

WOODWIND MATERIALS

THE STORY OF SHELLAC

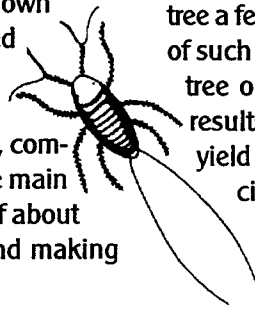
Shellac, as the word is commonly used, refers to all forms of purified lac - a natural resin secreted by the tiny lac insect on certain trees, principally in India and Thailand.

Known for three thousand years, lac provided the natives of India with colors for clothing and a material they fashioned into ornaments and trinkets. It first became commercially important for the purple-red dye extracted from it to dye textiles. Shellac has been prized as a decorative lacquer as far back as the sixteenth century.

Aniline and other chemical dyes have long replaced lac-derived dyes. But despite the many synthetic resins produced by the chemical industry, natural shellac still retains its important place in the decorating products field as well as in such diverse applications as pharmaceutical, candy and fruit coatings; printing inks; furniture finishing; adhesives; grinding wheels; hat stiffening; and paper and foil coatings.

How Insects Make Shellac

Shellac has the distinction of being the only known commercial resin of animal origin. It is produced by a tiny red insect (Lac Laccifer) which in its larval stage, is about the size of an apple seed. Swarms of the insects feed on certain host trees, commonly called "lac trees," in India and Thailand, the main lac-producing countries. Their whole life cycle of about six months is devoted to eating, propagating and making lac as a protective shell for their larvae.



During certain seasons of the year, these tiny red insects swarm in such great numbers that the trees at times take on a red or pinkish color. When settled on the twigs and branches, they project a stinger-like proboscis to penetrate the bark. Sucking the sap, they begin absorbing it until they literally feed themselves to death. In shellac lore this is known as the "feast of death". At the same time, propagation continues, each female producing about one thousand eggs before dying.

The sap undergoes a chemical transformation in the body of the insect and is eventually exuded. On contact with the air, it forms a hard shell-like covering over the entire swarm.

In time this covering becomes a composite crust for the twig and insects. Only about five percent of the insects amassed on the trees are males. The female is the main shellac producer. While she is exuding lac, she is preparing herself to die after providing a fluid in which her eggs will mature and from which the future supply of bugs will come, to repeat the process of swarming, propagating and making the next season's shellac supply.

The males, having fertilized the hordes of females, also begin their life-ending feast. Although they contribute relatively little more to the shellac crop, they have already assured an ample supply because the females vastly increase their output of lac after being fertilized. The great mass of male and female bugs on each tree gradually becomes inactive as the shell-like covering forms over them. In the sixth or seventh month, the young begin to break through the crust and swarm to new feeding grounds.

Shellac cultivation is carried on to produce a large lac crop by helping the larvae find better pickings for their feast. This involves simply cutting lac-bearing twigs from an infected tree a few days before the emergence of the larvae. A bundle of such twigs, known as 'broodlac,' is tied to an uninfected tree on which there are many tender new shoots. This results in a higher survival rate of insects and a greater yield of lac since only a little broodlac gives forth sufficient larvae to infect a tree thoroughly. No further attention is needed until shellac is harvested.

How Lac Is Harvested

Shortly after the young have swarmed at the end of the adults' life cycle, natives begin to harvest the lac encrustation from the trees. Only one crop is taken from a single tree. Young are hatched, however, twice a year.

Natives gather millions of encrusted twigs, called "sticklac", for transport to simple factories or refining centers where the encrustations are scraped off. They may also break the encrustations off right in the forest or orchard with a wooden mallet, much the way ice can be broken from around a tree branch. This material is called "grainlac." In either case, this is the first step in the harvest of shellac gum. The commercial shellacs fall into three categories which reflect the pro-

cesses used in their manufacture: hand-made, machine-made and bleached.

At refining centers, sticklac is scraped to remove the resin from the twigs and then it is ground (as is grainlac), usually in a primitive mill consisting of two millstones, with the upper one rotated by hand. At this stage, the ground lac contains a mixture of resin, insect remains, twigs and other impurities. This is now passed through a coarse screen to remove the larger size twigs.

