation. She has completed four years of law school and has no one to rejoice for her but Ben. I take a deep breath and re-enter the room. I'm startled by a glint from the chisel.

"Ben," I repeat louder this time. "If we leave in five minutes we'll have just enough time to get there."

"I know, I know. I've got to finish this one side. It'll take me another two minutes." The curled shavings land neatly beside his sandaled foot. I throw my cigarette on the floor and stomp on it. My head is pounding as I gather my shawl and purse.

"I'm leaving now. If you'd like to join me then put down that blasted knife and let's get out of here. If not, I won't have any excuses for your sister this time." I turn toward the door, prepared to get into the car alone, as I've done so often before. I cringe as he slams his fist on the smooth board.

"Why must you interrupt me when I'm in the middle of a piece? I can't drop everything and leave, damn it! Can a high diver stop mid-air?"

I refuse to answer him. I start the engine, flip on the air conditioner and start to hit the gas when I hear the 'tap tap' of metal on the window.

"Move over," he says, chisel in hand, "I'll drive."

—Beth Schecter, Topanga, Calif.

Bruce McQuilken

Bruce McQuilken showed his 'Devo '84' (rosewood, angelim pedra, ebonized mahogany and ebony) table at the Baulines Guild Design '85 show. McQuilkin's month of unpaid labor as exhibition production manager was rewarded—the table sold for $3,800.

Interior designing

The interior design market, with its flush private and corporate clientele, has long been coveted by craftworkers. But how to make craftwork known and appreciated by interior designers and architects, the aesthetic arbiters to monied taste?

Last July, the Baulines Craftsmen's Guild made a considerable effort to bridge the gap. Their exhibition, "American Crafts/Design '85" at San Francisco's annual Summer Market, a twice-yearly wholesale design-marketing and promotion week, brought the work of 100 Bay Area designer/makers to the attention of the region's interior design professionals. Guild-sponsored lectures, featuring eight nationally known craft and design heavyweights, reinforced the message of the juried exhibition, exploring the place of craftworkers in a market dominated by manufacturers and contract furnishers.

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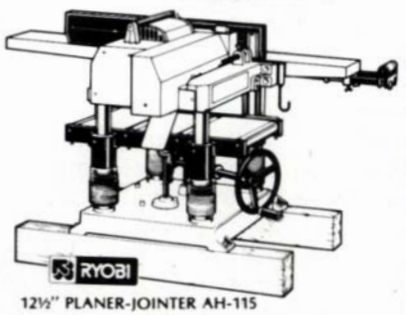

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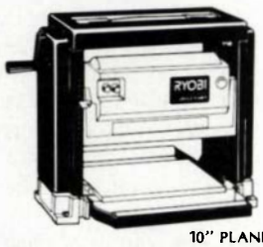

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ious money-raising schemes, including a $50 exhibitors' fee, the Guild managed to assemble, for $10,000, a show that would have cost four times as much to produce commercially. Furniture, textiles, ceramics and glass were shown in room settings and dramatically lit displays. To get the word out, $3,500 was spent on promotion for the show.

The show was well received and generated $6,000 in sales. More important, however, will be the show's long-term impact, the extent to which it convinced design professionals to add craftworkers to their traditional sources of supply.

—John Grew-Sheridan, San Francisco, Calif.

