The Story of *Shellac*

Lac Insect

Laccifer lacca

(Approx. 6X magnification)

The Story of Shellac 2004

In celebration of our 155th year manufacturing shellac, we have revised this booklet, which was first published in 1913 and reprinted seventeen times throughout the years. The purpose of this booklet is to share with those who use and buy shellac the lore of shellac – its cultivation and production – and to show how the unique properties of this natural resin offer advantages still not duplicated by any single synthetic resin.

About the cover: On the cover is a picture of a native Indian *Bhilwaya*, whose job it is to stretch out softened shellac so that it can be broken into flakes.

The Story of Shellac

Shellac has an Ancient History

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.

"Lac" is derived from the Sanskrit word "lakh" which means 100,000 and refers to the vast swarms of insect larvae that inundate lac trees during brood season. There is a connection between the word "lac" and the Indo-European word for salmon, "laks", very likely a reference to great numbers of the fish observed in spawning shoals.

Not much is known regarding the very early history of shellac. In the Vedic period about 3,000 years ago it was called "Laksha." One of the Vedic books contains an account of a whole palace constructed entirely out of lac resin.

Ancient Chinese and Indian civilizations used the dye extracted from lac for dyeing silk and leather and as a cosmetic rouge and a coloring for head ornaments. The superior adhesive quality of the resin made it useful for setting jewels and sword hilts as well as repairing broken pottery. The residue left after the extraction of the dye was made into a grinding wheel for jade – a technique still in use today.

It was in the field of medicine, however, that the most extensive applications for lac were discovered. It was prescribed either as an emollient, or as a stimulant to tissue growth or in the treatment of gum hemorrhages and menstrual disorders. In veterinary medicine lac was mixed with lard and the paste used to fill the cavities in the hooves of horses and cattle.

Europe Discovers the Wonders of Shellac

Following the historical journey of Marco Polo to the Orient in the late 13th century, shellac and its by-products began to make their way into European commerce and industry. Accounts dating as far back as 1534 describe the cultivation, harvesting, processing and use of lac in extraordinary detail.

By the mid-17th century shellac resin, shellac dye and shellac wax were used with increasing frequency by painters not only to create their masterpieces, but also to provide them with a protective finish. Shellac became the preferred finish for craftsmen and artisans; it was the coating of choice for fine furniture, woodcarvings and turnings. To this day some of the finest museum pieces still have their original shellac finish.

The Golden Age of Shellac

Ironically, it wasn't until the mid-19th century that shellac was commonly used as a clear finish. Until that time it was processed mainly for the dye that was extracted from the lac after it was harvested. This rich, reddish-purple colorant was highly prized and much sought after by the textile trade in both Europe and America because it was an excellent substitute for Cochineal, a dye imported from Spanish colonies in Mexico.

In 1856 an English chemist named Henry Perkin succeeded in synthesizing a mauve-colored dye from an aniline derivative of coal tar. His discovery forever changed the future course of the shellac industry.

As the demand for natural lac dye declined, the demand for shellac varnish began to increase. Production plants began springing up throughout Europe, most notably in Germany, which soon developed a reputation for manufacturing the finest shellac in the world. Efforts were also being concentrated on producing colorless shellac. As far back as the 1830's shellac chemists discovered that by chlorinating an alkaline solution of shellac, they could remove almost all of the color and then precipitate the resin. The result was a pale, straw-colored varnish that excelled any oil-base varnish for clarity.

By the middle of the 19th century, Germany was the center of shellac bleaching for all of Europe. One such bleachery, located in the town of Mainz, employed a man named William Zinsser as one of its bleaching foremen. Confident of his technological skills and convinced that a good market for bleached shellac either existed or could be created in the United States, Zinsser and his family emigrated to America.

1849: Shellac Comes to America

William Zinsser settled in New York City in 1849 and built a home in Manhattan on West 59th Street. Almost immediately he set up a workshop in a building next to his home and began to bleach small quantities of shellac that were sold to fellow immigrants. From this humble beginning arose the first shellac bleachery in the United States.

