Working Highly Figured Wood

Mix hand-tool and machine methods for tearout-free surfaces

by Peter Tischler

Figured wood makes beautiful furniture but can be tough to work. *Peter Tischler's two-section ash chest with its vertical cabinet and holly inlay (left) has curly oak drawers, while his low cherry bureau with its black horizontal base (right) has flame birch drawers. In both pieces, Tischler relied on hand-tool and machine methods to surface the figured wood.*

Working difficult wood by hand*—With three favorite hand tools, the author smooths this plank of walnut. First he skews a #4½ smoothing plane (with paraffin-waxed sole) to flatten the board. Next he'll use the cabinet scraper at various angles to work the knot area. Last he'll smooth out tool marks with the scraper blade.*

Photos except where noted: Alec Waters

Cabinetmakers usually save woods with high figure and bold grain to showcase the prominent features of their work, such as tabletops, door panels or drawer fronts (see the top photo on the facing page). But until I became familiar with the underlying structure and reasons behind beautiful grain and figure, I had difficulties working the surfaces of such solid woods.

I've since built many furniture pieces using wood with pronounced grain and figure. Along the way, I developed some unusual methods to cope with these showy woods. I've found a combination of hand-tool and machine techniques can overcome tearout and make surfacing go more smoothly. I'll share these tips as well as what I've learned about what causes some common figures and grain patterns and offer suggestions for working them (see the story on p. 48).

Understanding grain and figure

Because descriptions can be ambiguous, it's helpful to first define a few terms that describe wood's characteristics. Consider grain as the cell arrangement and direction of the fibers in the wood. (For more on this, see *FWW* #95, p. 58.) Texture is the differences in cell size and density between early (spring) wood growth and late (summer) wood growth. Early and late wood account for contrasts in color, as shown in the chair seat photo on p. 46. Color differences can also occur as you move outward in a log. The heartwood (center) of a tree is usually darker than the sapwood nearer the bark. Figure is a little harder to define. It refers to the patterns that appear on the radial and tangential faces of a board. Figure actually has to do with the light-reflecting properties of the wood. A further explanation of this is given in R. Bruce Hoadley's book, *Understanding Wood* (The Taunton Press).

Highly figured woods are also highly prized, so the best quality logs usually go to the veneer mills. This allows more of us to see and work the woods that have distinct signatures of nature. (For a gallery of figured veneers, see *FWW* #89, pp. 44.) For many furniture applications, however, veneers limit a piece's design and durability. Working figured wood in its solid form lets me reveal

Tearout-free block-planing

by John Henry Harper

Block planes offer many advantages for smoothing figured hardwoods. Because a block plane's iron is bevel side up, it requires no chipbreaker. The blade's bevel itself rolls the shaving over. Having the flat side down allows the iron to be supported from underneath, close to the cutting edge (see the drawing below), which dampens most of the tool's chatter. In addition, the ability to close the throat enables you to produce ultra-fine shavings, even in the most difficult woods. This is because the plane can be set to support the wood close to the cutter, which prevents the shaving from lifting and tearing out.

Standard vs. **low angle:** I prefer the higher quality block planes that have adjustable mouths. There are two basic models available: The low-angle (12 or 12½°) block plane, which is intended for end grain, but also works well at paring softwood, and the standard-angle (20°) block plane. The angle designation refers to the slope between the plane's iron and its sole. I've found that a well-tuned standard-angle block plane with a sharp, lightly set iron is the most suitable for surfacing figured woods. I actually modify the tool's edge somewhat to produce a steeper cut, which causes less tearout.

The cutting angle is the angle between a plane's sole and the direction that the shaving is diverted by the blade. On bench planes, this angle is fixed by the angle of the frog. By contrast, with a block plane you can change the cutting angle simply by grinding the bevel at the angle you want.

For general planing work, a bevel ground at 25° offers the best compromise between sharpness and edge durability. This gives a cutting angle of 45° for a standard-angle block plane. However, for smoothing figured wood, I like a 55° cutting angle. Once called the "middle" pitch, this is the angle found on many old molding planes specifically meant for hardwoods. To get this pitch, I grind the iron at a 35° bevel (a low-angle plane iron would have to be ground too bluntly). A 55° cutting angle shears off wood without causing tearout, and it works for the same reason that a cabinet scraper does—the edge is less likely to pry up the wood fibers.

