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Mitch Kohanek has been an instructor for the National Institute of Wood Finishing at Minnesota's Dakota County Technical College for 30 years. Mitch has completed an internship at the Smithsonian Conservation Analytical Laboratory and is a member of the American Institute of Conservation. Graduates from Mitch's program become the best professional finishers, finish restorers, spot repair artists and pre-finishers this country has to offer. As the only certified finishing program in America, Mitch's program has been featured in *American Woodworker*, *Fine Woodworking* and *Better Homes and Gardens WOOD* magazines. For more information on his unique finishing program, visit www.woodfinishing.org. Mitch also serves as a consultant to the finishing industry, and generously shares his finish knowledge with woodworkers around the country at shows and events.



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ADVERTISING SALES

1285 Corporate Center Drive, Suite 180, Eagan, MN 55121
CHICAGO **James Ford** (219) 462-7211
Classified Advertising, The McNeill Group, Inc.
Classified Manager, **Don Serfass** (215) 321-9662, ext. 30

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EDITOR'S LETTER

Finely Finished

As woodworkers, we love wood; the look, the touch and even the smell. When building a project we carefully measure, cut, joint and fit all the parts, striving to match their grain and color, so our project looks like it came from one magnificent piece of wood. The process can be very satisfying.

When it comes to finishing, however, we often feel differently. It's often a love-hate relationship. We love the beauty that a good finish adds, but hate the risk that finishing often involves. We know from experience that if not done correctly, the finishing phase can ruin the look of a project. Picking the wrong stain color or getting runs in the topcoat are just a couple of problems that haunt the finishing process.

To improve your chances for success you should ask yourself two questions before you even pick up your brush. First, how do you want the finished wood to look? Do you want to showcase the wood's natural color or change it? Do you want a pristine appearance or an antique look? Second, how much protection does the wood need? Will the project be inside or outside? Does it have to stand up to hard daily use—a kitchen tabletop, for example—or will it be rarely touched, such as a grandfather clock?

Probably the most common approach to finishing involves staining the wood and topcoating it with clear finish. It's straightforward and usually produces very good results. But there are several other options worth considering, especially if you want to add a professional look to your finish.

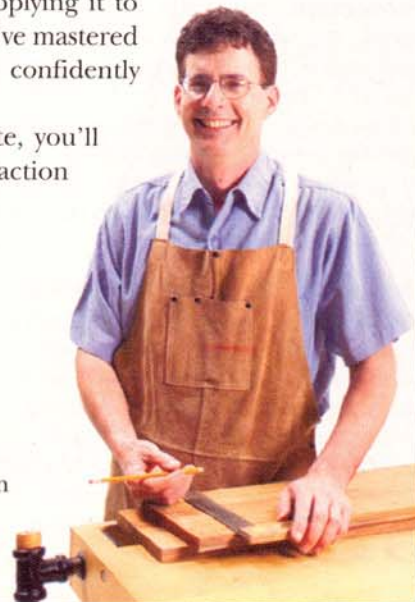
This *Guide to Finishing* will help you achieve that professional look. We've loaded it up with great finishing tips and techniques, such as ways to minimize blotches, how to get a glass-smooth finish and using stains and dyes to add depth and richness to your project. One final bit of advice before you charge off to your shop, and that is to always test your finishes on a scrap board of the same kind of wood before applying it to your final project. Then once you've mastered the technique, you'll be ready to confidently tackle your masterpiece.

When the finishing is complete, you'll be able say with pride and satisfaction that your project is *finely finished!*

Until next time,



Randy Johnson
Editor
rjohnson@americanwoodworker.com



A PRIMER ON FINISHES

Knowing how to choose is half the battle.

If you've lingered far too long in the finishing section of a paint or home improvement store, studying its huge and confusing array of products, here's some help sorting out what's what.

Let's start by dividing finishes into types. The most common wood finishes are oil, varnish, shellac, lacquer, water-based and wax. Sometimes, these finishes are mixed and given new names. "Danish oil," for example, is usually a mixture of oil and varnish. A "tung oil" finish is usually varnish thinned with mineral spirits. When finishes are mixed, they take on some of the characteristics of each component.

As you get to know these products better, remember this simple maxim: the purpose of finishing is to enhance the wood's natural beauty, seal it, and protect it. Enhance, seal, protect.

Each type of finish on those shelves performs differently. In making your choice, ask these four questions:

- How will the finish affect the wood's color?
- How easy is it to apply?
- How well does the finish protect the wood?
- How durable is it?

Color. Each finish affects a wood's color in a different way (see 6 Finishes, 6 Colors, right). Sometimes the effect is desirable, sometimes not.

Application. To a large extent, the method of application is a matter of personal choice, but some methods require more skill and practice than others. An oil-type finish or a wax is the easiest to apply: you just wipe it on and wipe it off, leaving a thin film. Shellac, varnish and water-based finishes are usually applied in a thicker film with a brush, which often requires deft handling to avoid runs, dry spots and lap marks. Lacquer is almost always sprayed. Unless you use an aerosol can, spraying requires extra equipment, such as an HVLP sprayer or compressor, and practice beforehand.

Protection. If you want your project to have a long life, choose a finish that offers maximum resistance to the exchange of water vapor between the wood and the air around it. The thicker the finish coat, the better it will slow this exchange. That's true for each type of finish. There is a limit to the effectiveness of thick coats, though. Any finish greater than about 0.006 in. (roughly four coats of polyurethane) has a tendency to crack, especially with sudden changes in the weather.

Durability. The thickness of the finish also affects how your project will survive daily wear and tear, although the type of finish matters, too. Some finishes resist scratches, water, heat and other abuse better than others (see chart at right). Durability is critical for a vanity or tabletop that will be subjected to regular use, but not as important for a decorative piece that is primarily for display.



HOW TOUGH IS IT?

Here's how the most popular finishes stand up to the most common forms of abuse.

Resistance to...	Oil	Varnish	Shellac	Lacquer	Water-based	Wax
Water	Poor	Excellent	Fair	Good	Good	Very poor
Wear	Poor	Excellent	Fair	Good	Very good	Poor
Solvents	Fair	Excellent	Poor	Good	Good	Very poor
Heat	Good	Excellent	Fair	Good	Good	Very poor
Acids and Alkalis	Poor	Excellent	Fair	Good	Good	Very poor

OIL

The two most common oils in wood finishing are linseed oil and tung oil (true tung oil, that is, not a mixture). Linseed oil comes from the seeds of the flax plant and cures slowly. Driers are commonly added to speed the process. When driers are added, this finish is called "boiled" linseed oil (even though it is not really boiled). It's easier to use than raw linseed oil.

Tung oil cures faster than raw linseed oil, but slower than boiled. It is rarely used to finish wood because it cures so slowly. Also, it can take five or more coats to achieve the desired build-up and sheen.

Oil finishes are easy to apply, but they don't cure hard, so you have to wipe off the excess after each coat.



An **oil finish** is easy to apply, but cannot be built up to form a thick, protective film. It's best suited for non-wear surfaces.

VARNISH

Varnish was once made by cooking oils, such as linseed and soya (modified soybean) oil, with a resin. Today, these natural resins have been replaced by synthetic resins, such as polyurethane and alkyd. Varnish finishes range from flat to gloss, with a satin finish probably being the most popular.

"Spar" varnish means there is a higher ratio of oil to resin, making it softer and more flexible. This makes it better suited for outdoor projects. By contrast, indoor varnish is harder because it has a higher

6 FINISHES, 6 COLORS

Here are six different finishes applied to six similar pieces of butternut.



Water based finishes add no color, but they do darken the wood.



Boiled linseed oil darkens and adds an amber tone to the wood.



Wax doesn't darken wood.



Polyurethane varnish (oil-based) darkens and adds an amber tone to the wood, but not as much as linseed oil.



Orange shellac adds a warm orange color.



Lacquer adds very little color.

ratio of resin to oil. When applied in multiple coats, varnish produces a very durable, protective finish.

Varnish can be thinned with mineral spirits or paint thinner to make it easier to wipe on wood. In this case, it is called "wiping varnish" and is widely marketed this way. Wiping varnish requires more coats than un-thinned varnish to achieve the same film thickness.



Varnishes, such as polyurethane, can be built up to create a very durable, protective finish.

VARNISH BLENDS

Varnish can be mixed with oil to create a finish that is more durable and protective than using oil alone. These oil/varnish blends are usually sold under names such as "Danish oil" or "teak oil." They are easy to use, but tend to dry slowly, so it is important to wipe off the excess after each application. You can attain a rich, smooth finish with these blends.



Blending a varnish with oil creates a finish that is more durable than a pure oil finish, and just as easy to apply.

SHELLAC

Shellac is a natural resin secreted by insects. The resin is collected, strained, spread into sheets and broken into flakes. You dissolve the flakes in denatured alcohol. More commonly, though, you buy canned shellac that's already dissolved in alcohol.

Natural shellac has an orange tint and adds warmth to a wood finish. However, you can buy bleached shellac that has the orange tint removed. Most shellac contains a wax that is also a natural product of the insects that create the resin. Some shellac is "de-waxed," that is, the wax has been removed. Use only dewaxed shellac as a seal coat under a polyurethane finish.

Before the advent of lacquer, shellac was the primary finish found on furniture. It was also used widely on woodwork in homes before the introduction of polyurethane. While certainly a time-tested finish, shellac is not as protective and durable as varnish, lacquer and water-based finishes.



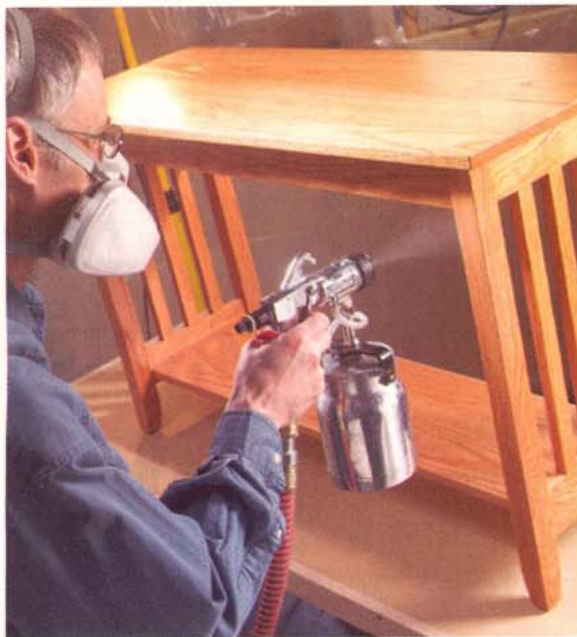
Shellac dries fast and can be applied by brush, pad, or spray. It's not as durable as many other finishes.

LACQUER

Lacquer is made from nitrocellulose, which comes from cellulose in cotton and wood, or from CAB-acrylic. It dries very quickly, so it is usually applied with a spray gun. It is fairly protective and durable, but its drying speed is its main advantage. Lacquer dries before dust has a chance to settle.

Lacquer can also be used as a toner (a transparent stain) by mixing it with stain and lacquer thinner. It also cures hard so that it can be rubbed with abrasives to an even sheen.

The drawback to using lacquer is that the thinner required for spraying is toxic and highly flammable. It must be used with adequate ventilation. Lacquer can be brushed on, too. To make a brushing lacquer, manufacturers dissolve it in a slow-evaporating thinner, which provides the time necessary to brush the mixture on a surface. But you still need to work quickly.

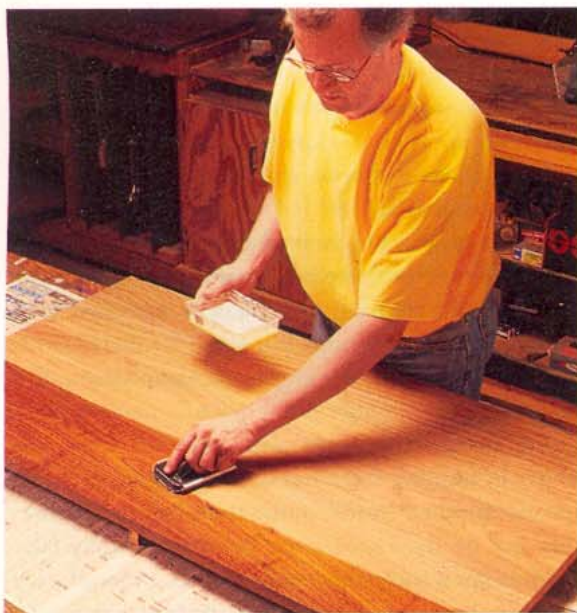


Lacquer dries so fast that it is best sprayed. You can apply multiple coats in one day.

WATER-BASED

Air quality concerns have fueled the demand for water-based finishes. They may be labeled as varnishes, polyurethanes or lacquers. In any case, water-based finishes are more user-friendly than solvent-based products because brushes and spray equipment can be cleaned up with water.

Water-based finishes provide about the same protection and durability as lacquer, with less odor and fire risk. They are also more difficult to apply. They tend to raise the wood grain, dry quickly and don't penetrate as deeply.



Water-based finishes can be brushed or sprayed. They meet higher air-quality standards than lacquer and most oil-based varnishes.

WAX

Commercial wax is sold in liquid and paste forms and can be a single wax or a blend of waxes. A wax finish adds shine to wood without darkening it. Wax is too soft and porous to be scratch or water resistant so it is not advised for use on items that will be regularly handled. It is excellent as a polish on top of another finish, however.



Wax is not as durable as other finishes. Use it on objects that aren't frequently handled or as a polish on top of another finish.

WHICH FINISH SHOULD I USE?

The type of finish you choose depends on the project and its use.

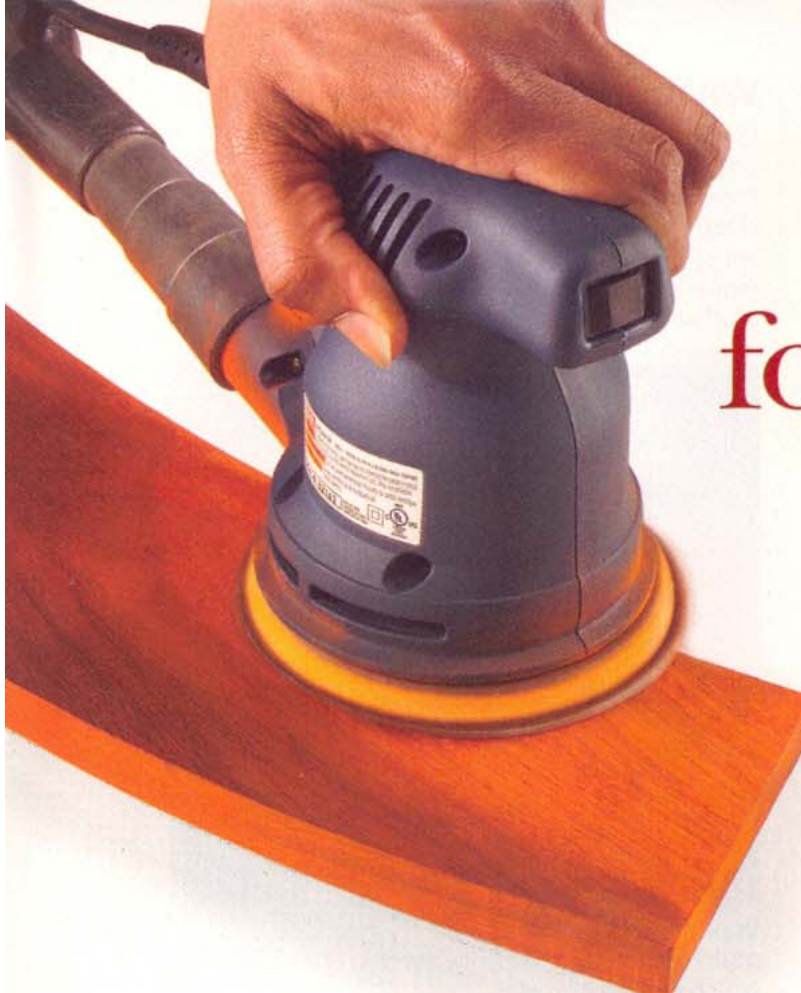
If you are building kitchen or bathroom cabinets, you're probably primarily concerned with durability. The finish has to be resistant to acids in body oils and alkalis in soaps. Varnish or polyurethane are the best choices. If their smell bothers you, consider water-based polyurethane. Lacquer is also an acceptable alternative, but stay away from shellac and oil.

For chairs and tables, you want a film-building finish to protect against wear. Your choice of finish depends on whether you want to rub it out. (Rubbing a finish removes all the dust nibs, making a finish feel ultra-smooth, and develops a high sheen.) Lacquer rubs out most easily, followed by shellac. Varnishes and water-based finishes can be rubbed successfully, but often only to a satin sheen.

Bookshelves and entertainment centers generally don't get a lot of heavy wear. Oil, oil/varnish blends and wiping varnish are acceptable and easy to apply. And as long as you let the coats cure thoroughly, you can apply other finishes over these later if you decide you want a thicker finish with more protection.

Smaller decorative items that don't receive wear can be finished with oil, oil/varnish blends or wiping varnish. While wax provides too little protection to be considered seriously for most projects, it does have applications for small decorative objects.

For floors, durability is of utmost importance. Polyurethane is clearly the best choice.



Prepping for Finishing

Eliminate machine marks, glue spots and surface imperfections before you stain

It can't be overemphasized how important wood preparation is for obtaining a nice-looking finish. Stains and finishes highlight flaws rather than disguise them. You can't achieve first-rate results if you don't do a good job preparing the wood. Sharp tools, clean hands, and good work habits all go a long way toward making this initial preparation a less daunting task.

KEY INGREDIENTS

The goal in wood preparation is to remove all flaws and not replace them with new ones. The machine tools you use to cut, smooth, and shape wood all leave marks (called machine or mill marks) that show up when you apply a stain or finish (photo at left). These marks should be hand-planed, scraped, or sanded out.

Excess glue is another problem (photo, bottom left). Glue can keep stain from penetrating and can cause uneven coloring. Glue may be squeezed from joints or deposited onto the wood by dirty hands. You should remove this glue before applying a stain or finish.

Any gouges and gaps also must be dealt with, either by sanding them out or by filling them in one way or another. Wood putty, the obvious solution, may not be the best answer because it rarely takes stain as the wood does, no matter what manufacturers may claim (top photo, page 9). If you choose to go this route, you should use a colored wood putty, or color the putty after it has dried to blend in with the surrounding wood.



Machine marks that are practically invisible on an unfinished board stand out when you stain.



Excess glue leaves telltale marks under stains and finishes.

On top of all this, bear in mind that the sandpaper and tools you use to remove flaws may actually create new flaws (middle right photo). Power sanders in particular remove wood so fast that it's easy to lose control and create divots and furrows on an otherwise flat surface. Even hand sanding can leave scratches that will jump out at you the moment you apply the first coat of stain. Always sand in the direction of the wood grain, using increasingly finer grits, until the scratches that are left are too fine to be seen.

SANDING WOOD

The reason you sand wood is to remove machine marks. All machine tools leave cuts or impressions in wood that are highlighted by finishes—especially stains. Before machine tools were developed in the mid-nineteenth century, no sanding was needed; indeed, sandpaper didn't even exist. Wood was smoothed with hand planes and scrapers.

You can still use hand planes and scrapers to smooth wood and remove mill marks. However, few woodworkers choose this route, because machine tools are much faster and easier to learn to use than hand tools. The price, however, is that sanding is tedious work.

HAND-HELD SANDING MACHINES

Most woodworkers use one of three hand-held power sanders to prepare wood for finishing: an orbital sander, a belt sander or a random orbit sander. Orbital sanders are the least expensive—and least efficient. They leave visible swirl patterns in the wood. These sanders usually have square pads, so they can sand inside corners.

Belt sanders remove a lot of wood quickly, but they can be difficult to control. The slightest rocking of the sander will leave a gouge in the surface that will be difficult to sand out. With enough practice, however, it is possible to use a belt sander effectively.

Random orbit sanders are rapidly becoming the most popular choice. They remove wood quickly, like a belt sander, but they're much easier to control, and they leave the least noticeable scratch pattern. They use round sanding discs, however, so they can't sand into corners.

For the best results after sanding with any of these machines, always follow up by hand sanding in the direction of the grain with your final grit sandpaper. Sand pieces that are already joined together in stages (see "Sanding Joined Parts," at right).



Wood putty rarely takes stain like wood, so special care is required to disguise it.



Sanding is the answer to many wood preparation problems, but it can also cause trouble. Sanding across the grain leaves ugly scratches that are emphasized by stain. Power sanders can leave gouges and divots.

Sanding Joined Parts



Step 1: To sand parts that are joined at a 90-degree angle, start by sanding across the joint.



Step 2: Remove the crossover scratches by sanding the long part.



Step 3: Sand across the joint on mitered parts, then remove crossover scratches by sanding to the joint with the block at a 45-degree angle.



Sanding to finer grits limits a pigment stain's ability to color the wood. The sanding scratches are smaller, so there's less room for pigment to lodge. The lighter side of this board was sanded to 280-grit; the darker side to only 100-grit.

START WITH COARSE GRIT

The trick to efficient sanding is beginning with sandpaper that's coarse enough to cut through the flaws you want to remove with the least amount of effort, and without creating larger scratches than necessary. This holds true whether you are sanding by hand or machine. In practice, it's best to start with 80- or 100-grit sandpaper. If 80-grit doesn't remove the flaws quickly, drop back to a grit that does.

On the other hand, if the flaws can be removed with finer sandpaper, such as 120-grit, you're wasting time and energy if you begin sanding with coarser sandpaper.

Once the flaws are gone, remove the scratches left by the coarse-grit sandpaper by sanding with increasingly finer sandpaper until the scratches are too small to see, usually 180- or 220-grit. With some woods, such as oak, you may achieve satisfactory results sanding to only 120- or 150-grit. The goal is to produce a surface that doesn't show machine marks or sanding scratches after you apply a stain or finish. The scratch sizes make a difference in color intensity when you use a pigment stain (photo, above).

Sanding is very personal. We apply different pressures, use sandpaper to different degrees of wear and sand for varying lengths of time. The only sure way to know that you have sanded enough is to apply a stain and see if any machine marks or sanding scratches show. It's wise to practice on some scrap wood until you get a feel for what works best for you.

FILL GOUGES WITH WOOD PUTTY

Wood putty doesn't take stain as wood does, so it's always better to patch flaws that can't be sanded out with real wood. Real wood takes stain like the surrounding wood, as long as you use the same kind of wood and make sure that the grain direction is the same. However, making and fitting a wooden patch requires much more work than using wood putty.

Most commercial wood putties are made with wood flour (very fine sawdust) and some type of finish that cures and binds the wood flour to itself and the wood. Homemade wood putties are typically mixtures of sawdust and glue. Since neither finish nor glue can absorb wood stain, it's simply not possible to make wood putty that will stain as naturally as wood.

Ready-made colored putties are usually identified by the name of the wood they are designed to imitate and the color is usually close to that of the unstained wood. So you can often use these putties if you don't intend to stain your project. If you intend to stain, however, all bets are off as to what color putty will actually match the final color of your wood.

You can color any type of putty by mixing in universal tinting colors (available at most paint or art-supply stores). The color you want to match is that of the wood after it is stained and finished. It may take some experimentation on scrap wood to arrive at the correct color. The trick is to judge the color while the

putty is still damp. At that stage you'll get a fairly good idea of how the putty will look under a finish.

APPLYING WOOD PUTTY

Take a little of the putty out of the container or tube with a putty knife (or screwdriver if the hole to be filled is small). Push the putty down in the hole or gouge, and if the depression is not very deep, smooth off the top by pulling the putty knife across the surface (top left photo, page 11). You want the putty to form a very slight mound so that it won't leave a depression when it shrinks as it dries. If the depression is deep, it's best to apply several coats to build the putty level with the surface. Don't manipulate the putty any more than necessary, as it becomes increasingly unworkable the longer it's exposed to the air. Once the putty is thoroughly cured, sand it level with the surrounding wood. If the surface you're working on is flat, back the sandpaper with a flat block.

Is sanding to finer grit better?

You often hear that sanding wood to 400-grit or higher produces better results. Sanding does make the wood look and feel better in its raw state. But it doesn't add anything to the appearance or feel once you have applied a finish that dries to a film on the wood's surface, such as polyurethane, lacquer, or shellac. Fine sanding does make a difference when you are applying a non-film-forming finish, such as oil or wax, but you can achieve the same smooth appearance and feel with much less work by sanding the finish between coats with 400- or 600-grit sandpaper.



Smooth the surface after packing in wood putty with a putty knife. Leave the putty slightly mounded to allow for shrinkage.

DISGUISE A PUTTY PATCH

Coloring the putty before applying it is one way to approximate wood, but you can get better results by coloring the patch after it is dry and sanded smooth. This method allows imitating the colors in the surrounding wood more exactly. Essentially, you paint the putty to look like wood.

Painting in grain and figure can be done only on film finishes such as shellac, lacquer, varnish and polyurethane. Oil and oil/varnish-blend finishes are too thin to color between coats. For the coloring medium, mix artists oil color with glaze or thinned varnish. If you don't like the result, you can remove the color by wiping with paint thinner and try again. When you're satisfied, allow the glaze to fully cure (overnight, or longer) before you apply finish. Here's how to disguise a patch by painting in.

Step 1: Apply your first coat of finish to the entire surface, putty and all, in order to see the correct colors you want to imitate. This sealer coat also creates a nonporous surface for painting with the glaze. Let this coat dry thoroughly.

Step 2: Paint in the grain and figure using an artist's brush (top right photo). To imitate large-pored woods such as oak, you may also want to scratch pores into the patch with the point of a knife.

Step 3: Once you have a close approximation of the grain, let the patch dry and protect it with a thin coat of finish.

Step 4: Apply the background color (the lightest color visible in the surrounding wood).

As an alternative, you can use colored putty that matches the lighter color of the surrounding wood. Then add the darker grain and figure lines.

AVOID GLUE SPOTS

One of the biggest problems you'll face in preparing wood for a stain or finish is glue getting on the wood's surface. It happens when glue squeezes out of a joint or when you touch the wood with glue on your fingertips.

Ideally, you should control the amount of glue you put into a joint so there is just enough to produce a strong bond, but no more. Of course, this is impossible. You work too fast to be that exact. So to be sure that you have enough glue in the joint, you err on the generous side.



Wood isn't any single color, so it's no wonder monochromatic putty patches look bad. For the best results, take the time to color putty to match the various colors and textures surrounding it.