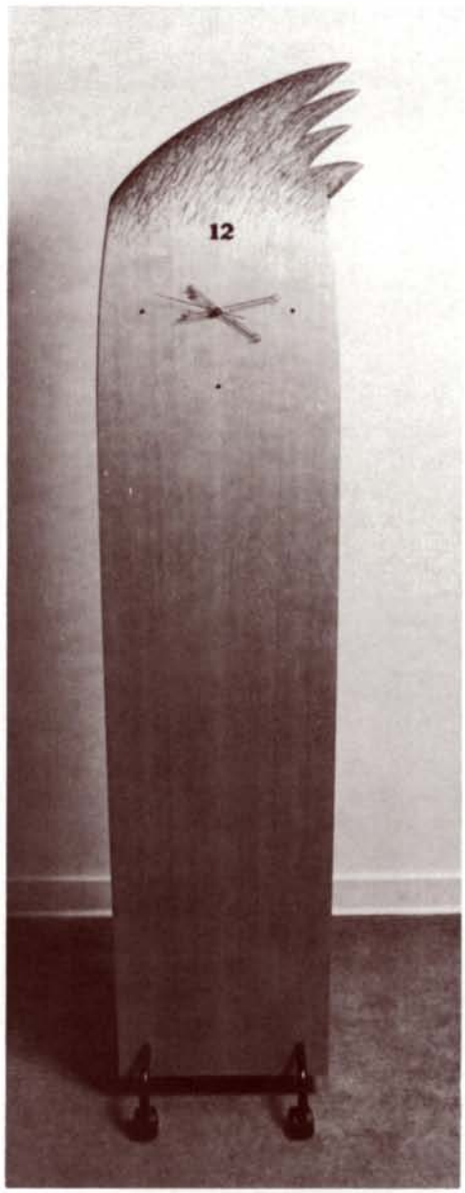
Training conservators

The Smithsonian Institution is taking applications for its new furniture conservators' training program, which will begin in September, 1986. According to Marc Williams, the Smithsonian's senior furniture conservator, formal training in the United States is limited at present to apprenticeship or one of only three graduate-degree programs. The graduate programs require three years of full-time study—a daunting prospect for those with families and work commitments. Williams also discovered that during the last five years, 16 institutional furniture conservation jobs were advertised, but the graduate programs produced just three furniture conservators.

The Smithsonian is trying a new approach. Unlike the multi-disciplinary graduate conservation programs, the Smithsonian will concentrate exclusively on furniture. And, by dividing the program into twelve courses, each one or two weeks long and offered sequentially at three-month intervals, the Smithsonian will enable students to continue their current jobs and commitments while they train. A year of full-time internship completes the training program.

The six places in the Smithsonian program will be filled on a competitive basis. Requirements are stiff, and reflect a desire to attract accomplished woodworkers. Applicants must have experience in cabinetmaking, veneering, carving, inlaying, marquetry, turning and finishing, plus a bachelor's degree that includes general and organic chemistry, art history and drawing, though some academic deficiencies can be made up. Once accepted, students will have only to support themselves—the Smithsonian picks up the tuition tab. For more information, write Marc Williams, Furniture Conservation Program, CAL, MSC, Smithsonian Institution, Washington, DC 20560.

Up and Coming



New York City's Workbench Gallery showcased 12 promising furnituremakers last September in a show aptly called 'Up and Coming.' Their works ranged from elegantly conservative to space-age modern. Gallery-goers got a laugh from 'Ronnie Clock,' by Peter Pierobon, of Toronto, Canada.

Calling all guilds

Time is ripe for a new survey of woodworking guilds. If you're involved in one, ask one of the officers to get in touch with us at: Guilds, c/o *Fine Woodworking*, PO Box 355, Newtown, Conn. 06470. We'd like to know the size and scope of your organization, whether you publish a newsletter, when you meet, and if you run programs and shows. We'd also like to include membership organizations with co-op shops or salesrooms. And, if your guild has faded away, let us know that, too. We'll publish the results later this year.

Doomsday tools

A few issues ago we asked for suggestions to fill an emergency tool kit, the sort of thing you'd depend upon should disaster strike. The responses were varied, informative and often amusing. It's surprising how little some folks figure they could get along with, and how much others feel essential. Here are a few of the ideas:

Teal Robinson, of Fort Collins, Colo., whose list covered three pages of single-spaced typescript, subscribed to the be-well-prepared faction. His kit includes hardware as well as repair, carpenters' and power tools, but no cabinetmaking tools, "I'd sure miss them, but I don't think that I would need them after an evacuation."

Edgar W. McCoppin Jr., of Monroe, Mich., fashioned a kit that ranged from ax head, froe, and drawknife to turning tools (for pole lathe), plane irons (make bodies to suit), chisels, and plough plane. "This will make a rather full tote box, but you should be able to make anything from houses (primitive) to country furniture, farm implements, primitive looms, etc. . . ."

Don Axt, whose original letter spurred the whole thing, answered his own question. Like many others, Axt's list was culled from the conventional tools in his workshop. He included a couple of chisels, rip hammer, panel and dovetail saw, two screwdrivers, hand drill, block plane, and a half-dozen others. Favorite (and useful) tools made the grade—sentiment as utility?

