THE AMAZING MULTI-MACHINE
It grinds, sands, and sharpens!
Plans, p. 40

WOODWORKERS’ STANDARDS
Nice-to-know design guidelines. In this issue: seating and tables

FURNITURE STRIPPING
Tips on removing that worn-out finish

JAPANESE HAND TOOLS
What makes them special?

‘PEG’ TREATMENT
The miracle that lets you work green wood

MORE PROJECT PLANS
Oak dining table, p. 64
Zebrwood jewelry box, p. 70
3 terrific clocks, p. 78
RYOBI SANDERS... THE ONLY THING THEY DON'T TAKE OFF IS WORKDAYS.

Twenty-five hours a day, eight days a week, Ryobi sanders will be takin' it on and takin' it off with toughness and professional features you won't find with just any sander. For example, motors are all ball-bearing construction. Platens are extra-wide to give you flush-sanding capability and more work in less time. And speeds range from 1,500 S.F.M. for our biggest belt sander to 10,000 o.p.m. for orbital sanders.

Made for more than weekends.
Get down to fundamentals... Experience the joys of woodworking

Are you missing out on the joys of woodworking? Imagine for a moment the shine in your little girl's eyes the first time she sees the rocking horse you built just for her. Or think of the fun you'd have on a deck added to your house — built with your own hands. Maybe the cooks in your family would like a kitchen custom-made to their needs. Or consider how much enjoyment you'd get from your stereo system if you built your own entertainment center.

Unlike many other hobbies, woodworking is a hobby of the imagination as well as the hands. Starting with nothing more than an idea, you create things that express your individuality, creativity and common sense. You solve problems, learn new skills — and save money in the process. But most of all, woodworking is fun.

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Now is the time to experience the joy of woodworking. And Shopsmith is here to help — whether you're an experienced craftsman or a first-time woodworker. We have the tools, the products and the support you need to fully develop woodworking as your outlet.

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The small-scale machine that handles large-scale work.

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Craft your own Vintage 1931 Duesenberg

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BASSWOOD: “HOW SWEET IT IS!”
Carvers aren’t the only ones who love this easygoing wood. The basswood’s flower also finds its way into perfumes and honey.

SECRET Chlorophyll
Up Canada way, we visited the shop of a world-class turning expert. Now you can learn the priceless techniques that Bert Thompson acquired from his forebears.

THE AMAZING 8-SPEED MULTI-MACHINE
Even the term “multi-use” doesn’t do justice to this incredibly hardworking homemade tool, designed for sanding, grinding, and sharpening.

PEG: THE MIRACLE TREATMENT THAT TURNS YOUR WOODPILE INTO A LUMBERYARD
It’s fast and it’s fun. It’s also somewhat unpredictable. Let us introduce you to the fascinating chemical that “freezes” wood in its green state, preventing cracks, checks, shrinking, and warping.

MADE IN JAPAN: DO THE JAPANESE HAVE A BETTER HAND-TOOL IDEA?
More and more American woodworkers are becoming enchanted by hand tools from the Land of the Rising Sun. Why? Because these tools really work, often in surprising ways.

WOODWORKERS’ STANDARDS: SEATING
Standard dimensions have been refined by woodworkers through the years, but they’re often difficult to look up in one place. We aim to correct that in this and upcoming issues of WOOD. Here we’ll discuss how to scale truly comfortable seating.

CUMULATIVE INDEX: ISSUES 1 THROUGH 8
We’ve compiled all the projects, techniques, buymanship advice, and other topics from our first eight issues into a handy, pullout index.
WOODWORKERS’ STANDARDS: TABLES
When you set out to design a table, you probably know what style and function you want. You also need an idea of how to support it, and what the dimensions should be. Here's help.

FURNITURE PROJECT
YOUR TABLE IS WAITING!
EXPANDABLE OAK DINING TABLE
This elegant oak dining table extends to accommodate up to eight in grand style. Build yours with a top of oak veneer, or opt for the durability of a laminate top.

A JEWELRY BOX OF A DIFFERENT STRIPE
Beautiful West African zebrawood makes this three-drawer box just as eye-catching as its contents. It's a beauty, if for a sweetheart!

FINISHING AND REFINISHING
OFF WITH THE OLD: A WORKSHOP GUIDE TO FURNITURE STRIPPING
The key to success in any furniture stripping project lies with the chemical you choose to do the job, and in applying it properly. See what we mean in this step-by-step feature.

HOME ACCESSORY PROJECTS
TIME AND TIME AGAIN: 3 GREAT CLOCKS TO BUILD
Build this striking see-through pendulum clock with the clock movement showing, or with the burled-veneer face.

Our Art Deco mantel clock is almost embarrassingly fast and easy to make. We won’t tell if you don’t.

The things you can do with wood! By laminating curly maple with the edge grain up, we achieved a luminous look similar to that of a real fish (only this one won’t get away).

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Woodworkers' Hardware ORDER FORM

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<th>BEST CUT</th>
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<td>3/8” KEY HOLE (This Bit only HSS)</td>
<td>Cuts 3/8” KEY HOLE FOR FLUSH MOUNTING FRAME, ETC.</td>
<td>8.50</td>
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THE EDITOR’S ANGLE

Never turn your back on an angry band-saw blade

Our Managing Editor does battle with a wily band-saw blade.

The other day when I offered to show Dan Kaecher, WOOD's Managing Editor, how to fold a band-saw blade, I asked him to come into the shop so I could record the experience photographically. Just for fun, we outfitted him in battle garb. Being fairly new to woodworking, Dan didn't know what to expect. But in a matter of minutes, he had the technique down pat. And, boy, was he proud!

When I saw Dan's sense of satisfaction, I was reminded once again of the truism that nothing is difficult once you know how to do it. And that's one of the main reasons why we are beginning a series of articles under the heading "Develop Your Shop Skills Step-by-Step." In it, we'll cover a myriad of topics that will add to your overall woodworking skill level. In this issue you can learn one good way to fold a band-saw blade on page 14. And in upcoming issues, we'll cover topics such as how to adjust a hand plane, sharpen and set jointer blades, turn your router into a precision circle cutter, change step pulleys on adjustable-speed motors, and much more—all step-by-step.

Two other series also make their debut this time out. In the first installment of "Talking Shop with Our Project Builder" on page 95, Jim Boelling explains why he uses the "dead reckoning approach" to measurement when building a project. And don't miss our first "Woodworker's Standards" article, which summarizes some hard-to-find design standards for seating and tables. Look for it on page 54.
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TALKING BACK

We welcome comments, criticisms, suggestions... even an occasional compliment. The volume of mail we receive makes it impossible to answer every letter, but we promise to do our level best. Send your correspondence to: Letters Editor, Better Homes and Gardens®, WOOD Magazine, Locust at 17th, Des Moines, IA 50336.

ORDERING 4x12' FLEXIBLE VENEER

You have stated that flexible veneer can be ordered in sheets as large as 4x12'. This is exactly what I am looking for. Where can I order it?

—Steven J. Shapiro, Methuen, Mass.

One manufacturer that can help is Laminating Services, 4700 Robards Lane, Louisville, KY 40218 (phone 502-458-1502). They suggested a distributor in your area: Design Wall Covering, 225 California, Newton, MA 02158. For readers in other areas, call or write Laminating Services for a distributor near you.

SURFACE SANDER UPDATE

The fun, and sometimes frustrating, thing about working here at WOOD is that somebody invariably comes up with a better idea—or at least an alternative. All indications are that the surface sander, which appeared in our October issue (p. 48), made a big hit with WOOD readers. Many took the time to send in comments and suggestions. Here's what we learned:

- There's an excellent alternative to the wooden sanding drum and adhesive-backed paper suggested in our original plans. Universal Clamp Corp. wrote to tell us of an aluminum drum that takes precut sanding belts. Spring tension keeps the easy-to-replace belts tight as they wear and stretch.

Our shop test indicates that the drum is well machined. It comes with an extended shaft, which must be cut to length. The shaft measures 1/8" diameter, compared to 3/8" with the wooden drum. The aluminum drum comes complete with shaft, field pillow-block bearings, and 4" pulley. (Note: You may need to move the mounting holes slightly.)

If you're interested, request further information, or place your order with Universal Clamp Corp., Dept. W, 6905 Cedros Ave., Van Nuys, CA 91405 (phone 818-780-1015). The drum, shaft, bearings, and three assorted belts are $92.50 postpaid. Order three replacement belts (80, 100, and 120 grit), cut to size, for $12.50.

- In case you hadn't figured this out: You must wire your motor to rotate the drum as shown in the drawing, right.

The correct address and phone number for Woodmaster Tools in the Buying Guide is: 2908 Oak, Kansas City, MO 64108 (phone 800-821-6651).
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HOW TO FOLD AN UNRULY BAND SAW BLADE

No doubt about it! Anyone who has nerve enough can unfold a band saw blade. Just grab it in one hand, remove the ties securing it in its innocent-looking configuration, hold the darn thing out away from you, and watch all the commotion as it gyrates and twists its way to its ready-to-use shape. But folding it again—that's the trick. There are several ways to go about it. Here's one that works particularly well for us.

With your hands about 6" apart, rotate both hands inward (you may notice some discomfort here as the teeth dig into your thumbs—just kidding!). Both ends of the blade will move away from you. If they don't, move your hands closer together and try again.

At the completion of the motion, the blade "magically" forms a series of rings, which you need to capture quickly with one of your hands. You may have to practice this technique several times to get it down pat, but you'll be the master of your blades in no time at all.

Now comes the easy part. Just shake the blade a few times to equalize the size of the rings, bind them together with masking tape, and store.

Illustrations: Jim Stevenson
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One-string shop apron
Shop aprons always are difficult to tie and untie behind your back, but it becomes a really knotty problem when the strings begin to unravel.

TIP: Snip off both of the old strings and replace one of the strings with a piece of new twill tape (available at fabric stores). Sew one piece of matching nylon hook and loop tape to the end of the new apron string. Sew the other half of the fastening tape to the body of the apron. You now can quickly fasten and unfasten the apron with one hand.

—Myron Nixon,
Longmont, Colo.

Stripping small parts:
Leave 'em hanging
Stripping finish from small parts, such as drawer pulls, is time consuming and wastes a lot of finish remover.

TIP: Remove the part from the piece, replace the screw, and tie a 12" piece of string around the screw. Fill a coffee can with enough finish remover to cover the part. Drop the part into the coffee can, hang the string over the edge, and cover the can with the plastic lid. Soak and clean as recommended in the finish remover instructions.

—Tom Brower,
Northboro, Mass.

Knee-jerk reaction for table-saw safety
You're making a cut on your table saw when, halfway through, the workpiece goes askew. Yet you can't shut off the saw without taking your hands off the workpiece. It can be a major shop safety problem. What do you do?

TIP: Buy a safety switch that pulls out for the "on" position and pushes in for the "off" position. Mount the switch on the front of your table saw at knee height. Now, turning off your saw is as easy as pushing your knee against the switch.

These switches have an added safety feature: Each comes with a plastic key that you can remove to keep little ones from turning on your saw.

—Bruce Wedan,
Des Moines, Ia.

Table-saw gear: Hang it here
Finding a place to lay your tablesaw wrench and miter gauge presents a challenge in everyone's shop. Too often they fall or get pushed to the floor and need to be recalibrated, too.

TIP: Use hooks designed for perforated hardboard to keep table-saw accessories right at your fingertips. Drill two ⅛" holes about 1" apart on the side of the saw. Because of the flat surface, straight hooks are best for the miter gauge; curved hooks are suitable for securely holding the wrench.

—Richard J. Wessels,
St. Louis Park, Minn.
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Because so much paint and varnish remain in a brush after it's been used, a lot of expensive mineral spirits and other brush cleaners wind up being wasted.

TIP: More effective than wiping your brush on a scrap piece of wood or cardboard is trapping paint or varnish between several layers of newspaper or magazine pages. Use finger pressure to squeeze the bristles while you withdraw the brush. Use mineral spirits or your favorite brush cleaner to remove the remaining paint or varnish.

—W. J. Morrison, Northport, N.Y.

Continued from page 18

Quick cure for wobbly joints
Although the size of most mortise or dowel holes remains the same, wood filling into the joint often shrinks over the years and creates a loose fit in chairs and tables.

TIP: Use a piece of linen or sheet between the wooden parts. Coat the cloth and hole liberally with glue. After you've fit the pieces together, wipe off the excess glue with a damp rag, and trim the unnecessary cloth with a knife or razor blade.

—Larry Bedain,
North Swanzey, N.H.
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TIPS FROM YOUR SHOP AND OURS

Continued from page 20

Know when to stop sanding
It's all too easy to sand through the thin veneer of plywood and fibercore lumber when belt-sanding a finished frame edge, whether in a cabinet or a picture frame.

TIP: Shade a wavy pencil line on the veneer edge that butts up against the frame. Stop sanding the joint just after the pencil line disappears. The same technique works well on banded tops and shelves.

—Terry Leach, Lovington, Ill.

Getting that damned knob attached
Some wood isn't thick enough to drill into to hold a knob like the one shown here. Or worse yet, you can't start a screw through the back of the dimensional lumber.

TIP: Make your own hanger bolts to secure the knob. First install a sheet-metal screw into the knob (try a 2½" or 3" no. 8 screw). Then saw off the head of the screw and grind the top to a point. Drill a hole in the drawer or door and fasten them together.

—Marion L. Adams, New Salisbury, Ind.
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TIPS FROM YOUR SHOP AND OURS

Continued from page 22

This tip is on the level
In a garage or crowded workshop, it's time consuming to reposition stationary tools on a level spot.
TIP: Once you've found that perfect level spot, spray paint around each leg to mark the position. The next time you use the power tool, roll it to the correct marked position.

—Frank Zalenski, Vancouver, Wash.

Fitting the pieces back together
After completely taking apart a chair for re-gluing, all the legs and rungs suddenly look alike. And just as suddenly, you have an assembly problem.
TIP: Before taking the chair apart, label all the parts with numbered or lettered masking tape. After you clean the joints, use your identification system to correctly glue and reassemble. When the glue dries and the clamps are removed, peel off tape markers.

—John Paul Christopher, North Kansas City, Mo.
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A clear advantage
Make the most of any piece of stock by laying out bowls and platters with this handy template. Because it's grooved to show eight different diameters, the template can help eliminate trial and error in spotting grain, color, and defects. To mark cutting lines, insert a nail in the center hole and a pencil in the correct diameter hole. Layout Template. $7.95 postpaid from Craft Supplies USA, Dept. W, 1644 S. State St., Provo, UT 84601.

Get the point?
When you need to measure beyond the range of your present compass or dividers, use these trammel points clamped to a board of almost any length. Both aluminum trammels have steel points, and either one can be removed and replaced by a pencil to make a large-scale compass. Trammel Points. $21 postpaid. We obtained ours from The Woodworkers' Store, Dept. W, 21801 Industrial Blvd., Rogers, MN 55374.

Continued on page 31
Here's a hobby that pays off twice—in fun and in cash! Cash that in this rare historic wooden ship model kit—absolutely no risk! Imagine, you can build the sleek, highly detailed Harvery, a replica of the Baltimore Clipper used by American Colonial shipping lines throughout the 18th century. And you have our guarantee that we'll buy it back from you anytime within 6 months of purchase. The Harvery measures an imposing 47" long from transom to bow. The hull is of solid mahogany and she's fitted with two 27½-foot-high masts, and her mainsail tower and fully spatted. The hull is beautifully turned with eight beautifully turned brass cannon. Even if you are not a professional ship model builder, you can build the Harvery, specially designed for the ambitious beginner.

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MODEL EXPO, INC. 23 Just Road, Fairfield, N.J. 07007
Continued from page 28

Gaining the edge
"Breaking" the sharp edges of a project makes it safer and more finished looking. This radius plane has two high-carbon cutters: The first makes the cut, while the second finishes the edge. Both cutters are adjustable for radius (1/8" to 1/4") and centering. The plane is built to last, too—the body is solid rock maple, and the soleplate is brass. Radi-Plane with a pair of replacement blades. $30.85 postpaid from Leichtung, Inc., Dept. W, 4944 Commerce Parkway, Cleveland, OH 44128.

Inflatable sanding helper
Sand to the sound of a different drum with this flexible sander. Designed for speeds up to 3,700 r.p.m., this tool fits any drill, drill press, or lathe with a 3/4" chuck. Use the sander fully inflated for fast work on flat surfaces or partially inflated for contours. A hand air pump and four sanding belts with grits of 40, 80, 120, and 180—or four belts with the same grits—are included with each unit. Air Drum Sander. $36.50 postpaid from Tri-Mex Industrial, Dept. W, Route 11, Moores, NY 12958.

A sharpening stone that gives the edge to all your cutting tools.
Garrett Wade has Japanese water sharpening stones that give a mirror-finish edge. They are fast cutting stones that use water, not oil, and make an often tiresome job easier. They come in five grades from 800 grit (coarse) to the 9000 grit G-3 stone (finishing).
Each stone (except the G-3 mounted on a wooden base) comes in its own plastic box—a Garrett Wade exclusive to keep your stones moist.
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<th>Belt Size</th>
<th>A/O Cabinet Paper</th>
<th>No Load Finishing Paper</th>
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<td>1&quot; x 42&quot;</td>
<td>40-D 1/7:pk. 100/25</td>
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<td>150-C 13:pk. 100/25</td>
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All-around sanding tools
The trickiest part of using sandpaper-covered dowels in those hard-to-reach curves is keeping them from loading up with particles—or wearing out when you’re almost finished. These sanding tools solve those problems with abrasive surfaces of tungsten-carbide grit brazed to a steel backing. The tools feature fine grit on one side and coarse grit on the other. Perma-Grit Sanding Tools. ⅛", $6.95; ¼", $6.95; ⅜", $8.25—all postpaid. We obtained ours from MicroMark, Dept. W, P.O. Box 5112-100, 24 E. Main St., Clinton, NJ 08809.

A turn for the better
Here’s relief for victims of wristlash: This line of three ratchet screwdrivers was designed to take the work out of projects that require multiple fastening operations. The large handle on each tool fits your fist for maximum comfort and torque, and the three-position drive switch lets you drive, loosen, or lock the shaft for use as a regular screwdriver.