Honing the iron at the same angle that I ground its bevel produces a nice edge. In other words, I don't add any secondary bevel. I begin with a 1,200-grit waterstone and then move to a 6,000-grit stone. If I'm using oilstones, I start with a soft Arkansas and then proceed to a hard Arkansas stone. As I'm honing, I ease the corners of the iron. The slightly crowned edge helps prevent the corners from digging in. I always sharpen several blades at the same time to keep handy.

Because highly figured woods exhibit frequent changes in grain direction, it's helpful to skew the plane, which reduces the shaving width. (For more on this, see *Fine Woodworking* #99, p. 67). Even more important, though, is to vary the approach angle. I get the best results on figured woods by planing in several directions. □

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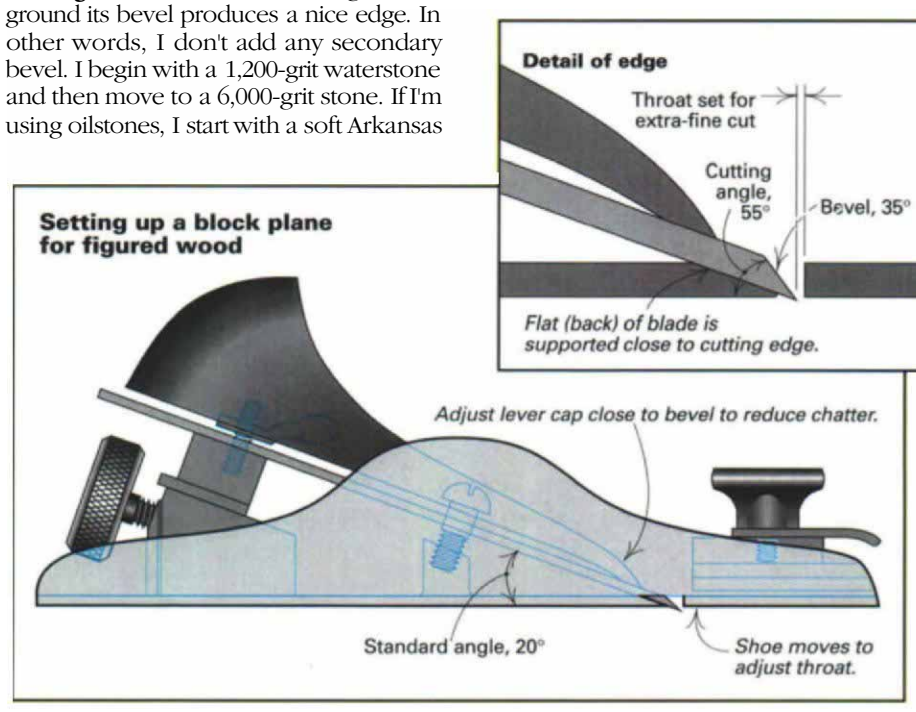
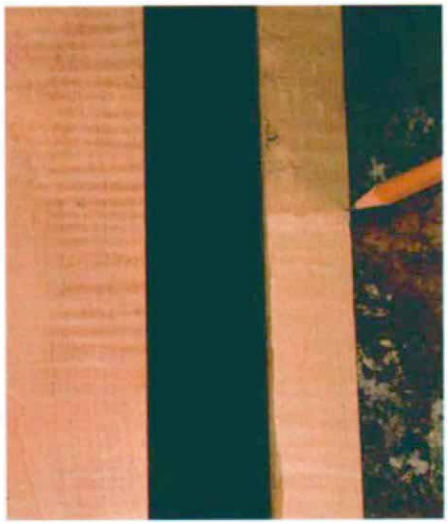


Drawing: Matthew Wells

Avoiding tearout in shaping—*The contrast of early and late wood (light and dark bands) form pleasing patterns in this walnut seat, Tischler glued up an odd number of boards, centering one for the pommel. To avoid tearout when shaping the seat, he used a power carving wheel followed by an auto grinder equipped with a coarse sanding disc. Next he removed high spots and tool scratches with a random-orbit sander. After he smoothed the contour with gouges and curved scrapers, he wet the wood for final hand-sanding.*



Jointing—*To minimize tearout, Tischler skewed the board on the left. For the board on the right, he honed a secondary bevel on his jointer knives to handle reversing grain. The tearout above the pencil point occurred before the knives were dressed.*

patterns on the face, edge and ends of a piece. I can also cut shapes into the wood and scrape and sand without fear of going through the veneer. And when I want thick veneer, I just resaw it from stock I have. I rely on several sawyers to get figured wood. Having flitch-cut stock gives me more options because I can select boards that are wider or have a natural edge. I've also learned to pay closer attention to lumber that the sawmills reject. To learn how to "read" the figure of a rough-sawn board, see *FWW* #99, p. 65.