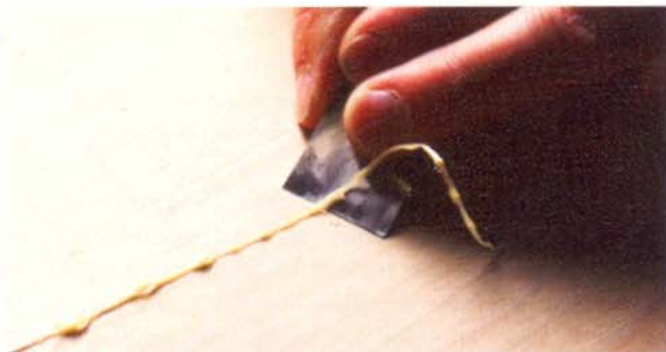
MAKE GLUE RESERVOIRS

One of the best ways to avoid glue squeeze-out is to cut cavities into the joint where the excess glue can collect. Cut mortises and dowel holes deeper than necessary, for example, and chamfer the ends of the dowels and tenons. This gives you some leeway in how much glue you can apply without squeeze-out.

PEEL AWAY SQUEEZE-OUT

Sometimes your reservoirs may not be enough to hold all the excess glue. And sometimes you may actually want a bit of squeeze-out to prove that you used enough glue and have tightened the camps sufficiently (when you join boards edge to edge, for example). In these situations, you're faced with a choice as to how to get rid of the excess. One method is to let the squeezed-out glue tack up and then peel it off. Get the peeling started by sliding a putty knife or dull chisel under the somewhat-hardened glue (photo, below). Hold the lifted glue between your fingers and lift it away from the wood as you slide the putty knife or chisel along the joint.

Squeezed-out glue can also be removed with a wet cloth before it begins to set up. After the glue has hardened, you can still soften and remove it by soaking with water, or you can sand or scrape it off. Glue squeeze-out along edge joints is seldom a problem, because you typically sand through all the glue penetration while leveling the surface. But for joints where boards meet perpendicular to each other, sanding requires extra care because of the different grain directions.



Allow glue squeeze-out to partially dry. When it becomes rubbery, remove it with a putty knife.

DEALING WITH GLUE SPOTS

You can limit glue spots, but some are unavoidable. You'll have to remove all the glue from the wood surface or it will cause color problems after you apply stain and finish.

Glue is easy to remove while it is still wet. Since most woodworking glues are water-based, simply wash the glue off with water. What you are really doing is thinning the glue with the water and then removing the excess, so it's best to wash the wood several times to be sure that you have removed as much of the glue as possible from the wood's pores.

There are only two ways to remove hardened glue—scrape or sand it off, or soften the glue enough so it can be scrubbed off.

Scraping and sanding are pretty straightforward. You need to remove the wood to below where the glue has penetrated and then re-sand the wood to the same grit you have used elsewhere to ensure that the stain colors the wood evenly.

You can soften white and yellow glues enough with water so that they can be scrubbed off. Water works better if it is hot, and best if you add a little vinegar to it. (Acids soften white and yellow glues, and vinegar is a mild acid).

You will probably have to scrub a little to get the glue out of the pores. A toothbrush is often enough to get the job done, but sometimes you will need to use a soft, brass bristled wire brush (available at paint stores). After cleaning all the glue out of the pores, sand the wood thoroughly to smooth any roughened grain. Be sure to finish sanding with the same grit sandpaper as you use on the rest of the piece, so the stain colors evenly.

Other glues, such as contact cement, can often be softened or dissolved with solvents. Epoxy squeeze-out has to be sanded or scraped off.

AFTER STAINING

What about glue problems that don't show up until after you have applied a stain? The solution is exactly the same as if you had caught the problem before applying the stain. You still have to remove all the glue, and there are still only two ways to do this: mechanically, by sanding or scraping, or with water or a solvent.

After removing the glue, you may find that the new application of stain is lighter than the original finish. This is because the stain that remained in the wood acted as a lubricant for the sandpaper, causing it to scratch less deeply. So, even though you may have re-sanded the surface to exactly the same grit as you used elsewhere, the stain colors a little less.

The easy solution to this problem is to apply more stain to the entire part (leg, stile, rail) and re-sand while the stain is still wet. Then remove the excess stain. This wet sanding will even the scratches over the entire part. If the part is then too light, wet sand again, using sandpaper with coarser grit.

Highlight Glue Spots

You'll have an easier time removing glue spots if you can see the excess glue clearly. The simplest method is to highlight the glue spots by wetting the entire surface with water or paint thinner. The liquid will soak deeper into the wood that surrounds the spot, leaving the areas that are sealed with glue a lighter color. If you use water to highlight glue spots, allow the wood to dry and then sand it smooth again, because the water will have raised the grain.

Another method of highlighting glue spots is to use glue with an ultraviolet additive, such as Titebond II Ultraviolet glue. This glue glows under black light, making it every easy to spot the smallest trace of wayward glue on your project.



Good Lighting

That's the key to a good finish.

If you want to get superior results when you finish, you have to be able to see what you're doing. That means the right types of light, properly placed. Here are three typical situations:

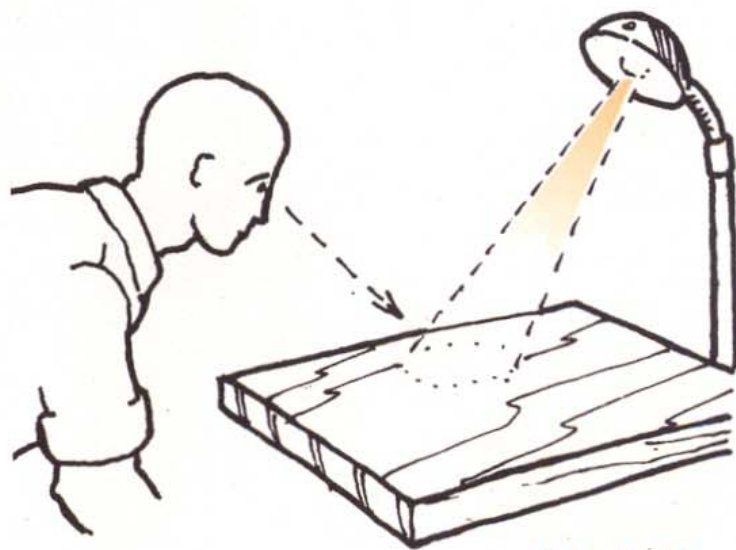
- **Inclusions.** When you're inspecting for inclusions (junk suspended within the finish), the light should be coming from your direction, so that reflections don't obscure your view into the finish.
- **Imperfections.** When you're inspecting for surface imperfections like "orange peel" (a dimpled-looking finish) or dust nibs, you need to position a portable light so that you're viewing its reflection at about a 60-degree angle away from you.
- **Finish Quality.** Inspecting the quality of the finish calls for two light sources: you'll need stationary lights and a portable light to provide good reflection.

CHECKING COLOR

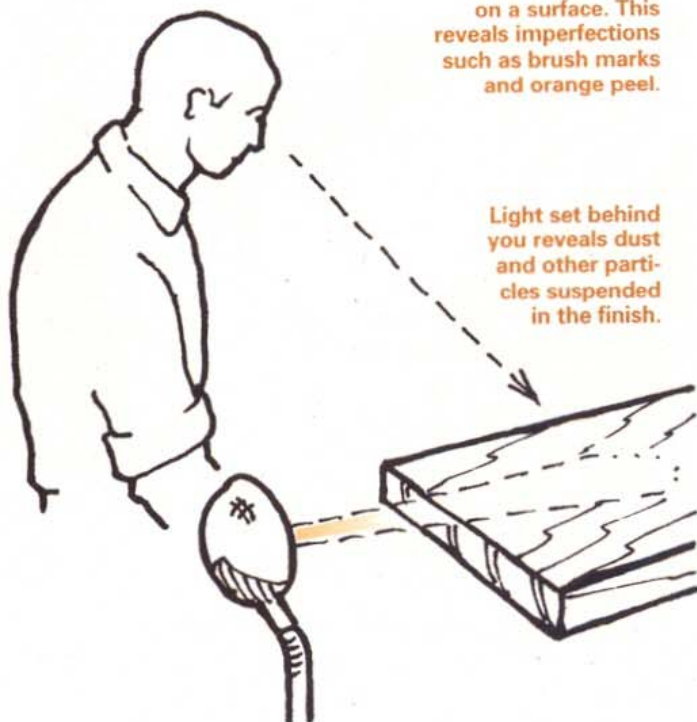
Inspecting for color correctness is a more difficult process. A color can appear quite different when viewed under different lights. This can mean problems if you want to match the color of a new piece to an existing one under all conditions. The best solution is to outfit your finish area with incandescent lights, cool white fluorescents, and 6,500-degree color-corrected fluorescents, which simulate daylight. That way you can see how the piece will react under all types of lighting.

To match a new project to an old one, inspect a part from the existing project in the room where the piece will reside. Note the type of lighting in the room, including daylight. Then bring the part back to your shop and match it, working under lighting that is similar to the piece's final home.

If you can get the existing part and the new piece to match under all three types of lighting separately, you won't have to worry about color changes if the pieces are moved to different lighting conditions. When this isn't practical, just make sure that your work and the older piece match under the type of lighting in which they will be viewed.



Light set at 60 degrees and pointing toward you reflects on a surface. This reveals imperfections such as brush marks and orange peel.



Light set behind you reveals dust and other particles suspended in the finish.

The ABC's of Varnish

Among casual woodworkers, and even the not so casual, varnish can be a misunderstood term. Many people think of varnish as any clear topcoat. But for the sake of this article, let's think of the more traditional definition: a brushable, oil-based clear coating that cures as it dries.



Oil based polyurethanes still provide the very best overall protection from things like heat, scratches, stains, and chemicals. Outdoor poly is formulated with UV blockers to protect the wood color and the finish itself from sun damage. Think of it as sunscreen for your outdoor furniture.

Varnish is formed by cooking one or more oils with resin, or by converting oils into resin. Add a solvent, such as naphtha or mineral spirits, and the result is a tough, durable, attractive finish.

Despite differences in durability, clarity, resin formulation and other details (see chart), all types of varnish have several attributes in common. They all improve the appearance of wood by enhancing its depth. All have excellent adhesion to wood. And all have more or less the same brushing characteristics.

Polyurethane varnishes have all but replaced traditional varnish on store



shelves. The polyurethane family can be divided into interior and exterior blends (see photo above).

Polyurethane varnish provides better scratch and stain resistance than wax, oil or Danish oil finishes, and better heat, solvent and chipping resistance than shellac or lacquer. It is the ideal choice for any furniture that is likely to get substantial wear, including tables, chairs, countertops, kitchen cabinets, doors and even wood patio furniture.

Oil based varnish will go over oil or water-based stains and dyes, and over any type of pore filler. It can also be applied over a dried coat of linseed oil or Danish oil, which some woodworkers

Type of Varnish	Active Ingredients	Recoat time (hrs)	Drying time (hrs)	Pros	Cons	Best Choice for:
Oil-alkyd brushing	Linseed oil alkyd resin	1 to 4	6 to 8	Usually the least expensive varnish; rubs out easily; rich appearance; good clarity	Less heat and scratch resistance than polyurethanes	Tables, chairs, bookcases, banisters, interior trim, furniture
Spar	Tung oil, phenolic resin	6 to 8	24	Most flexible varnish; natural UV resistance; best recoat adhesion	Softer than other varnishes; reddish color; slower drying	Brightwork on boats (but not decking or below the waterline), patio furniture, exterior doors
Interior Polyurethane	Oil-derived resin	1 to 4	6 to 8	Least expensive poly varnish; very durable; good scratch and heat resistance	May not resist UV degradation	Counter and bar tops, kitchen cabinets, tabletops, high-wear interior surfaces, interior doors and woodwork
Exterior Polyurethane	Oil-derived resin; UV blockers, light stabilizers	6 to 8	12 to 16	Very durable; protects wood from sunlight; resists UV degradation	More expensive than interior mixtures	Interior and exterior doors, patio furniture, any high wear furniture
Polyurethane floor coatings	Oil-derived resin, plasticizers	8 to 12	24	Tough; flexible; very durable; best levelling varnish on horizontal surfaces	Prone to sagging when applied on vertical surfaces	Wood floors, but not deck surfaces

use to bring out curl or depth in figured woods. Water based varnish, on the other hand, adheres best over water based dyes and stains. If you must use an oil based stain under water-based varnish, it's best to seal the stain with a coat or two of shellac first.

Varnish will cure and adhere to both oily and non-oily woods, with the exception of woods in the rosewood family such as rosewood or cocobolo. These woods contain an antioxidant that prevent varnish from drying. If you want to varnish these woods, first use a sealer coat of shellac.

Varnish is self-sealing, which means you can apply it directly on raw wood without a separate sealer coat. Some woodworkers like to cut their first coat as much as 50/50 with naphtha or mineral spirits so that it will soak in and dry faster. While not necessary,

this can be helpful on soft or very porous woods, such as pine and poplar. You can omit this thinned coat if you've already treated the bare wood with Danish oil, pore filler, oil stain or wood conditioner.

CHOOSING THE RIGHT VARNISH

TYPES OF VARNISH: There are three traditional varnish categories: brushing varnish, spar varnish and urethane or polyurethane varnish. The "poly" varnishes are also divided into subgroups based primarily on intended use. The chart above provides the basic information you need to select the types of varnish for specific finishing jobs.

COMMENTS ON CLARITY: Not all varnishes cure to a clear surface finish. Clarity or tone can vary from brand to brand, depending on the oil used to

make the varnish. Some polyurethanes are intentionally formulated to be almost colorless, but most varnish has a pleasant honey-amber hue. Spar varnish tends to be darker and redder than the others.

GLOSS, SATIN AND MATTE: All types of varnish are commonly available in these three grades, which refer to the sheen, or gloss, of the cured finish. "Satin" is between the high sheen of gloss varnish and the less reflective, flat finish of matte.

All sheens share the same durability and handling properties, but if you apply too many coats of matte or satin, the clarity of the finish will start to diminish. For a built up finish of three or more coats, it's best to start with gloss varnish then use the sheen of your choice for the last coat or two.

Brushing on Varnish

Varnishing is a simple craft. Anyone can learn to do it well. The objective is no more complicated than transferring a liquid varnish from a can to the wood. More often than not, a brush is used to apply varnish. Brushing takes a little practice, but the techniques are relatively easy to learn.

BRUSHES

There are three basic types of brushes (Photo 1). Each can be used to transfer stain or finish from the can to the wood. Brushes are often taken for granted and that should not be the case. Cheap, disposable brushes are great for applying stains, but it pays to spend some money on a high quality brush for applying varnish, shellac or lacquer.

High quality brushes are efficient tools for applying a finish. They are designed to hold a load of finish and distribute it evenly on the project surface. Quality bristle brushes require time and solvents to clean after use.

NATURAL-BRISTLE BRUSHES

Natural-bristle brushes are made from animal hair. They are the best brushes for use with all stains and finishes except those that contain water. Water softens natural bristles just as it softens human hair, causing the bristles to lose their stiffness and their shape. The best commonly available natural-bristle brushes are made from Chinese hog hairs. These hairs are thick enough to provide good stiffness, but can hold a lot of



finish because their ends are split or “flagged” (Photo 2). Finishing with a flagged brush is faster than with a non-flagged brush since the bristles can carry more finish. Also, because there are more bristles in contact with the surface, a flagged brush leaves a smoother coat. Though China bristle brushes are a little more expensive, the improved results are well worth it.

Superior even to China bristle in producing a level surface is an ox hair brush, or a badger brush. Ox hair brushes usually combine ox hair and China bristle. Badger brushes usually combine badger and skunk bristle. They are two to three times as expensive as good China bristle brushes. The bristles on these high end brushes are so numerous and fine, they often don’t require flagging. If you clean them well after each use, they will last a long time, so the additional cost per use will be minimal.

SYNTHETIC-BRISTLE BRUSHES

Synthetic-bristle brushes are made from polyester and nylon. These brushes became popular for use with water-based products because natural bristles become soft and swollen in water. Synthetic bristle brushes are the best choice for all water-based products. Again, buy a high quality synthetic brush for applying film finishes.

SPONGE BRUSHES AND PAINT PADS

Sponge brushes are cheap and are usually considered throw-away items. They are best used for making finish samples or applying stain.

Paint pads are flat sponge material to which many tiny fibers are attached. Paint pads are best at applying waterbased poly on a large flat surface such as a tabletop.

PREP THE WOOD

Varnish requires only minimal wood preparation. Start by sanding the wood smooth. Sand most woods to 180-grit. Finer grit sandpaper will yield better results on very hard woods, such as ebony and rock maple, which show sanding scratches more easily. When you are finished sanding, use compressed air to blow off the sawdust. As an alternative, you can wipe down the wood with a tack rag. Tack rags can be purchased at any hardware store or home center.

Remove any hardware and disassemble the furniture before finishing. To prevent runs and sags, it is best to coat surfaces horizontally. When surfaces must be coated vertically, turn them upside down.



1 Of the common types of brushes, the most popular and versatile are those with bristles, whether the bristles are natural or synthetic. Sponge brushes are popular because they are cheap. Most people throw them away after each use. Pad applicators are limited to use on flat surfaces. They are excellent for floors.

2 Flagged or split bristles allow the brush to hold down more finish and lay down a smoother coat. To check your brush, separate out a single bristle. If the brush is China bristle or a good-quality synthetic bristle, the end should be split into two or more strands.



3 A nail board suspends a piece for brushing and drying when both sides get varnished. Put the less visible side on the nails. The tiny imprints left by the nails are almost invisible.



4 Can't seem to beat the dust devil? Erect a temporary dust free zone with painter's drop clothes to really protect your freshly varnished piece from renegade dust particles. Don't forget a fan for ventilation.



5 Soak natural bristles in mineral spirits for a few minutes before varnishing. This charges the fibers with solvent so they more readily release the varnish from the brush.



6 Gently stir the varnish to disperse flattening agents evenly throughout. Shaking the can is not necessary or recommended.

That way, any missed runs or sags will be less visible if the light source comes from above, which it usually does. If you need to coat both sides of a piece, such as a cabinet door, have a nail board ready so you can flip the piece wet (Photo 3).

PREP THE ROOM

It is better by far to apply varnish in a clean room. If that is difficult to achieve, apply it at the end of the day when you can keep movement and thus dust to a minimum. Some woodworkers create a temporary dust-free finish room in their shop by draping polyethylene film on a frame (Photo 4). But remember, while you don't want dust blowing around, you do need good ventilation, so allow for a healthy amount of clean air flow.

Temperature is not critical as varnish will cure in a room as cold as 50-degrees. However, colder temperatures or high humidity will slow the curing process significantly. And that means more time for dust to settle on the surface. Whenever possible, choose a warm, dry area to work in.

PREP THE BRUSH AND VARNISH

When you are ready to start applying the varnish, prime the bristles of your brush by soaking them all the way up to the ferrule in mineral spirits (Photo 5). Squeeze out the excess mineral spirits, but don't shake or spin the solvent out. The bristles should be wet and the brush should be loaded with solvent. This will help the varnish flow better and make clean up easier when you are done.

Use a clean container to mix and apply finish from and another for cleaning brushes. Protect your skin by using a pair of thin vinyl gloves.

Stir the varnish gently until any sheen-flattening agents are thoroughly dispersed. Shaking isn't necessary or recommended (Photo 6). Then pour some varnish into a clean wide-mouth can or jar. Leave several inches of wall above the level of the varnish. You will need this area to properly load the brush.

The viscosity of varnishes varies considerably, but virtually all are too thick as they come from the can. You will usually want to cut them with 10-15% naphtha or mineral spirits (Photo 7). Thin is better than thick. Several thin coats will lay down smoother and dry faster than a few thick ones.

Stir the solvent into the varnish gently. Try it on a scrap to see if it flows out well. Then make necessary adjustments by adding either more varnish or more solvent. The finish should flow smoothly off the end of the brush with very little drag.

APPLY THE VARNISH

The application technique is the same no matter how many coats you are applying. Dip the brush into the varnish so that only the lower third of the bristles contain finish (Photo 8). Gently squeeze out enough excess varnish to prevent drips as you move the brush to the wood (Photo 9). Hold the brush near or by the ferrule and touch the bristles to the wood at about 45 degrees (Photo 10).

The surface of the bristles should be shiny, with varnish flowing gently off the brush. As you continue to move the brush along the wood, the top bristles will start to dry. Increase downward pressure to keep the varnish flowing out of the brush (Photo 11). A good long-bristle brush will allow you to coat a two-foot strip before reloading. When you come to the end of a stroke, lift the brush off the wood while still moving forward (Photo 12).

With flat surfaces, start from one end and coat in only one direction with the grain. On raised panel doors, do the recesses first with a sash brush, and then switch to a two-inch brush for the panel and finally, the frame. On oddly shaped pieces (spindles, legs, rails) go whichever way is most convenient, but work with a drier brush to prevent drips. Be careful not to overlap near sharp edges and corners where runs are most likely to occur.

When you've covered a manageable area and the varnish is still very wet, unload your brush by slowly scraping on the edge of the container. Then "tip-off" the fresh varnish with the brush at 90 degrees to the wood (Photo 13). If you're working a small area, like the top of an end table, you'll be able to tip off the entire surface at once. If you're doing a conference table, tip off the first few passes, then go back and coat the adjacent section.

Dealing with drips and runs is inevitable. It's always best to pick up a drip while the varnish is still wet. Unload your brush by slowly scraping it along the edge of the container to avoid bubbles. Go back over the drip or run with your brush, letting the tip of the bristles smooth it out as you pick up the excess. If you find a drip only after the finish has started to cure, level it by slicing off the bulb of the drip with a razor blade. Slice it at a low angle. Wait until the freshly exposed area fully cures, then sand lightly before applying the next coat.

Drying times vary from brand to brand, but all varnishes cure rather slowly. So to stay on the safe side, apply only one coat per day. Building the finish too fast can leave the inside coats partially cured, which can result in a soft finish.

Varnish's molecular structure changes as it cures.

7 To enhance leveling and minimize brush marks, thin varnish 10-15% before use with mineral spirits or naphtha. This works best when you can varnish on a horizontal surface where drips or sags are not a factor.



8 Load the brush with varnish by dipping the first 1/3 of the bristles in the varnish.



9 Lightly squeeze out the excess varnish from brush on side of the container. There's no need to scrape the brush on the side as this removes too much varnish.





10 Apply the varnish with the brush held at a 45-degree angle to the wood. Press down enough to deflect the tip so that the ends of the bristles start to splay out on the wood. Drag the brush slowly, about two inches per second, with the grain.



11 As the varnish drains from the brush, keep the brush angle the same, but increase downward pressure to deflect the bristles and squeeze more varnish out of the brush and onto the surface.



12 Lift the brush off at the end of the wood. This keeps the varnish from getting pushed over the edge and leaving heavy drips.



13 Tip off the fresh varnish with an unloaded brush held perpendicular to the surface. Run just the bristle tips lightly through the wet varnish with the grain. Tipping-off helps eliminate brush strokes.

Its solvents can no longer dissolve the cured coating. Each coat must adhere mechanically to the previous one. To help this adhesion, each coat should be lightly sanded before recoating. Use 220-grit stearedated paper between coats and move to a finer grit before the last coat. In areas that are difficult to sand, try 0000 steel wool or a synthetic abrasive pad.

Apply at least three coats of varnish. This builds enough of a finish to look good and wear well. For a deeper look or a gloss finish, add more coats as needed. If you want a very thick satin finish, stick with gloss until the last one or two coats, or rub down the gloss to produce a satin sheen.

It's almost impossible to keep a varnish finish dust free, so you should plan to rub the finish out to smooth it (see "Super Smooth Poly-Finish, p.66).

CARING FOR BRUSHES

If you use a good-quality brush, you will want to clean it and wrap it up after each use. This will keep your brush working at its best for a long time. It is wise, in fact, to clean it before you use it the first time in order to remove any loose bristles or dirt.

Woodworkers often don't clean their brushes well because they consider the job a nuisance at best. You will find that you get better results if you make brush cleaning an important part of the finishing process. It's much the same as the time you spend getting a chisel or hand plane tuned and sharp.

Cleaning Steps

Here's the best way to clean a brush after using oil based finishes:

STEP 1 Clean by rinsing the brush several times in paint thinner. Squeeze the bristles against the bottom of a container (jar or coffee can) that contains an inch or two of paint thinner. Wring out the bristles with your fingers. Gloves keep your skin from drying out or having an allergic reaction.

STEP 2 Change the paint thinner frequently, as it becomes saturated with stain or finish. Keep two or three old containers for brush cleaning. Label them "First Rinse," "Second Rinse," etc. Cycle your brushes through from one can to the next. As the thinner in each can gets dirty, pour it into the previous rinse. When the thinner in the first can is too dirty to use, let it sit for a while. Eventually the solids will settle to the bottom and you can pour off the clean thinner to reuse.

STEP 3 The final step before washing with soap and water is to rinse the brush in lacquer thinner. Lacquer thinner removes the oiliness left by the paint thinner. The oiliness makes it hard to get the soap and water to suds up and do its job in the next step.

STEP 4 Wash the brush in soap and warm water. You can use any mild soap. A convenient one is dish soap. The idea is to wash the brush until it is clean enough to make suds.

STEP 5 Store the clean brush in the cardboard holder it came in or wrap it in heavy brown paper such as grocery bag paper. The purpose of wrapping is to make sure the bristles dry straight.



STEP 1



STEP 2



STEP 3



STEP 4



STEP 5

20 Finishing Tips

1 MAKE DEWAXED SHELLAC

Take the wax out of shellac and you have a great sealer that's compatible with most other finishes. It's best to get this "dewaxed" shellac as dry flakes that you mix with denatured alcohol. Usually you have to order the flakes through the mail. But in a pinch, you can decant (draw off one layer of liquid from another) dewaxed shellac from the canned shellac you'll find at the hardware store.

Bring a clean can or lidded jar with you to the store. With the okay of a salesperson, carefully carry a can of shellac to the counter and open it. If the liquid looks creamy, like cappuccino, put the can back and try another one. A good candidate for decanting will contain a clear, deep amber-colored liquid with a creamy-colored layer of residue at the bottom. This indicates that the wax has settled out. You can decant between two and three cups of dewaxed shellac from a quart of liquid shellac. After decanting, pay for the shellac and ask the clerk to dispose of the can with the waxy residue.



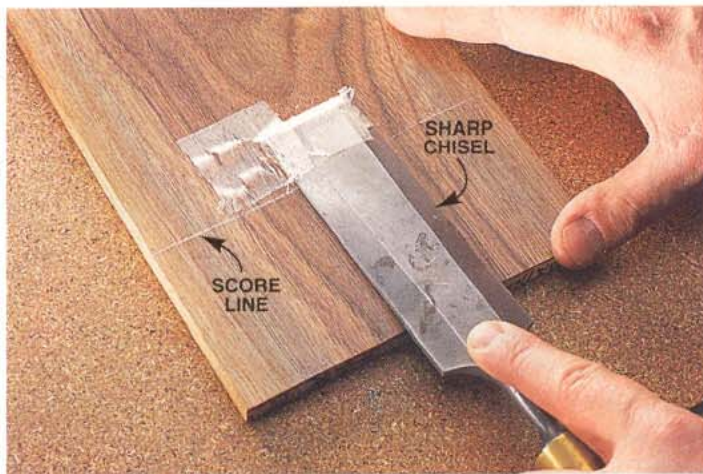
Decant dewaxed shellac from a can at the hardware store. Find a can in which the wax has settled to the bottom and pour off the pure shellac from the top.