The small set (shown above) includes the tool, five screwdriver bits, and storage case. The medium version adds a socket adapter and seven standard sockets; the large set includes everything in the medium set, plus seven metric sockets and five TORX bits. Stanley Workmaster Ratchet Screwdrivers. Six-piece set about $16; 14-piece set about $22; 26-piece set about $30. Available at hardware outlets nationwide.
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Today's carvers rate basswood highly, but it was probably the Iroquois Indians who first discovered this wood's adaptability to the knife. America's settlers found Indian braves carving ceremonial masks on living basswood trees, then splitting them off from the trunk for hollowing. In the process, the Indians saved the innermost bark fibers for fishnets, mats, and cord.

Basswood, also called linden in Europe and parts of the U.S., provides more than quality carving wood, however. Oil from the blossoms of a European variety are an ingredient in perfume, while in America, honey from basswood's sweet flowers nectar tingles taste buds. Even the boxes used to ship honeycomb are made of basswood because it imparts neither odor nor taste.

And, if you've ever picked berries in little baskets or received a free wooden yardstick from a lumberyard or hardware store, you probably unknowingly became acquainted with basswood, the source of many of these items.

Wood identification
Among the several basswood species in North America, only Tilia americana is commercially important and desirable for woodworking and carving. It grows from Maine to South Dakota and southward through Tennessee and northern Texas. But the Lake Superior area boasts the largest concentration of marketable timber.

A symmetrical tree, basswood reaches heights of 90' and has distinctive, large, heart-shaped leaves that make it a favorite for city shade plantings. The largest trees grow in the wild, along stream banks. In June and July, white flowers decorate its branches.

Older specimens have deeply ridged, dark gray bark about 1" thick. The bark of young trees appears lighter in color, smoother, and thinner.

The wood's color ranges from white to creamy white, often containing brown when taken near the center of the tree. Sometimes the wood has bluish mineral streaks, which many find objectionable.

Light in weight at 26 lbs. per cubic foot dry, basswood has fine, consistent grain, yet you can dent it with your fingernail. Stable when dry, it shrinks considerably during seasoning.

Working properties
As a carving wood, basswood ranks premier because it won't easily chip or break off ahead of the knife—attributes more apparent in slow-growing northern stock.

You'll have no difficulty working basswood with hand or power tools; it sands, glues, and accepts paint exceptionally well. Its fine grain and fibrous cell structure make it hard to stain.

Uses in woodworking
Because basswood holds detail without splitting or breaking, carvers find it perfect for relief work, caricatures, and other carvings with intricate cuts. While most woodworkers don't realize it, basswood can be used for drawer construction, hidden furniture parts, and as a substrate for veneering. It also turns quite well.

Parents looking for a wood easy for children to work should consider basswood, since it drills and finishes so effortlessly.

Cost and availability
Generally available at hardwood outlets and through mail order suppliers, basswood costs about $1 less per board foot than oak.

Boards may be up to 12" wide and 12' long, but smaller sizes are more prevalent. Carving blocks come in 2" to 4" thicknesses. Veneers are rare.

Photographs: Hopkins Associates
Illustration: Steve Schindler
Bert Thompson, 70, has operated his commercial wood-turning shop in Mississauga, Ontario, since 1940. Before that he worked for others—turning wooden pulleys, chess sets, trays, and at one time, even the wooden centers for discuses. On his own, the bulk of his work came and continues to come from builders and furniture manufacturers.

Besides his commercial work, Bert teaches turning. At his shop, students receive one-on-one training. Bert also travels outside Canada for sessions. May, his wife, shares his active life.

Bert’s practiced eye transmits the design of a finished piece to the stock on the lathe for duplication. His feet maintain position as he sways back and forth along the work.

Secrets of a Production Turner

Canadian Bert Thompson shares wood-turning techniques his dad taught him and his grandfather taught his dad.

Passersby on the busy street fail to notice the sign on the once-white workshop behind the house that says “Wood Turning.” Knowing tradesmen, however, often pull in to drop off wood to be turned on his huge, swirling lathe. The work they pay for, they’ve come to expect, will be exactly as ordered.

Bert Thompson does what’s ordered, to specification, for he’s learned that builders and furniture makers won’t tolerate incompetence. “They’ll give you six pieces of wood and want six back,” he states.

His skill makes him confident, however, for he’s based it on 155 years of wood-turning tradition. Bert has been a professional production turner for more than 50 years. He learned from his father what had been handed down from his grandfather—closely guarded turning techniques that date to 1830 when the elder Thompson settled in Oshawa, Ontario, and began making piano legs in a factory.

At 70, Bert claims to be the “youngest” production woodturner in Canada. Before he becomes the oldest, he wants to share and teach those willing to learn the proven methods passed on to him.

Real turners never scrape

His father, who could still turn at the lathe when he was 90, once turned a column 4’ in diameter and 54’ long. Bert says the column, “staved up like a barrel,” could hold four men inside. His father told him that in those days there were many good turners.

“You could look at a piece of wood and know who turned it,” relates Bert, “because every professional turner left his trademark the same as Raphael and other artists. You could tell by the cuts.”

You don’t, however, have to see a turner’s work to know how good he is. According to Bert, you can look under the bench when he goes home. “If you see lots of sawdust, he’s a wood scraper. Piles of curly shavings, though, show he’s a woodturner. A good woodturner never scrapes—that’s a sin!”

“Only shearing (cutting) is wood turning,” emphasizes the compact, wiry Bert, as he brushes a maple curl from his coveralls. “I know you can scrape something, then sand, and it will look all right. But if you turned it, it would be finished in half the time.”

Sanding, he admits, is OK once in awhile, “because some woods don’t have an even texture after turning.” Shiny spots and dull spots on the same piece of wood means it won’t take stain uniformly, so a light sanding becomes necessary.

Bert likes to describe his turned pieces as “smooth as satin.” Indeed, if you rubbed your hand across any of the newel posts, spindles, columns, balusters, or chair and table legs stacked around his workshop, you couldn’t argue the point.

Start with a vibration-free lathe

Bert’s lathe dominates his shop, as it would any space. The Clark de Mille model he uses was made before the turn of the century. It still has its original bearings. And the bed it rests on occupies an entire wall.

Long enough to span 22’ between centers, the bed was made by Bert 35 years ago of “British Columbia fir that will never wear out.” Its 3X8’ legs are sunk 4’ in the ground and the back of the 4X10’ bed timbers bolt to the building. Understandably, the lathe transfers no vibration.

Continued
Lathe speed also plays a significant role in Bert’s production turning. “Most turners turn too slow,” he claims. Pieces less than 2” in diameter, Bert turns at 2,500 to 2,800 r.p.m. Up to 6” work rates a slowdown to about 1,750 r.p.m. Larger turnings spin at 1,000 r.p.m. or less (depending on the diameter), like the 14” diameter, 18” long columns he turned for a local contractor some years back. They required a special reduction pulley to get speed down to 400 revolutions.

Tools that cut and last for decades

You can’t ask this turner for advice on which turning tools to buy. He’s always made his own.

“In my opinion, not one manufacturer makes a proper tool. When I want or need one, I make it, and it will last for 60 years,” offers Bert.

“I don’t find it necessary to use high-speed tool steel. If I shear with a tool, the edge will stay sharp. If you scrape with a tool, the steel has to be much, much harder so it won’t burn.”

To shear, tools have to be sharp, and Bert has found the only way to sharpen a shearing tool is to hollow-grind it. “A hollow-ground tool hugs the wood, a flat surface lays on the wood,” he points out. “Therefore, a hollow-ground tool takes off more wood because there is more metal on the wood.”

Knowing how to hollow-grind (see photo and drawing, below) involves more than the angle put on the end of the tool. Bert advises using a 7” medium-grit wheel 1” wide because “air bubbles trapped in the grit of the stone keep the tool cool as it’s sharpened.”

And never grind fast. “Don’t exceed the speed at which your motor was designed to operate,” Bert recommends. “You’ll have a chance to cool the steel, and it will burn.” His wheel runs at 1,725 r.p.m.

How can you tell when the tool becomes sharp? “When you see sparks coming over and across the tip evenly,” Bert says.

Too many tools slow you down

Three tools—a large gouge, a small gouge, and a parting tool shown in the photo, right—do 99 percent of Bert’s turning. He rarely uses a skew. Instead, his 1”-wide roughing gouge has a flattened side to smooth. “You save time by not using other tools,” he explains.

In this turner’s world of time and precision, handles make a difference, too. Bert has no use for “long and strong” handles. “That means long and stupid. If you turn right, you don’t need the leverage long handles give you.”

Handles must fit your hand or they’re of no use at all in his opinion. “They’re a very personal thing.

MAKE YOUR OWN TOOL HANDLES

Bert uses ash to make tool handles like this. His are 9” long “for even the largest tools” and large enough in diameter “so your fingers won’t meet the palm of your hand” when you close around it.

On the lathe, he tapers the end into which the steel will be inserted to 3⁄4” so it fits the ferrule (he fashions them of 3⁄4” i.d. galvanized pipe and other materials). “Don’t bother to put a finish on the handle because that just makes it slippery to hang onto,” advises Bert. “Let them weather. Be sure to get them smooth first, however.”

BERT THOMPSON’S TRIED-AND-TRUE CENTER FINDER

“You can’t buy a decent center finder,” Bert states. But you can make one like his.

To find the center of turning stock, loosen the wing nut so the top piece slides. Position the top on the stock at what looks like the center, then push the base up against the wood and tighten the wing nut. Now, mark a pencil line from each side of the wood with the finder (see photo, right). The resulting square between the lines will be the center. For round stock, use the “V” of the base against the wood.
made to fit you, not someone else." That’s why Bert makes all his tools himself (see box, opposite page).

How you stand makes a difference
At least once a week, Bert likes to go dancing. But when he talks about the "woodturner’s sway," it’s not the one he does to music.

"Until you learn it, you can’t turn," he says, his relish in showing how it’s done breaking his expression into a grin.

Bert’s an underhand turner—the steel rests and balances in the palm of his left hand and slides along the steady rest while the right hand slightly guides the handle. He insists that underhand is the only way to turn, but the sway has to accompany it, since footwork maintains your proper position to the spinning work on the lathe.

"You could call it ‘sea legs.’ Your feet never move, but your body does," he says as he shifts his feet into position among the wooden ringlets covering the workshop floor. "If you imagine a clock face, your left foot should be at half-past ten, your right at half-past four. You must keep your heels on the ground but your weight on the balls of your feet. Then, you can move along the work."

Combine the sway with the steadiness provided by tucked-in elbows and you’ll be able to shear smoothly in the Thompson tradition. "Every move must have a follow-through—not too quick or too slow," Bert cautions. "It doesn’t take much movement to put a ridge on the wood. And, if you make one mistake, it’s ruined."

Woodturners can always work
Compared to the days when Bert had a half-dozen men working for him, today things are slow. He now turns alone, yet believes he could make $200 a day every day of the week, if he wanted to. Even with today’s competition from high-tech machinery, which produces hundreds of turnings per shift, Bert thinks a good woodturner could still make a living.

"There will always be work for the hand woodturner because machines can’t be automated to turn only one or a dozen pieces," he states. "A woodturner needs only his lathe and no one needs to work for him. He can do it all alone."

Bert sees a future in woodturning, not only because he loves it, but because he doesn’t want the skill to become history. To preserve it, he began his Canadian School of Woodturning several years ago so he could pass on the techniques.

"You can learn to scratch, and scrape, and sand, but that is not wood-turning. You cannot learn it by yourself. You have to be taught to be good," says Bert. ♦

MORE OF BERT THOMPSON’S TURNING WISDOM
- "Before you turn a piece of wood, bounce it off the floor. If it doesn’t bounce, it’s bad and should break your nose."
- "Your steady rest must have a 20- to 30-degree angle to the wood so the tool can shear."
- "The lathe center should be elbow height to get the proper angle for taking off wood."
- "If you must use work lights, position them between you and the work. Daylight is best."
- "Take the stone to every new tool and bevel its edge so it will slide along the steady rest."
- "A solid piece is more likely to warp than if you cut it in half, reverse the grain, and glue it back together. Then one side fights the other and it stays straighter."
- "If you turn a lot of hardwoods, shorten the grind on your tools so they don’t heat up as fast."

Produced by Peter J. Stephano
Photographs: James Eager
Illustrations: Bill Zaun
INTRODUCING THE AMAZING 8-SPEED MULTI-MACHINE

IT SANDS, IT GRINDS, IT SHARPENS!
Even the term "multi-use" doesn't do justice to this incredibly hard-working homemade tool. With the accessories shown in these photos, you can disk-sand, drum-sand, and sharpen with a wetstone or grinding wheel. If that's not enough, you can mount a drill chuck to contour-sand with either a flap sander or inflatable-drum sander, or clean rust with a wire-brush wheel. The drill chuck allows you to add several accessories only suited to a drill before. And to top it off, this workshop jack-of-all-trades lets you choose from eight different speeds for just the right r.p.m.'s to do the job properly.

We show you how to construct the cabinet and disk-sanding table in this article, and where to buy the mechanical components. In the next issue of WOOD, we'll tell you how to build the add-ons and where to buy the accessories.

BUILDING THE CABINET
1 Rip, then crosscut base frame parts A and B to size from 2 x 6 stock. Glue and butt-join the parts as shown in the Exploded-View Drawing, using #8 x 3 " screws and checking for square. (For better adhesion when joining end grain to face grain, we rub a coat of glue into the porous end grain first, wait a minute, and give it a second coat. Then we coat the surface grain of the mating piece and clamp the pieces together.)
2 Cut two plywood rectangles for the cabinet's side panels (C). Using double-face tape, stick the panels together and cut them to shape as dimensioned in the Exploded-View Drawing (this ensures two perfectly matched panels). Cut 4" off the top of the left panel to a finished height of 37".
3 Rout the decorative ¼" vein ½" deep 5" up from the bottom of both sides. (The vein will match the slight gap between the base and the cabinet door.)
4 Glue and screw the side panels to the base frame as shown in the Exploded-View Drawing. (The panels will extend ½" beyond each end of the frame.)
5 Cut the center divider (D) and outboard shelf (E) to size as listed in Instructions continued on page 44

DESIGN NOTES
An arbor shaft, which is the heart of our multi-machine, has many uses in the shop. We've long thought the arbor shaft could accomplish even more tasks—if we could only adjust the speed to suit the job. Our multi-machine does just that. Here's how it works and what the terminology in the drawing at right means:

A mandrel consists of an arbor shaft with threaded ends supported by two pillow blocks. Accessories are held in position on the arbor shaft by arbor nuts and flanges.

To reduce the speed of the arbor shaft to do low-speed work, we had

MECHANICAL COMPONENTS

5-step pulley
Arbor shaft
Flange
Arbor nut
Pillow blocks
Upper belt
Lower belt
Jackshaft
Motor
Rotation
4-step pulley
Mandrel
10" pulley
2" pulley
10" pulley
Rotation
2" pulley
10" pulley
Rotation

You can drive the jackshaft at two speeds: high and low. High speed is attained by running the lower belt from the motor to the 2" pulley on the jackshaft. You can reduce the jackshaft speed by running the lower belt from the motor to the 10" pulley. The arbor-shaft speed can be reduced even further by running the upper belt on the smallest pulley of the jackshaft four-step pulley and the largest pulley on the arbor shaft.

—James Downing, Design Editor
Note: ¼" thick birch banding on exposed edges of plywood is not shown.
the Bill of Materials. Then, lay out and cut the center divider to shape as shown in the Center-Divider Drawing. Also, bevel the edges of E at 12° to match the angle of D.  
6 Using solid birch or laminated stock, cut the mandrel base (F) to size, then to shape as shown in the Mandrel-Base Drawing, bevel cutting the ends at 12°. Use flat stock, as the top of F must be perfectly flat when you later mount the mandrel assembly to prevent the mandrel shaft from binding. Mark the location of the belt opening on F. Drill a hole through F large enough for a jigsaw blade, then cut the opening to size.  
7 Glue and screw the center divider (D) to the mandrel base (F). (The top and sides of D should be flush with those of F.)  
8 Cut the two outboard shelf support cleats (G) to size plus 1" in length. Glue and screw both cleats to the bottom of the outboard shelf, and cut the ends of the cleats flush with the shelf’s beveled edges. Glue and screw the shelf-cleat assembly 4" down from the top of D, as shown in the Cabinet Front-View Drawing on page 43.  
9 Glue and screw the D-E-F-G assembly to the cabinet sides. Make sure that the assembly sits in ¼" from the front and rear edges of both side panels.  
10 Cut the toe kicks (H) to size, then glue and screw them to the cabinet base.  
11 Cut cleats I, J, and K to size. Drill pilot holes in the back cleats (one I and one J) before fastening them to the cabinet sides. Doing this makes it easier to mount the back panel (L) later. Cut a 12° bevel on one edge of each K cleat.  

Then, glue and screw all of the cleats to the side panels and the base frame. Position them ¾" back from the edges to accommodate the back panel and door. See the Exploded-View Drawing on page 42 for correct placement.  
12 Cut the back panel (L) and the door (M) to size, beveling the bottom and top end of each at 12°. Cut a 4" X 9" notch in both the back panel and door to accommodate the outboard shelf. Glue and screw the back panel to the cabinet. Attach the hinges and hang the door.  

INSTALLING THE MOUNTING BLOCKS  
1 Cut the motor-mount pivot blocks (N) to size. Find the center of each by drawing lines between opposing corners, and bore a 1¾" hole in the center of each to accommodate the ¾" pipe (1" outside diameter). Drill pilot holes through each block for mounting to side panels C. Cut the pipe to 16¼", and slip a mounting block on to each end. Glue and screw the blocks, with the pipe inserted, to the cabinet sides where indicated on the Side-View Drawing.  
2 Cut the motor-mount block (O) to size. Drill ¼" holes for the U-bolts where shown in the U-Bolt Detail. Attach O to the pipe and tighten the U-bolt nuts, allowing the block to slide on the pipe.  
3 Cut the jackshaft mounting blocks (P) to size, then lay out and cut them to the shape shown in the Jackshaft Mounting-Block Drawing. Measure and mark the location of each block’s slot, drill two ½" holes, and join the holes to form the ½"-wide curved slot by cutting out the path with a jigsaw. Drill ½" holes in each P for mounting the pillow blocks and for the pivot bolt.  