At that time Americans never before had seen bleached shellac, shellac varnish, or so-called French varnish and therefore were unaware of the many uses for this versatile, natural product.

Initially, shellac sales were confined to fellow immigrant artisans and craftsmen. As word of this marvelous new varnish spread among tradesman of all nationalities, the demand for shellac grew from a few pounds per day to thousands of gallons by the turn of the century. Up to that point Zinsser shellac was sold to vendors who packaged the product under their own label and name. This practice ended in 1908 when Zinsser's sons (shown standing on either side of him in the photograph below) took over the company and began to package their shellac under the Bulls Eye® label and name.

By the 1920's there were several other shellac manufacturers in the U.S., including Bradshaw-Praeger, Haeuser, Gillespie, Rogers and Mantrose to name a few. Most of these companies either imported shellac or prepared and packaged pre-mixed solutions of shellac and alcohol.

The next eighty years witnessed a veritable explosion in the commercial applications for shellac. It was used extensively as a binder in the manufacture of gramophone records from the turn of the century well into the 1950's, when manufacturers began using vinyl to press record albums. Shellac was used to make shoe polish, felt sizing for men's hats, hair spray, floor wax, printing inks, adhesives, grinding wheels, paper, foil coatings and electrical insulators. It is still used as an edible coating for candy, fruit and pharmaceuticals.

From the turn of the century through the 1950's home builders and painting contractors used shellac as a sealer for plaster walls and a fast-drying varnish for interior woodwork, trim and floors. Today this beautiful original finish can still be seen in many older homes.

The Rise of Lacquers and Polyurethane

The development of synthetic resin compounds early in the 20th century, together with advances in varnish formulation, heralded the end of shellac's industrial and architectural dominance. Ironically, many of these newly developed resins – such as Bakelite and similar phenolic-base compounds – were created by researchers attempting to synthesize shellac.

Following World War I, chemists discovered that nitrocellulose dissolved in a powerful solvent mixture produced a crystal clear coating that dried as fast as shellac, thus giving rise to the widespread use of lacquer as a furniture finish. After World War II alkyd varnishes were developed and by the 1950's the public was introduced to the first oil-base polyurethanes. As these finishes displaced

shellac as the standard finish coating for interior woodwork and floors, one by one America's shellac manufacturers either closed their doors or merged with others.

From the 1960's until the early 1990's, shellac seemed forgotten by everyone except those who manufactured it and the contractors, hobbyists and knowledgeable devotees who used it. All of the largest makers of shellac were out of business or existed as subsidiaries of the one remaining manufacturer: Wm. Zinsser & Co.

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 lac insect *(Laccifer lacca)* which, in its larval stage, is about the size of an apple seed. Swarms of these insects feed on certain host trees, commonly called "lac trees", in India and Thailand, the main lac-producing countries.

The entire life cycle of the lac bug spans six months and is devoted to eating, propagating and creating lac as a protective cocoon for their larvae. During certain seasons of the year, these tiny red insects swarm in such great numbers that at times the trees take on a red or pinkish color.

When settled on the twigs and branches, the lac insects project a stinger-like proboscis to penetrate the bark and suck the sap, which they continue to consume until they die. In shellac lore this is called the "feast of death". While the bugs eat, they propagate, with each female producing about one thousand eggs before dying.

In the body of the lac insect, the digested tree sap undergoes a chemical transformation and is eventually secreted through pores. 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 the female bug is secreting 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 creating the next season's shellac harvest.