Thin the decanted shellac with an equal amount of denatured alcohol for use as a sealer.

2 TEST FOR ADHESION

How do you make sure that old can of finish will work with the new stuff you want to use as a topcoat? Lay one coat of finish over the other, in the order you plan to use them. Allow each coat to dry before proceeding. Then score the surface across the grain and see if you can lift one layer off the other with a sharp chisel. If you can, don't use them together.



3

USE LEVITATORS

Brushing around the bottom of furniture legs is awkward. It's hard to see what you're doing, so it's easy to miss spots or lay on a coat that's too heavy. It's also hard to keep your brush from touching the workbench. If your brush gets contaminated, your finish can be ruined.

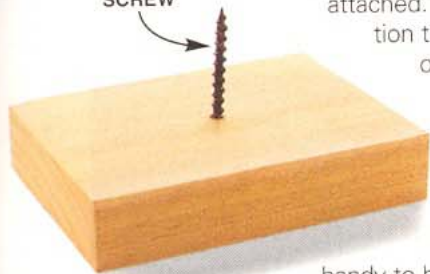
Simple-to-make "levitators" make this job much easier. By raising your workpiece off the workbench, they give more room to maneuver the brush. A slight tap on the top of each leg sets the screw points—pick up the workpiece and the levitators remain attached. This makes it easy to reposition the piece while you're working on it or move it out of the way when you're done.

Drywall screws work best because they have very sharp points.

(Standard wood screws don't work.) Levitators are

handy to have around, so make a bunch. Just stick them in a piece of rigid foam insulation board for storage so you won't get jabbed by the points!

2" DRYWALL SCREW



4

WARM THE LOOK OF WATERBORNE POLYURETHANE

Waterborne polyurethane finishes often make wood look parched (at right, top). Because they don't change the wood's color the way oil-based finishes do, the wood still looks raw. Tinting waterborne poly with amber-colored dye adds the warm color that's missing (at right, bottom).

It's easy. You can use either water- or alcohol-based dye. The dye is available as a dry powder or pre-mixed. If you choose the powder, mix it with water or alcohol following the instructions on the package. Add a teaspoon of the mixture to a quart of finish. Never add dry powder directly to the polyurethane. If you use a premixed liquid concentrate, add about five drops to a quart of poly. Experiment on scrap to get the right color intensity. Just remember—you'll want to apply three or four coats of waterborne poly for adequate protection, and each tinted coat will add a little color, so use the dye sparingly.

Adding color this way has another big advantage—it's blotch-free. Unlike stains, which can cause blotches when they soak in, waterborne poly forms a film on top of the surface. No soak, no blotch.

Source

Woodcraft Supply, (800) 225-1153 www.woodcraft.com Amber dyes: Transfast Powder #123826, early American maple, 1 oz. bottle, \$9; TransTint Concentrate #128481, honey amber, 2 oz. bottle, \$17.

CLEAR
WATERBORNE
POLY

TINTED
WATERBORNE
POLY

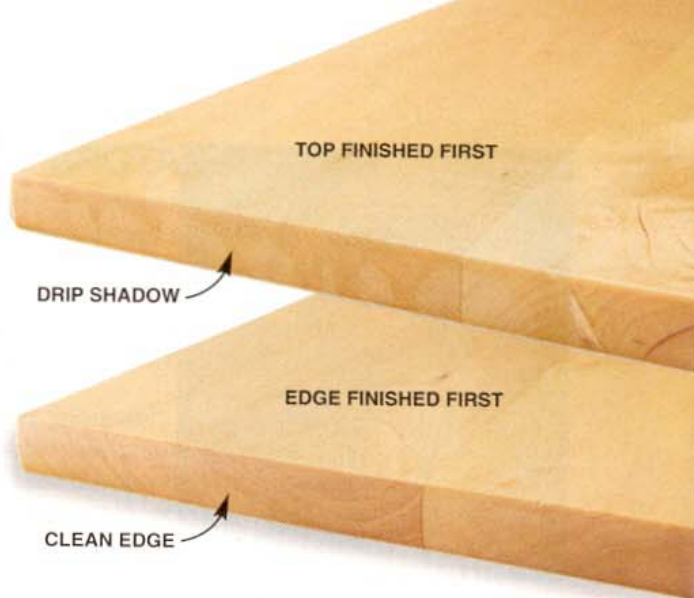


5

ELIMINATE DRIP SHADOWS

When finishing a large flat surface, the temptation is to finish the top first. Inevitably, some varnish runs over the edge and soaks into the end grain. Even after you finish the edge, the soaked-in drips remain as dark shadows. No amount of re-coating takes care of it and you're faced with having to strip, sand and refinish.

Fortunately, the problem is easily avoided. Coat the end grain with a thinned coat of varnish before tackling the top. A mixture of two parts varnish to one part mineral spirits works well. The drips won't be able to soak in and leave their shadow.



6

USE A PAD FOR WATERBORNE POLY

Remember finger painting in kindergarten? Wouldn't it be great if finishing could be that fun and easy? It can be with paint pad sponges. No more tortured hand positions as you maneuver a brush handle around chair rungs or into panel corners. These soft pads conform to contours while the short nylon bristles lay down an even coat of finish. The ends are cut at an angle so getting into corners is a breeze. The sponges also hold a lot of material, which means fewer trips back to the pan when finishing a large, flat surface. Look for pad sponges in the paint department of home centers and hardware stores.

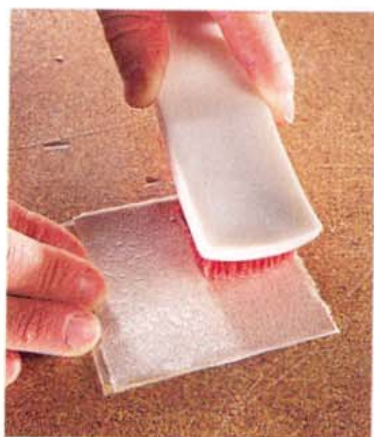


7

UNCLOG YOUR PAPER

When you're scuff-sanding between finish coats it's not unusual to get some loading on your sandpaper, even when the topcoat is good and dry. It's frustrating when you know the grit is still good but those clumps of powdered finish ruin its effectiveness. Don't toss it out just yet. Clean the clogged paper with a

nylon brush used for stripping. The stiff bristles knock off those pesky clumps and restore the paper to a useable condition.



8

BAG YOUR CARTRIDGE MASK

Organic vapor cartridges work great but their useful life is only about eight hours. That's not very long. And what's worse, they're such dedicated little buggers they actually keep right on working even when you're not wearing the mask. Give them a rest and prolong their life by storing your mask in an airtight container when not in use.

A resealable plastic bag or an old ice-cream pail work great.



9

IRON OUT THOSE DENTS

Here's a classic tip everyone should know: it's not hard to make a dent in wood and it's not hard to get one out. All you need is a household iron and a damp cloth. (Don't worry, the iron won't get wrecked, but you may want to ask permission if it's not yours!) Put a couple drops of water onto the dent and let it soak for a minute. Then lay the damp cloth over the dent and press the hot iron over it. The water in and around the dent is heated to steam, which quickly swells the wood fibers back to their original shape. Don't overdo it with the iron. Once you see the steam, remove the iron and cloth and give the fibers a little time to swell. If the dent isn't completely gone after the first try, repeat the process. A little light sanding completes the repair.



Yes, these really are genuine before and after photos.

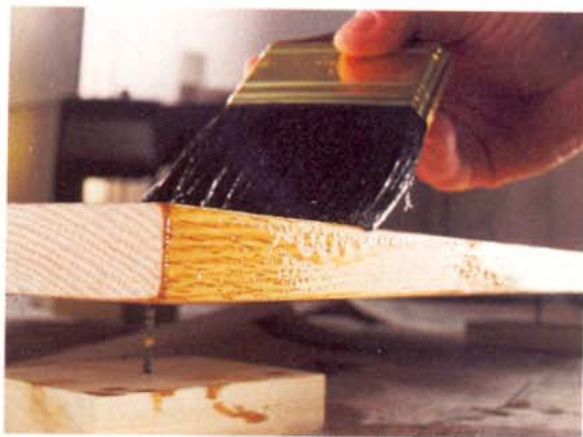
A household iron and a damp rag are all you need to repair most dings and dents.



10

USE TWO BRUSHES TO CONTROL DRIPS

A big brush that holds a lot of finish is great for covering a large flat surface. But that same big brush often leaves too much finish on its thin front edge. The remedy: use two brushes. First, using the big brush, quickly cover the front edge and an adjacent section of the top with finish. Tip off this swath of finish on the top with the big brush. Then switch to a second smaller brush and smooth out the coat on the edge, removing any sags and drips as you go. Once the edge is finished, switch back to the big brush, feather in where you left off and finish the top.



Drips and sags on the front edge of a board are hard to clean up with a big brush because it leaves a heavy coat that's likely to sag.

Use a second brush—small, disposable foam ones work great—to get rid of drips and sags on edges. The secret is to keep this second brush fairly dry—only dampened with mineral spirits—so it can wick up excess finish. Hold this brush at an angle so it cradles the bottom lip of the edge and make one long end-to-end stroke. If you need to make a second pass, put on a plastic glove and squeeze out the brush.



11

PORTABLE TOUCH-UP KIT

Mixing tiny amounts of stain from big cans and cleaning brushes all for one little touch-up job used to drive me crazy.

While watching my wife apply fingernail polish, I had a moment of inspiration. The clear 1/2-ounce bottles are perfect for storing different-colored stains and the self-storing brushes never need cleaning! I rinsed out some old bottles and brushes with lacquer thinner and filled them with my most-used stains. I keep a little plastic cup in my kit for mixing custom colors.



12

GLUE BEFORE YOU STRIP

When restoring old beat up antiques the typical sequence is to strip, repair and then refinish. I like to change the order a bit and re-glue the loose joints and do repairs first. That way I don't have to worry about glue squeeze out—it's taken care of when I strip. Also, any new wood used in repairs gets worked up like the old wood, which helps it blend in better. After stripping, all I have to do is sand and refinish.



13

REMOVE WATER-SOLUBLE DYE

It happens to everybody. On your sample, the color was perfect, but on your piece, it doesn't look right. Don't despair. There's an easy way to remove water-soluble dye color so you can try again. Sponge the surface liberally with regular household chlorine bleach. Almost instantly the color will lighten and begin to disappear. Two coats of bleach may be necessary and the process may slightly change the color of the raw wood. Rinse everything with water, sand the raised grain, and you've got a second chance.

14

SEAL POROUS END GRAIN WITH EPOXY

Outdoor furniture lasts longer if its legs are sealed with epoxy, which prevents the wood from wicking up moisture from the ground. Use a thin-bodied epoxy: it soaks in the best. Hobby stores usually carry epoxy in several formulations—just pick the runniest one. If you get too exuberant and drip epoxy over the edges, remove it with acetone before it cures.



15

TEST FINISHES ON HIDDEN AREAS

Here's one of the best (and most ignored) tips for getting a great finish: test the stain colors and topcoats you're considering for your masterpiece on its hidden areas. If your piece has no unseen surfaces, use offcuts from the project or leftover scraps of the same wood.

Prepare the areas for your hidden tests as diligently as the parts that show. Record your finishing procedures for each sample. Be sure to topcoat stains and dyes—they usually look totally different under a finish. Aerosol cans of shellac or lacquer work great for this. Be sure to look at your samples under the kind of light the piece will live in—finishes look different under natural or incandescent light than they do under fluorescent shop lights.



16

EBONIZE WITH INK

Ebonizing wood isn't as easy as it seems. Black dyes usually leave a bluish or greenish cast, oil stains look washed out and paint obscures the grain. But a good India ink, which is really a very finely ground pigment, does the job. It's available as a fast-drying waterborne liquid at art supply stores (Black Cat Waterproof India Ink, Dick Blick Art Materials, 800-933-2542, www.dickblick.com, #21101-2006; \$7.50/pint).

As with any waterborne finish, raise the grain before you apply the ink. Dampen the wood with water, let it dry and sand lightly to cut down the swelled fibers; then brush on the ink. Once dry, it's compatible under any finish.



17

MAKE YOUR OWN WOOD PUTTY

Tired of never having fresh wood putty when you need it? You've probably opened a can and found its contents dried out, unusable or the wrong color.

If you plan to use a clear finish, you can make your own putty from sanding dust (save some when you're sanding your project) and varnish. Just mix the two into a thick dough by adding the varnish to the dust, a little at a time. Varnish makes a good binder. Even though it takes a long time, once dry, it stays dry. Shellac and lacquer may dry faster, but putty made with them tends to dissolve under a fresh topcoat of the same finish.

Apply the dough with a putty knife and let it dry (at least overnight) before sanding. Under a clear finish, this putty closely matches the wood tone, although it may be a slightly darker color.



18

A DRYING RACK FOR KNOBS

In my shop, knobs wet with finish used to be accidents waiting to happen. They'd always end up on the floor. Then I discovered hidden value in a length of triangular scrap: With their fastening screws as counterweights, knobs rest on it securely.



19

STRAIN YOUR VARNISH

Have you ever tried to use varnish from a skinned over, half-used can? Even if you remove the skin carefully, lumps of dried finish get mixed in with the remaining varnish and eventually end up on your project. But don't throw the stuff away—there's an easy way to get clean varnish from a used can. Just pour the contents through a paint filter into a second container. The filter is a paper cone with a cheesecloth nose (available at paint stores and home centers for about 25 cents apiece). Working from a second container is a good idea anyway—it keeps the storage can from getting messed up. The brush often transfers bits of junk it picks up from the surface back to the container, so clean the leftovers again when you pour them back into the storage can. You can use the same filter if it hasn't dried out.



20

MAKE SURFACE CHECKS DISAPPEAR

Don't let small surface checks keep you from using an otherwise good board. Got a minute? You can make those checks disappear.

Squeeze cyanoacrylate (CA) glue into the crack. CA glue works better than yellow glue because it dries very quickly. Any brand of gap-filling CA glue with a 5- to 15-second open time will work (about \$5 at home centers and hardware stores). Use a tip with a pin-sized hole (you can get replacement tips for 50 cents at hobby stores).

Immediately sand the area, mixing sanding dust with the glue and packing it in the cavity. Keep sanding until the crack is filled and the excess glue is removed. You may need to repeat the process. Under a finish, the sanding dust/glue mixture is almost invisible.



Finishing Rack

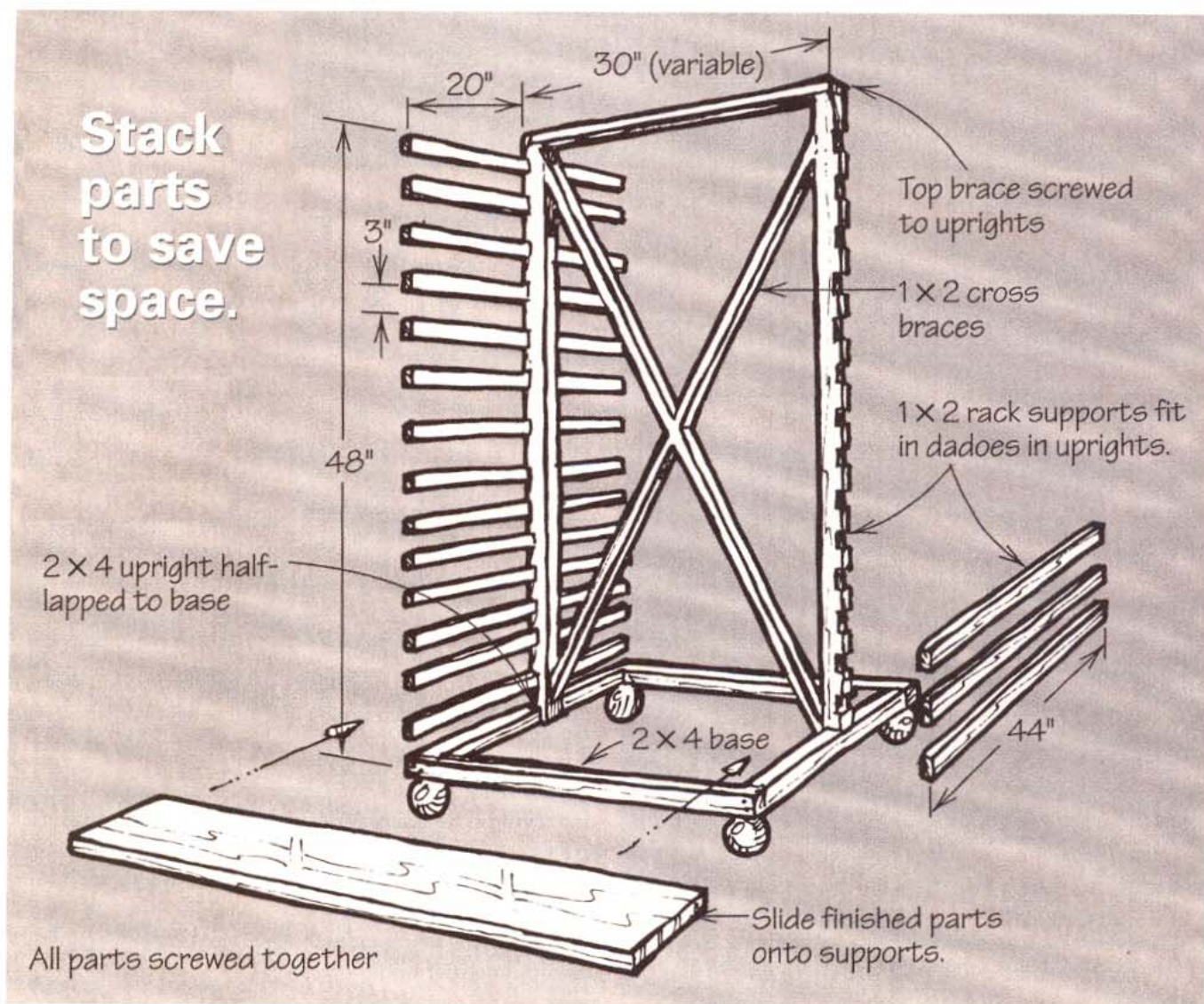
Keep surfaces flat so the finish won't run or sag.

The surest way to prevent a run is to deal with what causes it: gravity. This rack holds boards in a horizontal position so that the finish can't run or sag while it dries.

The rack has a 2 x 4 frame, with 1 x 2 supports to hold the finished parts. Use screws to fasten the base members and top brace. You can easily undo them to change the

rack's size, if necessary. Leave plenty of space between the dividers to insert the finished pieces. If you want to move the rack around the shop, add casters.

When using the rack, finish just one side of your pieces and slide them onto the supports. After the pieces are dry, finish their other sides.





Staining Wood

Bring Out The Natural Beauty In Any Wood

Staining is as problematic for woodworkers as any aspect of finishing. It's disheartening to see your hard work ruined by a blotchy stain or one that's too dark or light or even the wrong color. When you apply stain to wood, you may not get the intended effect. Even worse, because it's often impossible to correct staining problems after they've occurred, you may be stuck with what you have. This frustration causes many woodworkers to shun staining altogether.

This is a shame. If staining is done properly, it enhances the natural beauty of wood much more than simply applying a clear finish. Done properly, stains intensify the figure and grain of wood to make it appear more alive and interesting. Of course, stains can also be used to change or blend the wood's natural color.

Stains are often used to imitate the rich patina of old furniture or to make plain but affordable woods such as alder and birch, look more like their high-class cousins (Photo 1).

During the 1960s and 1970s, the "back to nature" movement influenced furniture styles. As a result, the natural look of wood became very popular. It's likely that among woodworkers, at least, this style was reinforced by the relative ease with which a natural look could be accomplished. All you had to do was apply a couple of coats of oil and wipe off the excess. It's a great look, but there are many beautiful options that only stain can deliver.

The trend today emphasizes an increased range of colors and textures. Even faux (imitation or fake) finishes are back in style.

You may not always choose to color your wood, but it is no longer acceptable to reject staining out of hand. Understanding stains and staining opens up new possibilities for finishing your woodwork.

KNOW HOW YOUR WOOD STAINS

The grain of each wood species will have its influence on how a stain performs. Wood is an uneven, porous material composed entirely of soda straw-like channels that carried water and nutrients when the tree was alive (Fig. A, below). When a tree is milled and the boards are dried of excess water, these channels are left open to absorb stain. More stain is absorbed into the ends of the straw-like channels than into the sides. That's why end grain and areas where swirly grain angles to the surface will always show up darker (Photo 2). Pine, cherry, birch, and maple are the woods most notorious for having grain where the channels undulate above and below the board surface. The result can be a horribly blotchy appearance.

On some species, uneven stain absorption can be an advantage. Coarse-grained woods, such as oak, ash, elm, and chestnut, have different-sized channels and unevenly spaced grain due to a large difference in density between spring- and summer-growth wood (Photo 3). Large channel openings, sometimes called pores, in the fast growing spring-wood retain a lot of stain and become quite dark. The denser, slower growing summer-wood does not retain much stain, so it stains lighter. Stain will accentuate the differences between the spring-growth and the summer-growth in these woods. (For more see "Finishing Oak" p.43)

Dense, fine-grained woods, such as maple, birch, cherry, poplar, alder, and gum, pose a problem if you want to make them dark. The pores are too small for many stains to color these woods well.

Medium grained woods, such as walnut, mahogany, and teak, are the easiest to stain evenly because their pores are of fairly uniform size, evenly spaced, and large enough for all stains to be effective. The limited amount of blotching that occurs in these woods is usually considered to be attractive.

Some woods, such as curly and bird's-eye maple, as well as crotches and burls of various species, have a swirly grain of uneven density that is not only attractive but eagerly sought. The natural beauty of these woods can be enhanced with stain.

A wood's natural color will also affect the hue you get after staining. For example, walnut is already quite dark, so stain has less effect on it than it would on a light colored wood such as maple. Mahogany and cherry have a natural pinkish to reddish coloring, which makes these woods come out redder than you would expect from the color of the stain. The heartwood of poplar is greenish in contrast to the sapwood, which is nearly white.

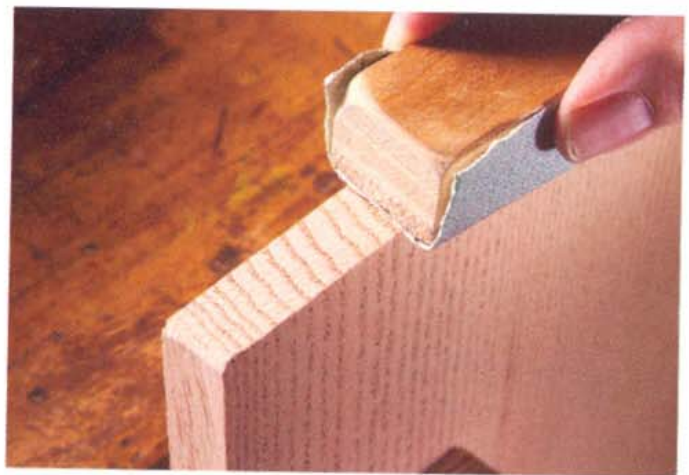
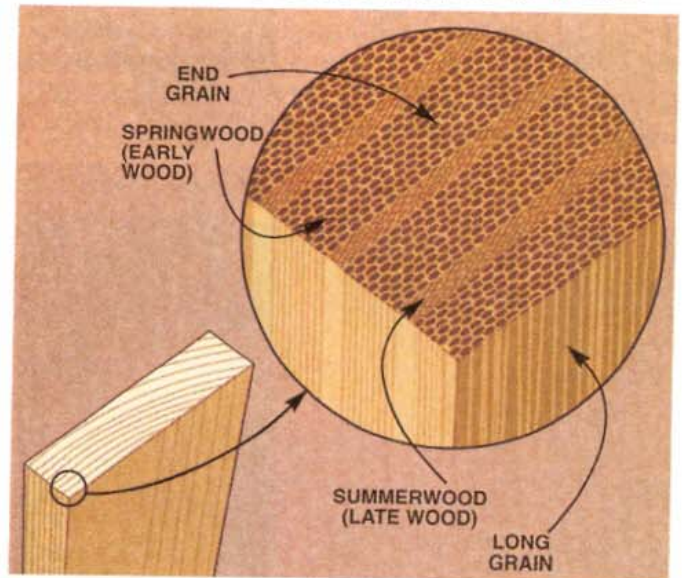
PIGMENTS AND DYES

The colorant in all common stains is either pigment or dye, or a combination of the two. Pigment is natural or synthetically made colored earthen powder. Each pigment parti-



1 Stain can do wonders for wood's appearance. It is often used to make less expensive wood, such as birch, look like its high priced cousins. All four samples came from the same plank of birch, but were stained to look like a different species.

FIG. A A MICROSCOPIC VIEW OF WOOD



2 End grain stains darker than the face grain. That's because wood fibers are like a bundle of straws. The ends are wide open and can absorb much more stain. Sand the end grain with finer grits than you used on the face grain. This will burnish the end grain, sealing up the pores so they take stain more like the face grain.



3 Uneven absorption can be a good thing when it accentuates the natural beauty of open-pored woods such as oak. In the spring, oak grows fast, producing the large pores in a distinct ring called early wood. The open pores absorb more stain and will look darker than the denser slow-growing late wood next to it.



4 The most common way to apply stain is to flood the surface using a brush, rag or spraygun, then wipe off the excess with a clean rag.

cle is large enough to see with your naked eye. These particles are much too big to penetrate into the fibers of wood. Pigment lodges in pores and other cavities, making these areas darker, but it doesn't add as much color to the denser, in-between areas. The finer the pigment particles, the better penetration a stain will have.

Dyes are transparent and do not obscure the wood like pigmented stains can. They are not as colorfast as pigments and can be tricky to apply if a strong color is used.

APPLYING STAINS

You can apply stains using any of three tools; a rag, a brush, or a spray gun. You can also pour the stain onto the wood and spread it around, or you can dip the wood into the stain. The method you choose is governed by the tools you have at your disposal.

But regardless of what tools you use, there are really just two ways to apply stain:

- Apply and wipe off all or most of the excess.
- Apply and leave the excess.

WIPING OFF THE EXCESS

The most common method of staining is to apply the stain and then remove the excess (Photo 4). It makes no difference in which direction you apply the stain, because you're going to remove all the excess anyway. It also makes no difference in which direction you remove the stain, as long as you remove it all. But, it's good practice to make your last wiping strokes go with the grain, just in case you leave some streaks. That way, the grain will help disguise the streaks.

The trick is to get all the stain wiped off the wood before it starts to dry. If you are working on a large surface, you can divide the object into smaller parts and stain them one at a time. The parts should be divided at natural breaks, so you don't risk lap marks.

Caution: Be sure the stain-soaked rags are disposed of properly (Photo 5).

LEAVING THE EXCESS

You can also leave some of the stain in order to make the wood a little darker. When removing the stain, wipe in long passes with the grain, so streaking will be less likely to show. You can leave as much of the excess stain as you like, as long as the coloring is even.