BUILDING THE MANDREL COVER  
1 Cut the cover’s sides (Q) to rectangular shape, then scribe a 4" radius 1" from the bottom, as shown in the Mandrel-Cover Side Drawing. Cut the sides to shape, and cut the shaft clearance slot. Using a straight bit and router table as shown in the photo, above right, cut a ½" rabbet ½" deep in each Q to house the hood (S).  
2 Cut the cleats R to size. Bevel-rip one edge of each cleat at 12° to accommodate the angle of the rabbet and the hood.  
3 Glue and clamp the sides (Q) to the cleats (R). Drill pilot holes and fasten the sides to the cleats with #8 X 1¼" screws. Position the screws toward the inside edge of the back cleat to prevent hitting the screws when you rout out the hinge rabbet in step 5 later.  
4 Rip and crosscut the hood (S) from ½" Baltic birch plywood. Sponge the outside of the plywood with hot water to make it more pliable. Apply glue to the rabbet in Q, then clamp and roll the plywood into the rabbet. (This step takes two people—one to hold the side-cleat assembly and one to roll the plywood into the rabbet and attach the clamps.)  
5 After the glue dries, rout a ½" rabbet ½" deep in the hood to accept the continuous hinge. Cut a 1"-wide hinge to 6", and screw it to the cover and to the stand.  
6 Position and drill the hole for the magnetic catch into the top edge of D. Install the catch, then  

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align and attach the strike plate to the bottom of the cover (Q).

**MOUNTING THE MECHANICAL PARTS**

1. Remove the pulley that comes with the mandrel assembly, and attach the four-step pulley to the mandrel, as shown in the Front-View Drawing. (While we used the sleeve-bushing pillow blocks that are part of the mandrel assembly, we highly recommend using self-centering pillow blocks. We experienced excessive power loss at high speeds due to bushing friction. See Buying Guide for details.)

2. Position the assembled mandrel on the mandrel base (F), and mark the pillow-block hole location. Drill the holes and bolt the mandrel to the base with a 38” V-belt looped over the pulley. Once the assembly is mounted, spin the ½” shaft by hand to check for any misalignment caused by tightening the mandrel assembly to the base (F). Shim if necessary. (The use of self-aligning bearings compensates for shimming.)

3. Drill the ½” and ¾” holes in both side panels as dimensioned in the Right-Hand Panel Drawing. Mount the jackshaft-mounting blocks (P) to the sides of C. Finger-tighten the nuts.

4. Cut ½”-round steel stock to 16¼” for the jackshaft. Slide the four-step pulley, 10” pulley, 2” pulley, and self-centering pillow blocks onto the jackshaft, as shown in the Front-View Drawing and in the photo, right. The pillow blocks we used (see Buying Guide on page 85) have shaft-locking collars that prevent the shaft from moving laterally when in use. Position the upper and lower V-belts, and secure the assembly to the mounting blocks (P) with carriage bolts.

5. Position the motor near the end of the motor-mounting block (O), and mark the location of the holes. Drill the holes, and secure the motor to the block. Slide the 2” pulley onto the motor shaft. Lift the motor and mounting block up and align the belts and pulleys as shown in the Front-View Drawing. Once everything is lined up, lower the motor and tighten the set screws on the pulleys.

6. Drill a ½” hole through the right-hand panel (C) as indicated earlier in the Right-Hand Panel Drawing, and feed the motor cord through it. Run the cord along the inside of the cabinet as shown in the photo, below, and connect it to the motor. Be sure to wire the motor so that it rotates clockwise during operation as illustrated in the Mechanical-Components Drawing.

7. Disconnect the electrical cord from the switch. Position the power switch on the door, then mark and drill the mounting holes. Drill ¾” wire access holes through the door and left-hand panel (C). Run the cord from the left-hand panel, along the inside back edge of the door, and through the power-cord access hole, and reconnect it to the switch. Allow plenty of wire between the door and cabinet so that the door opens and closes without stretching the cord. (We used plastic clamps to mount the cord to the cabinet and door.)

8. Attach the wooden knob to the door front. Install a magnetic catch on cleat J and the strike plate on the back of the door.

**Safety Note:** This system is designed so that you must unplug the switch in order to open the door to change speeds. This disconnects power to the motor, eliminating the possibility of accidentally starting the motor while changing belt positions or when working on the inside of the cabinet.

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Continued on page 84
It's a doggone miracle what PEG can do," says Patrick Sipleman, expert woodcrafter and teacher based at Fish Creek, Wis. "I first heard about it 20 years ago, and PEG's possibilities still amaze me!"

Back in the Fifties, forestry researchers began taking a close look at how PEG, short for polyethylene glycol, "freezes" wood in its green state. Since then, the chemical has seductively fascinated both researchers and woodworkers.

Why so much excitement about something that sounds as if it belongs in your car radiator? Far from being an antifreeze, this version of polyethylene glycol has special properties that allow experimenters to season freshly cut green wood chemically to prevent cracks, checks, shrinking, and warping.

What's so special about PEG? With PEG, there's no need to worry about conventional drying methods to stabilize woodworking stock—no

PEG, the waxy-looking block in the background, makes it possible to turn bowls with the bark still on and use fresh-cut green wood.
air-drying, no kiln-drying, no long waits for proper seasoning. Your woodlot becomes your lumberyard. You can work green wood right from the tree into lamps, bowls, vases, candlesticks, slab clocks, tables, or carvings. Treated with PEG, a project you spent hours on won't suddenly be ruined by a crack down the middle.

PEG offers good insurance against unplanned disasters, even with thick, heavy slabs, or chunks. And for a real rustic look, you can leave the bark on the wood—after PEG treatment, it won't fall off.

As for safety, it's not a problem. PEG is nontoxic, can't be absorbed through the skin, has no odor, and won't explode. In fact, "relatives" of PEG are used in lotions, cosmetics, and deodorants.

Even with all this going for it, PEG has a hitch: Clear-cut guidelines about its use just don't exist. You learn to use it by trial and error. However, after more than two decades of experiments, enough rules of thumb have been developed so even first-time PEG users have a good shot at success.

How PEG works its magic
Researchers have found that PEG with a molecular density of 1000 does the "curing" job best. PEG 1000 comes as a waxy, white, semi-solid that looks a lot like paraffin. When green wood is immersed in a PEG-water solution, the large PEG molecules displace the wood's natural moisture. Because PEG evaporates little compared to natural moisture, it stabilizes the wood's cell structure.

The challenge is to get PEG to infuse the intricate cellular structure of green wood without wasting time or chemical. Old hands such as Pat Spielman recommend using completely green, fresh-cut wood. If you want to use dry or partially dry wood you have on hand, soak it in water for two to three weeks.

PEG has to saturate wood to within 25 to 30 percent of its "dry" weight. For instance, a 4-pound dry log should weigh a little over 5 pounds after PEG treatment. PEG only works when there's water in the wood.

You can treat wood with PEG in two ways. Totally immerse it in a PEG solution, or if the project is too large or thick, surface-treat it. Often, only a few brush applications are needed.

Variables make using PEG tricky
PEG-treating know-how boils down to reading the variables: the concentration of the PEG/water solution and its temperature, plus the characteristics of the wood, such as its density, structure, moisture content, and thickness.

PEG suppliers offer charts showing how to mix up either a 30- or 50-percent PEG solution by weight.

A 30-gallon vat can hold about $50 worth of PEG—enough to treat a whole tree!

The difference is that the higher the PEG-to-water ratio, the shorter the treatment time. Heating up the solution to around 140 degrees also speeds up the absorption process.

Veteran PEG users stack the deck in their favor by reducing variables, such as the type of wood. Pat, for example, works mostly with butcher-nut. Another experienced PEG user from Grand Rapids, Minn., Jim Gabrielson, first started with birch, but now uses elm exclusively. And Jim is no dabbler—he goes through more than a half-ton of PEG a year, treating elm in a 500-gallon stainless steel commercial vat and drying it in a large drying room he built himself.

Getting started with PEG
PEG sells for about $3 a pound in a minimum order of 10 pounds. But a little goes a long way. Since it doesn't evaporate, only the PEG absorbed by the wood being treated gets used up. "It's only pennies when you figure it in cost per project," explains Pat. "A 30-gallon vat can hold about $50 worth—enough to treat a whole tree!"

Commercial PEG vats cost money, too. Those sold by Pat range from about $300 for a 10-gallon unit to $445 for a 50-gallon one. A heating element costs extra. But, you can side-step this investment by fashioning one of your own. To get started, use a plastic trash can, heavy-gauge plastic trash bag, or even a children's plastic lawn-type splash pool. Try for round shapes because they'll require less PEG: The chemical is wasted in the corners of square containers unless your projects tend to be square.

Keep the wood you're treating submerged in the PEG/water solution by wedging sticks across the surface between the sides of your temporary vat. Be careful not to puncture the sides or you'll lose costly PEG.

Turn the page to learn how PEG pros such as Pat Spielman work with this wonder chemical.


WHERE TO BUY PEG
These are the suppliers we know about from whom you can order PEG and PEG-related equipment:

- Albert Constantine & Son, 2050 Eastchester Rd., Bronx, NY 10461
- Craftsman Wood Service, 1735 W. Courtland Ct., Addison, IL 60101
- Crane Creek Co., P.O. Box 5553, Madison, WI 53705
- Jim Gabrielson, 2317 La Plant Rd., Grand Rapids, MN 55744
- Garret Wade Co., 161 Ave. of the Americas, New York, NY 10013
- General Finishes, P.O. Box 14363, Milwaukee, WI 53214
- Industrial Arts Supply, 5724 W. 36th St., Minneapolis, MN 55416
- PITSCO, P.O. Box 1328, Pittsburg, KS 66762
- Spielman's Wood Works, 188 Gibraltar Rd., Fish Creek, WI 54212
- Wilkens-Anderson Co., 4525 W. Division St., Chicago, IL 60651
- Woodcraft Supply, 313 Montvale Ave., Woburn, MA 01801

Continued
HOW PAT SPIELMAN USES PEG

Here's how Pat Spielman transforms wet, green wood into beautifully turned finished projects in less than a week. Remember that the process varies from craftsman to craftsman and from wood to wood—you may come up with a method that works better for you.

1. Preshaping green wood
Pat begins his PEG projects right outside his shop. With a chain saw, he cuts chunks of his favored butternut from a recently downed log. PEG allows him to be creative because it forgives knots, grain direction, and other features that normally would contribute to cracking.

Some pieces he cuts to turn with the grain; others he rounds off to turn against it. If Pat won't be working the wood right away, he seals it in plastic trash bags to preserve its moisture. Don't store wood this way too long, however. It tends to mold, deteriorate, and discolor.

2. Rough-turning the project
Pat rough-turns each chunk of log to its nearly finished shape at his lathe. Because PEG penetrates a maximum of 1" into the wood he uses, he has to leave ¼" to ½" of thickness for final working after the piece has been treated and dried. That way, there will be enough PEG left in the wood after it's finished to prevent checking or cracking. The core of the wood will remain forever green, frozen inside the PEG layer.

3. Treating wood with PEG
The formula that works for Pat calls for a 50/50 PEG-to-water concentration. PEG, which melts at 104 degrees F., would take days to blend with cold water, so Pat melts it down from its waxy state in a separate non-ferrous metal container. Then, he adds it to the water in his specially designed vat.

Except for stainless steel, PEG reacts with metals and causes the wood to stain. Therefore you have to use a non-metal container to hold the PEG-water solution. Pat uses a tank he developed and marketed called the Thermo-Vat. It's a heavy-gauge plastic container with a tight-fitting lid and built-in heating element that raises the solution temperature to 140 degrees F. for faster penetration into the wood.

A floating wood cover keeps the green, rough-turned pieces submerged in the solution. Depending on their thickness, the pieces stay in the vat for up to four days.

4. Drying and sanding the stock
You can dry PEG-treated wood by hanging it from the rafters of a garage or attic, a method that can take a few weeks. But Pat finds a kitchen oven much faster. He sets it at 180 degrees F., chucks in the wood, then forgets it for the 8 hours or less it takes to dry.

Out of the oven, the dry turnings go back on the lathe for final working. Pat turns them down just enough to be smooth. “You don’t want to go in too far and expose untreated wood,” he says. Next comes the sanding, which he does with wet-dry paper from 60- to 120-grit.

“Wet-sanding won’t hurt your project,” according to Pat. But, he cautions, “because PEG is water-soluble, you don’t want to soak the piece in water or put it under a running faucet.”

5. Finishing PEG projects
In only a few hours after sanding, Pat’s PEG-treated pieces can be finished. Pat likes to use Danish oil, but he occasionally applies polyurethane. For the luster evident in the “birds-eye” bowl shown, Pat topped the polyurethane off with a coat of paste wax.

Without PEG’s help, the figure showing in the end of the freshly sawn log couldn’t be used for woodworking. If it found its way to the lumberyard in the first place, chances are it would crack later.
SPIELMAN'S PEG TIPS

- **How to run a PEG treatment test:** "Cut six ½"-thick slices from a green log, and toss them in your PEG solution. Take one out after 24 hours and label it. Take another out after 36 hours, and so on, adding 12 hours each time. When they're all out, stick them in an oven set at 180 degrees. After 8 hours, see which ones haven't cracked or split and look the best, then base your PEG soaking time on those results. Try this for each type of wood you want to use."

- **About choosing wood:** "Start with low-density woods such as white pine, aspen, cottonwood, willow, or butternut. Avoid dense hardwoods such as black walnut, fruitwoods, maple, yellow birch or beech until you know the process. Then, you can start experimenting, which is half the fun of using PEG."

- **On PEG penetration:** "Drill holes in the bases of thick projects such as lamps to get better absorption into the end grain."

- **On sanding:** "Sand the wood with wet-dry paper right on the lathe. Keep one piece of paper soaking in water to wash off the gum buildup."

- **About overtreatment:** "Don't prolong soaking or use solutions greater than 50 percent PEG. The wood will become harder to sand and the piece may sweat in high humidity." ♠

Produced by Peter J. Stephano
with Gene Schnaser
Photographs: Jim Elder, Hopkins Associates; Ginny Peifer;
Gene Schnaser
Do the Japanese have a better hand tool idea?

Setting up for planing, above. Craftsman/teacher Fujieda Hiroaki aligns a plane iron for straightness, a delicate task.
More and more American woodworkers are becoming enchanted by hand tools from the Land of the Rising Sun. Why? Because these tools really work, often in surprising ways.

To the untrained eye, a Japanese plane, fashioned from a block of oak and two rough-looking slabs of metal, appears too primitive for precision. Yet, it shears paper-thin, translucent shavings. A Japanese saw, the blade thin and delicate, looks too fragile for hard work. But it can notch an 8\times 8'' beam with ease.

Does this make them better than the tools we're used to? In many respects, the answer is "yes." However, Japanese hand tools are very different, and intriguing.

Watching these tools perform, as we did at a recent seminar in New Hampshire, is both foreign and fascinating. The shokunin, as Japanese craftsmen are generally called, places the work he will plane on a downward-slanting beam and draws the plane toward himself. During the stroke, he steps back with a dancer's grace, Sawing, he either stands, bending over the wood and holding it in place with his foot, or sits. Then, to make the cut he pulls the blade through the wood, since its teeth are angled to cut only on the draw.

Technique for using Japanese woodworking tools runs contrary to many traditional Western methods. Yet, according to one major importer, U.S. retailers sold $3 million worth of better-quality Japanese tools last year—double the figure of just two years ago. What's behind it all?

To find out, we spoke with folks who sell, and most importantly, use Japanese woodworking tools. One of our first discoveries was that among the hoards of tools available (see page 53 for details about many of them), Japanese planes, saws, and chisels prove popular first-time choices because they adapt themselves well to the western way of doing things.

**JAPANESE PLANES: WELL WORTH THE HASSLE, BUT Frustrating For Beginners**
Fred Damersen, owner of The Japan Woodworker, a California-based tool importer/retailer, says that no Japanese plane comes ready for use. “When you get your plane home,” he instructs Damersen, “let it sit in your shop for a month so the wood and metal climatize. Then set it up.”

At the seminar we attended, which was sponsored by Robert Major's Mahogany Masterpieces, a prominent New Hampshire importer/retailer, we watched one Japanese instructor take more than half an hour adjusting the fit of a plane iron in its wood block.

Earlier, he had taken long enough to sharpen the iron that we thought we were witnessing a religious ritual. Clearly, adjusting and caring for these tools is a hobby in itself.

Matthew Connerton of Newburyport, Mass., a professional woodworking craftsman and recent Japanese tool convert, even protects his planes from too much sun. “The metal is lively. It moves just as the wood does,” he explained as he moved them into the shade.

In Japan, artists make planes for other artists to use. Thomas Hucker, a furniture designer and maker from Boston, came face to face with this tradition. In Japan, he went to a large hardware store and asked to see the best plane they had. “They wouldn't even put it on the counter. I think they assumed I wouldn't know how to work it,” he told us. “The one I bought. I'm scared to fool around with. I would never recommend that anyone buy expensive tools right off.”

Whether it’s expensive or moderately priced, a Japanese plane, in knowing hands, can be a real joy to use. Explains Nancy Hurwitz of the Japan Woodworker: “Because the quality of the steel is so high, and you can adjust it so fine, you get shavings you can see through.”

**RAZOR-SHARP SAWS ARE FRAGILE, TOO**

The Japanese laminate a layer of high-carbon, hard steel to a layer of softer, low-carbon steel for their plane blades. In doing so, we were told, the softer layer absorbs shock; the hard layer affords a sharp, lasting edge. Saws are different, however.

According to shokunin and author Toshio Odate, the pulling stroke used with the Japanese saw doesn’t allow the blade to bow. Therefore, it can be of thin, crisp, high-carbon...
steel. Since the steel is very hard, the teeth can be filed to razor sharpness—and they stay sharp.

In practice, we observed a thin-bladed Japanese saw slice through a cedar post in seconds and another much like it used to fashion fine dadoes and rabbets in 1/4" stock. How can this be? Hurwitz likens the use of the thin blade to a piece of grass. "You can pull a blade of grass through anything," she says, "but you can't push it."

Saws may be the most practical of Japanese tools for the home woodshop, and among them, the dozuki ranks as a useful, sensible choice. Similar to a backsaw, its blade, though extremely thin, is less likely to break than those of other Japanese saws. That's because its back has a steel reinforcing spine.