A different notion of what's essential came from Elizabeth Regan, whose Wilton, N.H., custom cabinet shop was actually threatened by a flood a while back. "My crew and I spent the whole day getting wood and tools as high off the floor as we could. We sandbagged the doors; then I shut off the power, took my two file drawers of customers, suppliers, designs and finances, and my cat, and left for home . . . . My reason for taking what I did was that the real value of my business is not its material content, but its cumulative information content—and of course my faithful shop cat, Hillary. Everything else is somehow replaceable." The water, mercifully, crested before it reached the shop.

Tom Wilson, a building retrofit consultant, cabinetmaker, and canoe paddle maker in Fairchild, Wisc., felt we allowed too much choice. What, he asks, if you were shipwrecked on a fertile but deserted isle and could choose only one tool? "For those who have never ventured outside the confines of our culture of affluence and specificity-of-purpose tools, such a choice seems impossible. For all who have spent any length of time in Africa or South America, the response is almost immediate: The tool would be a machete."

Wilson points out that the machete can

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fell trees like an ax, split them like a froe and surface them like a drawknife. The beauty of "primitive" art, often fabricated with only a machete and natural abrasives, attests to the precision possible with the tool. The catalog of additional machete virtues is long, and summed up nicely by Wilson, "If you want to know what is the *one* most valuable tool, ask the man who has only one. I'm sure you would find that 9 out of 10 sub-Saharan Africans and southern hemisphere Indians would chose the machete."

As it happens, we heard from a man who actually faced a dilemma similar to that posed by Wilson. R.C. Blankenship, of Florissant, Mo., is that man; here's his story: "What tools would you put in a carpenters' tool box in an emergency? The answer is quite simple for me, for I can go downstairs and take them out of the box I carried 30 years ago. But what if you faced the much harder decision to choose a single tool? I had such a decision to make in Europe during World War II.

Our unit was sent to a large locomotive works in Alsace-Loraine to put the plant back into operation so we could repair the many locomotives put out of commission by British Mosquito bombers before the invasion. The Allies were beginning their push into Germany and sorely needed the railroads. Unfortunately, the enemy had made sure that not a piece of machinery, or even a hand tool, was left in usable condition. A trainload of tools and machinery was dispatched to the plant, but was not to arrive until the day we left for home.

I'd been a carpenter in civilian life, so I was expected to make immediate repairs to living quarters and factory buildings. But my only tool was a pocket knife and sharpening stone. Three blacksmiths who had worked at the plant were willing to help us; their own tools and some forges were in operating condition. Our blacksmiths had no tools, so the locals were first put to work making hammers and tongs for them. Meanwhile, I was under heavy pressure to do something.

I could induce the blacksmiths to make me one tool in exchange for some C rations, but what would it be? A hammer is certainly a basic tool for a carpenter, and I could even find nails around the plant, but what about cutting? It was too much to expect a blacksmith to make me a saw and I had no files to sharpen it anyhow.

I chose a hatchet as my basic tool, or more accurately, a half hatchet. Its blade is curved at the bottom and flat across the top, the head is identical to that of a hammer, and the balance is as good as a hammer's. In other words, a combination hammer and cutting tool.

To understand my decision, you should know that although I had been trained in both house building and trim work, I had also done a lot of rough carpentry, building forms for concrete on industrial construction. In those days, most forms were built "from scratch" and a form builder was expected to be both ingenious and fast. Forms were expected to be strong and tight. One of my favorite tools was a razor-sharp hatchet with which I could "rip" a board faster than I could with a rip saw and, if necessary, almost split a line. For cut-off work it was less useful, but better than nothing.

When I showed the blacksmith a drawing of the tool I wanted, he refused to attempt it saying the walls of the eye were too thin and would crack. One after another, the local blacksmiths refused to try. It wasn't until the first of our 20-year-old American blacksmiths fired up his forge that I got my beautiful, basic hatchet. Though I acquired more tools during the coming months, the hatchet always had a special place in my tool box."

Our thanks to all those who responded.

Tim Simonds, of Chico, Calif., showed this cherry and cocobolo love seat, with cotton and silk upholstery, at last summer's Western States Invitational in Mendocino.

Mendocino spotlights western woodworkers

Gallery-goers apparently approved of the offerings displayed at the 5th annual Western States Invitational Wood Show at Gallery Fair in Mendocino, Calif., this summer. More than half of the 100 major pieces in the show were sold, said Bill Zimmer, owner of the gallery and juror for the exhibition. The show ranged from lifesize figure carvings to small boxes and bowls, to full-size casework and furniture.