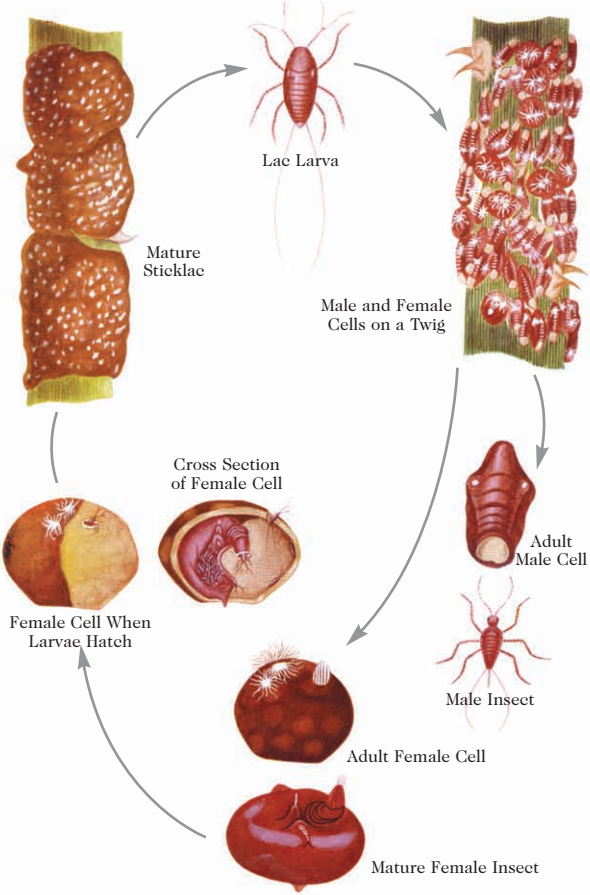
The males, having fertilized the hordes of females, also begin their life-ending feast. Although they contribute relatively little to the shellac crop, the male lac bugs already have assured an ample supply because the females vastly increase their output of lac after being fertilized. The great mass 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 newly hatched larvae begin to break through the crust and migrate to new feeding grounds. To obtain a larger crop shellac farmers help the larvae find better locations for their feast by cutting lac-bearing twigs from an infested tree a few days before the emergence of the larvae. A bundle of such twigs, known as "broodlac," is tied to an uninfested 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 infest 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 per tree. Natives gather millions of encrusted twigs, called "sticklac," for transport to simple factories or refining centers where the lac crust is scraped off and processed. The resin is also collected in the forest or orchard by smacking the branches with a wooden mallet. This material is called "grainlac." In either case, this is the first step in the harvest of shellac resin.

Life Cycle of the Lac Bug

(Laccifer lacca)



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, hand-cranked mill. 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 feet high and have rough serrated inner surfaces.

A *ghasandar* jumps into the jar and rubs the lac with his feet against the rough surfaces. This action causes the lac seeds to break open, releasing dye and insect remains. The ground lac is rinsed to remove the dye and then spread out on a concrete floor to dry in the sun. The dried resin is called "seedlac" because of its grain-like appearance and ranges in color from pale lemon to dark red.

Commercial shellac falls into three categories that reflect the processes used in their manufacture: hand-made, machine-made and bleached.

Hand-Made Shellac

This process involves a primitive method still used by small local factories to produce flake 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 continues to pinch the bag by twisting it, forcing more lac toward the *karigar*.

The *karigar* lets the oozing shellac fall on the hearth stone, which has been moistened with water, and scrapes the surface of the bag periodically with a spatula. To prepare for

the next step, he repeatedly picks up lac from the hearth-stone with an iron spatula and puts it on the rotating bag, basting it back and forth to get a viscous, uniform melt.

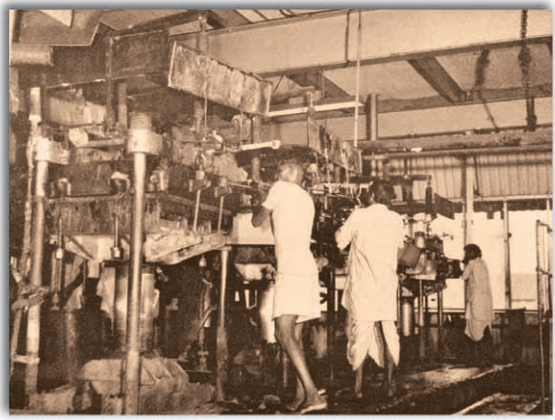
This soft lac is then turned over to a *bhilwaya*, who works it into thin sheets. With a strip of palm leaf, he spreads the molten lac over a ceramic jar filled with hot water, and then pulls off a piece about two feet square and a quarter inch thick.