**CHISELS THAT STAY REALLY SHARP**

Of all Japanese tools, chisels differ least from their western counterparts in use, but they still draw raves.

Harrison Stanley, a professional woodworker from Groton, Mass., oddly enough uses Japanese tools to craft Early American furniture reproductions. About chisels he says: "The steel they use means that I only have to sharpen mine once a week—and even then they don't really need it."

Here again, the key to their sharpness lies in the use of the layered high- and low-carbon steel.

**HOW TO BUY HIGH-QUALITY JAPANESE TOOLS AND STILL KEEP RICE IN YOUR BOWL**

Some converts to Japanese tools get infatuated right away. Conrington, for example, bought $1,500 worth of them in a day. Unbelievably, though, some folks have paid that much or more for a single saw, a plane, or a couple of chisels. One saw in the Mahogany Masterpiece line lists for $12,000!

That saw, crafted by a master artisan, is more a one-of-a-kind collector's item than a tool. Yet, saws priced by both The Japan Woodworker and Mahogany Masterpieces at $650 and up are meant to be used, and used hard.

Do you have to spend that much for a useful tool? Happily, the answer is not at all.

At The Japan Woodworker, Damsen and Hurwitz say a $26 saw will last through 30 years of weekend woodworking. But after using your first saw for a few years, you might want to move up to a $60 model. "In quality," explains Damsen, "the difference between a $60 saw and one at $120 might only be 15 to 20 percent." But, they both add, some people buy $650 saws, $400 planes, and $40 chisels for the same reason they buy cars that go 130 m.p.h., even though the speed limit is 55.

Major takes a slightly different stand. "There's a price level that I would never go below. In saws, that range is about $40. In chisels, it's three for $40. A small plane would be about $50, and a full-size plane not less than $75. "But," he says, "if somebody makes a big investment in cash and meets it with an investment in time, he's much better off than someone who bought a cheap tool as an experiment."

Assessing this advice, it appears as though you can buy Japanese tools of high quality and still keep rice in your bowl. But no matter what you spend,
how can you be sure you received the quality you paid for?

BUYMANSHIP ADVICE: WHAT YOU SEE MAY NOT BE WHAT YOU GET
Most Japanese tools sold in the United States are marketed through catalogs. But Major, who produces a striking four-color tool catalog, says you can’t always rely on photographs. "In a photograph," he says, "the Japanese saw that costs $30 looks identical to one that costs $12,000." And Damsen says that some saws with top-of-the-line price tags would not be good buys at half the price. "If you buy them," he advises, "you’ll be paying as much for the handle as the blade."

So where does that leave you when it comes time to buy and try some Japanese hand tools? Author Odate, in his book, suggests that because the trade in these tools is still so young and there’s so much to know about them, American buyers must depend on those who sell tools to offer quality choices. It may not be a case of "buyer beware," but buying from someone you can trust helps to ensure that your money will be well spent. If it’s possible, you may also want to try the tools first. If you order by mail, look for a "satisfaction guaranteed or your money refunded" statement.

Both retailers agree that tools should be given a hands-on test in the store before you buy, trying different grades of the same tool. Being informed helps, too. Major publishes a newsletter jam-packed with information about Japanese tools and sponsors a seminar each summer. Damsen provides helpful information in his catalog, and at his store, but advises the next best thing to handling and using the tools first is a phone call to the seller. "Talk to them. That’s the best way to tell what you’re likely to get," he says.

WHERE TO GET MORE INFORMATION
For a newsletter about Japanese tools, a catalog and seminar information, write: Mahogany Masterpieces, RDF 1, Wing Rd., Suncook, NH 03275. For a tool catalog, write: Woodline, The Japan Woodworker, 1731 Clement Ave., Alameda, CA 94501.

SPEAKING THE LANGUAGE
smooth as fine sanding.
Most Japanese planes have one blade that does the cutting and a chipbreaking second "blade," adopted from the West, which reduces tearout. Planes give you a variety of choices, for different purposes and of varying sizes. They can cut flat surfaces, grooves, rabbets, dovetails, and decorative moldings.

Mawashibiki nokogiri or keyhole saw
Mentori kanna or molding plane
Koguchi or carpenter’s hammer

Hammers, or tsuchi, in Japan, like hammers in the West, pound nails. Some even look like ours. Others are far more ornate than anything in a western toolbox. One type, shaped like a mallet, has no claw and is named ryokoguchi. Its head is flat on one end and convex on the other. The flat face drives the nail in until the second-to-last stroke. Then, the hammer is turned over and the convex face taps the head of the nail below the surface. Japanese gimlets, called kiri, of various sizes, drill holes for pegs by rolling them between the palms. Western drills work much faster.

An array of Japanese measuring tools—framing squares, rulers, marking gauges, and compasses—is available. They differ little from western versions, except for the sumitsubo.
A symbol of the shokunin, the sumitsubo has remained more ornate than necessary through the centuries. It looks less like a tool and more like an antique whale oil lamp, and does little that a western chalk line cannot do.
A bowl carved into the sumitsubo’s wooden body holds ink and a silk wad. A wheel with a crank shrouds a long silk line, which is drawn through the inky silk. In use, the line stretches tightly from one end of the work to the other, and is held in place with a pin. To mark, the line is snapped to produce a straight line as you would do with a chalkline. Held at an angle, while firmly attached to the wood at both ends, the line can be snapped to form a curve.


Written with Greg Erickson
Photographs: Hopkins Associates;
Greg Erickson
It's no accident that standard kitchen countertop height is 36", that 5/4 lumber measures 1 1/4" thick when dried and surfaced, and that the correct backrest angle for dining ranges from 0° to 5° to the rear. These and a host of other standards have been established over the years by the furniture and wood industries, and by designers.

Unfortunately for most home woodworking hobbyists, much of this vital information isn't readily available in easy-to-understand form. We're out to change that! In this and upcoming issues, we're going to summarize this data for you. We'll start with Seating and Tables this time, then cover standards for Shelving and Cabinets, Casework, the Workshop itself, Beds, and so forth. We think you'll find this series of articles a valuable reference tool as you pursue your hobby.

Louis Sullivan once said that, "Form follows function," and this design principle holds especially true in seating. Before considering form—that is, style, scale (or how it relates in size to its surroundings), wood species, or joinery techniques—you must consider comfortable support of the human body.

**AVERAGE SEATING DIMENSIONS**
The design of a comfortable chair depends on the size and shape of the person it's intended to support. So use the dimensions listed at right only as what they are intended to be—guidelines. You may need to adjust them slightly for your situation, and that's fine.

**SEATING ANGLES**
You've no doubt noticed that the angle of seating varies from one type of seating to another. Here again, it's function that dictates. We've categorized all seating into three groupings: Alert, Relaxed, and Reclining. In the box at the top of the opposite page, we discuss how these postures govern the angles that are right for a given piece of furniture.

<table>
<thead>
<tr>
<th>AVERAGE DIMENSIONS*</th>
<th>ADULT</th>
<th>9 yrs.</th>
<th>7 yrs.</th>
<th>5 yrs.</th>
</tr>
</thead>
<tbody>
<tr>
<td>A Seat height</td>
<td>16 1/2&quot;</td>
<td>12 1/4&quot;</td>
<td>11 1/2&quot;</td>
<td>10 1/4&quot;</td>
</tr>
<tr>
<td>B Seat depth</td>
<td>15 1/2&quot;</td>
<td>11 1/4&quot;</td>
<td>10 1/2&quot;</td>
<td>9 1/4&quot;</td>
</tr>
<tr>
<td>C Backrest height</td>
<td>15&quot;</td>
<td>11&quot;</td>
<td>10 1/2&quot;</td>
<td>9 1/4&quot;</td>
</tr>
<tr>
<td>D Backrest</td>
<td>12&quot;</td>
<td>5 1/4&quot;</td>
<td>5 1/4&quot;</td>
<td>5&quot;</td>
</tr>
<tr>
<td>E Seat to backrest</td>
<td>3&quot; min.</td>
<td>5 1/4&quot;</td>
<td>5 1/4&quot;</td>
<td>4 1/4&quot;</td>
</tr>
<tr>
<td>F Armrest length</td>
<td>6 1/4&quot; min.</td>
<td>6&quot;</td>
<td>6&quot;</td>
<td>6&quot;</td>
</tr>
<tr>
<td>G Armrest height</td>
<td>8&quot;</td>
<td>6 1/4&quot;</td>
<td>6 1/4&quot;</td>
<td>5 1/4&quot;</td>
</tr>
<tr>
<td>H Seat width</td>
<td>16-20&quot;</td>
<td>13&quot;</td>
<td>12&quot;</td>
<td>11&quot;</td>
</tr>
<tr>
<td>I Armrest spacing</td>
<td>18 1/2&quot; min.</td>
<td>14&quot;</td>
<td>13&quot;</td>
<td>12&quot;</td>
</tr>
<tr>
<td>J Armrest width</td>
<td>2&quot; average for all ages</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>K Backrest width</td>
<td>16-18&quot;</td>
<td>11&quot; min. for 9 thru 5</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*All dimensions are for alert posture (dining, writing, etc.). Adult dimensions are for the average American male. Seating designed for the typical American female should be downsized somewhat.

If you use cushions, adjust the dimensions so they are correct when the cushion is compressed by the weight of the occupant. As a rule of thumb, you can deduct half the cushion thickness from the seat height (A).
TYPICAL SEATING TYPES

DINING CHAIR
When entertaining, many people consider the dining table the center of activity. So you want to plan as much comfort into dining chairs as possible. Seat cushions help ensure a comfortable stay. We think that a simple foam cushion on plywood makes good sense in most situations. Figure on a 2" cushion being about average.
- The seat height of most dining chairs measures about 16 3/4", including the compressed height of the seat cushion.
- Armrests on a dining chair add to the comfort factor, too. Most designers plan on a maximum arm height above the seat of 8". But don't forget about the apron height of the table you're planning to use the chair with. You want to make sure the arms will slide under the apron. In any event, you wouldn't want the armrest height less than 6".

DINETTE CHAIR
Compared to dining chairs, dinette chairs are often smaller in scale, mainly because of the limited size of most areas they occupy.
- Normal seat height averages 16" and that includes the height of the seat cushion, if used.
- The overall depth of the chair may be as little as 15 1/2" up to a maximum of 20". And the width ranges from 16" to 18", depending on the style of chair being constructed.
- The style of furniture largely dictates the back height. A low-slung Padova chair, for example, has a back height of only 13 1/2" above the seat, but a ladder-back chair may be as high as 23 1/2".

Continued
EASY CHAIR
Chairs designed for relaxing typically have a lower seat height than those for dining or study. The seat tips back to a greater degree front to back, and the seat back angle increases, too.
- Seat height averages 16" and angles front to back at about 10°. With easy chairs, the seat cushion may be quite thick, so be sure to allow for cushion compression when figuring seat height.
- Because the seat is low and angled back, armrests aid in getting into and out of the chair. Typically, they rise 5 to 8" above the seat and measure between 2" and 4" wide.
- This chair’s seat back, angled back about 10°, rises 15° above the cushion. Some high-back wing chairs, though, have backs as high as 33°.

SOFAS
To provide the comfort desirable in sofas, you should figure on the seat height being about 15 1/2" and having it angle to the rear at from 5 to 12°. If the cushions you're using are thick and soft, you can count on cushion compression to create an angle of about 5°. But with firmer ones, you'll want to build the desired angle into the frame.
- Seat depth varies, depending on the thickness of the back cushions, but 18" to 22" is a good place to start.
- The back, typically 17" above seat height, usually angles back at least slightly, but can do so up to 25°.
- The armrests most often rise up from 4" to 8" above the highest point of the seat cushion.
- In figuring the width of a sofa, allow 24" per person, plus 4" to 6" for each armrest.

BAR STOOL
A bar stool, obviously, must fit the bar with which it’s used. Average bar height runs from 40" to 44". Whatever its height, you want the seat to be from 12" to 15" below the top surface of the bar, but never higher than 30".
- Bar stools average about 16" to 18" square, or 16 to 17" in diameter if you go with a round seat. Overall dimensions at the base rarely exceed 18" square.
- The top of the seat back normally is 11" or 12" above the cushion. And since people tend to lean forward when sitting in a bar stool, be sure to leave at least 3" between the bottom of the back and the top of the seat for the person to expand into.
- And don’t forget to provide for a place to hang your heels. A rung 20" below the top of the seat works nicely for this.

OUTDOOR LOUNGE
Three elements combine to create the overall length of 72"—the leg, rest, seat, and backrest. The leg rest measures 22" long and is designed to support the leg from the knee down. It raises along with the seat, creating a knee-bend angle of 120°.
- Seat depth averages 17" and can be inclined up to 10°.
- Backrest height typically measures 33°. You can adjust its angle backward from 45° to the flat bench position.

Please see page 61 for another 3-page section of Woodworkers Standards dealing with Tables. You'll learn how to choose a style and a support system, how dining style affects table size, and more.
Index

If you're saving back issues of WOOD for future reference—and many of you have kindly taken the time to write and tell us that you are—you'll want to save this index. Pull it out and keep it handy in your shop. We've kept things simple for your convenience. For example, the subject of "hearing protection" is listed as 7:59, 88. That means you'll find the article in Issue 7 beginning on page 59 and continued on page 88. Because projects are such a popular category, we decided to highlight them in a "mini-index" on page 59 for even quicker reference.

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CHOOSING A STYLE AND A SUPPORT SYSTEM

When you set out to design a table, you already know what function you want it to serve. But you also need to select a style that will complement the other furnishings in your home. If you’re unsure about which style to choose, stop by some furniture showrooms and browse a bit. Be sure to take along a pad of paper, a pencil, and a tape measure so you can record overall dimensions.

Also take a look at how the table you like is supported. The drawing at right gives you a preview of your options. Leg/apron-supported tables, the most popular traditional type, depend on a well-constructed leg/apron assembly for their stability.

Trestle-base tables, a favorite of Early American craftsmen, have two end legs with spread feet connected by a center support member that’s usually near floor level. The support structure usually goes together with “through mortise-and-tenon” joints, and are held secure with a wedge, which you can remove for easy disassembly.

The framework beneath pedestal-base tables can take several shapes. Some have a single pedestal with four feet at the base. Others have two smaller pedestals that connect to a split base. And a more contemporary version features a single cylinder without legs.

THE RELATIONSHIP BETWEEN TABLES AND CHAIRS

Any time you pull a chair up to a table or desk, the two must be sized correctly or you won’t be comfortable. Keep these pointers in mind as you are designing:

- Most dining tables and study desks have a height (A) of 29”.
- The average American male needs a leg space of 25” from the floor to the apron bottom (B).
- Keep the top of the chair seat about 12” to 13” below the top surface of the table (C). Be sure to figure in cushion compression (half the cushion thickness) if you use one.
- If possible, plan a 24” foot space (D) between the edge of the table and the support assembly. With pedestal tables, 18” is all you can get and still have a sturdy surface.
- Make sure the armrest height (E) allows you to slide the chair in under the apron of the table.
- When designing juvenile furniture, plan on a tabletop height of 22½” for 9 year-olds, 21½” for 7 year-olds, and 20” for 5 year-olds. And keep the top of the chair seat about 10” below that.

Continued
STYLE OF ENTERTAINING AFFECTS DINING TABLE SIZE
You've all been in dining situations where it seemed that you couldn't make a move without knocking into someone else's elbow or leave the table without having to ask someone to move their chair. These and other space problems can be solved while the table is still on the drawing board.

The drawing at right shows how your style of entertaining impacts directly on the space needed to accommodate a group for a meal. Casual dining requires less space, mainly because of the lesser amount of dinnerware used.

When determining the width and length of dining tables, keep these factors in mind:
- Allow a 12" by 24" space for each casual place setting. For formal tables, figure 15" by 28" each.
- Figure in a space of 12" wide and as long as possible to serve as a serving space.

TYPICAL TABLE TYPES

RECTANGULAR TRESTLE TABLE
Trestle-design tables have been a favorite of designers for centuries. They're rugged, practical, and fit in well with Early American and country furnishings.
- Make sure that you position the legs at least 18" in from the ends of the table to provide adequate foot space for the host and hostess.
- The table shown here, a typical example, measures 38" wide, 70" long, and 29" high. Though not many trestle tables extend, on this one, the ends pull out and accept up to two 15" leaves for a total length of 100".

ROUND PEDESTAL DINING TABLE (extension type)
This table measures 48" in diameter and can extend up to 78". As the tabletop is pulled apart, the pedestal comes apart. This type of table affords you more strength and stability when extended than one with a single base.
- When designing the base, be sure to allow for foot space. Notice how the cutouts between the feet of this table provide adequate clearance.
- Another type of pedestal table, the cylinder-base table, typically measures 48" in diameter with an 18" base, which allows for leg room and sufficient stability. You can add sand to the base, if desired.
DROPLEAF EXTENSION TABLE
This style of table continues to be popular, and ease of use and their space-conserving nature could be the reasons why. These tables function especially well in areas too small for other more bulky options. And they adapt quite nicely to use as either a dining table or a coffee table.
• This table measures 23" wide and 42" long with the leaves down, but with the leaves up it measures 42" in length.
• Drop-leaf tables such as the one shown here are supported at each corner by a leg/apron support structure that provides exceptional stability.

COFFEE TABLE
Though the shapes and sizes of these tables vary considerably, height remains fairly constant at between 16" and 17". It should approximate the height of the sofa seat, perhaps an inch or two taller. This table measures 22" wide, 60" long, and 16" high.
• Widths vary from 19" to 27", and lengths range from 36" to 60", depending on the length of your sofa. Figure on the coffee table being anywhere from ½ to ¾ the length of the sofa.
• Round and square tables range in size from 36" to 42" across.
• You may want to build in some storage or display space beneath the surface of the table, as in the example shown here.

END TABLE
For an end table to function as it should, it must be at the same height or a few inches lower than the armrest height of the sofa it sits next to. If you plan to set a lamp on the table, adjust the height so the bottom of the lampshade equals the eye height when seated.
• Most end tables are rectangular in shape and range in width from 22" to 24" and from 24" to 28" deep. Hexagonal and square tables typically measure from 24" to 28" across.
• Depending on the table support system you choose, you may be able to incorporate some storage space in the design.