After the lac is ground and the chaff sifted out, it is soaked in water for several hours in large cup-shaped jars. These are about two and a half feet high and have rough serrated inner surfaces. Next a stomper called a "ghasandar" jumps into the jar and rubs the lac with his feet against the rough surfaces. The object is to break open the lac seeds so the dye will flow out and the insect remains will be freed from the resin. Dye water and scum are removed in several rinsings. Then the ground lac is spread out on a concrete floor to dry in the sun.

The semi-refined product from this operation is known as "seedlac" from its grain-like appearance. It is yellow to reddish-brown in color, depending on the type of tree and the location from which it came. This is the raw material from which both orange flake shellac and bleached shellac are made.

Hand-Made Shellac

This process involves a primitive method still used by small native factories to produce orange shellac. Generally three workers carry out the process from start to finish. They begin by packing seedlac into a long round bag about the shape of a section of two-inch fire hose. These bags vary from 25 to 40 feet in length.

Small sections of the long bag are heated uniformly by slowly rotating them over a charcoal fire in an oven called a "bhatta". While a helper twists the far end of the bag, the operator, called a "karigar," holds the hot end of the bag and squeezes the molten lac through the pores of the bag. The helper at the far end keeps pinching the bag by the twisting action, forcing more lac toward the karigar.

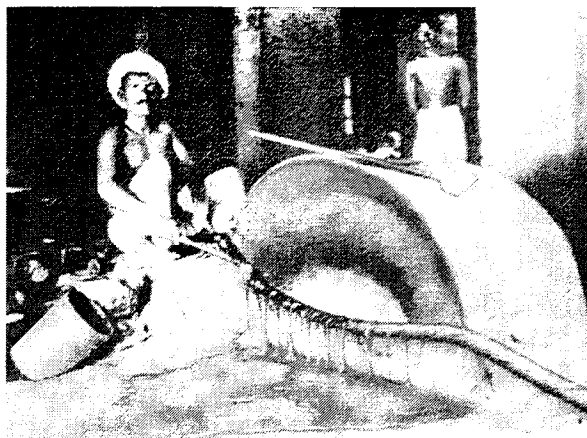
The karigar allows the oozing shellac to fall on the hearthstone, which has been wet with water, and scrapes the sur-

face of the bag periodically with a spatula. To prepare for the next step, he repeatedly picks up lac from the hearthstone with an iron implement and puts it on the rotating bag, basting it back and forth to get a viscous uniform melt.

This soft lac is turned over to a "bhilwaya," who, like a taffy puller, works it into sheets. With a strip of palm leaf, he spreads the molten lac over a ceramic jar containing hot water, and then pulls off a short sheet about two feet square and $\frac{1}{4}$ inch thick. Standing before the fire with the sheet, he manipulates it to soften it uniformly, then starts to stretch it using hands, feet and teeth. He ends up with a very thin sheet about 5 feet by 4 feet. This is laid aside to cool and harden, after which it is broken into thin flakes.

Machine-Made Shellac

Shellac manufactured by modern mechanical methods is called machine-made shellac, mainly to distinguish it from shellac made by the indigenous - and more colorful - hand process. There are two processes, one based on melting (heat process); the other, on solvent extraction (solvent process).



In the heat process, seedlac is melted on steam-heated grids. The molten lac is forced by hydraulic pressure through a filter cloth or fine wire screen. The filtered shellac, still molten, is collected and transferred to a steam-heated kettle from which it is dropped onto rollers. It is squeezed out on the rollers, coming off as a thin sheet to be bro-

ken into flakes. The thickness of the flake is controlled by adjusting roller pressure.

In the solvent process, raw seedlac and solvent, usually ethyl alcohol, are charged into a dissolving tank. The solution is refluxed for an hour or so and then filtered to remove insolubles. The filtrate is fed to a series of evaporators where it is concentrated into a viscous melt. The melt is then dropped onto rollers which "sheet it out" for removal in flake form.

Bleached Shellac

Even though most of the bright red lac dye is removed when sticklac is washed, some shade of orange persists. When dissolved in alcohol, orange shellac forms an amber-colored solution and the dried film has a distinctive amber cast. For

many applications, however, a colorless film is preferred. To meet this market preference, the color is removed by a bleaching process.