This is more difficult than wiping off the excess, because you must apply the stain evenly to keep the color even. It's almost impossible to apply a pigment stain evenly with a brush or rag. A spray gun works best. Keep in mind that pigment stain obscures the wood if all the excess is not wiped off. The more stain you leave on the surface of the wood, the closer the results will resemble paint.

Dye is transparent, so dye stains can be applied fairly heavily on top of wood without obscuring it. You may want to apply coats of dye stain and leave them in order to make the wood darker than it would get if you wiped off all the stain.

TIPS FOR APPLYING WOOD STAIN

PREVENT BLOTCHING

The most common and frustrating staining problem is blotching. Blotching is uneven coloring in woods that have uneven grain or grain that varies in density (Photo 6). There is no way to remove blotching except to sand, scrape, or plane below the depth the stain has penetrated. Stain can't be totally stripped out of the wood.

Blotching is most likely to be a problem with fir and pine, among the softwoods; and poplar, aspen, birch, and cherry, among the hardwoods. To prevent blotching, the stain has to be kept from penetrating unevenly. This is best accomplished by keeping all the stain very near the surface of the wood. There are two easy ways to do this.

- Use a gel stain to minimize deep penetration into the wood.
- Seal the pores first with a stain controller so the stain can't penetrate.

GEL STAINS

Gel stains are commonly marketed as easy to use, but this is not their real value in finishing. Their real value is reducing blotching. This can be both good and bad. Woods such as pine and cherry will blotch less with a gel stain. That is a good thing. However, gel stains don't flow into the wood's pores and fibers like liquid stains do. Thus, gel stains don't accentuate the wood's figure (or flaws) as much as liquid stains. This can be a bad thing on woods such as mahogany and bird's-eye maple. With these species, you usually want deeper stain penetration to bring out the beautiful figure.

WOOD CONDITIONERS

Wood conditioners can be used before applying stain to keep the stain from penetrating unevenly. Most wood conditioners work by filling up the pores and less dense parts of wood so the stain can't penetrate as far.

To get the best possible results from a wood conditioner, apply it liberally with a brush or rag until all parts of the wood stay wet. Keep applying more conditioner until no more of the liquid is absorbed into the wood. This usually takes continued applications for five to ten minutes. The number of applications varies with the type of wood and the ingredients used in the conditioner. This advice may be contrary to what the directions on the can say. Many manufacturers do not explain that more than one application is usually necessary.

When no more dry spots appear on the wood, wipe off all the excess conditioner.

WHICH IS BEST?

Gel stains can be more predictable. They produce consistent results because there are no variables, such as number of coats applied or elapsed time before the stain is applied. As always, it's best to experiment on some scrap before you decide what to use on the project.



5 Stain soaked rags are a fire hazard. Unfold the rags and drape them over an sawhorse or the edge of a garbage can to air dry before disposal. Bunched up rags trap the heat given off as the oils in the stain cure and can result in a fire.

6 Liquid stains penetrate deeper into areas of lower grain density causing ugly blotchiness in woods such as pine. Gel stains are so thick they won't penetrate as unevenly and tend to minimize blotchiness. On the other hand, gel stains don't highlight the beautiful grain in woods such as oak or bird's-eye maple like liquid stains do.



7 Wood conditioner or Gel stain help prevent blotching.

Tips for Finishing Cherry

Oil it, spray it, shellac it, or glaze it. This is how to make cherry look great.

Cherry is gorgeous wood, but as you've probably discovered, it can be nasty to finish. Cherry boards come in all different colors, the sapwood and heartwood don't match, it can look really blotchy and it darkens as it ages. Here are tips for choosing cherry lumber, getting rich color and a uniform appearance.

COLOR VARIES FROM BOARD TO BOARD

To make finishing easier, choose boards that look the same. Some suppliers sell boards from the same tree together, to ensure a good match. Usually, though, you'll be on your own.

If you plan to use solid cherry along with cherry plywood, stand the solid cherry boards against the veneer in good, natural light, so you can compare the colors. Wetting the surfaces with mineral spirits is a good way to get a true indication of color.

If you can't find enough boards of the same color for your entire project, group similar ones together for the various parts. Everyone will see that single off-colored board in the top, but no one will notice if one side of a cabinet is a slightly different color than the other.

CHERRY DARKENS OVER TIME

Cherry's color deepens from a pale pinkish-tan to a deep red-brown as a result of its exposure to air and light. The color change is so rapid at first that within hours, a partially covered board can develop a shadow line that can be hard to sand out. It's important to keep freshly planed cherry boards

either completely covered or completely exposed.

After the first couple of weeks, darkening becomes more gradual. Most finishes will slow cherry's color change, especially ones with

UV blockers (check the label), but they don't stop it. At first, oil finishes (page 36) give cherry a deeper, richer appearance than traditional finishes such as shellac and lacquer. But after a year or so, they'll all look pretty much the same. Cherry doesn't darken as quickly under varnish and polyurethane finishes (page 37).

If you want to give cherry a dark color right away, don't stain the raw wood. Stain colors cherry's pores and makes it look unnatural. Instead, seal the wood before you add color (page 38).

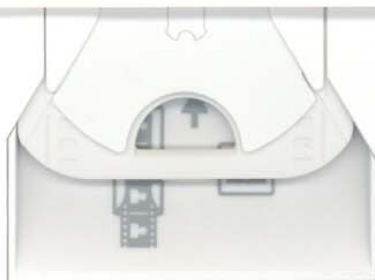
SAPWOOD AND HEARTWOOD

The difference between cherry's white sapwood and rosy-tan heartwood becomes more distinct over time. The heartwood darkens, but the sapwood doesn't. The best way to deal with sapwood is to cut it off, but it can be finished to



PHOTOGRAPHY: LEAD PHOTO: BILL ZUEHLKE, ALL OTHERS: STAFF

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blend with the heartwood (see “Coping with Cherry’s Light-Colored Sapwood”, page 39).

THIRSTY SPOTS AND CURLY FIGURE

Most cherry boards contain extra-absorbent spots and pockets of curly figure. With both, finishing results in a mottled appearance. To some, this is part of cherry’s inherent beauty; to others, it just looks blotchy. Before you choose a finish, check your boards for mottling by wiping them with mineral spirits.

CHOOSING A FINISH

There are two types of finishes for sealing and protecting

wood: those that dry to a hard film and those that don’t.

Film-forming finishes can be applied by wiping, brushing or spraying. Each layer you apply builds the thickness of the film. Finishes made from drying oils soak into the wood’s pores, but don’t harden enough to form a surface film. They have to be wiped, because you can’t leave any on the surface. On cherry, drying oil finishes emphasize a mottled appearance. Film-forming finishes, such as shellac, lacquer and polyurethane, minimize it. Polyurethane disguises mottling and curly figure the best, but it gives cherry less depth than shellac or lacquer.

WIPE-ON DRYING OIL

Oil finish gives cherry a rich tone, because of its amber color. However, cherry often contains figure that absorbs oil unevenly. The result is a mottled appearance. You'll either see this as part of cherry's appealing character or as unattractive blotches.

Tung oil, Danish oil and boiled linseed oil finishes soak into the wood, lodging in even the tiniest pores. As a result, cherry's super-absorbent spots and curly figure stand out. The amber color of these finishes amplifies the effect. If you like mottled cherry, use a drying oil finish.

Wipe-ons are the most worry-free finishes to apply. They're dust-free and you don't have to contend with drips, sags, or brush marks. Wiping can be tedious work, though, and you'll have to safely dispose of oil-soaked rags.

Brush, pour or rub the oil on the wood, according to the manufacturer's directions. Let the oil soak in, and then wipe all excess oil from the surface. After the first coat is completely dry, smooth the surface with very fine sandpaper or steel wool and apply a second coat. Once the wood has a uniform sheen, additional coats aren't necessary. These blends also contain solvents to make them easy to apply and driers to make them dry quickly. Wear gloves, a respirator and maintain adequate ventilation.

Pure drying-oil finishes contain only tung oil or linseed oil. They have no added driers or solvents, so they're safer to use, but they dry very slowly.

OIL FINISH

Cost: \$14 to \$25 per qt.

Coverage: 150 sq. ft.

PROS: Amber color adds warmth and depth.

Dust-, drip- and sag-free. Easy to renew.

CONS: Amber color highlights mottled figure.

Won't disguise color mismatches. Dries slowly.

Oily rags are a fire hazard. Sapwood remains

light-colored. Soaks into end grain and makes

it dark. Requires organic-vapor respirator.

SAFETY TIP

Rags soaked with finishes that contain boiled linseed oil can catch fire spontaneously. Spread the rags out to dry. Allow plenty of air circulation around each one. To play it safe, I always take them outside. It's okay to throw the stiff, dried rags in the trash.



Oil finish is easy to apply. Saturate the surface and keep adding more oil to keep it wet as the oil soaks in. Then wipe off the excess.

AEROSOL FILM FINISH

Film-forming finishes keep cherry from looking blotchy, but don't significantly enhance its tone. The cherry becomes richer looking on its own, as it ages under the finish. Within a year, it reaches an attractive coppery color.

Finishes that harden into a film minimize cherry's mottled appearance. They have less color than drying oils, and they don't soak in as much. The first coat of a film-forming finish seals the wood, so successive coats lay on top of each other. Each new coat thickens the finish film.

Spraying these finishes from an aerosol can is fast and convenient. It's great for getting into corners and covering intricate shapes. Spraying also eliminates brush strokes, and there's virtually no clean up. But you do have to deal with overspray and nasty fumes. At \$5 to \$8 for an 11- to 12-oz. can, it's also kind of expensive.

You can find shellac, lacquer and polyurethane in aerosol cans. Shellac and lacquer allow cherry to darken with age. Oil-based polyurethane dries the slowest, but it's the most durable. Waterborne poly makes cherry look pale and parched, unless you seal the surface with oil finish or dewaxed shellac first.

The secret with aerosol spray is to go easy. Sanding off drips and sags from one heavy coat takes a lot more time than spraying and sanding two light coats. Wear a respirator and maintain adequate ventilation any time you spray an aerosol finish. Here are some guide-

lines for using aerosol.

1. Keep the nozzle perpendicular to the surface and spray from a consistent distance, between 8-in. and 10-in. away.

2. Move the can at a steady rate. Start spraying before you reach the surface and don't stop until you're past it.

3. Move your project around (you may even want to turn it upside down) to get the best spraying angle. You can spray up and down as well as side to side.

4. Spray tough-to-reach areas first and areas that are most visible last.

5. Sand between coats with 280 grit or finer paper.

6. Use a new can for the final coat. Then you won't have to worry about a nozzle that spits because it's dirty or running out of finish.

AEROSOL FILM FINISH

Cost: \$5 to \$8 per can

Coverage: 25 sq. ft.

PROS: Minimizes mottled figure. Seals end grain so its color matches the face grain. Fast drying (except oil-based poly). Easy to rub out (except oil-based poly). Polyurethane is most durable.

CONS: Must sand between finish coats. Possible drips, runs and sags. Overspray. Requires organic-vapor respirator. Dust may stick to slow-drying polyurethane. Won't disguise color mismatches. Sapwood remains light-colored.

TIP

An aerosol tip that sprays in a wide fan pattern is less likely to leave sags and runs. Just look at the nozzle. If it's round, it sprays a cone pattern; if it's rectangular, it sprays a fan. You can adjust fan-type nozzles to spray horizontally or vertically. Cans with fan-spray nozzles cost about a dollar more, but they're worth every penny.

It's easy to get in corners with aerosols because there's no brushing or wiping. Avoid drips and sags by spraying light coats.



SHELLAC AND GLAZE

Shellac and glaze adds rich color and minimizes blotching. Shellac seals the wood so the glaze, which is thinned oil paint, adds color evenly. You can wipe the glaze hard, or feather it, leaving more in some spots than others. Glaze is great for disguising light sapwood.

This versatile process allows you to add color wherever it's needed, in a spot, or over the entire piece. It also helps to blend mismatched cherry boards or plywood and solid cherry. It disguises light-colored sapwood and hides mottling and unwanted curly figure. You can use it to make new cherry look older, because each coat of glaze deepens the color.

The technique is simple. First, apply two thin coats of Zinsser's SealCoat (liquid dewaxed shellac). Sand lightly after each coat, apply the colored glaze and wipe it off. That's it. Because the shellac has sealed the wood, the color goes on evenly, without making the surface look muddy. Once you're satisfied with the color, topcoat with polyurethane.

If you have serious color mismatches to deal with, two-stage coloring may work best. Put a coat of golden-brown-colored dye on the unfinished cherry, before the shellac (page 39, top right photo). It tempers the color differences so they're easier to blend with glaze.

You can brush shellac, spray it or apply it with a pad (Step 1). Let each coat dry thoroughly (usually about an hour). Sand each coat with 320-grit sandpaper. Sand evenly and carefully, because glaze will accentuate any scratches and leave a dark line wherever you cut through the shellac.

Glaze is nothing more than thinned paint. You can use gel stain as glazes or make your own, using artists oil colors and liquid glazing medium (Step 2).

Both are available at art supply stores. Artists oils contain very finely ground pigments, so they don't look muddy, and you can match just about any wood by using or mixing different colors. Liquid glazing medium makes the oil color spread evenly and dry faster.

Once you apply the glaze, you have plenty of time to work with it before it dries (Steps 3 and 4). It's also reversible (Step 5). Once the glaze is dry (overnight, in good conditions), you can deepen the color with a second coat, add additional glaze selectively to camouflage bad spots or highlight details, or finish with topcoats. As with other finishes, cherry will continue to darken underneath the glaze, although you'll hardly notice it.



STEP 1. Seal the surface with two thin coats of dewaxed shellac. This keeps glaze from lodging in cherry's tiny pores and turning them unnaturally dark.



STEP 2. Make your own glaze by mixing burnt umber artists oil and liquid glazing medium into a paste. Don't go overboard—a little glaze goes a long way.



STEP 3. Cover the sealed surface with glaze. It doesn't matter how you apply it or if you miss a few spots. Wiping evens things out.

COPING WITH CHERRY'S LIGHT-COLORED SAPWOOD

SHELLAC & GLAZE

COST: Shellac; \$8 per qt.

Glaze (Artists oil color and liquid glazing medium), \$15.

Topcoat: \$5 to \$8 per aerosol can.

COVERAGE: A little glaze goes a long way.

PROS : Rich color. Minimizes mottled figure. Goof-proof, because it's reversible. Disguises sapwood. End grain matches face grain.

CONS: Additional steps take extra time. Added cost. Finish topcoats necessary.



STEP 4. Use two rags for wiping, one that's fairly loaded with glaze and another that's fairly clean. Between the two you can feather the glaze however you want.



STEP 5. If you goof, mineral spirits removes glaze. If your glaze doesn't look right, you can take it off (before it dries) and try again.

It's not always practical to cut off all of the sapwood. If you can't remove all of the sapwood, hide it on the underside or turn it to the inside whenever you can.

You can disguise sapwood with pigments or dye, although these cover-ups look best when they're fresh, because cherry's color changes. And while pigments retain their color over time, dyes usually fade.

If you color sapwood with dye, it'll gradually get lighter while the surrounding heartwood gets darker. Matching the sapwood with pigment usually works better, but exposure to sunlight over an extended length of time can actually bleach cherry's heartwood, so sapwood colored with pigment can end up looking too dark.

The best way to color sapwood is to tone it with diluted golden-brown-colored dye, seal the surface with shellac and glaze over with burnt umber-colored pigment.

STEP 1. Color sapwood with oil paint. You may have to mix colors to get a good match with the heartwood. Thinning isn't necessary. First, seal the surface of the board with shellac. Then brush the paint on the sapwood only.



STEP 2. Wipe the paint carefully, so you tone the sapwood without adding color to the heartwood. If you mess up, remove the paint with mineral spirits and try again.



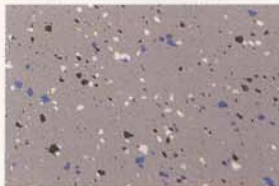
Diluted, golden-brown water-based dye makes dark-colored heartwood and light-colored sapwood appear more uniform. It also helps to blend unmatched boards.



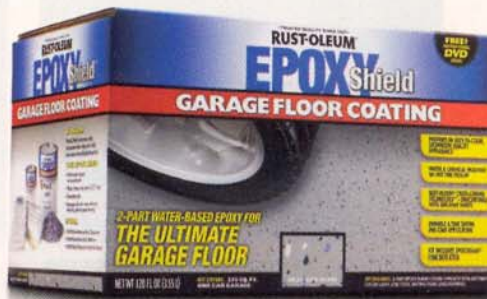
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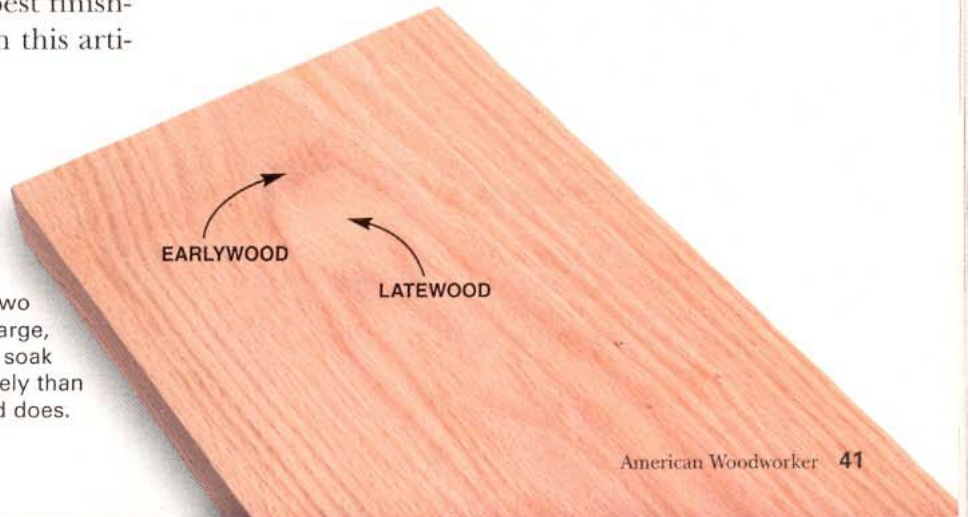
Tips & Techniques for Fantastic Oak Finishes

Like a movie star, oak possesses natural good looks. Unlike a movie star, however, oak is easy to work with—even during finishing. Oak’s distinctive grain pattern (see photo below) is what people are responding to when they say, “I love the look of oak.” The best finishes for oak celebrate its grain. In this arti-

cle, I’ll highlight some key finishing tips and techniques used to create the multi-layered finishes that bring out the best in oak. Check out the recipes that make use of these techniques in “4 Proven Oak Finishes” on page 46.

EARLYWOOD AND LATEWOOD STAIN DIFFERENTLY

Finishing oak is like finishing two different woods at once. The large, visible pores in the earlywood soak up stain much more aggressively than the relatively smooth latewood does.





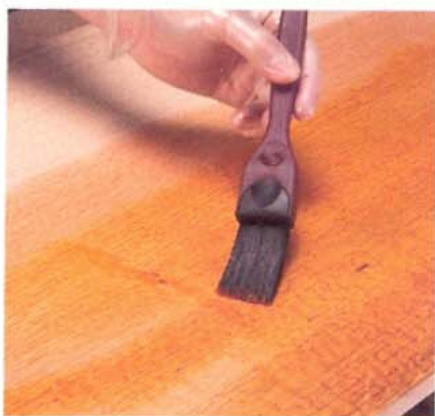
AVOID DISASTERS; MAKE SAMPLES FIRST

Always, always, always make samples before you begin to apply finish. Most finishing disasters can be avoided with this basic step. Making samples gives you the opportunity to tweak a recipe until you get the look you want. To get the most accurate preview of how the finish will look, make the samples out of scrap from the project you're finishing. Sand and finish the samples to the same level as your project including a topcoat.

Finally, accurately measure and record every step, including dye concentrations, mixture ratios, when to scuff-sand, number of topcoats, etc. There's nothing worse than hitting on the perfect look only to realize you don't know how you got there.

KEY TO A GOOD FINISH: PROPER SANDING

I sand oak to 220 grit. Although lots of people stop at 180 grit, I find going one more step polishes the dense late-wood and enhances its contrast with the coarse earlywood.



CREATE A GROUND COLOR WITH DYE

Many great oak finishes begin with a ground color made with dye, typically a yellow or reddish brown. The ground color establishes the finish's predominate undertone. Apply the dye liberally to bare wood with a brush or spray bottle. Blot up any excess with a clean rag. Even when thinned to manufacturers' recommendations, dyes produce very strong colors. To avoid too strong a color or problems with lap marks, I recommend thinning the dye 50 percent beyond the bottle directions. You can always add a second or even third application of dye for a darker look, but it's a lot harder to go from dark to light.

Tip: I use a spray bottle to mist the wood with water before I put on a water based dye. The damp wood takes the stain more evenly than dry wood.



ADD A BARRIER COAT OF DEWAXED SHELLAC

Shellac sealer brings the dyed oak to life. At the same time, it creates a barrier that prevents dyes or stains from bleeding into the next layer of finish. The barrier coat also creates distinct, well-defined layers that add depth and beauty. Be sure to use a dewaxed shellac like Zinnser Bulls Eye Seal Coat and thin to a 1-2-lb. cut. (A 2-lb. cut simply means 2 pounds of dry shellac flakes were dissolved in one gallon of alcohol - Seal Coat comes as a 2-pound cut but can be thinned even more.) Thin shellac is easier to brush and, because it's dewaxed, it's compatible with any topcoat. Be careful with pre-mixed shellac. Some cans use the words "finish and sealer" on the label but contain wax. Read the label carefully. It should say something like "universal sanding sealer" and "100-percent wax-free formula."



SCUFF-SAND CAREFULLY

Scuff-sand with 280- or 320-grit paper between coats of shellac and varnish. A light touch is all that's needed. Care must be taken not to sand through one layer of finish into the next. The sanding removes dust nibs and leaves a scratch pattern for the next coat to grip.

Tip: Scuff-sand the dye coat on quartersawn oak to make the ray fleck really pop. Because the rays are so dense, the dye tends to sit on the surface where a light sanding can easily remove it. This makes the rays lighter than the surrounding wood.



GLAZE DEEPENS THE GRAIN CONTRAST

A glaze layer is the secret ingredient to a great oak finish. A dark glaze emphasizes oak's beautiful strong grain. Glaze is nothing more than a thick stain, like a gel stain, applied over a sealed surface. Apply the glaze with a stiff brush across the grain (see inset photo). This helps push the pigment deep into the wood's pores. The glaze is removed with a pair of rags. The glaze left in the open pores of the earlywood turns it very dark. At the same time, the sealed latewood takes up very little stain.

The result accentuates the natural contrast in oak's grain.

You can control the color strength on the latewood by either wiping the wood clean or leaving a little glaze behind. Use one rag to pick up the bulk of the stain. When it becomes saturated, it will leave a thin layer of color behind. Use the dry rag to clean up stain in corners or molding profiles. If the glaze ends up too dark or dries too quickly, don't panic; just wipe the surface with a rag soaked with mineral spirits and start over.



Tip: Cut the bristles of a disposable brush in half. The short, stiff bristles make it easy to scoop the thick gel out of the can and push the stain deep into the wood's open pores.

TOPCOATING PROTECTS THE COLOR

A protective topcoat adds depth and durability. Typical topcoats are oil-based or water-based varnish or lacquer. They protect the finish you've labored so diligently to create, as well as the wood beneath it. Be sure to seal the glaze layer before a topcoat is applied. Dewaxed shellac is the perfect sealer because it's compatible with any topcoat you choose.



A protective
topcoat adds
depth and
durability.

4 Proven Finishes for Oak

A good finish should highlight the best characteristics of the wood it goes on. I've put together four finish recipes that make the most of oak's contrasting grain. The first three recipes use two different color layers, each separated by a seal coat of shellac. Light penetrates and reflects back through the layers, giving these finishes stunning depth and beauty. The fourth is a simple, out-of-the-can recipe that produces a surprisingly good-looking finish.

The layered finishes start with a ground color of water-based dye. I like water-based dyes because they don't bleed back out of oak's

pores like alcohol-based dyes do. Next, a barrier coat of dewaxed shellac seals in the dye. Shellac dries fast, allowing you to move through the steps quickly. A second layer of color, called a glaze, is applied over the sealed dye. The dark glaze fills the open-pored earlywood, increasing its contrast with the light-colored latewood. I use a gel stain for the glaze because it doesn't run all over or bleed back. Another coat of shellac seals in the glaze. The dewaxed shellac allows you to use your favorite topcoat. (Check out "Tips & Techniques for Fantastic Oak Finishes," page 43.)



1 Mission Oak

This finish is designed specifically for quartersawn white oak. Sanding the dye coat ever so lightly really enhances the ray flecks.

1. Apply a 50-50 mix of Trans Tint Dark Mission brown and medium brown dye to the bare wood and let it dry.
2. Very lightly scuff-sand the dyed wood with 320-grit paper.
3. Seal the dye with a barrier coat of wax-free shellac.
4. Scuff-sand.
5. Glaze with Varathane dark walnut gel stain.
6. Seal with wax-free shellac and scuff-sand when dry.
7. Apply a topcoat of your choice.



2 Golden Oak

This is a classic oak finish familiar to any antique lover. The glaze layer darkens the open-pored earlywood and contrasts beautifully with the brownish-gold latewood. This finish looks best on red oak.

1. Trans Tint honey amber dye to the bare wood and let it dry.
2. Seal with shellac and scuff-sand when dry.
3. Glaze with Varathane dark walnut gel stain.
4. Seal with shellac and scuff-sand when dry.
5. Apply a topcoat of your choice.



3 Deep, Dark, Red Oak

This finish looks great on plainsawn red oak boards and is impossible to get straight out of a can. The red dye is incredibly strong. But the gel stain is applied without a barrier coat so it darkens both the earlywood and latewood.

1. Apply Trans Tint bright scarlet to the bare wood and let it dry.
2. Apply Minwax jet black mahogany gel stain.
3. Seal with wax-free shellac and scuff-sand when dry.
4. Apply a topcoat of your choice.



4 Simple, But Nice, Oak Finish

This finish is as easy as it gets. Its results are not as spectacular as those of the other three recipes. But it makes up for its plainer look with ease of application.

1. Apply two coats of Rockler's Mission Oak Wipe-On gel stain.
2. Seal with shellac and scuff-sand when dry.
3. Apply a topcoat of your choice.

Source Woodcraft, (800) 535-4486, www.woodcraft.com Zinnser Bulls Eye Seal Coat, 1-qt., \$9, TransTint Dyes: honey amber, #128481, 2-oz. bottle, \$17, bright red, #128488, 2-oz. bottle, \$17, medium brown, #128484, 2-oz. bottle, \$17; dark Mission brown #128486, 2-oz. bottle, \$17. • Rockler, (800) 279-4441, www.rockler.com Mission oak wipe-on gel stain, #34921, 1/2 pint, \$8. • Home Centers and Hardware Stores: Varathane dark walnut gel stain, 1 quart, \$12; jet Minwax gel stain black mahogany, 1 quart, \$12.