Standing before the fire with the sheet, the *bhilwaya* manipulates it to soften it uniformly. At that point he uses his hands, feet and teeth to stretch it into a paper-thin sheet about 5 feet by 4 feet. This is laid aside to cool and harden, after which it is broken into flakes (see cover photo).

If there is a demand for it, the *bhilwaya* will opt instead to make button lac. Instead of stretching the molten lac into sheets, he takes the lac from the twisting bag with a spatula and drops it onto a flat surface to create numerous small disks or buttons about one to three inches in diameter. Before it hardens completely, the button is stamped with the seal of the manufacturer.

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, frankly, more fascinating – hand technique.



There are two processes – one based on melting (heat process) and the other on solvent extraction.

In the heat process, seedlac is melted on steam-heated grids. The molten lac is forced by hydraulic pressure through a 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 broken into flakes. The thickness of the flake is controlled by adjusting the roller pressure. All flake shellac produced by this process contains wax.

The solvent process produces three types of shellac:

1. **Wax-containing shellacs** are made by dissolving raw shellac into alcohol. The solution is refluxed for an hour or so and then filtered to remove insolubles. The filtered shellac is fed to a series of evaporators where it is concentrated into a viscous melt, which is then dropped onto rollers that sheet it out for removal in flake form. Darker, wax-containing flake shellacs, such as Garnet are made this way.

2. **Dewaxed shellacs** are made by dissolving seedlac in either cooled alcohol of a very high proof or heated alcohol of a lower proof. The resulting solution is then passed through a filter press to remove the wax, after which the filtered shellac is then concentrated in evaporator tanks. The viscous shellac is then rendered into flakes. Dewaxed Lemon and Dewaxed Garnet shellacs are manufactured using this process.

3. **Dewaxed/Decolorized shellacs** are made by the same process as dewaxed grade except that after dewaxing, the solutions are forced through activated carbon filters to remove the darker coloring constituents from the shellac. By varying the amount of carbon, contact time and quality of the seedlac, one can obtain grades of shellac ranging in color from light amber to extremely pale straw. Examples of these shellacs include Blonde, Super Blonde and Ultra Blonde.

Bleached Shellac

Although most of the bright red lac dye can be removed with activated carbon, some shade of red-orange remains. For many applications, however, a nearly colorless film is preferred. Kusmi shellac, while extremely light in color, is very expensive and not available in commercial-scale quantities.

The development of shellac bleaching in the early 19th century solved this problem with a relatively inexpensive process that could produce enormous quantities of very pale-colored shellac .

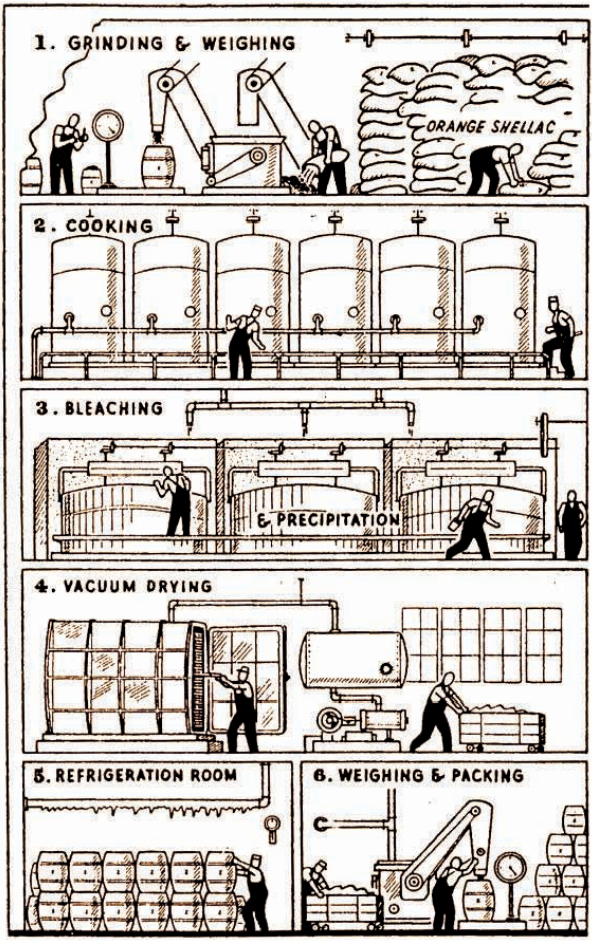
Since establishing the first U.S. shellac bleachery in 1849, Zinsser has made significant advances in bleaching technology. Today our MBZ division bleaches seedlac in its Attleboro, Massachusetts facility. From this bleached resin we make Bulls Eye Clear Shellac and B-I-N®, our white-pigmented, stain-killing primer.