SOFA TABLE
Sofa tables, those stately furniture pieces designed to sit behind a sofa, usually stand from 26" to 27" high, depending on the height of the sofa back.
• These tables’ main function is to conceal the back side of sofas that are not against a wall. As a result, most often, they’re quite narrow—from 14" to 17" wide.
• Sofa tables average 60" in length, again depending on the length of the sofa. Good scale calls for a sofa table that’s approximately ⅔ the length of the sofa.

As space permits in future issues, we’ll include other Woodworkers’ Standards articles on a variety of subjects. Watch for them!

Produced by James Downing
Illustrations: Advertising Art Studios Inc.
Greg Roberts
been scouting for just the right table design to build for your dining area? Then look no further. Made to last, this elegant, yet sturdy, table will serve your family for years to come. Choose the natural beauty of an oak top, or opt for the added durability of laminate. Guests for dinner? No problem! Simply add a leaf... or two... or three to seat up to eight people comfortably. P.S. We'll show you how to build the chairs in the next issue of WOOD.

FORMING THE LEGS
1 To form the four legs, rip and crosscut 12 pieces (A) of 1½" stock 3¾" wide by 29" long. Glue and clamp three pieces together for each leg, keeping the ends and edges as flush as possible.
2 After the glue dries, scrape off the excess and plane one of the laminated edges smooth. Set this planed edge against the table saw fence and rip the leg to 3" width. Now, rip ¼" off either adjoining edge to form a 3×3" square leg. Crosscut the legs to 27½".
3 Lay out and mark the two mortises on one end of each leg as dimensioned in the Corner Assembly Drawing.
4 Using a drill press with a ¼" flat-bottomed bit, drill a series of ½"-deep holes to remove most of the wood from the marked mortises as shown in photo, below left. (We used a back fence and stop, as shown, to ensure that all mortises were consistent in size and position. We also set the stop on the drill press to make sure that all holes were drilled to the same ¼" depth.) You will be able to drill one of the mortises in each leg with the setup shown. Move the stop block to the other side of the bit, reclamp the stop to the fence, and drill the other mortise in each leg.
5 Using a fence on the router table and a stop block clamped to the fence, rout the mortises clean with a ½" straight bit as shown in the photo below. You'll be able to rout one mortise on each leg with the setup shown. Move and reclamp the stop block to the other side of the bit, and proceed to rout the other mortises. Using a chisel and mallet, square the rounded ends of each mortise.

BUILDING THE BASE
1 Rip and crosscut the side aprons (B) and end aprons (C) to the size listed in the Bill of Materials.
2 Rabbet the ends of each apron to form ¼" tenons ¾" long. (We cut ours on the radial arm saw using a Instructions continued on page 87
EXPANDABLE OAK DINING TABLE

Bill of Materials

<table>
<thead>
<tr>
<th>Part</th>
<th>Finished Size</th>
<th>Material</th>
<th>Qty.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>T  W  L</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TABLE BASE</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A'</td>
<td>1 1/8&quot; 3&quot; 27 1/2&quot;</td>
<td>oak</td>
<td>12</td>
</tr>
<tr>
<td>B</td>
<td>1 1/8&quot; 3&quot; 67 1/2&quot;</td>
<td>oak</td>
<td>2</td>
</tr>
<tr>
<td>C</td>
<td>1 1/8&quot; 3&quot; 37 1/2&quot;</td>
<td>oak</td>
<td>2</td>
</tr>
<tr>
<td>D*</td>
<td>1 1/8&quot; 5&quot; 10&quot;</td>
<td>oak</td>
<td>4</td>
</tr>
<tr>
<td>E</td>
<td>1 1/8&quot; 1 1/2&quot; 68&quot;</td>
<td>oak</td>
<td>2</td>
</tr>
<tr>
<td>F</td>
<td>1/2&quot; 41 1/8&quot; 71 3/8&quot;</td>
<td>plywood</td>
<td>1</td>
</tr>
<tr>
<td>TABLETOP</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>G</td>
<td>3/4&quot; 35 5/8&quot; 40 7/8&quot;</td>
<td>oak plywood</td>
<td>2</td>
</tr>
<tr>
<td>H</td>
<td>3/4&quot; 12&quot; 40 7/8&quot;</td>
<td>oak plywood</td>
<td>3</td>
</tr>
<tr>
<td>I*</td>
<td>1 1/8&quot; 1 1/2&quot; 36&quot;</td>
<td>oak</td>
<td>4</td>
</tr>
<tr>
<td>J*</td>
<td>1 1/8&quot; 1 1/2&quot; 42&quot;</td>
<td>oak</td>
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</tr>
<tr>
<td>K*</td>
<td>1 1/8&quot; 1 1/2&quot; 12&quot;</td>
<td>oak</td>
<td>6</td>
</tr>
<tr>
<td>L</td>
<td>5/8&quot; 1/2&quot; 34 1/8&quot;</td>
<td>oak</td>
<td>4</td>
</tr>
<tr>
<td>M</td>
<td>1/2&quot; 1&quot; 34 1/8&quot;</td>
<td>flat alum.</td>
<td>4</td>
</tr>
<tr>
<td>N</td>
<td>1/2&quot; 3&quot; 3&quot;</td>
<td>oak</td>
<td>2</td>
</tr>
<tr>
<td>O</td>
<td>3/4&quot; 2&quot; 3&quot;</td>
<td>oak</td>
<td>2</td>
</tr>
</tbody>
</table>

*Some parts are cut larger initially, then trimmed to finished size. Please read the instructions before cutting.

Supplies: #8 x 1 1/2" flathead wood screws, #6 x 1 1/2" flathead wood screws, #6 x 1 1/2" flathead wood screws, 4—1/4 x 2" lag screws and washers, paraffin wax, 1/4" laminate and contact cement (for laminate top only)
Cutting Diagram

1 1/2" x 48" x 96" Plywood

3/4" x 48" x 96" Oak Plywood

1 1/4" x 3 1/2" x 120" Oak

3 pieces—1 1/4" x 7 1/4" x 96" Oak (12 A's required)

1 1/4" x 7 1/4" x 72" Oak

1 1/4" x 3 1/2" x 72" Oak

1 1/4" x 5 1/2" x 48" Oak

1 1/4" x 3 1/2" x 48" Oak

3/4" x 5 1/2" x 48" Oak

Continued
EXPANDABLE OAK DINING TABLE

dado blade. We test-cut scrap material first and checked the fit of the tenon into the mortises.) The outside face of the aprons should be flush with those of the legs when the tenon is installed in the mortise.

3 Cut a $\frac{3}{8}$" rabbet $\frac{1}{4}$" deep along the bottom edge of each apron to the size and position indicated in the Corner-Assembly and Section-View Drawings.

4 Glue and clamp the side aprons (B) to the legs, checking for square. Remove any excess glue after it forms a tough skin. After both side assemblies (A, B) are dry, join them by gluing and clamping the end aprons (C) in position, again checking for square.

**Note:** The table is rather fragile at this point. If you must move it around, do it with care and have a helper.

5 Cut the corner braces (D) to size plus 1" in length, noting the direction of the grain shown in the Corner Brace Drawing, below, to achieve maximum strength. Don't cut the notch yet. (We set our radial-arm saw blade at 45° and made one cut on each of the four braces. We then reset the blade to 45° on the other side of center, set up a stop block 10" from the blade, and cut the braces to size.)

6 Using a dado blade, an auxiliary wood fence on the table saw, and a miter gauge, as shown in the photo, top center, cut a $\frac{3}{4}$" rabbet $\frac{3}{8}$" deep in one edge of each brace.

To cut the other rabbet in each brace, set the miter gauge at 45° right of center, and push the brace through the blade as shown in the photo, below.

7 Notch the four braces (D) to fit around the inside corners of the legs. Drill four $\frac{3}{8}$" holes in each brace for the $\#8 \times 1\frac{1}{2}$" screws. Hold each brace in position in the corner, and drill pilot holes into the bottom of the aprons. Glue and screw each brace into the rabbets in the apron as shown in the Corner-Assembly Drawing. Now drill a $\frac{3}{8}$" hole through each brace and just into the leg. Switch to a $\frac{3}{16}$" bit and drill 1½" into the corner of each leg. Install the $\frac{1}{8} \times 2"$ lag screws and washers through the braces and into the table legs.

8 Sand the leg-apron joints smooth, checking that the tops of the legs are flush with the top edge of each of the aprons.

9 Fit your router with a $\frac{1}{4}$" round-over bit and rout the top edges of the base and down the outside edge of the legs (one edge only as shown in the Exploded-View Drawing).

10 Fit a router with a $\frac{3}{8}$" point-cutting ogee bit and edge-guide fence as shown in the photo. Locate the line of cut (1½") from the top edge of the aprons as indicated in the Section-View Drawing.

11 Rout the decorative groove around the perimeter of the base.

12 Fasten the slide rails (E) to the side aprons with $\#8 \times 1\frac{3}{4}$" wood screws. The bottom of the $\frac{3}{8}$" groove in the slide rails must be $\frac{3}{8}$" above the top edge of the legs, as shown in the Slide Rail Detail, right. This ensures clearance when installing the aluminum runners in the grooved rails. Chamfer the top outside edge of the slide rails to prevent drag later.

13 Carefully turn the base upside down. Cut the plywood panel (F) to size. Cut the corners of the plywood to accommodate the corner braces (D). You'll need to cut a small notch in each mitered corner for the head of the corner-brace lag screw. Drill pilot holes and fasten (but don't glue) the plywood panel to the base to test the fit. Remove the plywood panel; it will be reinstalled later.

14 With the base upside down, use a $\frac{3}{8}$" round-over bit to rout the bottom edges of each leg. Sand the entire base assembly smooth.

**BUILDING THE TOP AND LEAVES**

1 Cut the plywood top panels (G) and leaves (H) to size, as indicated in the Bill of Materials and as laid out in the Cutting Diagram. It is
SLIDING MECHANISM

$\frac{3}{4}''$ oak plywood top

#8 x $\frac{1}{2}''$ F.H. wood screw
Chamfer edge

$\frac{5}{32}''$ groove $\frac{3}{16}''$ deep

$\frac{1}{2}''$ plywood bottom

#8 x $\frac{1}{4}''$ F.H. wood screw

SECTION VIEW

$\frac{3}{8}''$ groove $\frac{1}{2}''$ deep (from the top for veneer plywood, $\frac{7}{16}''$ from the top for laminate)

$\frac{1}{2}''$ rabbet $\frac{3}{4}''$ deep

$\frac{1}{2}''$ round-over

Use a $\frac{3}{8}''$ point-cutting ogee bit.

$\frac{1}{2}''$ rabbet $\frac{3}{4}''$ deep

SLIDE-RAIL DETAIL

Slide rail E
Mount with bottom of groove $\frac{1}{32}''$ above top of leg

(H) to form a tongue, as shown in the Section-View Drawing and Cutting Diagram. (To reduce chip-out, we made the cross-grain cuts first, then those with the grain. We also used a feather board clamped to the fence to keep the oak veneer running flat across the blade.)

3 Rip the oak edging I, J, and K to $1\frac{1}{2}''$, then crosscut the pieces to length plus 2''.

4 Cut a $\frac{3}{8}''$ groove $\frac{1}{8}''$ deep along all edging pieces (I, J, K) to accept the tongue on the plywood. Test-cut scrap material first to ensure that the edging fits over the tongue, snugly against the veneer, and, most importantly, flush with the veneer surface of the plywood top.

5 Miter-cut both ends of each J to length. Then miter the mating end of each I piece and crosscut the other ends to length.

6 Glue and clamp the edging to the panels and leaves, checking that the miters pull tight. If the tabletop appears to be higher than the edging in spots, clamp a piece of scrap to the panel and edging, as shown in the drawing below.

7 After the glue dries, carefully remove the excess, and sand or scrape the edging flush with the veneer top. (We used a cabinet scraper and were extremely careful not to scrape through the veneer.)

8 Using a $\frac{3}{8}''$ round-over bit, rout the outside top, bottom, and corner edges (where the miters meet) of the top sections. Don't rout the edges that meet when the table sections close.

MAKING IT SLIDE SMOOTH

1 Position the two tabletop panels (G) face down on a blanket spread on a flat surface (to prevent scratching). Align the halves so that they butt uniformly. Position the base (also upside down) on the panels, and place $\frac{1}{8}''$ spacers between the aprons (B, C) and the edging (I, J) as shown in the drawing, below. This
A JEWELRY BOX OF

Beautiful West African zebrawood makes this three-drawer box just as eye-catching as its contents.

Note: You'll need some thin stock for this project. You can resaw your own or order stock. See the Buying Guide for our source.

FIRST, THE CASE
1 Rip and crosscut enough ⅛" stock to glue up the case top and bottom (A), sides (B), and back (C). Cut the pieces 1" longer and ¼" wider for trimming to finished size later. Lay out and match the pieces for the best grain pattern; then glue and clamp them as shown in the Edge-Joining Drawing, below.
2 Scrape off the squeeze-out and sand the joints smooth. Trim the case top, bottom, and side pieces to finished size.
3 Use a table saw with a dado blade or a table-mounted router with a ¾" straight bit and fence to cut ¼" rabbets ¼" deep on the back edge of the top and bottom panels (A). Use the same setup to cut the rabbets on the top, bottom, and back edges of the side panels (B).
4 Lay out and mark the position of the dadoes on the side panels (B) where indicated in the Exploded-View Drawing. Use a table saw and dado blade or a router table with a fence and a ¼" straight bit to cut ¾" dadoes ¾" deep where marked on the side panels.
5 Cut the shelves (D) to size, then dry-fit the case assembly (A-B-D) together. Glue and clamp the case assembly, checking it for square.
6 When the glue has dried, carefully trim the back panel (C) to fit snugly into the case assembly. Glue the back panel in place. Remove the excess glue after it forms a tough skin.
7 Using a router fitted with a ¼" round-over bit, rout all exterior edges of the case except the top front edge. (Leaving the front edge square allows the drawer top to fit tightly against the case as shown in the Cutaway Side-View Drawing.)

NOW FOR THE DRAWERS
1 To make the ⅛"-thick drawer fronts (E), cut six pieces of ⅛" zebrawood to 2¾" wide by 10¾" long. Now, glue two pieces together for each drawer front in sandwich fashion, keeping the edges as flush as possible. You'll end up with three ⅛"-thick laminations.
2 Rip and crosscut the three laminated drawer fronts (E) to finished size (2×10¾").

Note: Because the drawers are identical in size, we constructed all three at the same time, making the cuts on all corresponding parts before changing our saw or router setup.
3 Using your table saw or router, cut a ⅛" rabbet ⅛" deep on both ends of the drawer fronts (E). Then, cut a ⅛"-thick ⅛"-deep rabbet on the top edge of each. And, finally, use a router table with a ¼" round-over bit to shape all the outside edges of the fronts.
4 Cut the drawer sides (F), backs (G), and bottoms (H) to size. Cut a ⅜" groove ⅜" deep and ⅜" up from the bottom edge of the fronts (E) and sides (F). Also cut a ⅛" dado ⅛" deep, ⅛" from the back of the drawer sides (F), as shown in the Exploded-View Drawing.
5 Dry-fit the drawer assemblies (E-F-G-H) to ensure a good fit, then glue and clamp them together, checking for square.

TIME TO FINISH AND ADMIRE
1 Fit the drawers into the case, sanding if necessary for a good fit. Finish-sand the case and drawers.
2 Apply two coats of clear lacquer sanding sealer followed by two coats of gloss lacquer. Don't forget to finish the inside of the box to minimize warpage. [Tip: After the last coat of lacquer had thoroughly dried on our jewelry case, we coated the bottom edge of the drawer sides (F) with paraffin wax to ensure smooth gliding.]
3 Cut the drawer liner fabric and cork foot pads to size and attach them with double-faced tape or spray-on adhesive. Felt would also work fine for the foot pads.

Project Design: James Downing
Photograph: Hopkins Associates
Illustrations: Kim Downing, Randall Foshee
A DIFFERENT STRIPE

Bill of Materials

<table>
<thead>
<tr>
<th>Part</th>
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<td>H</td>
<td>1/4&quot;</td>
<td>7&quot;</td>
<td>9/4&quot;</td>
</tr>
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</table>

*Some parts are cut larger initially, then trimmed to finished size. Please read the instructions before cutting.

Supplies: velour fabric, double-faced tape or spray-on adhesive, cork or felt, lacquer sanding sealer, clear gloss lacquer finish

BUYING GUIDE
The moment of truth in any refinishing project comes near the beginning, when you lift off the old finish and get your first good look at the bare wood underneath. Look at what we found here!
What's the best way to give the heave-ho to a tired old finish? The answer almost always is with a chemical that interacts with the finish's vehicle, be it the resins in shellac, lacquer, or varnish, or the linseed oil in many paints. Once the vehicle liquifies, you then gently lift it off with steel wool, a putty knife, scraper, or, in some cases, with a stream of water from a hose.

The key to success in any furniture stripping project lies with the chemical you choose to do the job, and in applying it properly. Safety is a big factor, too—you’re working with toxic substances that can irritate the skin, eyes, and lungs (particularly methylene chloride). Many of the products are highly flammable as well.

Commercial paint and varnish removers will soften just about any finish, but before you rush out to buy a gallon or two, take a few minutes to analyze just what you’re dealing with.

First, what exactly is the old finish? Paint is obvious, but you may need to give clear finishes a couple of simple tests. Dab an area with denatured alcohol. If the finish liquefies, it’s shellac (you’ll know immediately). If it gets soft but doesn’t dissolve, it’s most likely a mixture of shellac and lacquer.

Now test with lacquer thinner; if it liquefies, the finish is lacquer. To strip shellac and lacquer, you don’t need a commercial remover. Instead, just use the appropriate solvent, mixing alcohol and lacquer thinner 50–50 to dissolve a combination shellac/lacquer finish.

If the piece is more than 150 years old and has been painted, you might want to try a third test, this time with ammonia. If ammonia liquefies the finish, it’s milk paint, and only ammonia will take it off. Think long and hard, however, about whether you want to remove milk paint. Much of the value of older painted furniture depends on its having the original finish. What’s more, ammonia is a dangerous, highly toxic chemical to be working.