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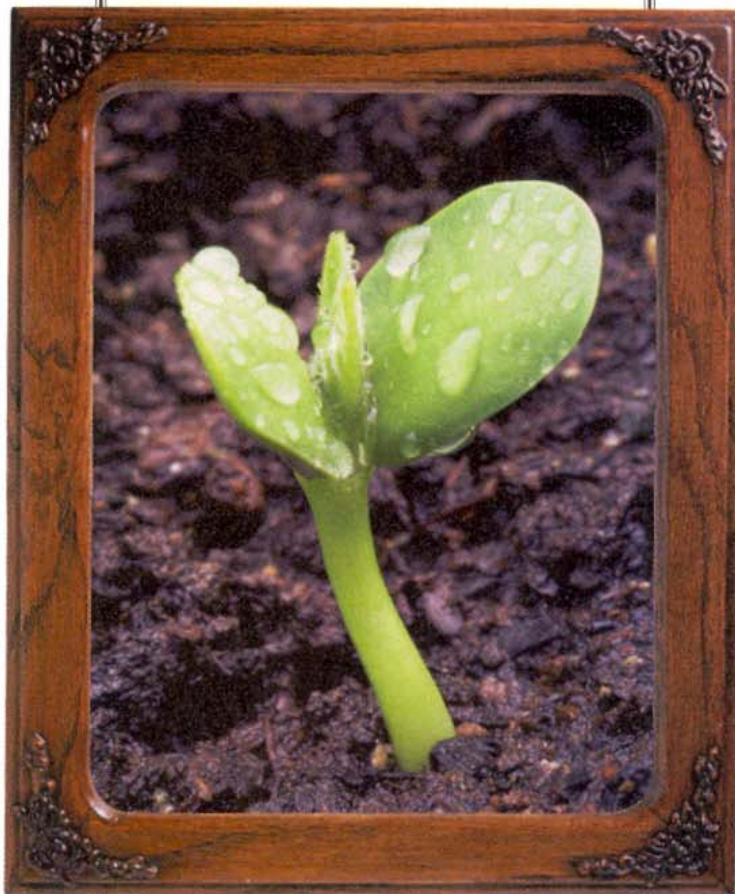
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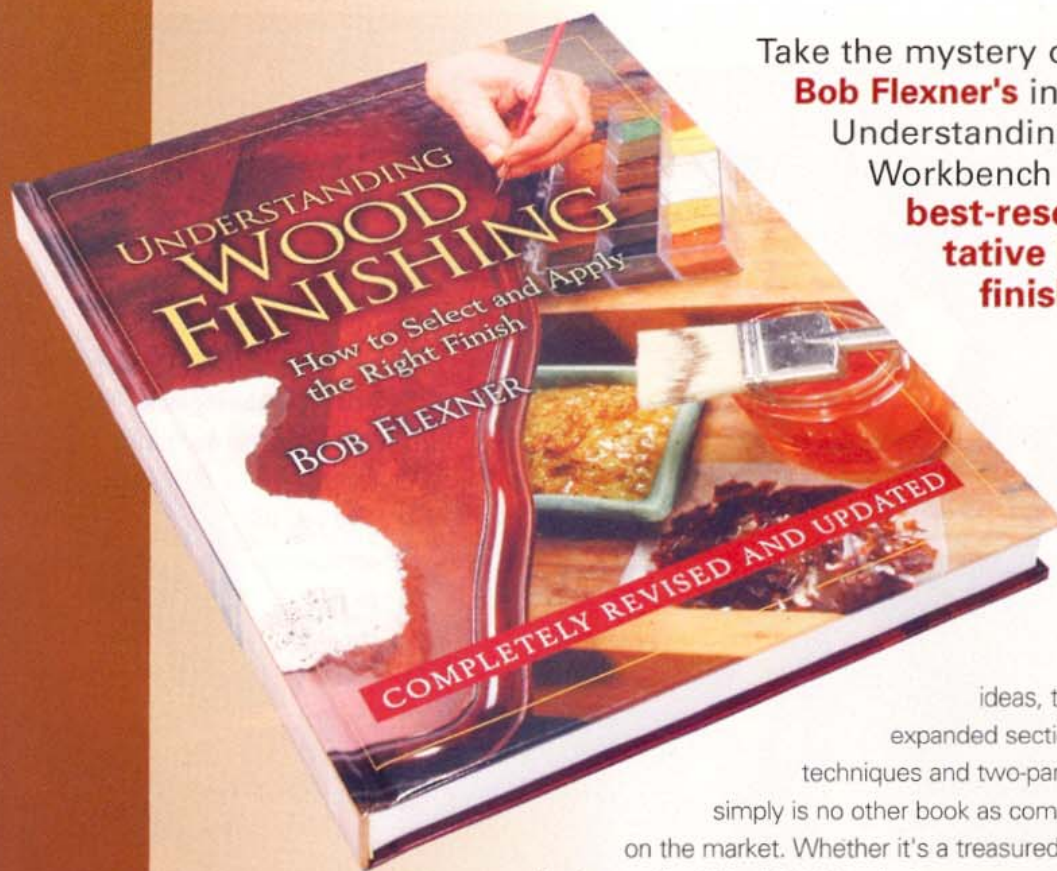
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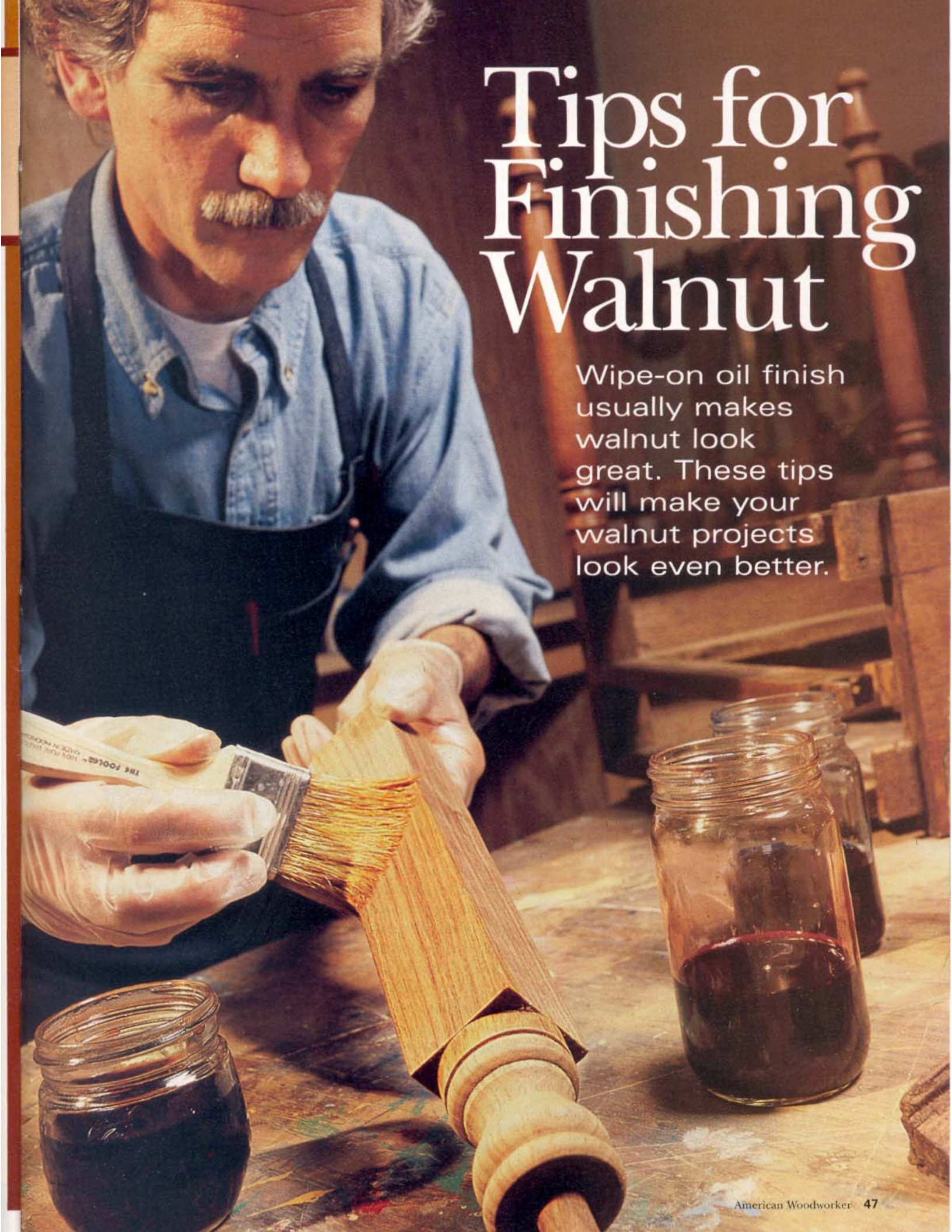
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Tips for Finishing Walnut

Wipe-on oil finish usually makes walnut look great. These tips will make your walnut projects look even better.

Make Sapwood Disappear



Color Mixing Chart

Red + Blue = Violet
Red + Yellow = Orange
Blue + Yellow = Green
Red + Yellow + Blue = Brown
To decrease Red add Green
To decrease Orange add Blue
To decrease Yellow add Violet
To darken a color add Black

Sapwood Dye Recipe

Start by mixing each of the powdered dyes with hot distilled water or rainwater in its own glass or plastic container according to the instructions on the label. Then combine the liquid dyes in the proportions listed below to create the sapwood dye color.

1 part red 1 part blue
2 parts yellow 1-1/2 parts black

Transfer a small amount of this dye to another container and dilute with up to 4 parts water. Check the intensity and hue on a scrap of walnut sapwood.

Even the best walnut boards are likely to contain an occasional streak of light-colored sapwood. Some projects benefit when the sapwood is skillfully placed, but in most cases it's merely a distraction. Fortunately, you can make walnut sapwood virtually disappear by adding color. Even though the initial investment for dye, shellac and glaze materials will set you back about \$100, most of these products should last you many years.

Coloring sapwood looks paint-by-number simple, but there are a few tricks. The key is getting the dye color to match the dark color of the heartwood. Walnut boards vary widely in color, so don't bother with dyes labeled "walnut." Buy red, blue, yellow and black water-soluble dye powder (available from Woodcraft Supply, www.woodcraft.com) and custom mix a sapwood dye according to the recipe (bottom, left). Gradually adjust the color of the dye by adding drops of blue and black to reach the purplish gray hue of kiln-dried walnut. An eye dropper works great for this. Adjust your dye accordingly, using a piece of scrap sapwood and the Color Mixing Chart (at left) as a guide. Then carefully brush on the dye (Photo 1).

Water-soluble dyes resist fading in sunlight and are easy to apply. The one drawback is that they raise the wood's grain. The solution is to purposely raise the grain before you apply the dye. Thoroughly wet the wood with a damp sponge. When the wood dries, the raised grain will make its surface feel rough. Simply sand off the raised grain with fine (280-grit or higher) sandpaper. Don't sand too much or you'll expose new wood and negate the effect.

Here are a few more tips for working with water-soluble dye:

1. Keep the end grain from turning too dark by saturating it with water before you apply the dye.
2. Start with a diluted dye. You can always increase the intensity of the color by applying a second coat of more concentrated dye.
3. Adjust the color by referring to the Color Mixing Chart (at left) and adding another coat of dye. Wipe on green dye to decrease red, for example.
4. The color you see when you apply the dye to the wood is close to the color you'll end up with. The wood will look dull when the dye dries, but the "wet" color will return when the finish is applied.
5. Lighten dyed wood by wiping with a damp rag. If you really goof, you can remove almost all of the dye by wiping the surface with household chlorine bleach.

Allow the dyed wood to dry completely. Then seal the entire surface by brushing on a thin coat of dewaxed shellac. Allow the shellac to dry and sand it lightly with 320-grit sandpaper. If you're happy with the way the sapwood blends after the sealer is applied, you can move on to applying the final coats of finish. To blend the dyed sapwood more completely and add greater depth and richer color, apply a thin layer of glaze before applying the final coats of finish (Photo 2).

Glaze is essentially thinned paint that's layered over a sealed surface. Commercially prepared glazes are available, but you can easily make your own. Combine artists oil (available at art supply stores) with a glazing medium consisting of three parts boiled lin-

Beautifully End Grain



1 Use a small artist's brush to dye sapwood. At the transition line, carefully follow the grain. Blend the edge of the dye into the heartwood with the corner of a damp rag. Dampen the wood before applying the dye.



2 Apply glaze with a rag or brush. Remove the excess, leaving a thin layer. Add or subtract glaze as needed to blend the dyed sapwood with the heartwood.

seed oil, two parts mineral spirits and one part Japan drier. Your glaze should have the consistency of heavy cream. Pick up the following artists oil colors as a starter set for blending your own custom glazes: burnt umber, raw umber, burnt sienna, raw sienna, Van Dyke brown, yellow ochre, black and blue. A burnt umber glaze looks great on walnut.

While applying glaze, keep the brush "dry" by removing excess glaze from the bristles with a rag. To add glaze in one section, "stipple" the surface by dabbing with the tips of the bristles. Then brush or wipe to blend the added color. If you make a mistake, remove the glaze using a rag dampened with mineral spirits.

Allow the glaze to dry completely, a minimum of 24 hours, before applying the final coats of finish. Check by running your hand across the surface. If glaze rubs off, it's not dry.



End grain reveals much about a board's history and provides an attractive detail in many woodworking projects. But end grain usually just soaks up finish and turns dark. To highlight the end grain in your next project, seal it with a thin coat of shellac or glue size. Let it dry and sand lightly before you apply the finishing oil or stain. Lightly sand the adjacent faces, too, to remove any sealer that may have seeped onto them.

Match New and Old Walnut

As walnut ages, its color changes. Matching the cool, charcoal-gray color of new kiln-dried walnut to the mellow mahogany red or amber gold of aged walnut is a challenge faced by anyone who repairs old furniture.

In most cases the first step is to lighten the new walnut, using two-part wood bleach, which is available at most hardware and paint stores (Step 1, below). Apply the bleach according to the instructions on the containers. Allow the bleached surface to dry. Then lightly sand the surface with 220-grit sandpaper.

Once the wood has been lightened, mix dye to match the lightest, most prevalent color of the old walnut (Step 2). To match old reddish-colored walnut (shown here), start with "aged walnut" dye (recipe at right) and adjust the color to match your wood. The process of dyeing and glazing (Step 3) is the same as for making sapwood disappear (page 48).

Leave extra glaze in the recesses around the turnings to duplicate the aged finish on the other legs.

REPLACEMENT PART

BROKEN ORIGINAL

Replacement parts made of new walnut must be artificially aged to match antique walnut.

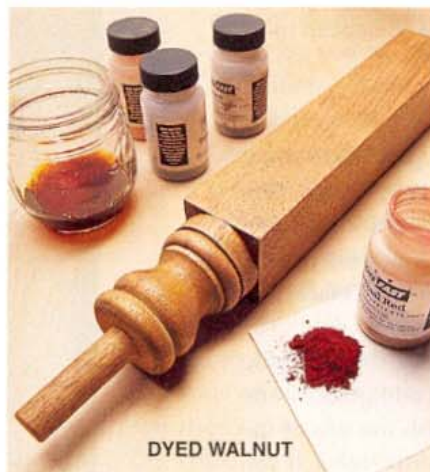
Aged Walnut Dye Recipe

1 part red
2 parts yellow
1/2 part black

COMPLETED REPAIR



Step 1. Bleach new walnut replacement parts with two-part wood bleach. (New walnut is usually darker than aged walnut.) Apply the bleach with a disposable sponge brush.

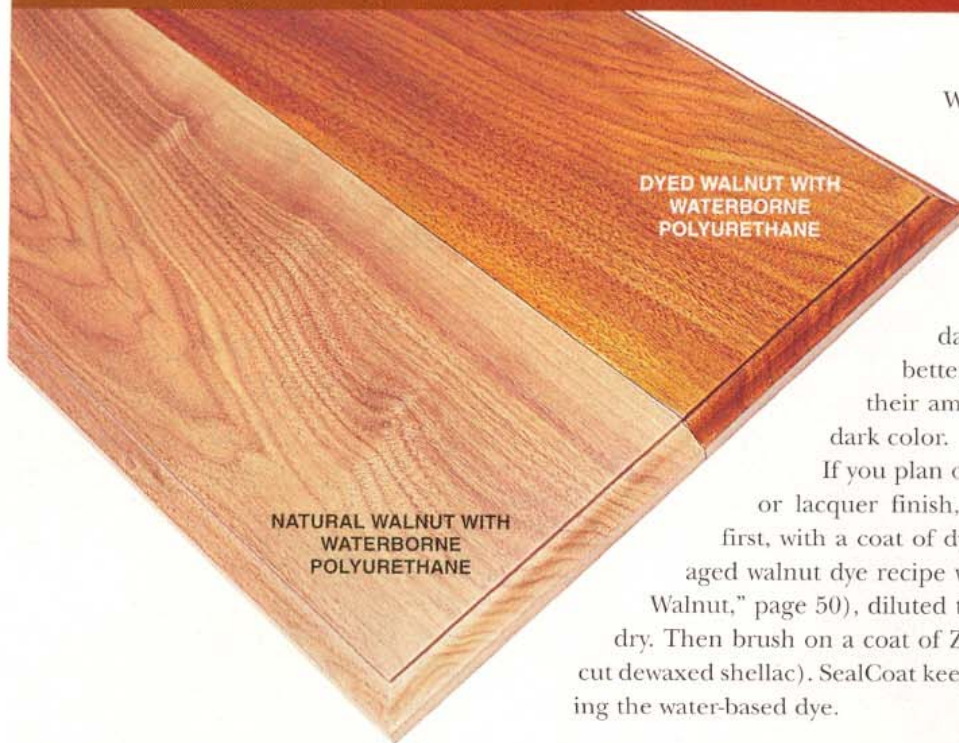


Step 2. Dye the bleached wood to approximate the color of the aged walnut—stay on the light side. Allow the dye to dry. Then seal with a coat of 1-lb.-cut shellac. When the shellac is dry, sand lightly with 320-grit sandpaper.



Step 3. Brush or wipe a thin layer of glaze over the dyed walnut. Remove the excess glaze with a rag or dry brush, leaving enough to match the color of the new piece to the aged walnut. Let the glaze dry before applying the final coats of finish.

Warm Up Colorless Finishes



Waterborne varnishes and lacquer have no inherent color, so they're often used on light-colored woods, such as maple, to avoid the amber tone added by traditional shellac and varnish finishes. On the other hand, darker woods, such as walnut, look better with traditional finishes because their amber tone amplifies the wood's rich, dark color.

If you plan on using a waterborne polyurethane or lacquer finish, consider warming up the walnut first, with a coat of dye. On the sample shown here, the aged walnut dye recipe was used (see "Match New and Old Walnut," page 50), diluted three parts to one. Allow the dye to dry. Then brush on a coat of Zinsser's SealCoat (it's actually 2-lb.-cut dewaxed shellac). SealCoat keeps the waterborne poly from dissolving the water-based dye.

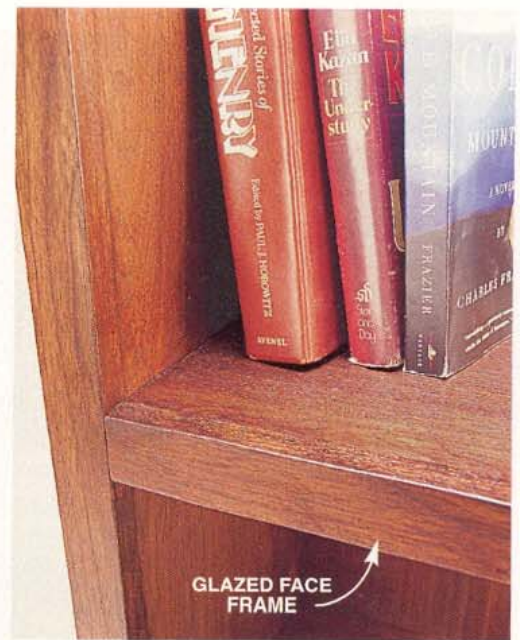
Coloring Mismatched Walnut

The intensity and hue of walnut often varies from one board to another, or between walnut veneer plywood and solid walnut. These color differences can detract from the appearance of your finished project. Achieve a more cohesive look by dyeing the lighter wood and applying a glaze to even out the color differences. Use the same procedure outlined in "Make Sapwood Disappear" on page 48.

If the mismatch doesn't show up until you apply a coat of finish, you'll have to skip the dyeing step. Blend the colors using glaze only, as on the bookcase shown here.



On this bookcase, the mismatched colors of the faceframe and cabinet weren't noticed until the clear finish was applied.



Glazing the face frame added tone that minimized the mismatch.

Staining Pine

MAKE THIS HUMBLE WOOD LOOK LIKE A MILLION BUCKS

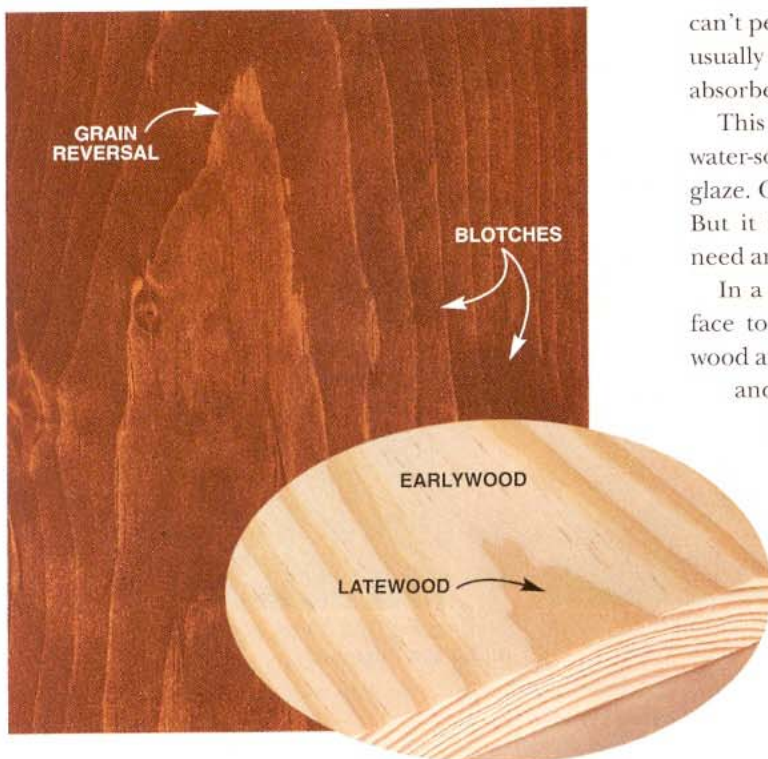
Antique pine often has a dark, mellow color. Unfortunately, when woodworkers try to duplicate that color on new pine by using stain, the results are usually disappointing. It's easy to end up with mega-blotches and it's hard to avoid "grain reversal," a peculiar effect that makes stained pine look unnatural (photo below). It doesn't have to be that way, though. If you follow the process presented here, you can give pine deep, rich-looking color without losing its natural appearance.

Pine is hard to stain for a couple of reasons. First, its grain is unevenly dense. Typical wood stains cause grain reversal because they color pine's porous earlywood, but can't penetrate its dense latewood. Second, pine's surface is usually loaded with randomly occurring figure and super-absorbent pockets that suck up stain and look blotchy.

This staining process includes four ingredients, glue size, water-soluble wood dye, dewaxed shellac and oil-based glaze. Our process isn't fast, because there are several steps. But it isn't hard, and it's home-shop friendly. You don't need any special finishing equipment, just brushes and rags.

In a nutshell, the glue size partially seals the wood's surface to control blotching. Dyes penetrate both the earlywood and latewood, so they minimize grain reversal. Shellac and glaze add color in layers, creating depth and richness. This coloring process works on all types of pine, although the end result varies from one species to another.

Staining usually causes blotches and always makes pine's porous earlywood darker than its dense latewood, just the opposite of unstained pine (inset). This transformation is called "grain reversal."



BEFORE YOU STAIN



A. FILL GAPS and stabilize loose knots with epoxy. Tape over the knot on the back side of the board, so the epoxy can't leak out.



B. SAND WITH A BLOCK angled across the growth rings. Because of the difference in hardness between the earlywood and latewood, bridging as many rings as possible helps to keep the surface level.



C. PREEMPTIVE GRAIN-RAISING is a must-do for all water-based finishes. After you've finished sanding, dampen the surface, to raise the grain. When the surface is dry, sand lightly with 400-grit sandpaper.



1 Brush on glue size to evenly seal the wood. Saturate the surface and then remove the excess by brushing with the grain.

LOOK BEFORE YOU LEAP

Before you touch your project with a brush or rag, get familiar with the materials and the process by practicing on good-sized pieces of scrap. Experiment on end grain, face grain and veneered stock. Practice until you're comfortable with the process and know what to expect.

FIX LOOSE KNOTS

Before you sand, stabilize any loose knots by dribbling epoxy into the gaps (Photo A, at left). To make cleanup easier, keep it off the surrounding wood surfaces. After the epoxy has set, sand it flush with the surface. Clear epoxy transmits the dark color of the knot. If your epoxy cures milky-white, color it later with artists oil, after you've dyed the wood and sealed it with shellac.

SAND THOROUGHLY

A good-looking finish always starts with a thorough sanding job, especially with a soft wood like pine. Here are some guidelines:

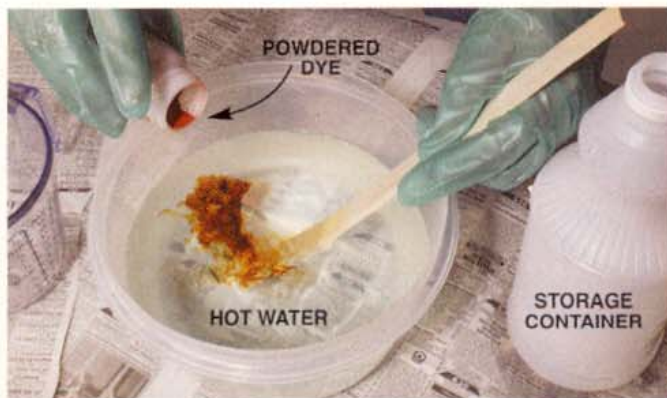
Sand with a block. Orbital sanders leave swirl marks that make the stained surface look muddy. After power sanding, always sand by hand, using a block, before you go on to the next grit (Photo B). Sanding with finger pressure alone wears away the soft earlywood, creating an uneven surface.

Change paper often. Pine gums up ordinary sandpaper with pitch-laden dust that quickly renders it useless. Dull paper mashes the wood fibers instead of cutting them, which also creates a muddy appearance when you stain. Stearated sandpaper, such as Norton 3X, lasts longer.