Welcoming vistors to the gallery was an attractive sculpted walnut rocker by David Crawford of Enterprise, Ore., three of which sold during the show. I was also impressed with the exhibition design, with furniture comfortably surrounded by paintings and other objects. —*Dick Burrows*

Infringements and inducements

Last June, the United States International Trade Commission ruled that eight Taiwanese manufacturers and domestic importers of Taiwanese woodworking machinery had infringed on **Delta International Machinery Corp.** patents, trademarks and copyrights. These firms' infringing products will be barred from entering the country. Of the 51 firms named in the original Delta complaint, all but eight settled with Delta before the ITC ruling. Those who settled agreed not to infringe upon Delta patents, trademarks and copyrights and to alter those nonfunctional features of their products that copied Delta features—for example, Delta's characteristic round 14-in. bandsaw wheel covers. The ITC did not require the eight firms that didn't settle to alter nonfunctional features of their machines.

The **Early American Industries Association**, long a promoter and supporter of historical research, much of it in wood related subjects, is offering annual grants of up to $1,000 to individuals or institutions for studies of early American industry in homes, shops, farms, or on the sea. Previous grants have aided in the study of toolmaking in New Hampshire, housewrighting practices prior to 1900, and a va-

INDEX TO ADVERTISERS

riety of similar topics. The research may be self-directed, as well as institution sponsored, and the grants are not renewable. Applications for 1986 awards are due March 15, 1986. For more information, contact Charles F. Hummel, Chairman, Grants-in-Aid Committee, Early American Industries Association, c/o Winterthur Museum, Winterthur, Del. 19735.

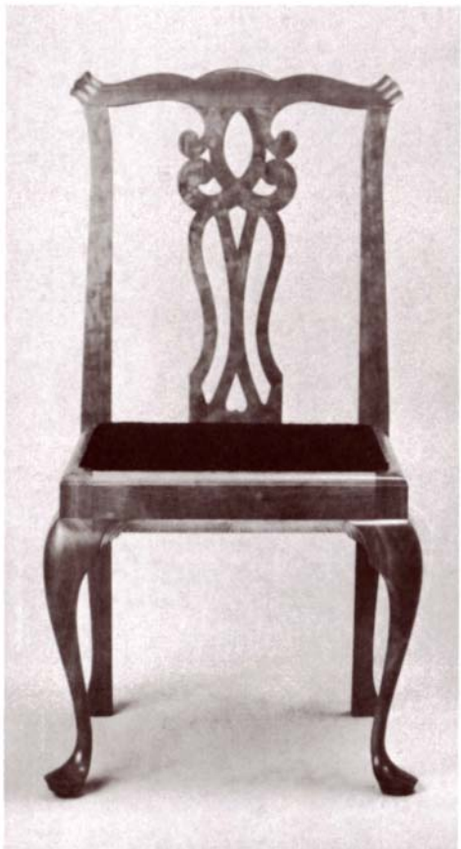
The professional handtooler

According to Linus Van Pelt, we all do some dumb things and some smart things. One of the dumb things I did was to try to earn a living using only handtools.

It was such an attractive idea at the time. Handtools are relatively cheap, quiet, compact and are relaxing to use. In 1972, my outlay for a complete set of handtools was $400, plus $200 for a used lathe, and my whole shop fit into a 12-ft. by 16-ft. room.

It seemed a sound idea, too. After all, I knew that Michael Dunbar, Dave Sawyer, and a number of other successful pros used only handtools. Unfortunately, I didn't realize it was no coincidence that they all made traditional country chairs—Windsors, ladderbacks and so on—and almost nothing else. Since I didn't want to make those kinds of chairs, I should have looked longer before I leaped.

Erik Borg



Before he saw the light and combined machine with hand methods, Jeremy Singley struggled to make this Chippendale chair by hand and make it pay.

Looking back, I see the mistake I made when I quit my job and took on my first order for a Queen Anne table and six Chippendale chairs. You can't make a living with handtools without either finding a way to produce at a speed competitive with machine shops, or finding a way to get people to pay a lot for each hand-made piece. I did neither.

Using only handtools, an experienced man like Dunbar can make a traditional Windsor as fast, or faster, than many powertoolers make chairs. He achieves this amazing feat by using the same mass-production techniques our forebearers used. He uses readily available, easily worked wood—pine for seats, riven oak for spindles, green maple or birch for legs and stretchers. He doesn't feel compelled to clean up the tool marks, and if a spoon bit chips out a hole or two, the damage will be under the seat or bow, where no one will see it.