Hand-tool methods

It's not uncommon to encounter highly figured lumber that won't machine well. I often turn to hand tools for flattening and final smoothing. Getting consistent results can simply mean becoming proficient with a tool you're already familiar with. For example, one cabinetmaker friend smooths figured wood using only a block plane (see the box on p. 45). I prefer hand tools when I'm smoothing a knot region (see the box on the facing page). Worked carefully, knot wood can yield highly figured, spectacular wood.

Planing and scraping—Sharp hand tools are essential for working high figure and changing grain. When I'm preparing a surface for a finish, I smooth in several stages, using three of my favorite tools (see the bottom photo on p. 44). First I flatten the board with a Stanley #4½ smoothing plane. To ease my effort, I keep the sole waxed, and I skew the plane. Next I take an old Stanley cabinet scraper (#80) and work in different directions, according to which way the grain runs. Because the face of a figured board can contain substantial end grain, heavy scraping may be needed, especially if the handplane didn't work well. The steep angle of the cabinet scraper blade almost always leaves a silky finish. Finally, I use a Sandvik card scraper to remove tool marks and scratches. I scrape at different approach angles, and I take both short and long strokes. Unlike working veneers where a light burr on the scraper is needed, scraping solid wood calls for a heavy burr. To get this, I use extra pressure when I'm turning the scraper's burr.

Sanding and hardening the wood—On hard, finely textured woods, scraping leaves the wood smooth—with maybe only light sanding required. However, a few figured woods will be fuzzy after scraping, particularly those with wood in tension like curly birch or quilted maple or those with high moisture content. I try aggressive sanding with the grain. I start with coarse paper and work my way up to fine to minimize the scratches.

Another way to deal with surface fuzziness is to chemically harden the problem area ahead of time. I've used everything from shellac and sanding sealers to cyanoacrylates and wood hardeners. Each time I was able to control fuzzy or otherwise difficult grain before scraping. If you use a hardener, first apply some on scrap, so you can check the substance for compatibility with the stain and finish you'll be applying to your project.

Machine methods

Much of the difficulty in machining highly figured wood comes from changes in grain directions. The amount of grain slope greatly affects how a figured board will machine. I always feed stock with the grain running "downhill" (see *FWW #102,* p. 48). But reading the edge grain can be confusing. Many boards want to be fed in two directions. Other boards that should plane well according to the edge grain will chip out severely. And when fed in what should be the wrong direction, the boards plane smoothly. This can happen when the pores of the wood are oriented opposite to the apparent grain.

Safety precautions are important when machining figured woods. Internal stresses in the wood can cause a board to plane roughly, or worse, bind and kick back at the saw or during shaping. Crotch wood will often machine surprisingly easily considering its degree of figure. This is because the grain slopes noticeably. Conversely, straight-grain quartersawn wood that has prominent fleck patterns (oak or sycamore, for example) can be difficult to machine. In this case, the rays are not parallel to the surface, which causes them to chip out easily. I've found it helpful to follow a few basic, but fundamental machining methods.

Use sharp, balanced knives, and take slow, light cuts—According to Ryszard Szymani, director of the Wood Machining Institute, there are several ways to minimize tearout while jointing and planing figured stock: First, make sure the knives are sharp. Sharpness is especially important because part of the cells may be

cut against the grain. Second, keep knives properly set and the cutterhead balanced. (For more about this, see *FWW* #103, p. 86). Third, adjust the depth of cut and feed rate according to the wood you're working. In general, take light (not over 1/32 in. deep) passes, and move the stock slowly. A slow, light pass will keep up the cutterhead speed and lessen the chance of the fibers lifting.

Adding a secondary bevel and skewing the work—Another way to reduce jointer tearout is to increase the sharpness angle of the knives by grinding a secondary bevel on them (see *FWW* #102, p. 52). This will give the knives more of a scraping action and lessen their lifting tendency. The board in the photo at right on the facing page shows the improved edge that results. If you add a secondary bevel, remember that this will increase the jointer's feed resistance, and the knives may dull more quickly.

In woods with interlocked grain (elm is a prime example), skewing the work can reduce tearout by increasing the slicing action of the cut. Skewing can be done on both the planer and the jointer. This is effective on curly maple. But with woods whose curl runs diagonally to the edge of the board (curly birch and cherry come to mind), a skewed cut can actually be detrimental. You'll just have to try it on some scrapwood to see what will happen.