Sand up to 220 grit. First, level the surface with 100-grit paper. Then work through the grits to create finer and finer scratch patterns. 220-grit scratches are fine enough to disappear when you stain, as long as they don't go across the grain.

RAISE THE GRAIN

Invariably, sanding leaves some fibers bent over. Water-based finishes swell these fibers so they stand up, leaving a



2 Dissolve powdered dye in hot water. When the powder is completely dissolved, transfer the dye solution to a lidded container and let it cool.



3 Brush on a liberal coat of dye and keep the surface wet. Wipe the end grain occasionally to check its appearance. After the surface is uniformly colored, wipe off the excess dye and let the wood dry. Then repeat the process.



4 Seal the surface with two coats of dewaxed shellac. Sand after each coat with 400-grit paper.



5 Make your own glaze by dissolving artists oil into glaze medium. You don't have to be scientific about the ratio as long as you use only one color.



6 Glaze acts as a toner on the sealed surface, resulting in a deep, rich color and a uniform appearance. Just brush it on and wipe it off. Blend uneven areas by varying the amount of glaze you leave on the surface.

rough surface. For smooth results with these finishes, raising the grain prior to finishing is essential (Photo C).

PRIME THE PINE

Glue size is diluted glue. It limits the dye's penetration by partially sealing the wood, like a thin coat of finish (Step 1, page 53). To make glue size, combine one part white glue with three parts water and stir thoroughly. Saturate the wood's surface and then remove the excess, leaving an even coat. Sand lightly with 400-grit sandpaper when the surface is dry. Go lightly on contours and edges, so you don't sand through.

APPLY THE GROUND COLOR

I use Transfast "Antique Cherry Brown" water-soluble dye powder (available from Rockler, www.rockler.com) to create the ground color. Water-soluble dye from other manufacturers will work just as well, although the color will be different. Dissolve the dye at the label-recommended ratio of 1-oz. powder to 2-qts. hot water (Step 2). Let the solution cool to room temperature before use.

On the primed surface, the dye acts like a liquid oil stain (Step 3). Brush or wipe on a generous coat. Let it soak in for a minute or so and then wipe off the excess. The second coat of dye imparts a deeper color and a more uniform appearance.

It's tough to get uniform penetration on end grain. Fortunately, you can minimize any uneven appearance later with the colored glaze.

When you have a large surface to cover, use a spray bottle to apply the dye and a brush to spread it. Simply re-spray previously worked areas to keep the entire surface wet until you're ready to wipe it dry. Spraying and brushing also works great on vertical surfaces. Start at the bottom and work your way up.

SEAL THE SURFACE

Shellac prepares the dyed surface for glazing (Step 4). It also keeps pitch sealed in the wood. Without shellac, pine's pitch can bleed into oil-based finishes, leaving fissures or shiny spots that remain tacky, especially around knots.

APPLY GLAZE

Glaze is nothing more than paint formulated for wiping. It's easy to make your own pro-quality glaze (Step 5). Don't go overboard with the amount you mix—a little glaze goes a long way. Artists oils contain high-quality pigments for pure, clear color. Glaze medium makes the artists oil easy to spread and quick to dry (within 24 hours). Artists oils and glaze medium are available at art supply stores.

Glazing adds a second, separate layer of color that really makes the pine come alive (Step 6).

TOPCOATS

You need to protect this layered finish with clear topcoats. Any topcoat will work as long as you wait until the glaze has completely dried. To check, wipe the surface gently with a cotton rag. If it picks up any color, wait another day.

Finishing Birdseye Maple

Birdseye maple is captivating, but has a reputation among woodworkers of being hard to find and miserable to work with. These are myths. Actually, birdseye is readily available in staggering varieties. I'll tell you where to find it and how to choose the best boards. And surprisingly, birdseye is easy to work with. I'll show you how to tame its unruly grain and give you a recipe for a great-looking finish.

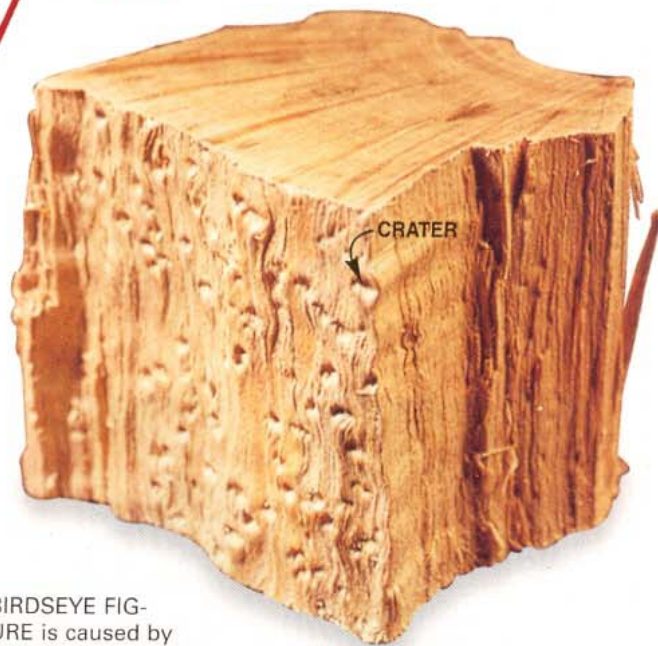
THE TRUTH ABOUT BIRDSEYE

"Birdseye" describes a figure pattern that occurs in the sugar maple tree (*Acer saccharum*). It's also found occasionally in several other varieties of wood. Individual birdseyes are randomly located pockets of irregular growth. Nobody knows what causes a tree to produce them, despite decades of research. We do know they have nothing to do with birds!

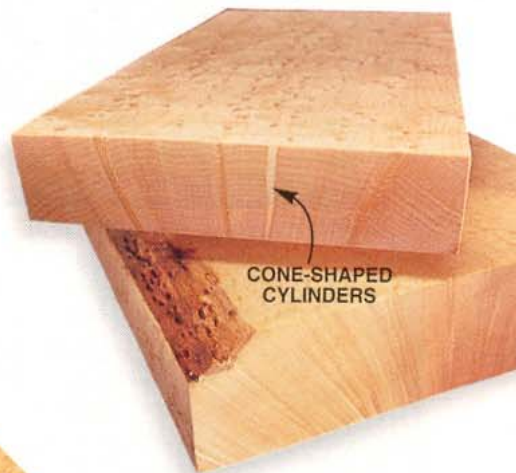
Birdseye's occurrence in sugar maple is not rare. In fact, a recent field study of old growth stands in the upper Midwest suggests that, because it occurs so frequently in old growth, birdseye could be considered the normal growth pattern for sugar maple. However, it typically occurs in such small amounts that its presence is considered a defect that actually reduces a tree's value. What's rare are trees with enough birdseye to make them commercially desirable.

TIPS FOR BUYING BIRDSEYE

- Buy surfaced material. It's hard to pick good birdseye from rough lumber, which is the way you're most likely to find it. Even if you're accustomed to looking at rough-sawn material, it'll be tough to see the birdseye



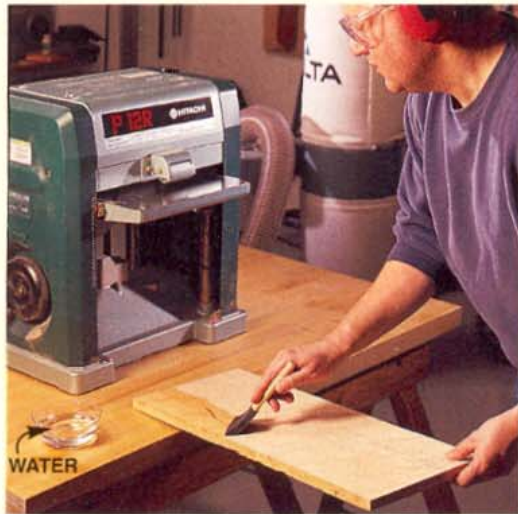
BIRDSEYE FIGURE is caused by craters of wild grain that recur in successive layers of growth. On the face of a board you see the "birdseyes," on the end grain you see cone-shaped cylinders.



BIRDSEYE VENEER HAS MANY ADVANTAGES over solid wood. Logs chosen for veneer are the cream of the crop, so you'll have access to the very best birdseye figure. You won't have to try to read the quality of figure in rough lumber or deal with tear-out. With veneer, you can see exactly what you're buying.



TEAR-OUT IS TYPICAL when you run a birdseye board through a planer. The grain changes direction around each birdseye, so it doesn't matter which way you run the board. It's gonna tear out in chunks.



WET BIRDSEYE BOARDS before you plane them. Let the water soak in for a couple seconds before you run them through the planer. Make shallow passes, removing only 1/32 in. at a time.



TEAR-OUT IS DRAMATICALLY REDUCED when a birdseye board is wetted just before planing. Look at the birdseye pattern—this is the same board as the one above!

figure. It's easier to choose from birdseye that's been planed "hit-and-miss." This light planing sacrifices a bit of the board's working thickness so you can see what you're buying, but the trade-off is worthwhile.

- Look for flat boards. Birdseye's ornery grain gives it a tendency to warp or cup as it dries. If you can't find boards that are flat, look for ones that are extra thick so you can plane them flat and still end up with the thickness you want.

- Order from a specialist. Few lumberyards stock birdseye. The only way to get it may be through a mail-order supplier. There are several that specialize in figured woods (see Sources, page 57).

- Consider using birdseye veneer, especially for large surfaces such as tabletops and cabinet sides. The color and figure varies so much in solid birdseye lumber that it's hard to find boards that look good together. Sheets of birdseye veneer have a consistent appearance because they're cut sequentially from the same log. Veneer saves money, too. It's less expensive than solid lumber (per square foot), and costs less to ship.

PLANE BIRDSEYE WITHOUT TEAR-OUT

Planing rough-sawn birdseye is a challenge because the eyes are pockets of swirling grain scattered all over the surface. When you run it through a planer, the birdseye figure tears out dramatically—usually with disastrous results. The commonly recommended alternative is to take the rough lumber to someone who has a drum sander for surfacing. Technical schools and cabinet shops often rent time on their machines, but you have to pay a minimum of \$25 per hour. And it's a hassle.

Here's a much easier solution. Wet the surface before you joint or plane it. Don't worry about warping. Planing removes the wet layer before the moisture affects the board. The effect of wet-planing on your machines will be negligible if you follow these simple maintenance procedures.

- Moisture causes rust, of course. Keep cast iron tables and fences protected with paste wax or a metal sealer.

- Use a dust collector to draw the wet shavings away from the machine—they contain all the moisture.

- After you've finished running the birdseye, wipe the cast iron tables dry with an absorbent cloth. Then run a dry board through the machine. The friction-generated heat helps evaporate any remaining moisture.

- Wipe the pressure roller, cutterhead, knives and other effected surfaces with denatured alcohol. Don't cut yourself on the knives. Be sure to unplug the machine first.

SAND OR SCRAPE

After planing, you have to remove mill marks and minor tear-out before the birdseye is ready for finishing. It's too risky to do this with a hand plane—even one that's finely tuned. One bad pass can cause enough tear-out to ruin everything. It's safer to sand or scrape.

A random-orbit sander helps make sanding less tedious, but sanding dust is a problem. It lodges in torn-out areas, making it hard to know when to quit. A scraper is better. It makes shavings instead of dust, so you can see when the tear-out is gone. The best time to use a random-orbit sander is for final smoothing, after scraping.

EASY FINISHING

Even the simplest wipe-on finish makes birdseye look good. Here's how to make it look great:

- A coat of penetrating oil, like tung or linseed, brings out the birdseye figure and adds a warm amber tone.
- A thin coat of dewaxed shellac on top of the oil makes the figure shimmer.
- For non-wear surfaces, buffing the shellac with wax adds luster. Protect tabletops and other wear surfaces by topcoating with lacquer, varnish or poly. These finishes adhere to dewaxed shellac that's been lightly sanded.
- To minimize yellowing (a problem with all maple), skip the oil. Start with a seal coat of dewaxed super-blond shellac and top it with waterborne polyurethane. Waterborne finishes are clear and don't yellow with age.
- If you want to color birdseye, don't use traditional wood stains—they're made with coarse pigments that obscure the figure. Dyes are a better choice, but over time they can fade.



REMOVE MINOR TEAR-OUT with a scraper or by sanding. Scraping is best because it's fast, quiet and dust-free. Sanding is effective, but tedious. Hand planing may create even more tear-out.

Sources:

Solid birdseye maple:
Sandy Pond Hardwoods
(800) 546-9663
www.figuredhardwoods.com

Birdseye maple veneer:
Certainly Wood
(716) 655-0206
www.certainlywood.com

ATHIN COAT OF PENETRATING OIL (one part oil, two parts mineral spirits) followed by a seal coat of dewaxed shellac and topped with varnish or polyurethane is a great finish for birdseye. It warms the color, brings out the figure and protects the surface.



PAINTING WOOD

Get a
Super-Smooth
Finish



Pine knots will stubbornly bleed through regular paint no matter how many coats you apply. To hide them, seal the wood first with a shellac-based sealer.



The porous edges of an MDF panel or the end grain of boards need to be sealed thoroughly or they'll look and feel rough. Just brush on a sealer, such as white pigmented shellac, and sand after 45 minutes or so. Repeat until edge feels smooth.

SEAL BEFORE PAINTING

The best start for any painted wood surface is to seal and prime it first. White-pigmented shellac, such as B-I-N, is one of the most convenient products to use for a sealer. B-I-N is available at most home centers and paint stores. You can use a brush, roller or spray gun to apply the sealer. It dries in about 45 minutes, so you can apply numerous coats in one day. Sealers are designed to sand easily and leave a smooth foundation for the paint.

Sealing knotty pine before painting is a must. That's because the resins in pine, which are used to make turpentine, will bleed through even an oil based paint. The problem is especially noticeable around knots and pitch pockets where sap concentrates. Shellac is unequalled at sealing knots in pine so the resins will never bleed through the painted surface (Photo 1).

If you're painting a new project, sand the wood and scrub it with a rag saturated with naphtha to remove some of the resin first. Then load up your paintbrush and seal the ends of every board and spot prime over knots and sap streaks. Let the primer dry, then apply at least two coats of sealer over the entire project. Apply two sealer coats before topcoating with paint and three sealer coats before topcoating with lacquer. An extra coat on the end grain of boards and on the edges of man made material like MDF (Photo 2) helps to fill these rough areas. Let the sealer dry, then sand and apply the topcoat.

If you're repainting a project where the knots and sap streaks are bleeding through, you can still seal in the resins. Make sure the paint is completely dry, then sand and prime the problem areas with the shellac-based sealer. Once it's dry, sand and apply a finish coat of paint.

Stop pine knot bleed through with a shellac based primer.

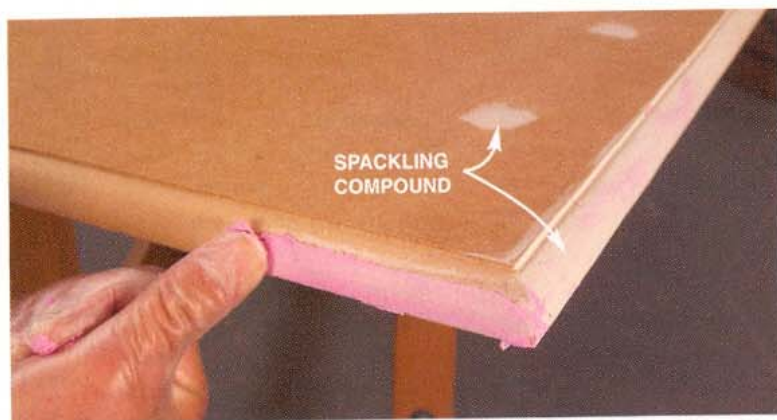
FILL PAINTED EDGES

Make inexpensive plywood look like solid wood by filling voids and end grain with exterior spackling compound. Let the spackling compound dry for half an hour, round over the edges of the plywood with a router bit or sandpaper and sand the edge smooth. Brush on a primer and top coat and you've made economical materials look classy.



ULTRA-SMOOTH EDGES

Here's the trick to make the rough edges on man-made material such as MDF, particleboard and plywood as smooth as the surface. Simply coat the edges with spackling compound before priming. First, sand the raw edges with 150- or 180-grit paper. Sanding sponges are ideal for this job. They're stiff enough to get into corners but soft enough to conform to a rounded edge. Use a putty knife or your fingers to apply the spackling compound on the edges and to fill any surface defects (see photos below and left). Dap Dry Dex is a spackling compound that goes on pink then turns white when it's ready to be sanded. Sand the spackled edge with the 180-grit sponge. It's okay if you sand down to the wood a bit. The spackling compound does not have to completely coat the edge; it just has to fill in the pits. Before you paint, seal the whole piece with a couple coats of high-quality primer sealer such as Zinsser BIN, a shellac-based primer that dries super-fast and sands beautifully. Switch to 220-grit paper to sand the primer. Finally, spray on several coats of color enamel paint. Be sure to lightly sand between coats. The result will be a stunning, glass-smooth surface.



Spread a thin coat of spackling compound onto the edges and sand smooth before painting. Spot-fill any defects on the face of the MDF as well. The result will be ultra-smooth edges and faces on painted MDF.

Sources 3M SandBlaster sanding sponges, Dap Dry Dex spackling compound, Zinsser BIN Primer Sealer and Rust-Oleum Painter's Touch gloss are all available at most home centers and hardware stores.

Bleaching Wood

Subtract color to add life



Woodworkers commonly use three types of bleach: chlorine, two-part wood bleach, and oxalic acid. Two-part bleach is the only one that actually changes the color of wood; the others remove stains. Read on to find out what each one does and how to use them safely.

CHLORINE BLEACH

Common household laundry bleach (sodium hypochlorite) will kill mildew on your deck and outdoor furniture, and will remove dye-based stain from wood, but not pigment-based stain. Chlorine bleach can irritate skin and mucous membranes, so wear gloves and goggles.

Deck cleaner. To remove mildew from your deck or exterior furniture, first hose off the wood to remove any loose debris. Mix about a quart of chlorine bleach (Clorox, Purex, etc.) to each gallon of water. Use a synthetic-bristle brush and scrub the surface with the bleach mixture. Be sure to wear goggles—it's easy to splash. Reapply the bleach if necessary in order to keep the surface wet for about 15 minutes. Then, brush off the surface again and hose it down thoroughly with water. Keep the runoff away from plants, pets and other wildlife.

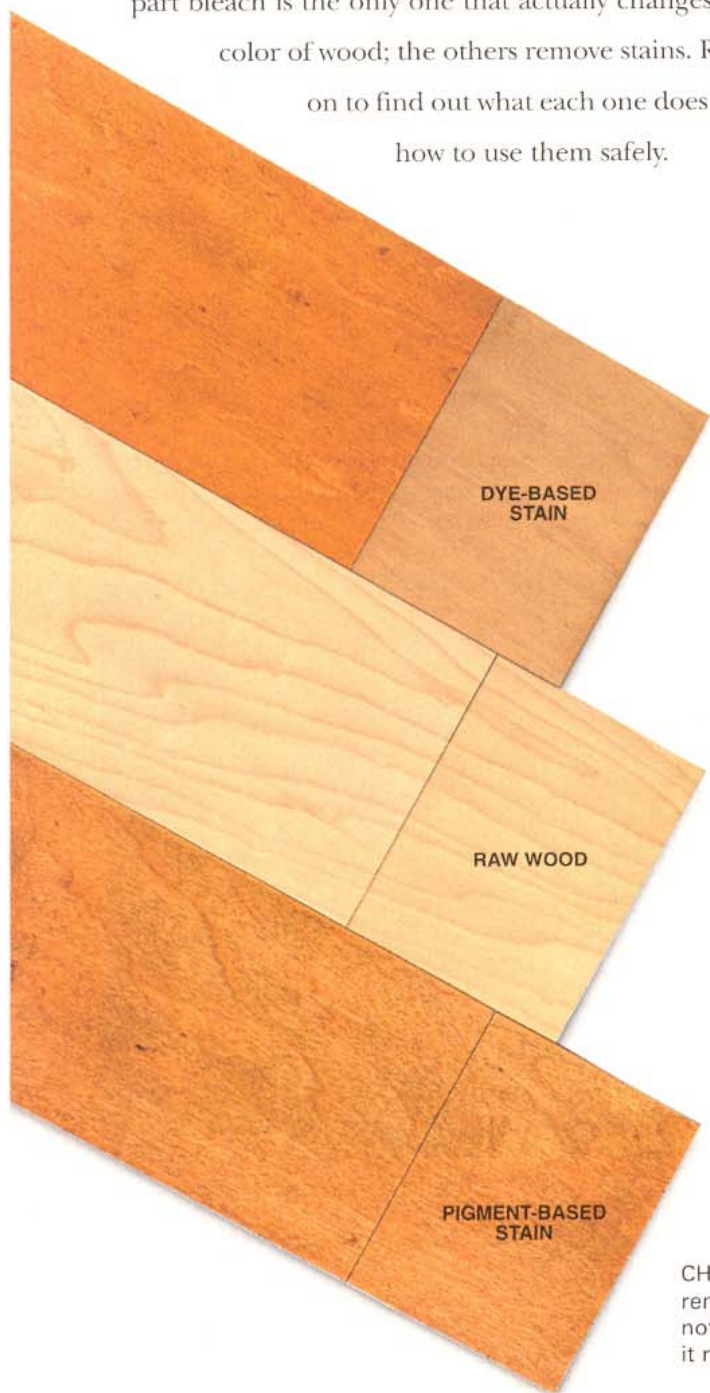
Fortunately, deck stains are formulated with pigments, so they are not affected by the bleach. Let the wood dry completely if you plan to re-stain. If you live in an area where mildew is a problem, choose a deck stain that contains a mildewcide. Most home centers and paint stores sell them. Another option is to buy mildewcide and add it yourself.

Dye remover. Chlorine bleach will remove most dye-based stains from raw wood but will not lighten the wood itself. This is handy to know if you finish your project with a dye and then decide you want to "erase" it and start over. Chlorine bleach will also remove old dye you might encounter during a refinishing project.

Use a synthetic-bristle brush or a clean rag to apply the bleach full strength. It should remove the color by the time it dries, but for stubborn stains, repeat the process. If you are removing the stain from an old piece of furniture you are refinishing, make sure all the finish is off the surface and lightly scuff-sand it first. Bleach will not penetrate a finish.

As chlorine bleach dries, it breaks down to salt and water. Once the water evaporates, you'll have salt residue on the wood. Brush it off before you finish the wood.

CHLORINE BLEACH, full strength, easily removes most dye-based stain (top) but will not bleach raw wood white (center), nor will it remove pigment-based stain (bottom).





MAPLE

WALNUT

MAHOGANY

TWO-PART WOOD BLEACH takes the color out of most dark woods and blends the color of maple's heartwood with its sapwood.

TWO-PART (A/B) WOOD BLEACH

Wood bleach actually lightens the color of wood. It can also de-color many pigments and dyes.

A package of wood bleach contains two bottles, usually labeled "A" and "B." One contains lye (sodium hydroxide) and the other peroxide (hydrogen peroxide). The bleaching action occurs when the two chemicals come together in contact with wood. Instructions for use vary from brand to brand. Some say to put part A on first, then apply B before A dries. Other suggest mixing the two just before application. The object is to get both chemicals and the wood in the same place at the same time. Read the directions.

Use a synthetic-bristle brush or a clean rag to apply the bleach. When the lye goes on first, it initially darkens the wood. Once the peroxide goes on it is likely to foam as it reacts with the wood and lye. Let the wood dry completely, usually overnight, then sponge off all residue with plenty of clean water.



APPLY A/B BLEACH SAFELY. Wear long neoprene gloves, with ends cuffed to catch drips, a waterproof apron, and goggles. Brush carefully. A/B bleach is extremely caustic and will quickly burn your skin and eyes.



OXALIC ACID dissolved in water removes black iron stains like magic from tannin-rich wood, such as oak.

OXALIC ACID

Iron, in the form of nails, hardware, or even bits of steel wool, often leaves a blackish stain on woods high in tannin, such as oak. A wash of oxalic solution removes these stains as well as the grayed color of oxidized wood.

Oxalic acid is sold in most hardware stores and home centers as a dry, white crystalline powder. The crystals are toxic and irritating to mucous membranes, so wear goggles and a dust mask when handling the dry powder. In a glass or plastic container, dissolve an ounce of oxalic acid into a pint of warm water.

Make certain that you have removed all the offending metal before you bleach the wood. Sometimes stains are caused by broken-off nails or bits of fencing that are hidden in the wood. Wet the surface with the oxalic acid mixture and let it dry. Repeat if the stain is not completely gone. Once dry, sponge the wood with plenty of clean water to remove the crystalline residue. Any oxalic acid residue left in the wood will make irritating dust when you sand, so wear a dust mask and eye protection.

SEALERS

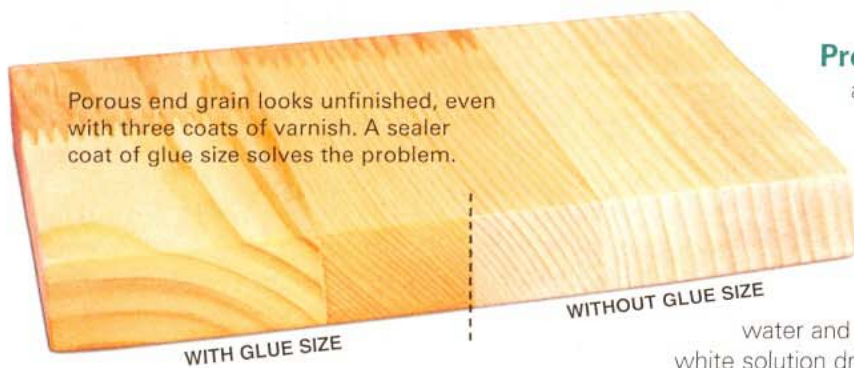
The ideal solution for many finishing problems



The first coat of finish that you apply to wood forms a thin barrier known as a sealer coat. That barrier isolates all subsequent coats of finish—called topcoats—from the wood. Any finish that forms a film over wood acts as a sealer, whether you apply it over raw, stained or filled wood.

As a rule, your objective in finishing is to seal the wood against moisture and dirt with the first coat, and then build protection and beauty with subsequent coats. In some cases, such as when you use Danish oil (an oil/varnish blend), you may need two coats to completely seal the wood. With these finishes, the third coat starts building the film.

In most cases you can use the finish you've chosen for the topcoats for the sealer coat. There are certain situations, though, when applying a special sealer can help you avoid disasters and achieve the best results with your chosen finish. Here are five common finishing problems and the special sealers used to solve each of them.



Porous end grain looks unfinished, even with three coats of varnish. A sealer coat of glue size solves the problem.

Problem #1: The end grain keeps absorbing finish. The face and edges of a board look nice and satiny after two or three coats, but the end grain still looks dry and unfinished.

Sealer Solution: Glue size, which is nothing more than thinned-down glue. To make glue size, simply mix equal amounts of water and white glue. Don't worry—this milky-white solution dries to a clear, colorless film.

