Stains, Dyes and Pigments

The wood grain should remain readable

by George Frank

We all love wood because of its endless variety of grain. To put the natural markings of the wood in evidence is the true task of anyone who tries to beautify it through finishing. Concerning beauty in woodfinishing, I have set up a rule for myself: The first requisite of a beautiful finish is that the wood must remain "readable." This means not only that the grain must be clearly visible after finishing—that is self-evident. It also means that from the grain of the wood, qualified people can read the whole history of the tree: its origins, age and environment, its fights for survival, its adventures.

Woodfinishing is the stepchild of the woodworking industry. Even its vocabulary is poor and misleading. We use the word "staining" when we refer to a chemical action that changes the color of the wood, to a process where a dye brings this change about, or to a process where we cover the wood with a colored film, or a thin layer of colored pigment. Only this last method should rightly be called staining. The first two should be called dyeing. The difference between dyeing and staining is like the difference between getting a deep suntan and using makeup to imitate one. While stains always reduce the readability of the wood, they have great merits, especially on the production line. Ease of application is one, but far more important is that stains help to achieve uniform coloring, and this, especially on the assembly line, is a fair compensation for the reduced readability.

Chemical action

Cuban mahogany has the color of raw steak. Sponge it with a solution of potassium dichromate, a yellow crystal, and its color deepens considerably. Not only does it become a dark rusty red, but the contrast between the light and dark markings becomes more accentuated. This chemical process, wrongly called staining, really enhances the beauty of the wood. Napoleon's craftsmen often used this process, and most French Empire furniture is "stained" by this method.

It is a well-known fact that wheat-colored oak becomes brownish-grey when sponged with ammonia. Here is a short story about another chemical action: In 1938, a Pennsylvania manufacturer imported a shipload of timber from Europe. To mystify the competition, he gave it a name—palazota. It looked like bird's-eye maple, but was whiter and had more eyes in it. He made bedroom suites of it and sold them successfully. By 1942, the market was saturated with white palazota bedrooms, and dealers asked for something new. Since he had over two-thirds of his lumber still in stock, he tried stains. His stains obliterated most of the delicate markings of the wood, and the stained palazota did not sell. That is when I was called in. After three weeks of experimenting, I found the answer. A weak solution of ferrous sulfate brought unbelievable changes to this wood. The miniature eyes opened up considerably, while the flat areas remained almost unchanged. The wood seemed to acquire a third dimension, depth. When I added some coloring dyes to the ferrous chemical, I produced a whole new gamut of decorative effects. Regardless of whether the palazota was tinted grey, brown, gold or red, its markings always came out loud and clear. Three years later, the manufacturer did not have a single board left in his factory.

A simple example illustrates the possibilities: Apply potassium dichromate solution to a piece of birch or maple and the wood becomes pleasantly dyed a rich yellow color. Apply it to a piece of oak, and the wood becomes a dark rusty brown. So far so good. Now imagine that you can get somehow a cake of logwood extract, more scientifically called extract of campeche wood. Dissolve one ounce in a pint of water, and with this wine-like brew you sponge the three pieces of wood you are experimenting with. Let dry, sandpaper lightly and apply the potassium dichromate solution. After an hour you will find that the birch and the maple have become rusty brown, and the oak a rich chocolate color.

Potassium permanganate is a common chemical. One ounce dissolved in a pint of water will stain most hardwoods a pleasant brown. But the tint will fade and change color—from brown-violet to brown. If the color you get is too dark, wash down the wood with a fairly strong solution of sodium thiosulfate (available from photo-supply stores as hypo solution). You will get a nicely bleached wood.

Another woodfinishing concoction can be prepared by mixing equal amounts of ordinary vinegar and water, then throwing in all the rusty iron you can find—old nails, screws, hinges, tools and so on. Let sit for a week, then filter through a piece of cloth. The resulting liquid will produce a silvery grey color on oak. It won't be so effective, though, on woods lacking tannic acid. This can be remedied by prestaining with a mordant made of an ounce of tannic acid in a quart of water. Obviously the vinegar mixture is rather iffy, since its strength depends on the amount of iron the liquid will absorb. Ferrous sulfate dissolved in water (about 1½ oz. to one quart water) will produce a more positive and very pleasant grey color on oak.

Dyeing

Until about 1870, dyes for textiles or for wood were always extracted from plants, insects or animals, and rarely from minerals. For example, to obtain one pound of the dye called Tyrian purple, Mediterranean fishermen had to bring up close to four million mollusks *(Murex branderis),* break their shells individually and carve out a small sac from their bellies, which contained the coloring matter. The price of this dyestuff was so high that in ancient Rome, its use was reserved by law to royalty and to the princes of the church (hence its popular name, cardinal purple). Another red dye was brewed

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from a little bug, *Coccus cacti L.* Seventy thousand of these bugs had to give up their lives so that men could brew one pound of dye from their dried bodies. Only a hundred years ago, England imported seven million pounds of these dried insects annually. Tea is not only one of the most popular beverages in the world, it is also an excellent dye, used mostly on antique reproductions, since it conveys to the wood a pleasant golden hue, characteristic of many fine antiques. There are a few hundred of these natural dyes that can be used on wood, but progress has relegated them mercilessly to obsolescence.