**CHOOSE YOUR WEAPONS AND PREPARE FOR BATTLE!**

Once you’ve ruled out shellac, lacquer, and milk paint, you can stop testing. Regardless of what the finish might be—varnish, polyurethane, or whatever—you’re going to have to invest in a commercial paint and varnish remover.

The chart, below, compares the major types of strippers (liquid, semipaste, heavy paste, and water rinse), as well as denatured alcohol and lacquer thinner.

Stripping formulas vary according to the maker and to the jobs they do best. Methylene chloride is the highly toxic substance in most strippers that eats away the old finish. It evaporates rapidly, so strippers also contain waxy additives to slow evaporation. The amount of these additives determines how effective—and also how costly—a stripper will be. In general, the harder the finish and the more layers underneath, the more potent the stripper required and the more likely that you’ll need several applications.

Major manufacturers often offer several, if not all, of the strippers, so if you’re not having much luck with, say, a semipaste, step up to a heavy-paste remover from the same manufacturer. Don’t mix brands, though; some formulations can neutralize others.

Water-rinse strippers are a good all-around choice. They have lots to recommend themselves, with a few drawbacks. Instead of only being able to scrape off the softened finish, you may be able to wash it away with a wet sponge, brush, or steel wool, or, better yet, hose it off.

Water-rinse strippers are very effective, easy to use, and nonflammable. Because you’re literally floating away the finish, you run almost no risk of gouging the wood. The only trouble is, you really have to flood the surface, and water can stain some woods and peel off veneers. If you decide to use a water-rinse stripper, be sure to thoroughly dry the wood with a soft towel afterward and let the piece air dry for several days.

<table>
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<th>TYPE</th>
<th>USE ON</th>
<th>SAFETY</th>
<th>HOW TO APPLY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Liquid stripper</td>
<td>Works best on large horizontal surfaces such as tabletops.</td>
<td>Toxic and flammable</td>
<td>Pat on with a brush, let stand for about 15 minutes, and lift off sludge with a putty knife. Liquid stripper evaporates rapidly.</td>
</tr>
<tr>
<td>Semipaste stripper</td>
<td>Removes most paints and varnishes, but not effective on polyurethane or epoxy-based finishes.</td>
<td>Some are nontoxic and nonflammable.</td>
<td>Pat on with a brush, let stand, lift off.</td>
</tr>
<tr>
<td>Heavy-paste stripper</td>
<td>Effective with many layers of paint, varnish, epoxy, polyurethane, and marine finishes.</td>
<td>Toxic but nonflammable.</td>
<td>Pat on, let stand, lift off.</td>
</tr>
<tr>
<td>Water-rinse stripper</td>
<td>Removes just about any finish, but don’t use on veneers or inlays.</td>
<td>Nontoxic and nonflammable.</td>
<td>Brush on, let stand, then wash off with a hose or sponge. Dry off as quickly as possible.</td>
</tr>
<tr>
<td>Denatured alcohol</td>
<td>Shellac. Alcohol can also remove shellac sealers under other finishes, such as varnish.</td>
<td>Toxic and flammable</td>
<td>Brush on, then rub off immediately with steel wool. Work quickly, in small sections at a time; alcohol evaporates quickly.</td>
</tr>
<tr>
<td>Lacquer thinner</td>
<td>Lacquer. Mixed 50–50 with alcohol, thinner will remove combination shellac and lacquer finishes.</td>
<td>Toxic and flammable</td>
<td>As with alcohol, brush on and rub off with steel wool, doing small sections at a time.</td>
</tr>
</tbody>
</table>

Continued
STEP BY STEP: BRUSH IT ON, WIPE IT OFF, AND CLEAN 'ER UP

Believe it or not, furniture stripping can be fun, albeit messy, as we discovered when we unmasked the beautiful Honduras mahogany occasional table pictured here and on page 72. The whole process took just a couple hours in our shop, start to finish (see photos, opposite page). Chemicals strong enough to dissolve layers of old paint and varnish are toxic, and most are flammable as well, so be careful and protect yourself (see tips, opposite page). Methylene chloride fumes pose the biggest health hazard in many strippers: At this writing, several federal agencies are weighing the possibility of restricting its use.

Set up in an open, well-ventilated place, such as a garage, driveway, or patio, but avoid direct sunlight. Heat can quickly dry out stripping agents and impede their effectiveness. If you must work in a basement or other location where ventilation is not especially good, place a fan near floor level. Fumes, which can be highly explosive, tend to settle.

Protect the floor by first spreading out a plastic drop cloth, then laying several thicknesses of newspapers on top. Remove layers of paper periodically as they become saturated with stripper sludge. Cat-box filler, sawdust, and/or wood shavings spread over the papers will help absorb sludge.

Before applying stripper, remove all hardware, handles, knobs, and latches. Drop them in a can partially filled with stripper, and cap it. You needn't totally cover the hardware; the fumes will soften the finish. When you have your piece stripped, grime will wash away.

Now, pour a small quantity of stripper into a metal—not plastic or glass—container. Use old or cheap synthetic brushes and plan to throw them away at the end of the day.

(See photo.) Brush on a generous amount of stripper in one direction only, and don't go back over an area unless the stripper appears to be drying out immediately. Apply stripper to top surfaces unless you want to test a small, less visible area first. You may want to remove the top entirely in order to treat both sides of the piece—an important precaution if you want to avoid warpage that can occur if only one side is treated.

Remove sludge from rounded and turned surfaces with medium-fine steel wool, not a scraper; scraping could flatten the wood.

To clean out the crevices in turnings, loop a piece of heavy string or thin hemp rope around them and pull it back and forth shoe shine fashion. For slight tapers, make a thick rope of steel wool and use it the same way.

Use a toothpick to clean out tight corners, beads, and joints. Carvings are especially tricky, because finish tends to build up in them and because you don't want to damage these important decorative elements.

You can also use a toothbrush in tight spots. A word to the wise: With delicate carvings (this piece had none), don't use metal tools that could gouge the wood.

After you've removed all the sludge, scrub the stripped piece with sawdust, then a sponge, rag, or with fine steel wool soaked in water or the solvent recommended by the stripper's maker. Lacquer thinner is the most common. This washdown not only removes any remaining finish, it also neutralizes and flushes away stripper chemicals. If you find clear streaks that seem embedded in the grain, the wood was probably sealed with shellac, which can be removed by rubbing with steel wool dabbed in denatured alcohol.

Our final step with any project is a washdown with a household cleaner solution like Spic 'n Span or Soilax. Rinse several times, changing water if necessary to avoid discoloring the piece (notice how dark the newly lifted stain appears in our final photo).
TIPS ON WORKING SAFELY WITH STRIPPERS

Once you've seen what a chemical stripper can do to paint or varnish, you'll want to keep it away from your skin. Wear old clothes, long sleeves, and rubber gloves, and protect your eyes with safety goggles. Fumes from strippers can irritate eyes; cause headaches; and, after prolonged exposure, damage throat and lung membranes. Always work in a well-ventilated place and take a fresh-air break every 10 minutes or so. Also keep these pointers in mind:

- Never smoke in a space where stripper is being used, and avoid any areas near an open flame, such as a furnace pilot light.
- Don't drink beverages containing alcohol before or while using a stripper. Not only can alcohol affect your judgment, it may make you more sensitive to fumes.
- Keep children and pets completely out of the area.
- If stripper accidentally splashes onto your skin, wash it off immediately with cool, clear water.
- Don't save old brushes or partially filled jars or coffee cans of stripper. Seal the manufacturer's can (virtually all have childproof caps) and store it in a cool, safe place.
- Dispose of sludge-covered newspapers and other stripping residue as soon as you're finished with a job. Bag them in a plastic garbage bag, seal it well and keep it away from heat (poke a few holes in the bag for ventilation). Spontaneous combustion can result if trash containing stripper lies around very long.
- Read your product's instructions carefully. Not all strippers work alike.
You did it again! We asked you to share your projects with us, and you sent us an array of top-notch woodworking.

Here's just a sampling from the many talented readers across the nation who sent us their project photographs. See how a few of your fellow woodworkers occupy themselves—from an Alaskan carver's sculpted decoy to a Minnesota cabinetmaker's Honduras mahogany display case.

AN INSPIRING WORK
William E. Henderson, 39
Fl. Shawnee, Ohio
Cooperative extension 4-H agent

Undoubtedly, it was his craftsmanship that finally persuaded a local church to have Bill build its altar. But the initial contact with the congregation came through 4-H. The minister's son is a 4-H member. Should it be any surprise that a former 4-H member designed the intricate inlaid wood panels on the altar's front?

Instead of simply inlaying the wood on the front panels, Bill created a "3-D feeling." The cross and the dove, for instance, are ½" thicker than the surrounding woods to create a relief surface. After some trial and error, Bill crosscut the walnut on the trees for a leafy look. Variety in grain and color came from crotch-cut walnut, cherry, curly maple, and hard maple, used with the primary walnut.

The altar is finished in tung oil topped with paste wax. Bill, you're an inspiration!

A BIT OF OPTICAL ILLUSION
Steven Hodgson, 32
Northfield, Minn.
Cabinetmaker

Steven took on this elegantly lined display case of lacquer-finished Honduras mahogany for an optical company. The bottom shelf, a mirror, reflects the image of the eyeglass frames displayed on the glass shelves above. You might say that the result is a bit of optical illusion.

The base, which has doors for access to a storage area, was made using frame-and-panel construction. The mahogany stiles cut from one piece are mortise-and-tenoned to the rails. Steven dadoed the stiles so the glass panels could slide into place from above. One stile hides a wire to the light fixture in the top.
AN ALLURING DECOY

Nate Silvola, 39
Homer, Alaska
Carver

Nate’s half-size decoy may not lure any feathered friends, but as sculpture, it catches our attention. In the two years he’s been carving, Nate has done a variety of wildfowl.

Redwood was Nate’s choice for this pintail drake. He discovered, however, that among redwood’s attributes lies a shortcoming: its brittleness. Preventing the head from breaking off was a problem. The solution was to insert a ¼” hardwood dowel through the body and into the head.

To keep feathers from breaking off, Nate makes them out of birch tongue depressors from a surgical supply dealer. Before carving and gluing them to the body, he moistens them in his mouth, or in coffee, then bends them to shape.

Nate paints his creations with acrylics, texturing first with a wood-burning tool.

COLLECTIBLES FROM A RARE COLLECTION

Frank M. Knox, 83
New York, N.Y.

Retired management consultant

Some folks collect things to sit around and look at. Not Frank Knox! He collects rare woods and transforms them into collectibles. Frank made the finial for this ornately turned, covered bowl from one of the world’s rarest woods, pink ivory. The stock came from what was originally a 5’-long, 10”-thick log he found 30 years ago. Frank says the stock “survived better than the five bandsaw blades I wore out cutting it!”

You won’t find run-of-the-mill wood in the rest of this turning either. The bowl itself is pernambuco, the stem and base is African blackwood, and the cover is bubinga.

Frank’s turning, which he does on a 1853 Holtzapffel ornamental lathe, will be featured in a forthcoming book. Look for it from Prentice-Hall Press, a division of Simon & Schuster.

To submit your projects . . .

Send a 35-mm color slide, with the project as the focal point and a simple background—no people. Include a capsule description—materials, special joinery, finish, and dimensions, for example. WOOD will pay $25 for published projects. Slides cannot be returned unless you enclose a self-addressed, stamped envelope.

Project Showcase
Better Homes & Gardens®
WOOD magazine
Locust at 17th
Des Moines, IA 50336
Time and Time

3 great clocks to build

Haven't built a clock before? It's never too late to start. Don't worry about the mechanical parts—you can order them from the sources listed in the Buying Guide. Choose from a cozy, old-time mantel clock, a just-for-fun wall clock, and a strikingly simple pendulum clock. Each requires different woods and techniques to build, so pick your favorite and head for the shop—time's a wastin'!
Again

See-Through Pendulum Clock

The choice just wasn't clear: Some of us liked the clock movement showing; others preferred the burled-veneer face. Either way, the laminated walnut veneer shell used in both clocks couldn't be more "striking." But beware—the clever veneer-bending form and the circle-cutting jig are almost as fun to build and use as the clocks themselves are!

Note: Build the exposed-movement clock the same as the burled-faced canister clock, with one exception: You'll need a second piece of acrylic positioned flush with the back edge of the laminated shell. This second piece forms a dust barrier for the exposed movement and supports the chime. The movement used with the burled-faced clock has no chime.

Laminating the Veneer

1. Build the bending form as shown in the Bending-Form Drawing and to the dimensions listed in the Bill of Materials. Glue the form body (A) together, and screw (don't glue) the base (D) to the form body for removal later. Mark a centerline at the top of the completed form as shown in the drawing.

2. Rip and crosscut 12 pieces of veneer (F) to 4" wide by 32" long. Mark a centerline 16" from either end on the top of the best piece for the top layer.

3. To ensure successful gluing later, place the pieces on the form without glue, and check that the veneers fit snugly between the form and the dowel mounted in the bending levers.

Depending on the precise thickness of your veneer (it varies), you may need to add or subtract a piece of veneer for a tight fit. By placing the piece with the marked centerline on top and aligning it with the top center of the form, the veneer should sit centered on the form, not

Continued
TIME AND TIME AGAIN

quite reaching the base (D) on either side. Note the gap between the ends and the base for reference later when laminating.

4 Cover the form with waxed paper, and have sliding-head clamps at the ready. Mix the epoxy and apply it to one side of each piece of veneer except the top piece. (We placed the epoxy in a paint tray. We then used a disposable 3” roller for applying the epoxy and wore disposable gloves.)

5 Center the veneer stack on the form, leaving the predetermined gap between the base and the ends of the veneer. Position and clamp one of the clamp blocks (E) and waxed paper to the form, sandwiching the veneer in between. (When clamping the veneer, we tried to keep the veneer edges as flush as possible.)

Install the dowels (B) in the bending lever and form. Starting on the same side as the clamped block (E), pull the veneer over the top radius of the form as shown in the photo, below. The bending levers and dowel will squeeze out excess epoxy and trapped air. Clamp the other clamp block and waxed paper to the form.

6 Let the veneer lamination dry on the form overnight, then remove the clamps and waxed paper. Remove the lamination from the form, then unscrew the form body (A) from the base (D).

7 Lay the form body (A) horizontally flat on a work surface, and clamp the lamination back onto the form, with one edge of the lamination about ½” above the form. Now clamp the whole works onto a Pendulum clock continued on page 90.
Art Deco mantel clock

Just about everyone who's passed this clock in our offices has paused to admire it. Yet, it's almost embarrassingly fast and easy to make. We won't tell if you don't.

BUILDING THE CLOCK BODY
1. Lay out and mark the oak front (A) and walnut back (B) as shown in the Half-View Grid. Also cut the base (C) to the size indicated in the Bill of Materials.
2. Cut pieces A and B to shape with a band saw or jigsaw. Using a hole saw, bore a 3/16" hole through A (you could also drill a hole large enough for your jigsaw blade, and cut a 3/16" hole). Drill a 3/8" hole in B for the clock shaft.
3. Rout the front edges of A and B and the top edges of C with a 90° round-over bit. Drill and countersink two 3/8" pilot holes through the base where dimensioned in the Exploded-View Drawing.
4. Position the clock movement on the back side of the walnut back (B) with the clock shaft in the 3/8" hole. Trace the outline of the clock on the back of B. Using a large diameter flat-bottomed bit, drill 9/16" deep holes to form a recess slightly larger than the drawn outline to house the clock movement. Check the fit of the clock in the recess, and make sure that enough of the threaded shaft protrudes through B to fasten the shaft nut to.

MAKING THE HANDS
1. Resaw scrap oak stock to 7/16" thickness. (We cut enough thin stock for a few extra hands. It's a lucky thing we did because we broke one when drilling in a later step.) Stiff veneer stock will also work for the hands.
2. Using tracing paper and the full-sized patterns, trace the hands and hole positions onto the thin oak stock. Drill holes in both hands to fit the clock shaft.
3. Cut the hour hand (D) and minute hand (E) to length and sand to shape.

FINAL ASSEMBLY
1. Finish-sand all clock parts, using extra care when sanding the hands.
2. Glue, clamp, and screw the back (B) to the base (C), then glue and clamp the front (A) to the base and back. Remove the excess glue.
3. Remove the clamps and do any touch-up sanding necessary. Finish the clock body and hands as desired (we sprayed on several coats of lacquer).
4. Install the clock movement, and carefully attach the hands.

BILL OF MATERIALS

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<tr>
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Supplies: #8x1 1/2" flathead wood screws

BUYING GUIDE

Project Design: Ralph Peterman
Photograph: Hopkins Associates
Illustrations: Kim Downing; Bill Zaun

WOOD MAGAZINE FEBRUARY 1986
Prize catch

Angelfish Clock

The things you can do with wood! By laminating curly maple with the edge grain up, we achieved a luminous look similar to that of a real fish.

LAMINATING THE CLOCK
1. Using ¾" curly maple, crosscut one 8"-wide piece 18" long. Then rip seven pieces ¾" wide from it. Now crosscut the 18" pieces in half. You should now have 14 pieces measuring ¾" x ¾" x 9".
2. With the edge grain up, glue and clamp the pieces to form a rectangular lamina measuring 9" x 10¾". Keep the surface of the lamina as flush as possible when clamping. After the glue dries, scrape off the excess, and belt-sand both sides smooth.
3. Using the dimensions shown in the Front View Drawing, lay out and mark the shape of the fish on the maple lamina. The lamina is extra large so you'll have excess on all edges.
4. To mark the position of the hour marks, use a compass to draw a circle with a ¾" radius from the centerpoint. Bisect the centerpoint at 90° with two lines, one vertical and one horizontal, to mark 3, 6, 9, and 12 o'clock. Using a compass with the lead 1¾" from the compass point, mark the points on the drawn circle to locate the position of the other hours. Now mark the location of the fish's eye.
5. Drill ⅜" holes ⅜" deep for the hour marks. Then, drill a ⅛" hole through the center of the 4" radius to accommodate the shaft of the clock movement. Switching bits again, bore a 1½" hole ¾" deep for the fish's eye.
6. Use a plug cutter to cut a 1"-diameter walnut plug ⅛" thick for the fish's eye. Using a ⅛" plug cutter, cut 11 maple plugs ⅛" thick for the hour marks. If you don't have plug cutters, substitute dowel stock (remember though, the dowel stock will show end grain and a plug will show surface grain).
7. Glue the walnut eye and maple hour marks in place. Sand the walnut and maple plugs flush.
8. Position the clock movement on the back of the lamina with the shaft inserted into the hole. Trace the outline of the clock onto the back of the lamina. Using a 1½" flat-bottomed bit (we used a Forstner) bore several holes ⅜" deep to form the recess to house the clock.
   Bore the recess slightly larger than the outline drawn. Clean out the corners and rough edges with a chisel and mallet. (You could also use a router, template, and straight bit to form the recess.) Check the fit of the clock in the recess and the shaft through the hole.