Brush a coat of glue size onto the exposed end grain. Let it dry and sand it smooth with 220-grit sandpaper before applying your first coat of finish. Avoid getting the glue size on the faces and edges of the board.



Fisheyes can appear in a waterborne finish if the wood's surface is contaminated. Seal with dewaxed shellac first.

Problem #2: Waterborne finishes tend to raise the grain. They can also develop "fisheyes"—small round craters caused by oil, wax, grease or other contaminants in the wood.

Sealer Solution: Dewaxed shellac. Seal the surface with a coat of Zinsser SealCoat to limit grain raising, lock in contaminants and make the waterborne top coat behave as it should.

Problem #3: Stain and clear topcoats won't cooperate. Either the stain bleeds into the topcoats or the topcoats don't adhere to the stain. For example, water-based stains often bleed into water-based topcoats, and sometimes water-based topcoats don't adhere to oil-based stains.

Sealer Solution: Separate the stain and topcoats with a barrier coat of dewaxed shellac. A thin coat of 2-pound-cut dewaxed shellac will seal in the stain and provide a base that both solvent-based and water-based coatings will stick to.

You can make your own dewaxed shellac by dissolving dewaxed shellac flakes in alcohol at the ratio of 2 pounds per gallon, or you can buy Zinsser SealCoat. It's liquid dewaxed shellac in a 2-pound cut.

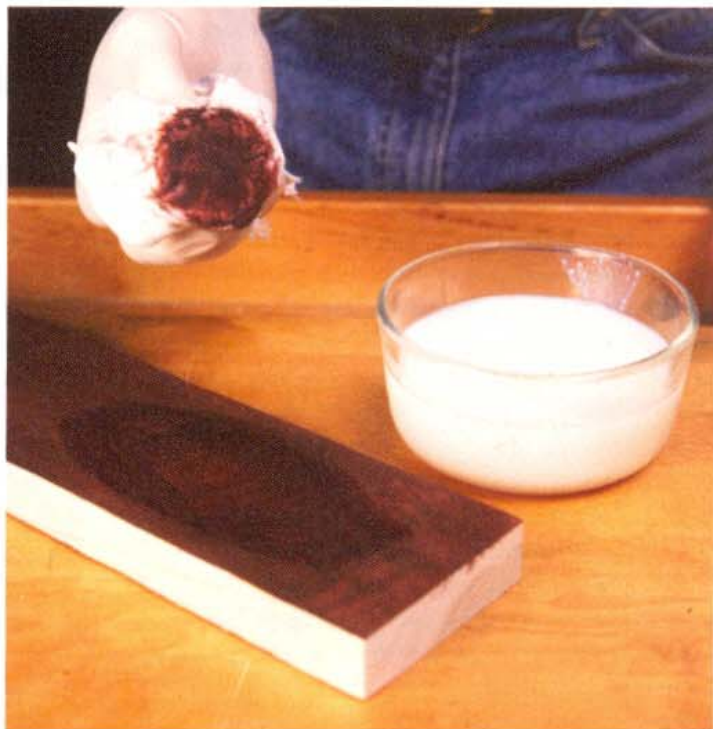
Problem #4: Polyurethane and lacquer finishes are hard to sand, so when they're used as the sealer coat, they take a lot of effort to level out.

Sealer Solution: Sanding sealer. Topcoat finishes are meant to resist scratches, and that goes for sandpaper scratches, too. Sanding sealers are formulated to dry quickly to a (relatively) thick film that sands easily—perfect qualities for an initial finish coat. Sanding sealers are not suitable for use as topcoats, unless you want a finish that scratches easily.

Problem #5: Disastrous finish results with oily woods, such as rosewood and teak. Rosewood is notorious for preventing varnish from curing, and its dark color often bleeds into lacquer and discolors adjacent light-colored wood. Some oily woods let finishes cure, but the dried finish peels off.

Sealer Solution: Zinsser SealCoat (liquid dewaxed shellac) is the best choice for home shops. Commercial shops often use vinyl sealer. Both will adhere to and seal oily woods.

Vinyl sealer is available from paint dealers. It has to be sprayed on and it requires spray booth ventilation. If your topcoat is lacquer, spray on a coat of vinyl sealer and follow with the first coat of lacquer no more than 45 minutes later, before the vinyl is completely dry (lacquer adheres poorly to fully-cured vinyl). If the topcoat is varnish, let the vinyl sealer dry overnight, but scuff it with an abrasive pad before you apply the varnish.



Water-based stains and dyes can bleed into waterborne finishes. Sealing the colored surface with dewaxed shellac before applying the finish is the solution.



Sanding sealer is much easier to sand than polyurethane, and its sanded surface allows topcoats to firmly adhere.

GET GREAT-LOOKING RESULTS AND AVOID FINISHING DISASTERS.

Gel Stain

Gel stains should be a part of your finishing arsenal, whether you're a first-time finisher or an experienced pro. Gel stains don't need to be stirred and won't splash or drip, so they're easy to apply. Gel stains don't soak deeply into the wood, the way traditional liquid oil stains do. Instead, they soak in very little, drying on the wood's surface to form an even layer of color, like translucent paint.

GEL STAIN WIPES ON

Gel stain is nothing more than pigmented gel varnish. It has the same pudding-like consistency. And it's applied the same way: Load up a lint-free cotton rag and rub the wood's surface in a series of overlapping circles to spread the stain and wipe off the excess. Finish by wiping with the grain to remove any streaks. That's all there is to it.

Just because gel stains are easy to apply doesn't mean you can take it easy when you prepare the surface, though. You must sand thoroughly, because gel stains highlight surface blemishes, such as sanding scratches. Sand up to 180-grit paper and examine the surface with a raking light to make sure no scratches remain from coarser grits.

SOME LIMITATIONS

Gel stains set up faster than liquid oil stains, so divide staining into manageable sections. For example, stain the panels on a large door first; then tackle its stiles and rails. Using gel stains on large flat surfaces, such as a desktop, is a challenge. Work at a steady pace and maintain a wet edge.

Most gel stains slightly obscure the wood's figure, because, like paint, they contain pigments. For this reason, you shouldn't use them directly on bird's-eye maple, quartersawn oak or other highly figured woods. Also, putting more than one coat of gel stain on finely grained woods, such as maple, can completely hide the grain.

Gel stains need to be topcoated. Wiping on several coats of gel varnish is easiest; brushed or sprayed on polyurethane is more durable.



GEL STAIN ON HARD MAPLE

LIQUID OIL STAIN ON HARD MAPLE

COLOR WOOD EVENLY

Gel stain doesn't soak into wood the way liquid oil stain does; it stays near the surface, like paint. This is important to remember when you stain unevenly porous woods, such as maple, birch, pine and cherry. These woods contain randomly located pockets of super-absorbent grain that are virtually invisible—until you stain. Liquid oil stain makes these woods look blotchy and unattractive. Gel stain colors them much more evenly. Both samples pictured above have one coat of walnut-colored stain made by the same manufacturer.

End grain is also super-absorbent. Liquid oil stain soaks in and turns end grain black. Gel stain stays near the surface, so it keeps end grain looking like face grain. Both samples shown here have one coat of walnut-colored stain made by the same manufacturer.



OIL STAIN



GEL STAIN



EARLY WOOD LATE WOOD

ACCENTUATE PORES

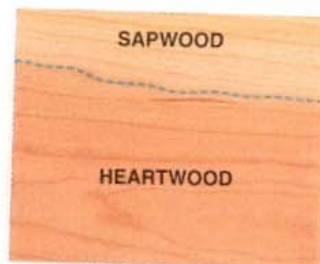
If you want to show off oak's grain, use gel stain. As you can clearly see in these samples, thick-bodied gel stain lodges in the pores, almost like paste filler. When used on woods such as oak and ash, which have large open pores clustered in the earlywood, gel stain highlights the pattern more effectively than liquid oil stain can.

You can also see that gel stain colors oak's hard latewood more effectively than liquid oil stain. A second coat of gel stain will darken the overall color, and make the pores less prominent. Both samples have one coat of walnut-colored stain made by the same manufacturer.

COLOR SAPWOOD TO MATCH HEARTWOOD

Used on top of clear gel stain or gel varnish, colored gel stain allows you to blend sapwood and heartwood, plywood and solid wood, and color variations between boards.

Begin by covering the entire surface with a coat of clear gel stain or varnish (Step 1). In addition to sealing the surface, this coat shows the wood's natural color, so you can choose a colored gel stain that matches the heartwood. When the seal coat has dried, apply colored gel stain to the light-colored sapwood only (Step 2). Gel stain is perfect for this job, because its thick, no-drip consistency makes it easy to control. When the first coat of colored stain is completely dry, apply a second coat of the same gel stain over the entire surface (Step 3).



1. CLEAR GEL ON ALL



2. COLORED GEL STAIN ON SAPWOOD ONLY



3. COLORED GEL STAIN ON ALL



CREATE AN ANTIQUE LOOK

Gel stain dries to a hard film, so it can be used for another classic technique: antiquing. You can do this with gel stain alone, but it works best to apply a coat of clear gel stain or gel varnish before you apply stain. Instead of completely wiping off the excess gel stain, leave some in crevices and corners to imitate the accumulation of years of grime and soot. Rub some areas harder to imitate wear spots or use a dry brush. Experiment. If you hate the look you're getting, just wipe off the stain and start again. You can create this type of finish all at once or in steps, adding a little more "age" with each coat of gel stain.

ADD NATURAL-LOOKING TONE

Most woods change color as they age. Maple and birch turn yellow; cherry turns reddish brown. You can easily imitate aged color on these and other close-pored woods by starting with clear gel stain or gel varnish.

The surfaces of these woods are covered with legions of tiny pores that are almost invisible. Staining the raw wood turns them dark. To an experienced eye, the tiny dark spots are a giveaway; on naturally aged maple, birch or cherry, they wouldn't show.

Here's how to complete the process on cherry.

Step 1. Wipe on two coats of Varathane "Natural" gel stain. Allow each coat to dry.

Step 2. Wipe on a custom gel stain made by mixing Varathane "Early American" and "Cabernet" gel stains in a 3 to 1 ratio. For a deeper tone, apply a second coat of gel stain after the first coat has dried.

Step 3. Protect the color layer and add durability by brushing or spraying on polyurethane.

The coats of clear gel fill the pores and seal the surface, so when the colored gel stain goes on top, it adds uniform



overall tone without darkening the individual pores, just as exposure to air and light would.

To create the look of naturally aged maple or birch, simply use a golden-yellow gel stain in Step 2.



Super-Smooth Poly Finish

A Defect-Free Finish, Even with a Brush

Polyurethane is a tough, high-quality finish, ideal for tabletops and other surfaces that take a lot of abuse. But no matter how clean your finishing area or how good your brushing technique, a few bubbles, dust particles and streaky spots always manage to sneak into the final coat (Photo 1). Directions on the can don't say anything about it—leaving you to assume a less-than-perfect finish must be your own fault. However, the solution is quite simple—rub out the finish with fine sandpaper and synthetic steel wool. Sanding removes defects and levels ridges. Synthetic steel wool creates an even, silky smooth finish that's a joy to look at and feel. This age-old two-step technique is commonly used on shellac and lacquer finishes, but it can work well on water- and oil-based polyurethane, too. The only drawback with poly is that it is difficult to bring up to a high gloss. If a satin or semi-gloss look is what you're after, this technique will give you great results.

MATERIALS AND SUPPLIES

SANDPAPER

Sandpaper is used to flatten the finish and remove dust nibs and brush marks. Stearated aluminum-oxide sandpaper is by far the best product for sanding a finish. Stearated paper has dry lubricants that help prevent “corning” or the balling up of finish on the paper. Wet-dry silicon-carbide paper balls up like crazy if you don’t use water as a lubricant. The trouble with wet sanding is the water slurry can make it difficult to see your progress.

SYNTHETIC STEEL WOOL

I used synthetic steel wool on both water- and oil-based polyurethane. Traditional steel wool is not recommended for water-based finishes; it sheds steel particles that leave a mess and give the user steel wool slivers. Synthetic steel wool pads equivalent to 00 steel wool are widely available at home centers and hardware stores. Fine synthetic wool equivalent to 0000 steel wool is harder to find. I had good luck at auto-body supply stores and mail-order woodworking suppliers (see Sources, page 41).

POWDERED ABRASIVES

Pumice and rottenstone are sold at some paint stores and at woodworking suppliers. Pumice is ground volcanic glass that comes in grades from 1F (coarse) to 4F (fine). Rottenstone is even finer than 4F pumice. It’s made of ground limestone (see Sources).

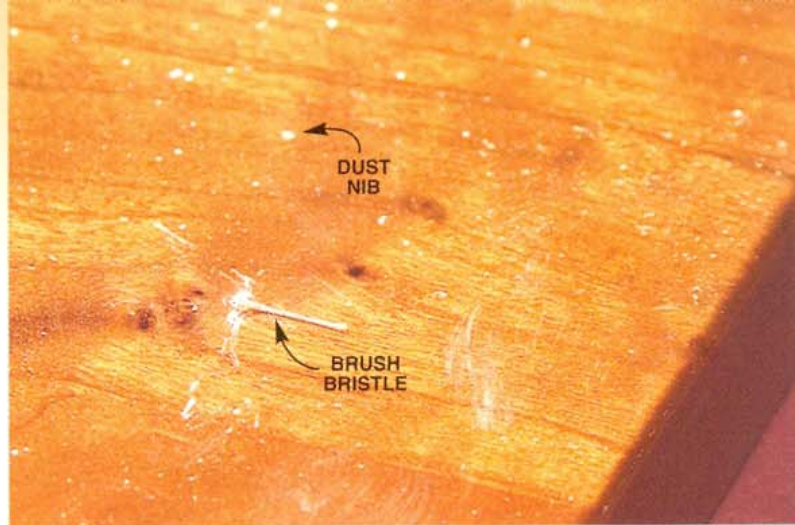
BUILD A GOOD FOUNDATION FOR THE FINISH

1. I use 220-grit sandpaper for final sanding on raw wood. I always sand a little bit longer than I think is necessary. Then I vacuum thoroughly and wipe the wood with a clean, soft cloth until I stop getting dust on my fingers when I run them over the wood.

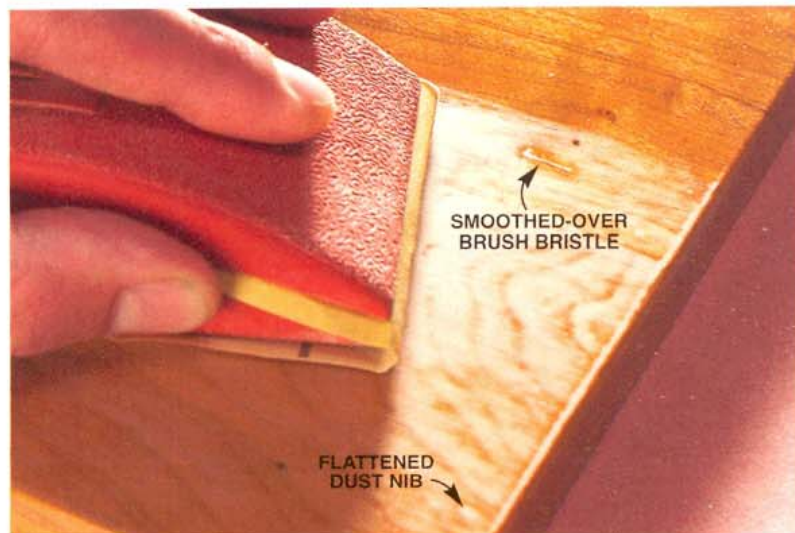
2. Use grain filler on open-pored woods, such as oak or walnut. Otherwise, after rubbing out, the pores will look shiny compared with the rest of the wood.

3. Before applying finish on any project, test different finishing options on scrap pieces of wood. Water- and oil-based polyurethane finishes look completely different. If the color doesn’t look right or seems too bland, which is sometimes a problem with water-based finishes, use a sealer coat of clear, wax-free shellac or experiment with stains to warm the color of the wood before applying the topcoats.

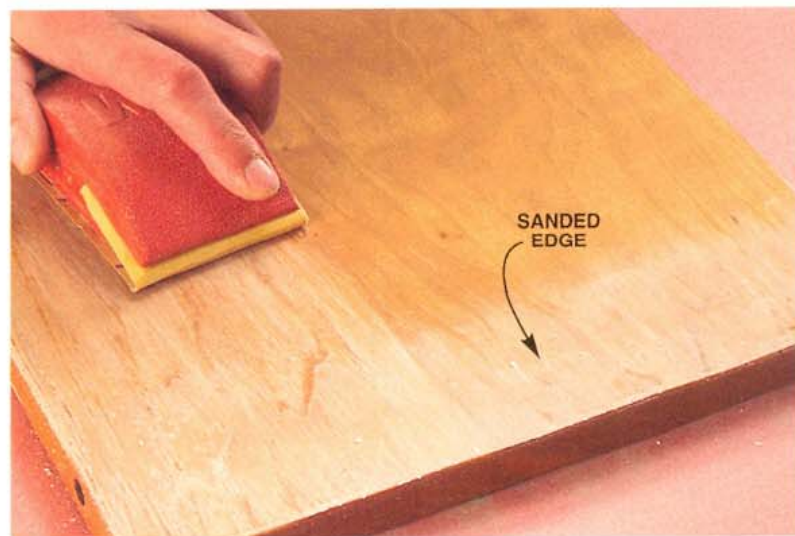
4. I applied a gloss polyurethane on my tabletop because it can be rubbed to any sheen from flat to semi-gloss. I used a semi-gloss poly on the rest of the table. Vertical surfaces and legs don’t collect the



1 The Problem: A few dust nibs, broken brush bristles and bubbles are almost inevitable on big horizontal surfaces finished with slow-drying polyurethane.



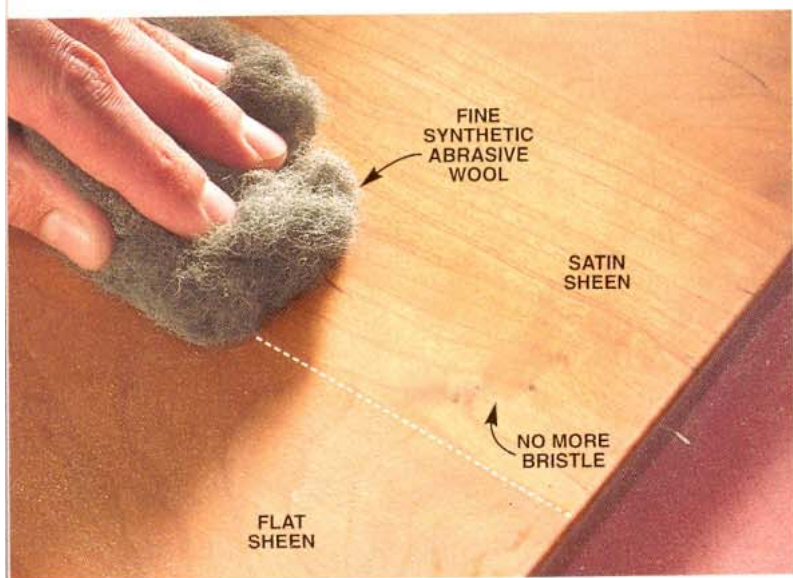
2 The Solution: Flatten the surface imperfections with 600-grit sandpaper on a sanding block (or 400-grit followed by 600 if the surface is really a mess). Sand just enough to flatten bubbles, dust nibs and ridges, but don’t try to sand away all the shiny spots.



3 Extra care should be taken when sanding near the edges of a tabletop to avoid sanding through. Sand the 2 to 3 in. nearest the edge first. Short strokes make it easier to control the block. After the edges are done, sand the centers with long strokes that slightly overlap the sanded border.



4 Rub out the finish using a medium synthetic abrasive pad (00 steel wool equivalent). Rub until you get a flat, even sheen across the entire surface.



5 Switch to a fine synthetic abrasive wool (0000 steel wool equivalent) to bring the finish to a satin sheen.



6 For a semi-gloss sheen, continue rubbing with fine synthetic abrasive wool lubricated with soapy water.

dust the way a flat, horizontal top does. A light buffing with steel wool will clean the occasional dust nib on vertical surfaces.

5. Sand with 320- to 400-grit steared paper between coats, depending on how smooth the coat looks. Use a sanding block to level ridges and bumps. With a gloss finish, coarser paper may leave scratches that are visible through subsequent layers of poly.

6. Apply an extra coat or two of polyurethane on tabletops for more durability, depth and protection. Lay the last coat on a little thick to protect against accidentally rubbing through the top layer of finish. Remember, polyurethane does not melt into itself the way shellac or lacquer do. Each layer sits on top of the previous one, so there is a danger of sanding through one layer into the next. This will leave a visible ghost line where the top layer was sanded through. If this happens, you need to start over and reapply the last layer of polyurethane.

7. Finish the test boards at the same time you're finishing your tabletop. Use these sample pieces to make sure the finish is properly cured and ready to rub out. Then experiment on them to get a feel for rubbing out.

The No.1 rule for a successful rubout is to let the finish fully cure.

8. Let the finish fully cure! This is most important for a successful rubout. A finish that has not cured will not be hard enough to take an even scratch pattern from abrasives. The result will be an uneven sheen. Polyurethane should cure for two weeks to a month after the last coat is applied. If the finish balls up on the sandpaper or it won't buff out to more than a satin sheen, let it sit for another week or two.

SMOOTH AND FLATTEN THE FINISH

It seems completely counterintuitive, but to make a finish really shine, you have to start by sanding it dull (Photo 2). Sanding removes dust nibs and brush marks and leaves the finish smooth and flat.

Caution: The finish tends to be thinner at tabletop edges. Use special care in these areas to avoid sanding through (Photo 3).

9. Apply consistent, light pressure as you sand. When you're done, the surface should feel smooth and level and will still have a few small shiny spots. Don't feel that you have to completely erase every

visual defect at this point—just go for a smooth feel. Unless you have lots of bubbles to flatten, you should only need to sand five to 10 strokes in any given area with the 600-grit sandpaper. Sand dry so you can see what's happening to the finish, and change paper often. Vacuum all the sanding dust off the surface and wipe with a damp cloth. Tackcloths can be used on oil-based poly but not on water-based.

RUB TO AN EVEN, FLAT SHEEN

10. Begin rubbing-out with medium-grade, (00 steel wool equivalent) synthetic abrasive pads (Photo 4). This is where the finish begins to come to life, taking on an attractive, flat sheen with no visible defects.

RUB TO A SATIN SHEEN

11. Clean the top with a damp cloth and continue buffing with fine synthetic abrasive wool (0000 steel wool equivalent) (Photo 5). Rub until the whole piece has an even, satiny sheen, and then rub a little more. There's not much danger of rubbing through the finish at this point.

RUB TO A SEMI-GLOSS

12. To bring up the sheen even more, use soapy water or paraffin oil as a lubricant for the abrasive wool (Photo 6). Rub thoroughly; then wipe dry.

13. If that's still not enough shine for you, rub the entire surface with 4F-grade pumice. After sprinkling the pumice on the surface, rub it into a paste with water and a dampened rag (Photo 7). Wipe the slur-



7 Using finer and finer abrasives brings the sheen closer to a full gloss. Start with finest-grade (4F) pumice lubricated with water and a moist rag, followed by rottenstone. With these finer grits, it's OK to use a circular motion as you rub.

ry away, and then repeat the process with rottenstone. Keep firm pressure on the rag, and sprinkle more of the powder or water as needed. Continue rubbing in any direction until your arms hurt and the finish looks satisfactory. Now your furniture has the good-looking finish it deserves.

Sources Home centers and hardware stores: 3M packs of two finishing pads, 00 steel wool equivalent, \$4. 3M Sandblaster 400-grit stearated aluminum oxide paper, \$5 for a pack of six. • Woodworker's Supply, (800) 645-9292, www.woodworker.com Oilfree abrasive wool, fine (000 to 0000 equivalent), #115-271, \$21 for a 4.35-liter box; medium (1 to 00 equivalent), #115-274, \$21 for a 4.35-liter box. 4F pumice stone, 1 lb., #849-832, \$7. Rottenstone, 1 lb. #849-839, \$7, Paraffin Oil, #910-829, 1-qt., \$16.

Dealing with Molded Edges

Avoid using sandpaper on molded edges, table legs and other vertical surfaces. The risk of cutting through the finish with the sandpaper is just too great. Instead, rub molded edges with synthetic abrasive pads and rub to the sheen of the top.





Waterborne Polyurethane Basics

It's easy to see why waterborne polyurethanes have become so popular: they're as durable as solvent-based polyurethanes, they dry faster, smell less, present a lower fire risk and clean up with soap and water. If you haven't tried waterborne polyurethane, here are answers to some of the most commonly asked questions.

WHY IS WATERBORNE POLY WHITE?

Water and urethane, the main ingredients in waterborne poly, don't dissolve one another. That means they must be combined in an emulsion, a type of mixture in which insoluble substances can be suspended together. In this emulsion, the water and urethane molecules (which are both colorless) refract light differently, making the mixture appear opaque, like milk (photo, above). After being laid on a sur-

face, the water evaporates, leaving the solids covering the surface in a protective, colorless film.

WHICH APPLICATOR WORKS BEST?

For flat surfaces, many finishers prefer a paint pad—a flat plastic plate covered with thousands of tiny bristles. They're designed for applying latex paint, which is really just another waterborne finish. Soft-foam-backed versions (without handles), made for contoured surfaces, are a joy to use on flat surfaces too. Finishing pads made of velour fabric don't lose bristles and lay on a smooth, thin coat.

Many folks swear by foam brushes, saying they eliminate brush marks and air bubbles and are easy to use. On the other hand, a good synthetic bristle brush can handle everything: flats, spindles, edges and inside corners. Natural bristles don't work well because they absorb water and lose their shape.

CAN I PUT WATERBORNE POLY FINISH OVER OIL-BASED STAIN?

The answer is “yes,” if you use a tie coat between them. As its name implies, a tie coat ties one type of finish to another with good adhesion.

A thin coat of dewaxed shellac, such as Zinsser SealCoat will do the trick. SealCoat will adhere to the dried oil stain and the waterborne poly will adhere to SealCoat (photo at right). You can also mix your own dewaxed shellac from flakes. Mix about two ounces of dewaxed shellac flakes into a pint of denatured alcohol and apply one thin coat to the stained wood. In about two hours you can apply the waterborne finish. Be aware that most types of pre-mixed shellac contain wax, and should not be used for this application.

WHY DOESN'T WATERBORNE POLY LOOK GOOD ON DARK WOOD?

Waterborne poly makes dark woods, such as walnut or rosewood, look pale or pasty. Two things contribute to this, but both can be countered (photo at right).

First, oil finishes, shellac and lacquer make wood look wet because their molecules are small enough to get down into the wood fiber. The result is similar to what you'll see if you put oil on a brown paper bag—the paper gets darker and translucent. Molecules in waterborne polyurethanes are gigantic, compared to those in other finishes. Instead of getting into the wood fiber and “wetting” it, they can only lay on the surface in a colorless film that makes dark wood look lifeless. A slick way around this problem is to seal the wood first with dewaxed shellac, a compatible finish that makes the wood look wet.