Wetting the wood and power-sanding—Another aid to machining difficult stock is wetting the surface between passes. This helps control tearout in bird's-eye figure. The moisture seems to hold the fibers and flecks in place better. This technique sometimes helps when I'm running a board against the direction its grain wants to be fed. I also dampen the wood to raise the grain between sanding stages (see the photo at left on the facing page). Wetting is time-consuming; I only do it when all else fails.

If, after trying all my machining tricks, I'm still getting excessive tearout, I turn to power-sanding—but only as a last resort. Even tiny sanding scratches reduce the wood's reflective properties and thus hide the figure. A belt sander can flatten a board, remove mill marks or do heavy surfacing when the wood doesn't handplane. Power sanding also works in certain shaping operations. If I'm contouring stock with difficult grain, I rely on an auto-body grinder fitted with a coarse (down to 36-grit) disc. I used this technique on the chair seat in the photo at left on the facing page. After working my way up through the grades of sanding grit, I finished with a sequence of random-orbit sanding, scraping and hand-sanding. □

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Smoothing knots and fitting gaps

Defects in wood can add visual interest to furniture. The best examples I've seen are from the late George Nakashima, who liked to highlight the natural forms in wood by using wavy edges, checks and knots. A while back, I was fortunate to refinish a few of his pieces. Inspired by how he handled defects, particularly knots, I now use some special methods to make a seemingly worthless piece of wood usable.

One problem with knots and their associated reaction wood is the gaps or pithy areas that surround the center (see the bottom photo on p. 44). To stabilize these regions, I first clean out any loose material. Then I fill in the voids and scrape the surface smooth. If the process is done carefully, the repaired area will gain strength, contrast and workability.

Stabilizing gaps and pithy areas: I use the sequence of steps shown in the photos below to repair loose knots. The method also works on cracks and small (vacant) knot holes. First I pound in and glue custom shaped end-grain plugs and wedges into the voids. The wedges match the surrounding wood well because most reaction wood around knots has a high percentage of end grain showing. Next I mix up some sanding dust with five-minute epoxy, and I spread it into remaining gaps.

Once the glue and epoxy are hard, I saw off the wedges. To smooth the repair, I scrape in almost every direction, which addresses the changes in grain. As I'm scraping, I try to repeat the motions that produce the least amount of scratches.

Occasionally, I'll sand difficult spots with medium-grit paper, though this won't leave as nice a feel as scraping. Next I sand with fine paper and burnish with 0000 steel wool. I dust off the surface to see how I've done. Then using alcohol-soluble aniline dye, I touch up the blemishes in the filled areas until I'm happy with the color match. Once the project is completed, I wipe on some finish, usually Danish oil, which brings out the full colors.

I try to keep an open mind when I'm handling defects because I want them to retain an organic look. When I'm willing to put in the effort, I'm rewarded with a surface that shows enhanced figure. —*P.T.*

Step A: Filling the knot involves spreading a mix of epoxy and sawdust into the cracks and then driving and gluing in shaped wedges into the gaps.

Step B: Smoothing the surface with a scraper blade at various angles all around the knot and its reaction wood shows that the surface is now solid.

Step C: Oiling the wood reveals the colors of the repaired areas. Darkening the fillers with dye will finish them to a near perfect match of the knot.

Approaches for different figures

Wood is not homogeneous. Similarly, every board is unique. Surfaces with high figure and striking grain can be attributed to many factors, the most likely being growth and development of the tree, cellular orientation, color variation and external influences, such as fungi, insect or mechanical damage.

The descriptions here offer at least a partial explanation of how the colors and patterns got there. I've also offered suggestions for working surfaces, though they are not foolproof because each wood can have its own peculiarities. In fact, I'm always refining my approach to working high figure because even the most unusual methods are worth it when I can fully bring out a wood's potential. —*P.T.*

Samples are from the following sawmills: Rob Roth, Verona, N.J.; The Burl Tree, Eureka, Calif.; Randle Woods, Randle, Wash.

Burl (maple) is an irregular growth on a tree caused by mechanical or insect damage. Burls appear as bulges on the trunk. This example shows a burl's cross section. Burl grain is tightly compacted and resembles small bud-like knots. In lumber form, burls are difficult to work and are traditionally cut into veneers or saved for carvers, turners and instrumentmakers. When preparing a burl surface for a finish, use a razor-sharp scraper in many directions.