The process involves dissolving seedlac, which is an alkali soluble, in an aqueous solution of sodium carbonate. The solution is then centrifuged or passed through a fine screen to remove insoluble lac along with any dirt and other insoluble material. The next step is bleaching the solution with dilute sodium hypochlorite to the desired light color. The shellac is then precipitated from solution by the addition of dilute sulfuric acid, filtered off, washed with water, ground and dried in vacuum driers.

The final product is a white powder commonly referred to as bone dry shellac, which dissolves in alcohol to give a milky white solution. The opaqueness is caused by the natural wax content of shellac which settles out on standing, leaving a clear solution above. The wax is easily redispersed and should be stirred back into suspension before use. Solutions of bleached shellac have traditionally been called 'white shellac' to distinguish them from orange shellac solutions. This is somewhat of a misnomer because they dry to a clear, colorless film.

Shellac's Great Properties

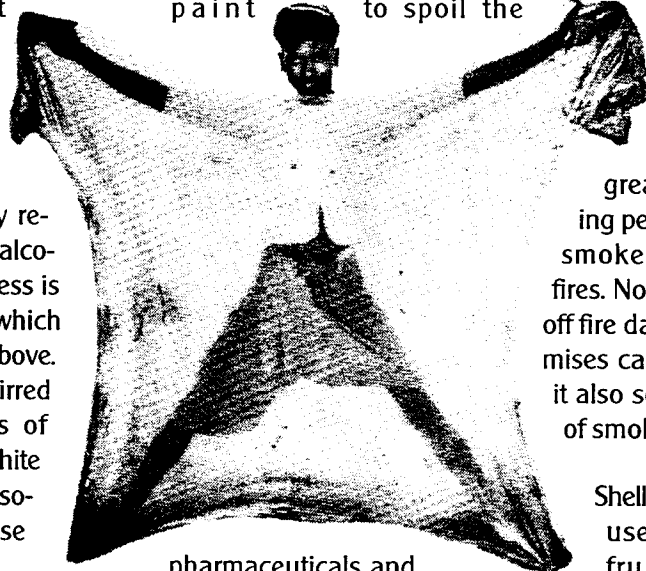
Shellac is a resin with such a remarkable combination of properties that if it were a new synthetic material, it would be hailed as a wonder product of modern chemistry. Probably its solubility in alcohol at a time when alcohol was one of the few available solvents led to the discovery of its value as a finish for early furniture, musical instruments and other wooden objects. And it is as an ethyl alcohol solution that it is used today as a finish and sealer.

Alcohol solubility has two big advantages: shellac solutions dry fast - in just 45 minutes - at any temperature and there is no objectionable "paint smell," only the familiar fleeting odor of alcohol. Shellac is also alkali-soluble. This is important in bleaching (and in some industrial uses). It also lets the painter or wood finisher clean up his shellac brushes in a solution of household ammonia and water. It is as modern and easy as cleaning latex paint in soap and water.

Shellac is unmatched in its adhesion to just about any material that needs finishing or painting. Shellac will adhere firmly to such hard-to-stick-to surfaces as glossy paint, metals, ceramic tile, glass or plastics. Shellac has wide compat-

ibility. Shellac may be used over most finishes - including old shellac, varnishes and lacquers - and under most lacquers and varnishes (except urethanes) and under any type paint.

Shellac forms a continuous film that is impermeable to the most hard-to-contain stains. It seals off bleeding knots and sappy streaks in new wood that are the bane of painters. With shellac, there's no popping through a finish coat of paint to spoil the



job. It works equally well on stains of all kinds - stains from water leaks, grease marks, marking pens, graffiti, crayon, smoke and soot from fires. Not only does it seal off fire damage so the premises can be painted, but it also seals off the smell of smoke as well.

Shellac's FDA-approved use to coat candy, fruit says all that needs to be said about its non-toxicity. It is absolutely safe to use on children's toys and furniture.

A shellac finish is easy to maintain. Worn spots, scratches or marred areas can be touched up easily by shellac liquid brushed on or sprayed from a handy aerosol can. The new shellac blends in well with the old. Best of all, a shellac finish also looks great. Shellac imparts a clear hard film with a high gloss that can be buffed to a glowing velvety sheen. No wonder it's still the craftsman's finish of choice.