Second, oil-based finishes make wood look warmer because they're slightly amber colored. Waterborne poly, on the other hand, is either colorless or slightly bluish-gray, so it doesn't add warm tones. The solution: tint the waterborne finish with amber-colored dye, such as Transtint Honey Amber dye, available from Woodcraft Supply, www.woodcraft.com. Mix the dye according to the manufacturer's directions. Then add one or two tablespoons of the liquid dye to a quart of finish. Don't be alarmed by the brown color the waterborne turns—it'll look great on the wood's surface.

WON'T WATERBORNE POLY RAISE THE WOOD'S GRAIN?

Any product that contains water will raise the wood's grain, making it feel rough after it dries. The trick is to raise the grain purposely and then cut it down before you apply the finish.

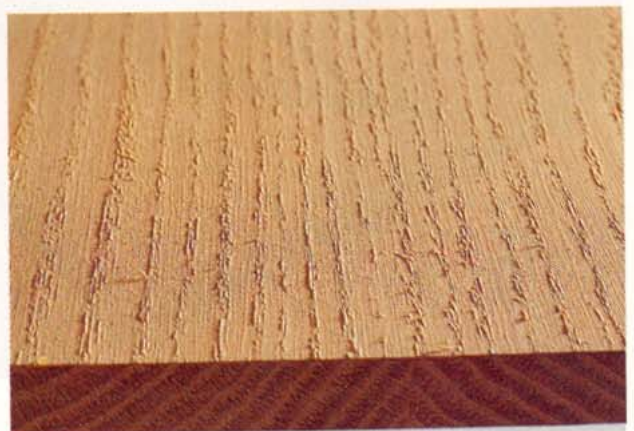
To raise the grain, sponge clean water liberally over the wood after your last sanding. Then wipe it off so no puddles remain. Let the wood dry overnight and in the morning you should have raised grain (photo at right). Using 320-grit



Use dewaxed shellac between oil-based stain and waterborne poly to eliminate compatibility problems.



Improve the look of waterborne poly on dark wood quickly and easily. Warm the wood's appearance by tinting the poly with amber-colored dye. Bring out the wood's natural color and figure by applying an initial coat of dewaxed shellac. Using both techniques dramatically changes the wood's appearance.



Raised grain, the morning after.



Add half-and-half to counteract "foaming," tiny bubbles that can form in the finish and get trapped there as it cures. Don't worry; half-and-half, like waterborne finish, dries clear.



On a large surface, lay on the finish in successive, slightly overlapping end-to-end strokes, each about as wide as your pad or brush. Wet the surface with the first pass, go back over it only once to smooth and level the finish and then move on. Work fast and don't go back.

sandpaper, sand the surface lightly, so you remove only the raised wood fibers. Stop sanding as soon as the wood feels smooth. Sanding too much creates new wood fibers that will raise up when the finish goes on. It's a lot like shaving. You want to remove the hair that stands up, but stop before you cut into the skin!

DOES WATERBORNE POLY CONTAIN HARMFUL SOLVENTS?

Although waterborne polyurethanes have little odor, they still contain volatile organic compounds (VOCs), just like their traditional oil-based counterparts. The difference is that waterbornes have far fewer of them.

For example, lacquer typically contains about 75-percent solvents and about 25-percent solids. The solids make up the finish that will remain on the wood after the solvent evaporates. Waterborne coatings generally contain 10-percent solvents or less, and as much as 35-percent solids, with water filling in the rest. With such a small percentage of solvent, you don't need as much ventilation as you would with lacquer. However, you still need some. If you spray, use your spray booth; if you brush, crack a window and run a fan on low speed. Always wear a mask equipped with organic vapor cartridges.

WHY ARE THERE BUBBLES IN MY FINISH?

Air bubbles trapped in the finish are one of the more vexing problems associated with waterborne coatings.

You can usually minimize the problem with good application technique. First, don't brush too hard or fast—that's sure to generate air bubbles. Stick to a smooth, gentle application technique and use paint pads and bristle-free foam brushes when you can. Still, clusters of very tiny bubbles, called "foam," sometimes show up in the dried finish. The result, particularly in gloss finishes, is an uneven, hazy look that no amount of rubbing or polishing will remove. You can often minimize these pesky air bubbles by stirring about an ounce of half-and-half into a quart of finish before you apply it.

HOW DO I AVOID BRUSH MARKS ON LARGE SURFACES?

Use a paint pad or foam brush. They're less likely to leave marks than a bristle brush. Part of the problem, though, is that waterborne poly dries so fast, there's no time to "work it out," especially over a big surface. In fact, going back and forth will only make the finish look worse.

Another problem is applying too thick a coat on each pass. Put on only as much as you need to get the surface entirely wet. This is true whether you are spraying, brushing or using a pad.

If you must, you can slow down the drying time a bit by adding an ounce of propylene glycol to a quart of finish. You can get propylene glycol from a chemical supply house or at most cigar stores, because it is used to charge the humidification devices used in humidors.

Outdoor Finishes

Simple to Super Durable



Outdoor finishes have one thing in common; they all require maintenance. Of course, paint is unequalled at protecting the wood from its two biggest enemies: moisture and ultraviolet (UV) light. Moisture causes the wood to rot, and sunlight bleaches out its natural color. Still, who wants to cover up beautiful wood with paint? If you want the wood to show through on your outdoor projects, you need a clear finish.

There are three basic clear finishes for outdoor furniture: exterior oil, exterior varnish, and an epoxy sealer with an exterior varnish topcoat. Application ease and service life are the two major differences between these finishes.

Of the three clear exterior finishes, exterior oil is by far the simplest finish to apply. Just flow it on, let it soak in and wipe off the excess. Unfortunately, oil offers the least amount of protection and it must be reapplied every year. Exterior varnish, on the other hand, is more difficult to apply: up to eight coats have to be carefully brushed on. While exterior varnish offers excellent protection from moisture and UV light, it has to be recoated every few years to maintain that protection. An epoxy sealer with an exterior varnish topcoat is the most durable outdoor finish and can last for many, many years. However, the initial application does take longer than exterior varnish.

Exterior Oils



An exterior oil finish is definitely the simplest, quickest way to treat an outdoor project. On the downside, it will only give you about a year of protection from the ravages of outdoor life. Oil finishes don't provide a protective film that sits on top of the wood like varnish does. Instead, oil soaks into the wood fibers and dries. Exterior oils have added trans-oxide pigments for UV protection and mildewcides to protect against mold and mildew. You'll find colors ranging from dark brown to light amber.

Application is simple: a garden sprayer and a rag are all you need. First, flood the surface of your project with oil. I use an inexpensive hand pump garden sprayer. It's fast, easy and cost less than \$10. Let the oil soak in according to the manufacturer's directions, then wipe it off. That's it. Done! Depending on local conditions, you'll have to reapply about once per year. The built-in UV protection should keep your wood looking natural for many years (as long as you keep up with the applications).



Exterior Varnish or Urethane



Exterior varnish or urethane (both finishes are technically "varnishes") builds a protective layer over the wood. It offers superior protection and durability over an oil finish. Often, the term "spar" is found in the name, but this does not indicate any additional or special ingredient. The term "spar" originates with its use as a coating for the spars on sailing ships. All exterior varnishes are formulated to protect against moisture and UV radiation.

Exterior varnish is applied with a natural bristle brush in multiple coats. Manufacturers recommend eight thin coats for maximum protection and a deep lustrous finish. Sand the hardened varnish lightly between each coat.

Exterior varnishes cure to a more flexible film than ordinary varnish. The flexible coat is not as likely to crack from seasonal wood movement caused by humidity extremes in an outdoor environment.

Exterior varnish will usually last 2-3 years before it starts to look chalky. As soon as you see a chalky film start to develop, it's time to freshen the finish. Simply sand the topcoat smooth, and apply a new coat of varnish. Don't put this important maintenance step off too long or cracks will develop in the finish allowing moisture to penetrate and degrade the wood. That will necessitate a complete strip and refinish to restore the furniture. You don't want to go there.



Epoxy with Exterior Varnish



An epoxy sealer with exterior varnish topcoats is the most durable, but also the most labor-intensive finish you can apply to outdoor furniture. This is the finish favored by boat builders so you know it's going to last a long time. Epoxy and exterior varnish enjoy a symbiotic relationship: The epoxy forms an impenetrable moisture barrier that prevents seasonal swelling and shrinking of the wood. This dimensional stability, in turn, gives longer life to the exterior varnish because it no longer has to stretch and shrink with the wood. The exterior varnish returns the favor by providing UV protection, without which the epoxy would rapidly deteriorate.

Apply three thin coats of epoxy. The best way to get thin, even coats is to use a foam roller cut in half. It works kind of like a squeegee. Epoxy cure times vary depending on their formulation and the ambient temperature. Be sure to use an epoxy with a long enough open time (approximately 30 minutes), so it doesn't set up before you're done putting it on. For large projects, mix the epoxy in small batches so you can finish

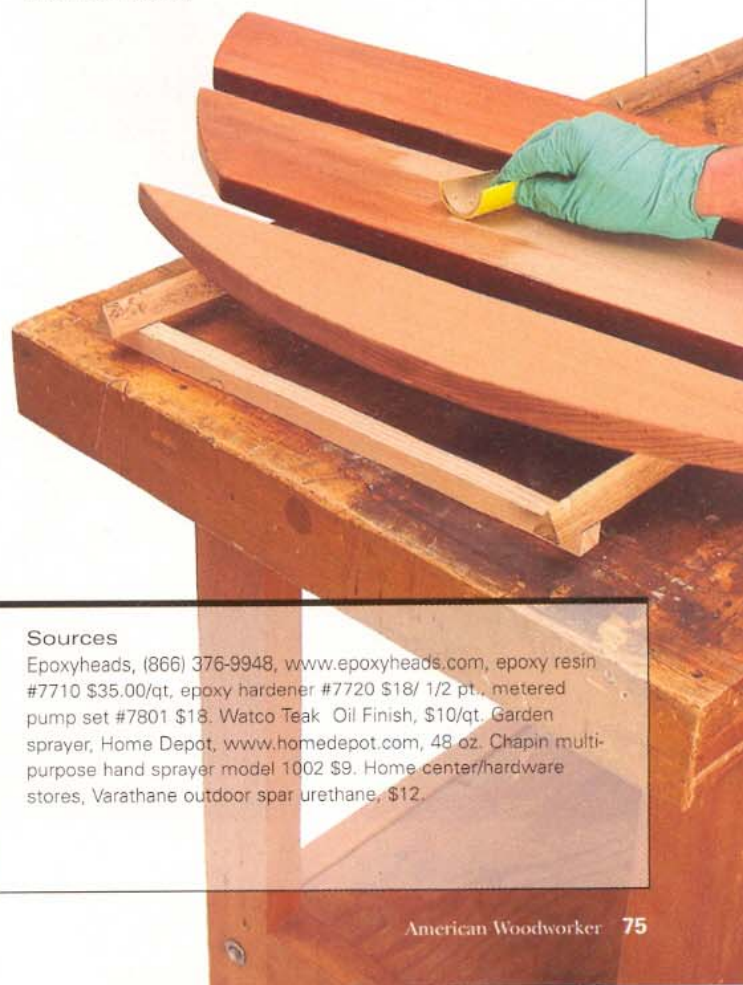


Sand out any unevenness and defects in the cured epoxy before applying the exterior varnish topcoats.

an area before the epoxy sets. Also, for optimal flow out and penetration into the wood fibers, make sure the epoxy you use doesn't contain any thickeners. Always read and follow the instructions that come with your epoxy. If possible, apply the epoxy undercoat prior to assembling the parts. You can recoat without sanding while the previous coat is still soft but not sticky. If the epoxy seems uneven or bumpy, allow it to harden. Then, sand it smooth and apply the next coat.

Before applying the varnish topcoats, I use a card scraper or sanding block with 100 - 120 grit sandpaper to level the cured epoxy (see photo below left). The sanded surface also provides some tooth for the spar varnish to adhere to.

Rinse the sanded epoxy with clean water and dry with paper towels. The rinse water should not bead on the surface. Beading indicates that contaminants from the epoxy curing process are still on the surface and could interfere with the varnish bond. To remove the contaminants, wipe down with mineral spirits and dry with paper towels or a rag. Follow this with eight coats of exterior varnish, sanding lightly between coats.



Sources

Epoxyheads, (866) 376-9948, www.epoxyheads.com, epoxy resin #7710 \$35.00/qt, epoxy hardener #7720 \$18/ 1/2 pt., metered pump set #7801 \$18. Watco Teak Oil Finish, \$10/qt. Garden sprayer, Home Depot, www.homedepot.com, 48 oz. Chapin multi-purpose hand sprayer model 1002 \$9. Home center/hardware stores, Varathane outdoor spar urethane, \$12.

Basic HVLP Spray Techniques



How to succeed at spraying a waterborne finish

When it comes to finishing, we're all looking for easy answers that give professional results. Shooting waterborne finishes with a high volume, low pressure (HVLP) turbine sprayer is quick and safe and the results look like a thousand bucks.

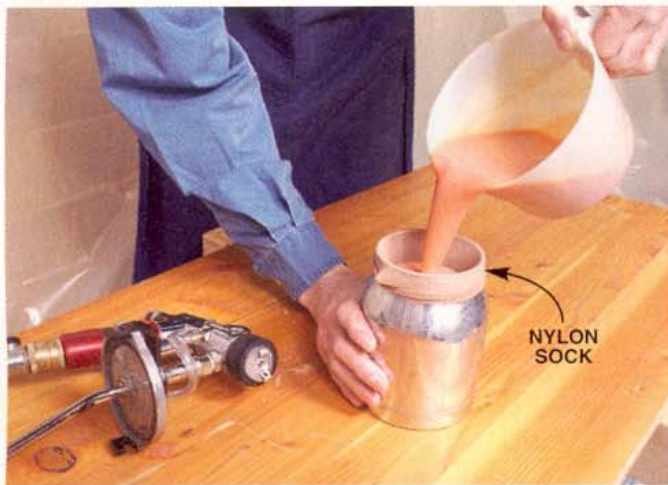
Spraying is a whole craft in itself. This step-by-step guide will help you avoid the most common pitfalls.

Waterborne Finishes Are User-Friendly

Waterborne finishes are clearly the best choice for spraying in a home shop. You get most of the benefits of sprayed lacquer or polyurethane without needing an explosion-proof exhaust fan or explosion-proof lights. Waterborne finishes generally dry to the touch in 10 minutes, and you can often re-coat in less than an hour.

PREPARE YOUR SHOP

Outfit your shop with plastic sheeting on the walls, a tarp on the floor, a halogen light and a window fan. Dust kicked up by the gun can ruin a finish. The paper and sheeting eliminate the dust hazard and keep overspray contained.



STRAIN THE FINISH

When you pour finish into the sprayer's cup, strain it through a small nylon sock, cheesecloth or paper funnels with mesh bottoms. The nylon sock can be rinsed with water and used over and over.

PRACTICE HOLDING THE GUN

Fill the gun with water. Then turn on the HVLP turbine to pressurize the cup and keep the fluid from traveling back up the pressure tube and dribbling out of the gun.

Pick up the gun and hold it at 90 degrees to the surface. Hold the gun 6 to 8 in. away from the surface. Lock your wrist and move the gun back and forth with your arm as you press the trigger. The speed of your arm movement determines how much finish you apply. Move too slowly and the finish will pool. Move too fast and the coat will be too thin. You'll figure out the right speed after you set the gun's controls.

Adjust the Gun

For the steps ahead you'll need a large disposable surface to practice on. Builder's rosin paper, plain brown paper or cardboard work well. For starters, we will shoot for a fan size of about 6-in. As you gain experience, you can reset the controls for larger or smaller patterns as conditions dictate.

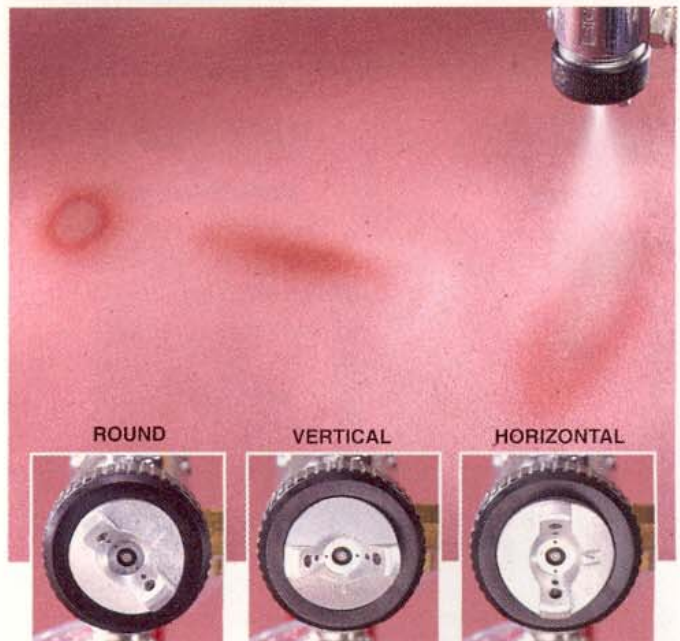
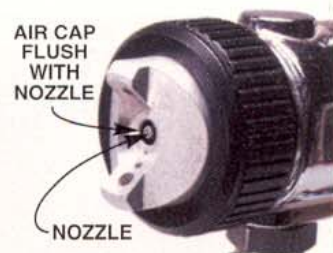
KNOW THE GUN'S CONTROLS

Every HVLP system has three basic controls: the volume of airflow, the volume of fluidflow and the shape and size of the fan pattern. These controls may be located in different places than on the gun shown so check the owner's manual.

An HVLP gun uses air to break up a fluid finish into tiny droplets, this is called "atomization." Once atomized, the droplets are formed into an adjustable spray pattern, called the "fan." The trick to adjusting the gun is to get the right atomization across the entire width of the fan pattern.

SET THE AIR CAP FOR FAN SIZE

If your gun has an adjustable air cap, turn the ring around the cap until the nozzle is flush with the face of the cap. This will produce a middle of the road size fan. As you become better at spraying, you can readjust the air cap to change the size of the fan pattern.



SELECT THE FAN PATTERN

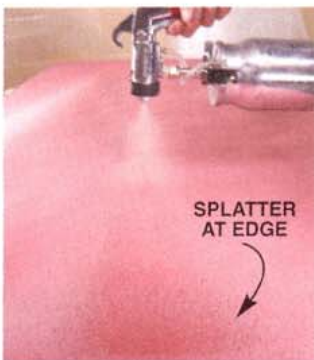
All air caps can be set to three different fan patterns: vertical, horizontal and round. A vertical fan is good for tops; a horizontal fan is good for sides; a round fan is used to concentrate the finish in a small area. You can switch between vertical and horizontal settings without changing the air and fluid volume settings. Switching to a round fan requires readjusting these settings.

Adjust the Air



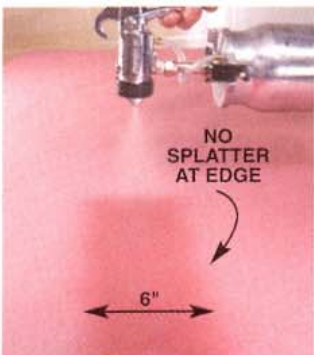
ADJUST THE AIR VOLUME

Regulate the air flow from the turbine with the air volume control knob. Increasing the air flow creates more atomization. Thick finishes need more air to atomize properly than thin finishes.



TOO LITTLE AIR

Start out with the air turned down most of the way. Hold the gun at 90-degrees to the paper and about 6-in. away. Pull the trigger half way and make a pass. If you see splatter at the edge of the fan pattern, turn the air up a bit.



JUST RIGHT

Slowly increase the air volume until the fan is evenly atomized and has clearly defined edges, without splatter.



TOO MUCH AIR

Too much air volume leaves an oversize spray pattern that looks like a fine mist with an excessive amount of overspray.

Note: If the air volume is at the maximum and the gun is still spitting finish, thin the finish up to 10% with distilled water.

Adjust the Fluid



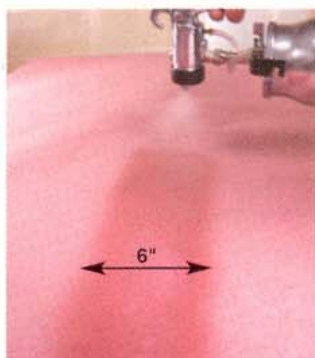
ADJUST THE FLUID VOLUME

Regulate the fluid volume with the knurled knob at the back of the gun. This knob controls how far you can pull the trigger. As you pull the trigger, the volume of finish increases and so does the size of the fan pattern. Your goal is to set the trigger so it automatically stops at a 6-in. wide fan.



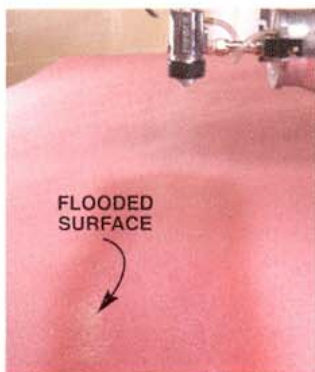
TOO LITTLE FLUID

Begin by adjusting the trigger for a fan that's less than 6-in. wide. Note: Some spraying situations, such as a narrow face frame, call for a small fan to minimize overspray.



JUST RIGHT

Increase the fluid volume until the fan is 6-in. wide.



TOO MUCH FLUID

Back off the fluid volume if your surface is flooded with finish or the fan pattern is more than 6-in.

Spraying

SPRAYING INSIDE A CABINET

Always begin with the inside of a cabinet. A general rule of thumb of spraying is to start with the least visible surface and end with the most visible surface. That way, any overspray on visible areas will be covered when they get sprayed.

Fill your cup 3/4 full with finish to prevent starving the fluid nozzle of finish when you tip the gun up into corners.

Adjust the air cap for a vertical fan. Increase the air flow to create a light spray pattern. Light coats are fine inside a cabinet.



1 Spray under the top, moving from the back to the front. The top of the fan pattern should just reach the edge of the cabinet back.



2 Spray the back, overlapping each pass by 50 percent. Position the edge of the fan pattern to just reach the inside corners. Do not spray directly into the corner or finish will pool and create runs. Whenever possible, remove the back and finish separately.



3 Spray the sides, moving from back to front.



4 Spray the bottom from back to front. This is the most visible part of the cabinet interior. Spraying here last covers any overspray from the previous steps.

SPRAYING FACE FRAMES AND SMALL SURFACES



Switch the air cap to a horizontal fan pattern. Reduce the size of the fan pattern to about 3-in. across. You can reduce the fan by reducing the air and fluid settings, or by holding the gun slightly closer to the surface and moving faster. Always test on paper before spraying your cabinet.

For any exterior surface, start the spray before it contacts the piece and release the trigger when you're past the bottom. Do this in one fluid movement, always holding the gun perpendicular to the surface you are spraying.

SPRAYING VERTICAL SURFACES

Adjust the air cap for a horizontal fan pattern. Adjust the fluid volume and the air volume to make a 6-in. fan pattern.



1 Aim the gun at a point above the cabinet and pull the trigger. Move down the cabinet and release the trigger when you're past the bottom edge.



2 The next pass starts below the bottom, overlapping the first pass by 50 percent. Repeat the up and down pattern until the side is covered.

Spraying

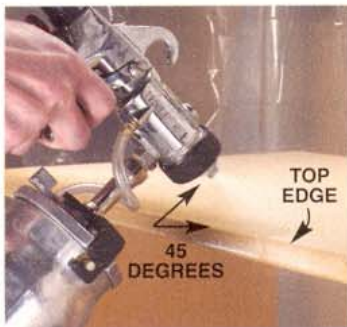
SPRAYING TOPS

Set the air cap for a vertical 6-in. fan pattern for both the edges and the top surface. It's not worth the time to reset the air cap to a small fan for the edges. Instead, hold the gun closer and make a quicker pass on the edges.

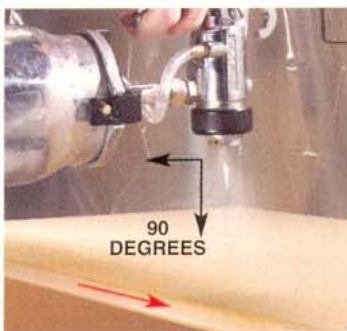
Waterborne finishes dry very fast. Keep the gun moving so that each pass can blend into a previous pass while it's still wet.



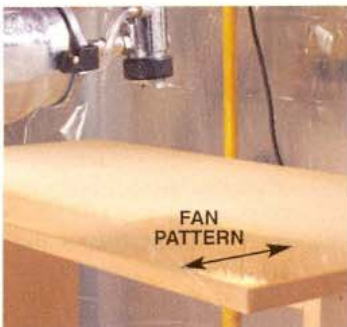
1 Spray all four edges, all the way around the top. Hold the gun at 90 degrees.



2 Spray the top edges with the gun at 45 degrees.



3 Spray the top surface with the gun at 90 degrees. Pull the trigger before you reach the top and release the trigger after you've passed the top.



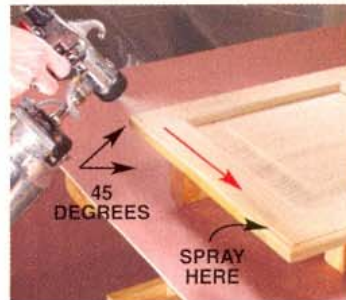
4 Overlap each pass by 50 percent. Alternate direction back and forth to keep the gun moving quicker than the finish can dry.

SPRAYING RAISED-PANEL DOORS

Turn the air cap to a vertical fan pattern. Then increase the air flow a bit beyond where you set it for the 6-in. pattern for a finer spray and lighter coat. Reduce the fluid volume to make a 4-in.-wide fan pattern. Place the door on some 2x4s to elevate it off the table.



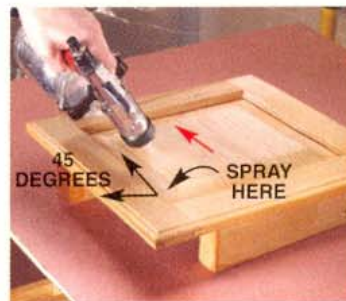
1 Spray all four edges with the gun held about 6 in. away.



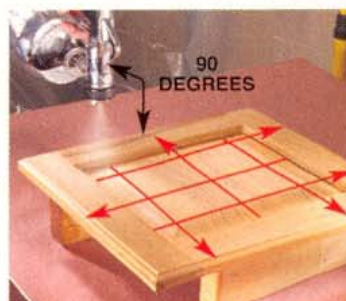
2 Spray the outside top edges with the gun at 45 degrees.



3 Spray the inside top edges with the gun at 45 degrees. Keep the gun moving to prevent finish from building up in the corners.



4 Spray the bevels of the panels. Continue to hold the gun at 45 degrees.



5 Spray all the top surfaces. Hold the gun at 90 degrees. Spray two continuous coats. One from side to side and the second from top to bottom.