Quilted (bigleaf maple) figure is formed by crowded, elongated bulges of growth layers. Due to its varying reflectivity, I consider quilted figure to be the most three dimensional. Quilted is mostly found in bigleaf maple native to the Pacific Northwest and in tropical species like mahogany. It often machines poorly, leaving a fuzzy feel. The fuzziness usually does not scrape well. Wetting the wood and reducing the cutting angle are helpful, but sanding through finer levels of grit is generally the most effective. Blister figure, which appears as small, uneven bulges (mostly in maple), works similarly.

Worm wood (silver maple), caused by insect damage, produces striking markings. Species that are prone to burrowing insects, such as silver and red maple and paper and gray birch, exhibit dark streaks (insect tunnels) along the surface. Because the bore holes are usually small, the wood is still usable as long as the insects are exterminated early enough. Beetles, particularly the powder post variety that attack drying lumber, form maze-like patterns in the wood. Careful scraping, sanding and filling should give an acceptably stable and smooth surface.

Ribbon stripe (African mahogany) figure has alternating bands of light and dark fibers caused by spiral growth. Quartersawing is needed to fully bring out the figure. Mahogany, bubinga, sapele and zebrawood are common tropical species with ribbon stripe. Elm is a common domestic hardwood with this figure. Ribbon stripe is difficult to machine cleanly. But taking slow, light passes, reducing the cutting angle and skewing the work can all be beneficial. I often harden the wood with cyanoacrylate and then scrape in both directions. When ribbon stripe is combined with a wavy grain, a mottled figure occurs.

Ray flecks (quartersawn white oak) are caused by long tissue plates (called rays) oriented horizontally in a tree. Quartersawn, species with large rays, such as oak, sycamore, and beech, display highly decorative patterns. Because the ray cells are made up of weaker tissue and because they aren't always in the same plane as the surface, they tend to chip out. Keeping cutting edges, both for machines and hand tools, extra sharp is the best way to minimize chipping.

Photos these two pages: Robert Marsala

Knot and reaction wood (American elm) are caused by growth layers forming over the stem of a branch where it joins the trunk. The resulting changing grain can cause tearout on one side and not the other. But more importantly, there are hazards involved. Because reaction wood is unpredictable and because encased knots can dislodge, machining should only be done with sharp cutters and slow, light passes. This is why I prefer to work knot wood by hand. The knots tend to be hard and brittle, so I try scraping followed by sanding.

Curly (hard maple) figure is caused by the grain undulating at right angles to the length of a board. When light reflects off the surface, the wood appears wavy. Maple is the best known species to have curl, although pockets of curl, especially around knots, can be found in almost any hardwood. Common maple curl varieties include tiger stripe and fiddleback (shown here). Cherry and birch can exhibit broad diagonal curls, which are called flame. I smooth curl with coarse paper on a random-orbit sander or belt sander. I follow this with a scraper that has a heavy burr. If needed, I lightly sand with fine paper.

Spalted (beech) wood has a bold appearance, and it occurs in species that are prone to fungi attack, such as birch, maple, beech, poplar and red oak. In the initial stage of decay (before the wood becomes punky), dark stain lines form. Spalted wood works according to how much decay has taken place, and it must be surfaced before too much rot occurs. Areas surrounding the spalted area can be spongy, and they won't machine or finish evenly. Expect a large amount of waste to get enough usable, attractive wood. I work spalted wood much the same way I do worm wood.

Bird's eye (hard maple) figure is caused by localized indentations of the annual growth rings. I've seen bird's-eye figure in cherry, poplar, walnut and pecan, but the figure is most common in maple. Because the bird's eyes' dense, distorted fibers intersect perpendicularly to the boards face, they are prone to tearout. Wetting the wood between light, slow passes helps, as does reducing the cutting angle of the knives. Bird's eye usually scrapes well. To improve finishing, I use grain fillers or seal with shellac or lacquer. Applying several coats of finish and rubbing between coats is also helpful.

Crotch wood (black walnut)— Crotch wood occurs where two major branches of a tree meet and cause the cells to crowd and twist. The figure ranges from dramatic swirling patterns when sawn near the outside of the tree, as this V-shaped piece shows, to feather-shaped markings when cut through the center. Stump wood, sawn from the butt of a tree, will have figure similar to crotch when the outside of the stump is irregularly shaped due to the roots. Surprisingly, stump and crotch wood usually machine cleanly. Avoid using coarse sandpaper because the resulting scratches are difficult to remove.