The bleaching process involves dissolving seedlac, which is 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 cooled solution with dilute sodium hypochlorite to the desired light color. The shellac is then precipitated from solution by the addition of dilute sulphuric acid, filtered off, washed with water, ground and dried in vacuum driers. The final product has a granular consistency and is dissolved in alcohol to give a milky, creamed-honey colored solution. Both Clear and Amber Bulls Eye Shellac contain from 3% to 5% natural shellac wax, which gives them their somewhat milky appearance in the container but does not affect the clarity of the dry film.

While more efficient equipment and machinery have replaced much of the work that was done by hand in the 19th and early 20th centuries, the bleaching process itself has not fundamentally changed in over a hundred years.

The diagram below – made in the 1950's – illustrates basic bleached shellac production.



Types of Shellac and Shellac By-Products

Sticklac

Shellac Dye

Shellac Wax

Siam Seedlac

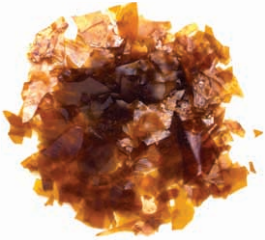
Kusmi Seedlac

Kusmi Buttonlac

Various Grades of Shellac

Ultra Blonde

Super Blonde



Orange

Bleached Shellac

Garnet

Dark Garnet

What Does the Term "Pound Cut" Mean?

Bulls Eye Shellac is manufactured in a 3-lb. cut. "Pound cut" is a term unique to the shellac industry. It refers to the number of pounds of shellac dissolved in one gallon of alcohol. A 3-lb. cut contains approximately 29% shellac; a 2-lb. cut contains about 21% shellac.

Different pound cuts are generally used for the following applications:

1-lb. - Pre-stain sealing, French Polish finishing
2-lb. - Pre-finish sealing; general wood finishing
3-lb. - Floor finishing; sealing knots & sap streaks
4-lb. - Sealing tough knots & sap streaks, stains*
* The 4-lb. cut is generally used by professionals

What is the Shelf Life of Shellac?

Freshly made shellac dries very quickly to a hard, durable and water-resistant finish. However, because it is a natural material, shellac is also perishable. After six months, an ordinary solution of shellac and alcohol begins to undergo a chemical change. It gradually takes longer to dry; the dried film is softer and more prone to scratches and water damage. This change is even more pronounced in bleached shellac. After 18 months it may take hours to dry, or not even dry at all, and is considered to have expired. Exposure to heat also accelerates the expiration process.

Zinsser research chemists have succeeded in prolonging the shelf life of shellac in two ways. The first involves a specially formulated solution; the second involves a patented process (U.S. Patent No. 6,348,217 issued 19 February 2002) for the production of the resin itself.

Bulls Eye Shellac is the only pre-mixed shellac in the world guaranteed to dry quickly to a hard, durable, finish for up to 3 years after the date of manufacture. However, since storage conditions can greatly affect the shelf life of our shellac, always check the manufacturing date to find the freshest Bulls Eye Shellac and apply some of the product to a test surface to check the dry time and film hardness.

To ensure the long life of Bulls Eye Shellac, keep the container tightly closed and store in a cool, dry place where

the temperature does not exceed 75° F. Extreme heat can ruin shellac in less than a week. There is no need to worry about cold weather – since shellac is alcohol-based it is unaffected by freezing temperatures.