In this age of polished perfection, most woodworkers wouldn't dream of such rough-and-ready workmanship, but Dunbar isn't in business to impress other woodworkers. His job is to make chairs that look good going out the shop door, and they do. They are honest renditions of 200-year-old rough-and-ready workmanship, and their integrity attracts enough buyers jaded by polished perfection to keep Dunbar's accounting software busy.

Dunbar's is a handtool option that works, but when I began my career I didn't want to make country chairs. I wanted to make things of cherry and walnut, with a glowing hand-rubbed finish. Ultimately, I wanted to try some ideas of my own, but I thought I'd start with a tried-and-true traditional form like the Chippendale chair, which seemed a viable alternative to the traditional Windors the others were making. It wasn't.

Because he can make them fast, Dunbar's Windsors cost no more than other woodworkers' machine-made contemporary chairs, and they're cheaper and more available than antique Windsors. The Chippendale, on the other hand, was designed not for hand-tool mass-production, but for ostentation. It was the rich-man's chair, and the idea was to show off just how much of an artisan's time you could afford. The more curlicues the better, and the absence of handtool marks, so expensive to handscrape away, was a must.

Since superfluous curlicues consume production time no matter how you make them, a one-off set of Chippendales made in a machine-equipped shop often costs at least as much as the antique they are patterned after, and a handmade set can cost much more. Naturally, people buy the antiques, or if they can't get them, settle for machine-made. Since tool marks were all but absent on Chippendale chairs, to the untrained eye a machine-made Chippendale looks no different from an original. Why use a bowsaw to rough out a cabriole leg when you can use a bandsaw? After you've drawshaved the rough leg to size, who will know? For me, the answer to that question was my first power-tool purchase, and the legs on those first Chippendales were, in fact, bandsawn.

In the end, I settled for a machine-handtool mix that I find quite satisfying. Handtools will always have a place in careful workshops, and I still enjoy using a drawknife and hog plane to waste away bulk when saddling seats, or using various planes and chisels to trim machined joints to an airtight fit, but I use these tools because they're the most suitable for the job, not as a selling point. In the end, there's no way to tell if I've used them or not.

On the other hand, the hand-spokeshaved spindles on my hardwood Windsors are a selling point. These I rough turn on an automatic lathe before spokeshaving, a machine option that allows me to accurately cut a variety of spindle shapes that would be difficult to rive, giving me the best of both worlds. I then spokeshave them with clean but crude cuts, leaving the spindles roughly octagonal, so that my tool marks show from across the room. Since this takes hardly any longer than machine-sanding the rough-turned spindles smooth, and looks better, it makes sense, and after seven years I'm still selling chairs as fast as I can make them.

This is, I think, the bottom line commercial handtoolers must address. If the reason for using handtools isn't inherent in the piece, if it doesn't make sense in a way that people can see without being told, then all you'll get for your pains is a "so what?"

If the work looks distinctive *because* it was made with handtools, and if the time spent shows in an obvious way, it will sell. Likewise, if it is such a sensational idea that its value covers the time spent whatever the method used, it will sell. If it could have just as well been made by machine, but wasn't because the maker didn't want to, it won't. □

—Jeremy Singley

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THE MERRY CEMETERY

Cemetery sculpture, gray and grim, sets a sepuchral tone in graveyards the world over. Vivid exceptions are the brightly painted wooden grave markers in Rumania's Merry Cemetery, where each marker includes a colorful portrait of the departed. The good are remembered at their daily occupations, the bad indulging in their vices, and the unlucky at the moment of their deaths.

Located in Sapînta, the Merry Cemetery is the creation of Ion Petrach, who carved nearly 200 grave markers for his neighbors between 1935 and his death in 1975. Since then Petrach's apprentice, Toader Turda (top left), has carried on. One of Turda's first commissions as chief carver was to fashion his master's marker (bottom left). Turda carved the piece while Petrach lay on his deathbed, waiting to give his final approval.

—John Gary Brown and Barbara Brackman, Lawrence, Kansas.

Most of the markers in the Merry Cemetery portray the deceased at work. The quarry accident that killed this man is also described on his marker: 'Look well at me. What happened to me never happened before to anybody. . . . A boulder exploded. It buried my body and took my life. . . .'