FORMING THE SHAPE
1. Using the guidelines shown on the Front View Drawing, mark and drill ⅜" holes at the intersection of the body and tail. These two holes create a smooth ⅜" inside radius.
2. Using the lines previously drawn, cut the fish to shape. Then sand the tips of the tail to shape. (We taped sandpaper to a small-diameter dowel and mounted this in a hand drill to sand the small radii where the tail meets the body.)
3. Fit your router with a ⅝" round-over bit, and rout the top edge, except the fish's mouth.

FINAL ASSEMBLY
1. Finish-sand the clock. If you notice small gaps around the hour marks, inject a small amount of glue into the crack and wipe off the excess with a wet finger. Pack the glue-filled crack with fine maple sawdust with your finger (dry this time), and then continue to sand. The dust will fill the crack and make it nearly invisible.
2. Apply the finish. (We used two coats of gloss lacquer to highlight the curly grain of the maple.)
3. Attach a saw-toothed hanger, the clock movement, and the hands. Hang the clock, and show off the one that didn't get away.

BUYING GUIDE
*QC09 quartz clock. 2¼" square, short shaft, $5.80. Precision Movements, P.O. Box 689, 2024 Chestnut St., Emmaus, PA 18049. Or call 215-967-3156.

Project Design: James Downing
Photograph: Hopkins Associates
Illustrations: Kim Downing; Bill Zau

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Continued from page 45

BUILDING THE DISK-SANDER TABLE
1 Cut the sanding table's end (T), sides (U), and bottom (V) to size as listed in the Bill of Materials and as shown in the Disk-Sander Table Drawing. (Part T is dimensioned in the Table-End Drawing.) Bevel the top and bottom edges of the sides at 12° when cutting to size. Do the same to the edges of the bottom (V) that meet the sides.
2 Cut a hole through one of the sides for the vacuum-hose adapter.
3 Attach an 8" sanding disk to the shaft so it clears part D. Notch both of the table's sides (U) for clearance against the sanding disk.
4 Glue and screw the end (T) to the bottom (V). Glue and screw the sides to the table's end and bottom.
5 Mount the table-base assembly (T-U-V) on the cabinet, check for clearance, and drill two ½" holes through the table's bottom and just far enough into the outboard shelf (E) to mark their position. Change to a ¾" bit and drill through the outboard shelf. Insert a ¾" T-nut into each of the ½" holes in V. Attach the table-base assembly to the cabinet using machine screws.
6 Cut the top (W) to size; lay out and cut 1/8" radii on all four corners.
7 Temporarily position the top (W) on the table-base assembly. Mark where the sanding disk and shaft will need clearance. Cut the clearance notch slightly oversized, and fit it against the sanding disk and shaft to make sure there is no point of contact between the two.
8 Cut the laminate top and balance sheet slightly larger than the top. Apply the balance sheet to the bottom of the top with contact cement. Using a flush-cutting router bit, trim the excess balance sheet flush with the outside edges of W. Glue and screw the top (W) to the base (T-U-V). Apply the plastic laminate to the top of W and trim flush.
9 Use your miter gauge to mark the size and location of the groove on the top of W. Allow at least 1/8" clearance between the edge of the miter gauge and the edge of the sanding disk.

Using a dado blade, cut the groove to size and test-fit the miter gauge. Mount the vacuum-hose adapter.

SANDING AND PAINTING
1 Finish-sand all surfaces. Mask off the laminate and magnetic catch hardware, electric cords, and switch. Remove the pulleys, motor, jackshaft, and mandrel.
2 Apply a coat of primer followed by two coats of gloss enamel to the entire assembly.
3 Reassemble all mechanical parts. (The belts must go on before you fasten the jackshaft and mandrel.)

USING THE MULTI-MACHINE
See the Speed Chart, right, for the correct speed and belt placement for the various workshop uses listed. Photocopy the chart and tape it to the door. To switch from low to high speed, raise the motor with one hand and move the belt from the 10" pulley to the 2" pulley on the jackshaft. Slide the motor on the pipe to align the pulley with the 2" pulley on the jackshaft.
To change speeds from the jack-
BUYING GUIDE

We obtained some of the mechanical parts for this project from Dayton, a wholesaler whose supplier is W. W. Grainger. If you have trouble locating Grainger parts, look in the yellow pages under "electric motors" for the Dayton dealer in your area. They'll inform you of local retailers. Grainger prices are not quoted here as they vary among retailers. Some parts are available from two sources, in which case we have given both companies' stock numbers and addresses.

- **Mandrel assembly.** ¾"x12"; ¼"-20 R.H. and L.H. thread; comes with shaft, bearings, pulleys, collars, flanges, and nuts; stock no. H0741. \$16.95. Craftsman Wood Service, 1735 W. Cortland Clt., Addison, IL 60101, 312-629-3100. (We recommend using the heavier pillow-block bearings described below.)

- **Ball-bearing pillow block (2).** Used on jacksquilt. Rigid-mount VPLE-210; ¾" bore, self-aligning. Grainger stock no. 5X682. Craftsman stock no. H0738. \$19.95 each. (Address above.)

- **Motor.** 1 hp.; 1725 r.p.m.; capacitor start; volts 115/230; ball-bearing; manual reset; stock no. GT112.15C. \$134.99 from Sears.

- **Four-step pulleys (2).** For type "A" ¾" V-belts. ¾" bore; stock no. GT27922. \$65.99 from Sears. Grainger stock no. 4X560.

- **2" pulleys (2).** 2" outside diam.; ¾" bore; stock no. GT28012. \$1.69 from Sears. Grainger stock no. 3X896.

- **10" pulley.** 10" outside diam.; ¾" bore; Grainger stock no. 3X935.

- **Power-tool switch.** Pull on/push off; stock no. GT13632. \$21.99 from Sears. (Order by phoning your local Sears store.)

- **Vacuum-hose adapter.** 2¾" interior diam.; 2½" exterior diam.; stock no. AE0130. \$3.50 from Shopsmith Inc., 6640 Poe Ave., Dayton, OH 45414, 800-543-7586 (in Ohio, 800-762-7555).

Produced by Marlen Kemmet
Project Design: James Downing
Photographs: Hopkins Associates
Illustrations: Randall Foshee, Bill Zaun

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WOOD MAGAZINE FEBRUARY 1986
BRISTLECONE
the Methuselah
of the pines

Very little vegetation thrives at
elevations above 8,000 feet.
But the bristlecone pine, *Pinus aristata*,
lives thousands of years in the
mountains of California,
Nevada, Utah, Colorado, New Mex-
ico, and Arizona.

Among these oldest of the
world's living trees is a California
specimen that actually is named
"Methuselah," for the biblical patri-
arch said to have lived 909 years.
This tree has lived over 4,500
years, and still grows!

What secret does the bristlecone
pine possess that enables it to thrive
on the mountainous habitat it calls
home? Gnarled by winds and stunt-
ed by the arid ground, these pines
manage to survive by, of all things,
learning to die slowly.

As bristlecones become old, they
concentrate their vigor on a few
branches, and thus prolong life.
Even when completely dead, they
resist decay and stand thousands of
years more.

The wood of bristlecone pine
yields firewood, fence posts, and
mine shaft timbers for local use
only. To archaeologists, though, its
wood has provided a landmark reve-
lation. By correlating the annual
growth rings on both live and dead
wood, they have been able to trace
back weather patterns, volcanic
reactions, fires, and other natural
occurrences for 9,000 years.

Most importantly, traces of the
radioactive isotope, Carbon 14,
found in the dead wood of bristle-
cone pine at one location, exactly
matched the carbon content of an
ancient beam in the Mesa Verde
cliff dwellings. This discovery
allowed archaeologists to correctly
date this civilization, and spawned a
new research technique.

While the biblical Methuselah
contributed only to legend, the bri-
stlecone pine provides mankind with
accurate records of the conditions in
which it grows..., then and now. ♦

Illustration: Jim Stevenson
is to ensure that the edging sits \( \frac{3}{8}'' \) above the top of the aprons and legs, avoiding friction when you open and close the tabletop.

2 Cut the aluminum runners (M) to length. Sand or file the corners at a slight radius to remove burrs from cutting and to further ensure a smooth slide. Drill and countersink holes through the runners for \#8 x 1\(\frac{1}{4}''\) screws to attach the runners to the cleats (L).

3 Insert the aluminum runners into the \( \frac{3}{8}'' \) groove in E, and measure the distance between the bottom of the tabletop and the top of the runners for the correct thickness of the spacer. Ours measured \( \frac{3}{8}'' \) (see the Section-View Drawing for help with this). Cut the cleats to size.

4 Align the cleats (L) alongside the slide rails (E) and secure them to the bottom of the tabletop with \#8 x 1\(\frac{1}{4}''\) screws. Now, fasten the runners (M) to the spacers. Take your time aligning and fastening these parts; the outcome will determine how easily your tabletop will open and close.

5 Center and fasten the stop pads (N) to the inside edge of each end apron. Measure in 8'' from the inside or closing edge of each half of the tabletop and fasten the stop blocks (O) to the bottom of the tabletop halves.

6 Using a helper, turn the table right-side up. Lay out and mark the position of three table pins in one of the tabletop halves. Using a doweling jig to ensure that the holes are drilled straight, drill \( \frac{3}{8}'' \) holes \( \frac{1}{8}'' \) deep. Insert dowel centers and bring the halves together with the edges aligned.

Drill corresponding holes in the other tabletop half, and insert (but don’t glue) the pins to check for a proper fit with the halves closed. If the pins align properly, remove them and use the same procedure to mark and drill the leaves. Once all the holes are drilled, glue the pins in position.

7 Remove the stop pads (N) from the bottom of the tabletop. Slide the tabletop sections off the base.

(The table is easier to finish with the top off.)

**FINISHING AND FINAL ASSEMBLY**

1 Finish-sand the entire base assembly and round any sharp edges on the legs. Finish-sand the tabletop halve and leaves.

2 Mask the aluminum slides to prevent getting any finish on them. Stain, if desired, and finish the base, tabletop halves, and leaves. Be sure to finish both the bottom and top of the tabletop halves and leaves. (We left the oak natural and finished it with several coats polyurethane.)

3 Wipe on a bit of paraffin wax to the aluminum stock (M) and into the groove in the rail. The paraffin wax will lubricate the moving parts, helping to reduce friction and ensure smooth-sliding parts.

4 Reattach the top to the base and reinstall the stop pads (N). Using two people, turn the table upside down, being careful not to scratch the finish. Refasten the plywood panel (F) to the bottom of the table and stand the table on its feet.

**Buying Guide**

- **Table pins.** Turned hardwood pins, \( \frac{3}{8}'' \times 1\frac{1}{4}'' \). Stock no. TP100, 45 cents for 10. Constantine, 2050 Eastchester Rd., Bronx, NY 10461 (or call toll-free to order, 800-223-8087).

- **\( \frac{3}{8}'' \) point cutting ogee bit.** Stock no. 9GT25583. $7.49 from Sears. To order, phone your local Sears store.

- **Aluminum stock.** \( \frac{3}{8}'' \times 1\times 96'' \) rectangular stock. Macklanburg-Duncan stock no. 0741-3123. $7.98 ea. You can purchase M-D parts at or through Ace Hardware Stores, True Value Hardware Stores, Payless Cashways Home Centers, and other dealers.

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OFF WITH THE OLD

NONCHEMICAL WAYS TO REMOVE PAINT AND VARNISH

Usually, commercial paint and varnish removers offer the best way to strip furniture, but there are a couple of other methods for getting rid of an old finish, and occasionally they make better sense.

Scrapping. Artisans who restore pieces for museums often prefer to shave off old finishes with cabinet scrapers, rather than risk subjecting valuable furniture to chemicals and lifting out the original stain, filler, or sealer. Also, some strippers break down old glues, causing joints to weaken. Obviously this process requires highly skilled hands and a lot of patience.

There is, however, one instance when you might want to consider scraping—with an old, badly cracked, flaking, dried out finish. When you can already see a lot of bare wood, especially on pieces such as outdoor furniture that have been exposed to the elements, stripper won't do a very good job because most of the vehicle, which stripper is formulated to liquefy, has already worn off. Fortunately, without a vehicle, the pigment has only a very weak grip on the wood, making it fairly easy to scrape away.

To scrape off a finish, use a cabinet scraper or a pull scraper, working always in one direction with the grain and held at a low angle. Keep a burr on the edge and rub in one direction toward you. You are in essence shaving off the finish, but you don't want to cut the wood underneath.

Melting. Heat from a propane torch or an electric paint remover offers another, although risky, way to strip away an old finish. With a torch, you use a spreader tip and play the flame over the finish until it begins to buckle and lift, then scrape it off. With an electric paint remover, you hold it close to the surface until the finish softens, then you scrape.

Torching can easily scorched wood, or even set it on fire. Electric paint
removers work only on large flat or gently curved surfaces. Both are more appropriate for large expanses of woodwork, siding, or paneling than they are for furniture.

MANUFACTURER LISTING

Here’s a list of some leading manufacturers of remover products. These companies provide information to consumers who write (free of charge, unless otherwise noted):

- W.M. Barr & Co. (Klean-Strip Removers), P.O. Box 1879, Memphis, TN 38101
- H. Behlen & Bro. (Fire-Fly Remover), Route 30 N., Amsterdam, NY 12010
- Bix Mfg. Co. (Quick Strip, Bix Stripper, Tuff-Job), P.O. Box 391, Old Hickory, TN 37138. Tell free number for technical advice: 800-251-1098.
- Chemical Products Co. (Kwik Removers), P.O. Box 400, Aberdeen, MD 21001.
- Duffy Products Co. (Duffy’s Remover), 3209 1st Ave. SE, Cedar Rapids, IA 52402.
- DuMont Chemicals (Peel-Away stripper-impregnated fabric), 1502 Broadway, N.Y., NY 10036.
- Formby’s Inc. (Formby’s Paint Remover, Formby’s Refinisher), Consumer Services; 825 Cross- over Lane, Suite 240, Memphis, TN 38117.
- General Finishes (Dyna-Strip), P.O. Box 14363, Milwaukee, WI 53214.
- National Solvent Corp. (Nasco Remover), 955 W. Smith Rd., Medina, OH 44256.
- Red Devil Paint and Varnish Removers, 30 N. West St., Mt. Vernon, NY 10550.
- The Savogran Co. (Strypeze, Super Strip, and Kutzil), P.O. Box 130, Norwood, MA 02062. Endorse $1.
- Star Bronze (Zip-Strip), P.O. Box 2206, Alliance, OH 44601.
- UGL-ZAR Removers, P.O. Box 70, Scranton, PA 18501.

Written with James A. Hummel
Photos: Bill Kern Photography

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WOOD MAGAZINE FEBRUARY 1986
**SEE-THROUGH PENDULUM CLOCK**

Continued from page 80

work surface. Using the form body as a guide, scrape and sand the protruding edge flush with the form body.

8. Again, remove the lamination from the form body. Using a small combination square, mark a line ¾” away from the edge just scraped and sanded. Using a fine-toothed handsaw, cut on the outside of the line just drawn to form an edge parallel with one sanded and scraped.

9. Remount the lamination to the form, and sand the edge that you just cut.

10. To trim the ends of the veneer parallel with each other, rescrew the base (D) onto the body form (A). Position and clamp the lamination back onto the form. Position and clamp a 1½”-wide board at the base of the form. Using the 1½” board as a guide, cut one bottom end of the lamination. Redclamp the board to the other side and cut the other end of the lamination.


**MOUNTING THE ACRYLIC FACE AND CLOCK WORKS**

1. Cut a piece of ⅛” acrylic to 6 x 13”. Position the lamination over the acrylic and scribe the inner outline of the lamination onto it. Using a band saw, cut just outside the scribed line. Now, sand to the line until the acrylic fits snugly into the lamination.

2. To locate the shaft hole for the clock, measure down 3” and in 3” from either side of the acrylic. Drill holes to accommodate the clock shaft and winding key.

3. Position the acrylic ⅛” in from the front edge. (We used ¼” scrap blocks and clamped these to the lamination, then clamped the acrylic to the ¼” blocks.) Drill and countersink pilot holes through the lamination and into the center edge of acrylic where shown in the Exploded-View Drawing. Fasten the acrylic to the lamination with #4 x ⅛” screws. (We used brass
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SEE-THROUGH PENDULUM CLOCK
Continued from page 90

screws for a classy look, but be careful not to over-tighten and break the screw head off. Brass is soft! Remove the clamps.

4 Remove the screws and acrylic, and finish the veneer as desired. (We first filled the walnut, applied two coats of sanding sealer, and followed with two coats of gloss lacquer.)

5 Build the jig shown at left. Then cut the round veneer disk to shape as shown in the photo. (After several unsuccessful tries with a compass and an X-acto Knife, we came up with the jig shown for perfect circles every time. We used flexible Carpathian-elm burl for the disk. You can use regular veneer and glue it to the clock canister with contact cement, or easiest of all, use adhesive-backed veneer.)

6 Cut holes in the veneer disk to match those on front of the clock movement canister. Attach the

Continued
SEE-THROUGH PENDULUM CLOCK

Continued

veneer disk to the front of the clock. (We left the veneer disk unfinished; you may want to oil yours to make the swirled-grain pattern really stand out.)

7 Fasten the acrylic to the lamination. Use a clean rag and a bit of glass cleaner to wipe the acrylic clean. Mount the clock movement to the acrylic with the two threaded inserts (included with the clock), then attach the hands to the front of the clock. Read the directions for winding the clock and starting the pendulum.