Common Shellac Myths

Myth: Shellac is made from bugs or bug droppings.
FACT: Shellac is a resin secreted by the lac insect to form a cocoon, much like a silk worm. It takes about 100,000 lac bugs to make 1 lb. of shellac resin.

Myth: A shellac finish turns white when water touches it.
FACT: Fresh shellac is remarkably water-resistant and, in most cases, will stay clear after hours of exposure to water, making it a great finish for most interior surfaces, including woodwork, trim, doors, cabinets, paneling, floors *(yes, floors!)* and furniture.

Myth: Shellac scratches easily and is very brittle.
FACT: Shellac is a durable finish that is much less brittle than lacquer and does not scratch as easily. Unlike polyurethane, a damaged shellac finish can be easily touched up or renewed by applying another coat.

Myth: Shellac turns an ugly dark color as it ages.
FACT: Shellac is UV-resistant and does not yellow or darken with age. The dark shellac that people see in older homes is a less-refined version of shellac that either was naturally dark or was tinted by contractors when dark wood colors were preferred in the early 20th century.

Myth: Shellac is incompatible with other finishes.
FACT: Shellac will adhere tenaciously when applied over almost any other type of finish. When used as a sealer under certain polyurethanes, regular shellac may not be compatible because it contains a small amount of natural wax. To seal wood before applying polyurethane and other finishes, we developed Bulls Eye® SealCoat,™ a shellac-base universal sealer that is 100% wax-free.

Myth: Shellac is an old-fashioned, outdated finish.
FACT: Shellac has more modern features and benefits than any other wood finish in the world.

Shellac's Great Properties

Shellac has such remarkable properties that if it were just recently discovered, it would be hailed as the miracle finish of the 21st century.

- **All-natural -** Shellac is an all-natural resin that is harvested regularly and is, therefore, a renewable resource.
- **Mild alcohol odor -** Shellac is dissolved in denatured ethyl alcohol. It has a mild, antiseptic odor that dissipates quickly as the product dries.
- **Easy to use -** Shellac is user-friendly and virtually goof-proof. It can be applied with a brush, pad, sprayer or wiping cloth.
- **Super-fast dry time -** Shellac dries to the touch in MINUTES and, in most cases, can be sanded or recoated in little more than half an hour.
- **Cold temperature application -** Unlike other finishes, shellac can be applied in cold temperatures (40° F. and below) without concern over proper drying and curing.
- **Non-toxic/hypoallergenic -** The U.S. Food & Drug Administration has certified shellac as a protective glaze for candy and pharmaceuticals.
- **Non-yellowing/non-darkening -** Shellac is UV-resistant and will not yellow or darken with age, unlike oil-base finishes.
- **Enhances the beauty of wood grain -** Shellac brings out the rich warmth of wood grain. Finished surfaces look soft and natural, not plastic-coated.
- **Sticks to glossy surfaces and finishes -** Shellac is prized by everyone who uses it for its incredible adhesion. It will stick to just about anything.
- **Dried film is impervious to odors -** Two or more coats of shellac will seal in any kind of odor in any type of porous surface.

- **Stain sealer -** Shellac is one of the world's most effective stain and knot sealers . . . another reason why we use it to make B-I-N® Primer-Sealer.
- **Easy to touch up and recoat -** Unlike other finishes, shellac can be easily touched up if it is scratched or worn; a new coat of shellac melts itself into the existing coat.
- **Easy to clean up or remove -** Shellac is dissolved by household ammonia as well as alcohol, making it very easy to clean brushes and other tools.

Best of all, a shellac finish looks great! Shellac imparts a clear, hard film with a high gloss that can be buffed to a glowing, velvety sheen.

Bulls Eye® Shellac in liquid and aerosol form is still the craftsman's choice as a finish for woodwork and as a protective sealer for countless uses.

On the Internet you can find out more about shellac and how it is used at:

www.zinsser.com

For further information about shellac and its uses, write to us at the address on the back cover.