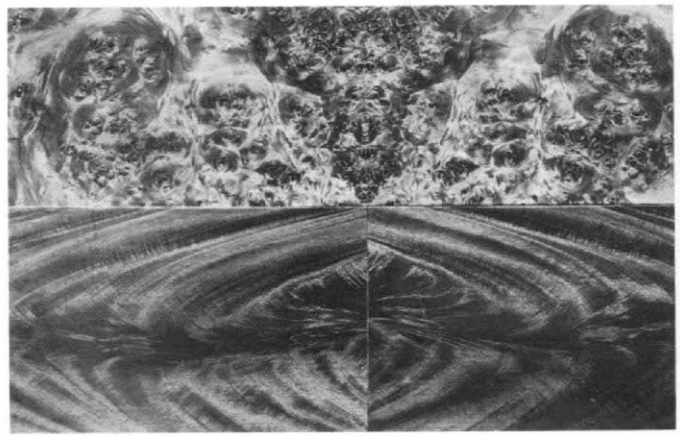
A little over 100 years ago, W. H. Perkin accidentally came across the first aniline dye. Others were discovered in rapid succession and the era of synthetic dyes began. Between the two wars, a giant industry was born in Germany, the manufacturing of colors and dyes. A huge company, I.G. Farben, had almost a monopoly, and its subsidiary, Arti A.G., specialized in dyes for wood. There were no wood-coloring problems in Europe during the 1930s because Arti always had the answer. They had simple dyes that would give the selected color to nearly any wood. Other dyes involved two applications, a prestain, or mordant, which was followed by the dye, resulting in deeper penetration and more positive coloring. The most important tools in any woodfinishing shop during this period were a pharmacist's scale and a graduated glass to weigh and measure the proper amount of dye and water. All these dyes were properly numbered and matched a master color chart. Arti also supplied dyes to be dissolved in alcohol or in oils, for special needs. Before World War II, Arti tried to gain a foothold on the American market, evidently without success. I do not know of any manufacturer here that markets dyes for wood with proper color samples and reliable instructions. This does not mean that American-made dyes are inferior to European. I simply deplore that they are presented in a very haphazard way.

Pigments

Any solid substance that can be reduced to powder can become a pigment. With the proper carrier and a binder, it can become a pigmented stain. All pigmented stains have the same formula: pigment, carrier and binder. Again, let me give you an example from my past. The first person who ever sought my professional help was a small-town manufacturer of a line of children's furniture, such as playpens and high chairs. The local lumber he used varied so much in color that he simply could not obtain a uniform light finish. I mixed for him equal amounts of powdered chalk and French ochre powder, and stirred the mixture into a pail of lukewarm rabbit-skin glue solution. This simple stain not only solved his coloring problem, but also acted as a sealer on his wood. In this instance the chalk-ochre combination was the pigment, the water was the carrier and the glue was the binder.

The most popular and the best-known pigment-stains are the commercial oil colors. They contain very finely ground pigments mixed into the oil (the carrier), to which a drying agent is added (thus the oil becomes the binder, too). Almost always, the carrier in this mixture is extended with turpentine or other paint thinner. Pigment stains in general do not change the color of the wood. But even after the most thorough wiping off, some of the pigment remains on the wood and adds its own color to it.

There appears to be a clear-cut difference between the three ways of changing the color of wood. The reality is far more complex. The three methods can be and very often are intermixed. My story about coloring the palazota illustrated how chemicals can be combined with dyes to create new horizons in changing the color of the wood. But that is just one story out of thousands. Chemicals can be mixed to dyes, dyes can be mixed to pigment-stains, and all three can be combined together to improve the quality of the finished products, this time correctly called "stains." Nearly any stain purchased in a paint store contains pigments, dyes and some chemicals (for deeper penetration), and all do an adequate job for the amateur, even for the average professional. The fine woodworker sticks to chemicals, natural dyes maybe, or accepts synthetic dyes to color the wood, but seldom uses pigment stains in spite of their great advantages and simplicity.



Top, ferrous sulfate brings out contrasting figure in 'palazota' maple, Bottom, mahogany treated with potassium dichromate gives illusion of great depth.

Application

Waterstains, dyes and chemicals should be generously applied with a sponge. The area to be dyed should be thoroughly soaked and then the excess should be taken off with the same sponge, squeezed out, to leave the wood uniformly moist. The stronger the concentration, the more potent the stain or dye. Chemical dyes, more than aniline dyes, should be used in weak concentration and applied repeatedly, since they show their final effect only after thorough drying, and it is far more difficult to lighten the wood than to darken it.

Some dyes can be dissolved in alcohol or lacquer thinner. Therefore, a liquid shellac can be further diluted and tinted with colored alcohol and the resulting colored shellac when applied would convey a tint to the surface. The same goes for the lacquer—if the thinner is colored, it becomes a tinting lacquer. Wax, varnish, shellac and lacquers can be tinted with dyes dissolved in their respective thinners. They can also be "loaded," that is, some finely ground coloring matter can be mixed into them—a fourth way of "staining" the wood. These four ways are very much like the four strings on a violin. The melodies one can play on these four strings are really endless, but the beauty of the melody depends on the person holding the bow. ☐

EDITOR'S NOTE: H. Behlen & Bros., Inc., Box 698, Amsterdam, N.Y. 12010 makes and sells a wide range of stains, pigments and dyes. Their products are also sold by Constantine, 2065 Eastchester Rd., Bronx, N.Y. 10461. For chemicals, check in the Yellow Pages under "Hobby Supplies" and "Chemicals."