Shellac's 1001 Uses

To say that shellac has 1001 uses may sound like an exaggeration. It's doubtful that anyone has counted all of them, but even after 140 years new applications are still being discovered.

"Pound Cut" (3-lb. cut, 4-lb. cut, etc.), a term unique to the shellac industry, refers to a manufacturing formula. It specifies the number of pounds of shellac dissolved in one gallon of alcohol. Over the years, it has been used to express the solids content or "strength" of shellac solutions. The ready-to-use 3-lb. cut, for example, is about 29% shellac; a 4-lb. cut, 35%. For some uses, as in French Polishing discussed below, shellac is thinned to a 1-lb. cut. Shellac should

be thinned only with denatured ethyl alcohol (often identified as "shellac thinner"). Here are directions for common thinning requirements:

To Reduce Shellac	Add Alcohol
4-lb. cut to 3-lb. cut	$\frac{1}{2}$ pt to 1 qt shellac
4-lb. cut to 2-lb. cut	$\frac{3}{4}$ qt to 1 qt shellac
4-lb. cut to 1-lb. cut	2 qts. to 1 qt shellac
3-lb. cut to 2-lb. cut	$\frac{3}{4}$ pt to 1 qt shellac
3-lb. cut to 1-lb. cut	3 pts. to 1 qt shellac

Applying Shellac. It is best to apply shellac at low humidity and at room temperature. If humidity is high, a whitening or "blushing" of the film may occur due to vapor condensation on the surface cooled by the evaporation of alcohol. Normally this disappears as the film dries. If extreme humidity causes it to persist this can usually be corrected by lightly brushing alcohol over the affected areas. This releases the moisture trapped in the film.

Shellac is easy to apply but there are a few tricks involved in brushing that are readily mastered by any amateur. Work with a full brush and just before your film "sets" (i.e., when shellac is still wet but no longer flowing), go back over it lightly with the tip of the brush to take out any bubbles. If you discover a missed spot (a "widow"), do not attempt to touch it up. Wait for the next coat and catch it then. Brushing after the coat "sets" will lift or wrinkle the finish.

Proper surface preparation is the key to good results with shellac as it is with any finish. With new wood, the last sanding should be done with a fine paper to remove the wood fibers loosened by coarse papers used on first cuts. All dust must be removed with a tack cloth. When finishing old finishes, extra care should be taken to remove all traces of wax. Any wax left on the old surface will impair the adhesion of the new shellac finish.

French Polishing. For the craftsman who desires the most beautiful and lasting of all finishes, French Polishing is recommended. The surface, thoroughly sanded and stained, must be completely dry. Then a 1-lb. cut of shellac (see thinning directions) is wiped onto the wood with a soft lintless cloth rolled into a ball. Dip the ball into the shellac and rub on the wood in rapid straight strokes, exerting only light pressure. After one hour drying time, rub with 4/0 steel wool or #600 sandpaper and remove dust. Continuous coats are applied with sanding or steel wooling every third coat, until a light glow begins to appear. If there are hair-line cracks, sprinkle very fine pumice stone very lightly on the surface between early coats. The following coat combines with the pumice to fill the wood.

After the first few coats, when a faint sheen develops, add several drops of boiled linseed oil or pure olive oil to the shellac. Continue applications as before, but with a rotary motion. Add more oil by degrees with subsequent coats. Ordinarily 8 to 12 coats are required for this technique. The result will be a superb, deeply glowing finish that with ordinary care can last for generations.

How to Maintain a Shellac Finish

A shellac finish is easily maintained by cleaning with a damp rag or by waxing. Where stubborn stains are involved, use mild soap and water.

If shellac has been water spotted, the discoloration can usually be removed by rubbing gently with an alcohol-dampened rag. If damage is too severe for correction by this remedy, or where the spot is the result of a burn or other physical damage, remove the old film in the affected area by sanding. Then apply two or more coats of shellac. Use either aerosol shellac or 3-lb. liquid shellac. Allow to dry. Then buff with #00 steel wool until the new finish blends into the old.

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