BUYING GUIDE


- Jauch half-hour gong strike (used in the exposed-movement clock). 6¾" pendulum. Catalog no. 2250-524, $49. Spade-black hands. 110MM, catalog no. 2431-K20, $1.75. Craft Products Co., 2200 Dean St., St. Charles, IL 60174. To order, call 312-584-2711.

- Walnut “short cut” veneer. Walnut short cut veneers are 3" in length and 9" to 12" wide. Item no. 63, 40 cents per square foot. Artistry in Veneers, Inc., 450 Oak Tree Ave., South Plainfield, NJ 07080. To order, call 201-668-1430.

- Carpathian(elm) burl. Veneer has a thin, tough paper backing that adds strength while preserving its flexibility. 18 × 24", $17.50. Bob Morgan Woodworking Supplies, 1123 Bardstown Rd., Louisville, KY 40204.


Project Design: Jim Boelling
Photographs: Hopkins Associates
Illustrations: Kim Downing, Bill Zahn
How 'dead reckoning' keeps sailors and woodworkers true to course

It was my Navy division officer who opened my eyes to dead reckoning. We steamed out of port one day, and by the next, we were surrounded by sea. I asked him, "How the heck do we know where we are, let alone how to get where we're headed?"

The answer was simple. Our course had been charted from a given home port. Then our speed and direction were factored in to determine where we were and how we'd get to our destination. I've since found out that what applies to sailors applies to woodworkers, too.

What I mean is this: A project plan on paper is perfect. Nothing can go wrong with it. But as you build it, you can't assume everything is going according to plan. You have to stop and measure, or dead reckon.

Here's an example. You build a shelf system with a few upright supports dividing up the space. Following the plan, you cut full dadoes as indicated to hold the shelves. But, your shelf stock turns out to be shy of thickness. So, you end up having what I call a " rattling good" fit. Cutting those dadoes without checking the stock first put a knot in the rope that can't be untied at the end.

Look at the dead reckoning concept as a tool you use to overcome the variables in material, tools, and measurements that always seem to creep in a project.

Materials can throw you off
For one thing, count on solid stock to be a variable. It's processed to different tolerances. You can buy 1" stock at one place, and it will be $\frac{3}{64}$" thick. At another, it will often measure out to $\frac{4}{64}$".

Plywood, too, may vary from $\frac{1}{8}$" to $\frac{7}{64}$" off in thickness. By industry standards, that's OK, but your measurements will be off.

Make your cuts to suit the plus or minus factor of your materials, then measure from there, step to step, as you go. Remember, it's always better to measure twice and cut once.

Hardware also varies a great deal. You can't count on the same mounting clearance for drawer slides from two different manufacturers, for example. You have to buy all your hardware components before you begin a project.

Tools don't always tell the truth
Don't rely totally on the tilting-angle and depth-of-cut scales on most power tools. They're only indicators, like idiot lights in your car's dashboard. You must take the time to check all machine setups with an accurate square or folding rule before you use them.

After you've made the cut, dead reckon the stock that will join it. Maybe you can right a wrong on the next cut. Let's say you made a 44 $\frac{1}{4}$" miter cut. On the adjoining piece, cut the miter to 45 $\frac{7}{8}$" and they'll mate to a perfect 90°

Mistaken measurements add up
Mismeasuring isn't always your mistake. Measuring instruments could have been dropped and dented or become rusty.

Beware of the inch lines on a ruler or tape, too. They can be $\frac{1}{64}$" to $\frac{1}{32}$" wide. Make it a practice to always use the same part of the line—right edge, left edge, or center.

Finally, use the right measuring tool. Tapes hook over the end of a board. Folding rules measure up against or between two things. Double-check with the opposite tool. Always measure twice—it's part of dead reckoning.

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THE CABINETMAKER and the fallen walnut tree

It could have happened back then, in just this way:

During a winter storm in the late 1700s, a huge black walnut tree toppled, smashing a chicken house into kindling wood and nine Sunday dinners. The next day, the farmer invited the woodworkers from town to come out and look at his windfall, and to stay for supper as well. The carpenter came, but said that the low-branching, open-grown walnut would be too hard to hew for building timbers. The wheelwright came, but said that the convolutions in the grain would make weak stock for his wagons. The cooper came around, too. He never had any use for walnut, but he wasn’t one to pass up a free chicken dinner.

Earlier that year, though, a cabinetmaker had set up shop in the growing town. While others were in the kitchen gnawing the last of the bones, he remained outside, poring over the tangled mess of deep brown bark and emerald fronds.

He looked and thought. He felt the bark and figured in his head.

He walked inside and struck a deal. Everyone was happy now—except for the chickens who had provided the dinner.

Careful sawing for cabinet wood

The cabinetmaker’s men soon came for the tree and cut it into lengths exactly where he told them to. They hauled the logs back to his sawpit and spent the next three days sawing it into heavy planks. The cabinetmaker directed the lining out of every cut.

While he was away in the shop, the sawyers carelessly allowed the growing pile of slices to get out of order. There was much grumbling as he insisted that the planks be restacked just as they had been arranged in the tree. Hadn’t he made it hard enough already, insisting that they saw straight through the heavy knots and gnarly crotch grain? They were relieved when the job was done, and only slightly amused when the cabinetmaker told them to report back in seven years.

Working the stock—years later

In the spring of 1793, the sawyers went at the walnut again. This time the cabinetmaker had them use a smaller, thin-bladed frame saw, but directed their work with just as much care. They recut some of the planks into strips as thin as ¼"; others they left untouched. Now the sawdust, instead of being green, granular, and heavy, appeared brown and dusty, making them cough and sneeze. Their complaints were nothing, however, compared to those of the apprentice boy, who now had to plane the boards.

The apprentice had never seen anything like it. He had planed straight-grained pine for the cabinetmaker before, and had spent an extra twenty minutes sharpening his plane iron, but the wood tore out and the plane chattered and jumped as if it were a ball of spit on a red-hot stove. The cabinetmaker heard the accident and ran to stop him before the board was ruined. From his own tool chest (holy of holies!), he chose a plane with its iron set at a high-pitched angle, and for the next hour showed the boy how to follow and ride the flow of the grain as if he were running a canoe down a rocky rapids.

As the boy sweated at one bench, the cabinetmaker stood at another, trying different arrangements of the tan-brown stock. Deliberation soon gave way to delineation, and with folding rule, try square, and frequent reference to a large leather-bound book, he marked each piece before adding it to the stack on his bench.

The wood rejoined at last

The shop was now filled with the sound of sawing and pounding as

Continued on page 99

By Roy Underhill
Master housewright at Colonial Williamsburg and host of the popular PBS series The Woodwright’s Shop, Underhill is also an author and lecturer.

Fourth-generation master cabinetmaker Mack Headley works on a Chippendale desk like the one described in this article. The setting is the cabinet shop at Colonial Williamsburg.
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Continued from page 96

master and apprentice cut the dovetails to join the pieces together. Three broad walnut boards and one of pine stood ready. Hot hide glue oozed from the joints as they drove them together. The walnut formed the upright sides and top; pine, the bottom, and for the first time the object of all their labor was clear. It was to be a slant-topped Chippendale desk.

The stretchers to separate the drawers came next. Were this Philadelphia, the dovetails that joined the stretchers to the sides would have been covered with a separate facing, but in this small town in the mountains honest joinery showed.

Slowly the cabinetmaker filled the empty spaces in the frame. One by one, the drawers took shape. On the front of each, a faint arc showed where a bend of the old walnut tree was recorded in the grain of the wood. The desk top showed the biggest figure of all, an oval of concentric rings. The sides, when examined closely, had the look of a handful of long, soft feathers. The desk, all woodwork completed, had the dusty look of a ghost. But not for long.

This same walnut in Philadelphia might have awaited a coat of shellac, refined from the imported exudate of a million Asian beetles. This country cabinetmaker, though, scraped the dirt from a block of local beeswax, rubbed it hard into the wood and polished it with a cork until the magic took effect. The faint figures in the wood came to life as purple-chocolate rainbows, bursting medallions, and flames that seemed to burn forever in the depth of the wood.

Six weeks of work spread over seven years now stood completed before the cabinetmaker. The finished piece embodied decades of work, if you counted the years of his own training. Centuries, if you counted the age of the tree. And millennia, if you counted the tradition of the cabinetmaker and his forebears through the ages.
BUYING A POWER SAW?  
TABLE THAT MOTION

Q. What stationary power tool should I buy first for my home workshop—a table saw or a radial arm saw?

—Gil Leinn, Evanston, Ill.

A. Buy the best 10" table saw your budget allows, for a couple of reasons. First, a table saw is safer to use, since your workpiece will be between you and the blade. Second, a table saw is a better training ground for both accuracy of cuts and different techniques—from dadoing to resawing.

Don't economize by opting for a smaller table saw if you can help it. Most 10" table saws have work surfaces that are large enough to handle any project you'll tackle and you'll be able to make cuts in material up to 3/4" thick.

WHAT TO USE BETWEEN FINISH COATS

Q. The "experts" at the hardware store can't agree: What should I use between finish coats—#000 steel wool or 150- to 200-grit sandpaper?

—Peter W. Daniels, Jacksonville, Fla.

A. Here's a happy instance where everyone's right. We recommend that you use steel wool on circular, convex, and concave shapes—and sandpaper on flat surfaces where even the slightest imperfections might be noticeable. To prevent finger streaks from hand-sanding, back the sandpaper with a wood or rubber sanding block.

WHAT YOU DO TO ONE SIDE, DO TO THE OTHER

Q. Is it true in wood finishing that you should finish all sides?

—Robert Allen, Phoenix, Ariz.

A. Since all woods are a little unstable and will change with temperature and moisture variations, it's important to finish all sides equally—right down to the same number of finish coats. If you finish one side of a board only, the wood might warp on the unfinished side. The same rule applies to using strippers and fillers.

LUMBER SHOPPING: HOW TO BREAK THE SECRET CODE

Q. I've seen terms like 4/4 and 5/4, referring to wood dimensions in various projects. How do I know what size wood to use?

—John R. Wither, Williamsport, Pa.

A. You've probably noticed that we don't use those terms in WOOD—we think it's easier to relate to thicknesses stated as 1" (which corresponds to 4/4), 1 1/2" (5/4), and so forth. However, many hardwood lumber dealers do use these terms routinely.

The tricky part is knowing whether you're talking about rough or surfaced (also called "surfaced") lumber. When you go to the lumberyard, specify rough lumber if you'll be surfacing the boards yourself. Otherwise, ask for S2S boards (surfaced on both sides). The chart below, from the National Hardwood Lumber Association, indicates the difference between rough and surfaced dimensions.

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<th>STANDARD THICKNESSES OF SURFACED LUMBER</th>
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GO WITH THE FLOW WHEN JOINTING EDGES

Q. I have a problem with chipping out boards on my jointer. What am I doing wrong?

—Thomas X. Scott, Indianapolis, Ind.

A. The most common cause of rough edges is feeding against the grain of the wood. Before you start jointing or planing, follow the grain in the board to determine its direction—and then feed in the direction of the grain or the majority of the grain. If you must cut against the grain—or the grain changes halfway down the board—slow your feed rate to compensate for the extra load on the cutting head.

RIGHT

WRONG

GETTING UP TO SPEED

Q. Can you give me the recommended operating speeds for motors on stationary power tools—I'm buying new motors for used equipment.

—Jim Prachak, Plymouth, Wis.

A. Generally speaking, most stationary tools operate at two speeds: 3,450 r.p.m. for table saws, sanders, and jointer-planers—and 1,275 r.p.m. for drill presses, lathes, and band saws. If you're buying new motors, it's wise to spend $10-$20 more for units with ball bearings and built-in overload protection.

STANDARD THICKNESSES OF SURFACED LUMBER

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How to properly tighten handscrews

Handscrews—or parallel clamps—have several things going for them. First, unlike any other clamp, they can easily clamp parts that meet at odd angles. Second, they provide greater reach than most metal clamps. And if that weren't enough, they tend not to crawl or mar project surfaces when they’re tightened.

Handscrews are produced in a dozen sizes. Maximum jaw openings range from 2” to 17”, and reach (the distance from the front spindle to the jaw end) varies from 2” to 12”. The hard maple jaws and cold-drawn steel screws last a lifetime, and have outlived many a woodworker.

If you have never used a handscrew, figuring out how to properly tighten one can be perplexing. But like most everything else, it's not hard once you know how to do it.

Clamping parallel surfaces
Start by making sure the jaws run parallel to each other. The best way to do this is to start with the jaws closed. Also, always hold the clamp the same way—grasp the rear handle in your right hand and the front handle in your left. With the clamp in hand, extend your arms, and imagine that the clamp handles are pedals on a bicycle. To close the jaws, “pedal” forward, rotating your wrists to spin the handscrew around. To open the jaws, “pedal” backward.

When clamping an object, adjust the jaws until they are slightly wider than the item being clamped, then position the handscrew with the front spindle as close to the work as possible.

With the jaws parallel to each other, and just slightly wider than the object being clamped, close the front spindle until it is finger-tight on the object, as shown below.
Apply final pressure to the object being clamped by tightening the handle on the rear spindle as shown below. (The jaws of the handscrew must sit flush on the workpiece to distribute pressure evenly along the length of the jaws.) Closely eyeball the mating to check for continuous contact between the clamped project and the maple jaws. Light peeking through either near the jaw end or the front spindle indicates uneven pressure and may require adjustment or reclamping. It only takes a few practice clamping to get the "swing" of these versatile clamps.

Clamping projects at an angle
The goal remains the same when you clamp irregular objects: to bring as much of the jaw surface as possible in contact with the project being clamped.

Start by "pedaling backwards" to open the jaws. Turn either the front or rear handle to make the jaw ends come together or move apart at an angle. Adjust this angle to match the object being clamped (see photo at left). Place the clamp on the object and tighten either the front or rear spindle for continuous contact between both jaws and the clamped object. If "slippery" glue causes the pieces to slide, separate them and let the glue get a little more tacky before clamping.

Photographs: Larry Clayton
Illustration: Jim Stevenson

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Your ivory disappeared? How will you make all those carvings, inlay pieces, and scrimshaw items you promised? Never fear, friend, help is here.

Thanks to Woodcraft Supply Corporation of Woburn, Mass., for letting us know about an ivory substitute in the form of very large, hard, and plentiful tagua nuts. Perfect for scrimshaw, carving, inlay, and even small turnings, the nuts come from the ivory palm (Phytelephas macrocarpa) of South America. Natives there have carved these nuts for centuries.

About 3" long and 1½" thick, the nuts seem rock-hard. When sliced, their insides resemble ivory. The secret to carving them, we found out, is to soften them by soaking in water for a day or less. Then, they carve easily.

Eight nuts cost $9.95, postpaid, from Woodcraft Supply, 41 Atlantic Ave., Woburn, MA 01888 (how-to instructions included).

FREE HELP IN IDENTIFYING THAT MYSTERY WOOD
When you come across wood you want to identify, but can't, what do you do?

Try the U.S. government. Madison, Wis. hosts the vast facilities of the Forest Service's Forest Products Laboratory, and they can help. In addition to research into maintaining, utilizing, and preserving our wood resource, the Laboratory also identifies it, free of charge.

There's no guarantee that they'll be able to tell you more than the wood's genus (oak, for instance) without your notes on origin and age, so provide this information if you can. Send a sample about 1" x 3" x 6" in size for examination (be sure you can spare it, as the wood cannot be returned). For a free fact sheet describing this service, write: Wood Anatomy Research, USDA Forest Products Laboratory, 1 Gifford Pinchot Dr., Madison, WI 53705-2398.

AROUND THE NATION


ACC Craftfair, Feb. 28-March 2. Baltimore Convention Center, Baltimore, Md. 500 fine craft exhibitors selling.

Craftsmarket America, Feb. 28-March 2. Omni International Hotel, Baltimore, Md. 300 exhibitors selling fine crafts.


HARDWOOD LUMBER LEADER FRANK PAXTON, JR.

West to the Rockies, east to the Ohio, and south to the Gulf, Frank Paxton Lumber Company heads the list of hardwood suppliers to industry, cabinet shops, millwork houses, and school shop programs. Their "Beautiful Woods" retail stores offer hardwoods to home craftsmen.

At the helm of this 72-year-old firm based in Kansas City, Mo., is Frank Paxton, Jr., 67, who tells as many tales as there are woods.

Once, in the Bolivian mountains, Frank bought the only carload of lapacho wood that he believes ever entered the U.S. (Lapacho is an exotic hardwood resembling magnolia.) The entire shipment went for flooring in a Kansas City art museum. "I was lucky the architects loved it," he says, "there wasn't a demand for it anywhere else."

On his honeymoon, Frank traveled with his bride, Millie, to Africa. There they watched natives of the Cameros harvest zebrawood. "I had to take her to Paris on the way back," he relates.

A hardwood mogul he may be, but a woodworker he is not. Frank says his dad, who founded the company, made him take enough woodworking classes to last a lifetime. He loves wood, though, and marvels at what even amateur woodworkers make today. He's concerned that the skills taught in vocational education, which contribute to the present high quality in woodworking, may be abandoned by schools in the near future.

"It's important that academics be applied," Frank states. "Youngsters should learn to use their hands as well as their minds, and build something." ♠

Frank Paxton, Jr.
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- **MAX RPM's**: On a 10" diameter is 7000.

![Freud Sawblades](image)

**FU84M Hook angle 7° Carbide Used: C4**
- While this type of blade is a compromise of the following blades, it will give you the results you expect in your shop. No one blade will do it all, however this is the one that comes closest. Most woodworkers we know have one of them. They are practical and inexpensive.

**LU85M Hook angle 7° Carbide Used: C4**
- This is the world's best production made carbide sawblade. You can be sure of one thing that we are out to prove: You can spend as much as twice the price of our LU85M blade, but you will not find a better one! We guarantee it! The use of this blade should be limited to super fine finish work only. The primary and secondary bevels and the Teflon coating make this unique sawblade so very precise that the cut seems effortless in all kinds of materials.

**LM72M Hook angle 20° Carbide Used: C2**
- This blade is designed for fast ripping along the grain of the wood. Excellent finish is obtained when ripping. The advantage of using a C2 grade carbide is to allow us to use an aggressive 20° hook for fast ripping and yet go through occasional knots without fracturing the tips.

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