VARNISHING

Spirit Varnish

Violin varnishes are clear, protective layers on the wood, traditionally composed of the clear, more or less hard resins of various plants. One example of such a resin is common rosin, which is related to the clear drops of “sap” one sometimes sees dripping down the sides of pine trees. These resins come from all over the world, and are fresh (rosin, mastic, and sandarac, for instance), or pre-historic (amber and some copals), in origin. Shellac, one of the most common varnish materials, is also the most mysterious. This substance exudes from insects that feed on the branches of an Asian tree, and it’s unclear whether it is simply passed through the insects or processed by them into something different from the tree’s own sap.

While it is possible simply to dissolve resins in a solvent such as turpentine or alcohol, paint them on, and let them dry (as the spirits, or solvents, evaporate), such coatings remain vulnerable to their original solvents. For the varnisher this is a serious disadvantage, because it means that if more than one coat is needed (as is always the case), subsequent layers immediately dissolve previous layers, increasing the likelihood of making a mess.

Such varnishes—resin solutions in solvent spirits—are called “spirit” varnishes, regardless of the precise solvent used, which might commonly be alcohol (usually grain alcohol in very high concentration) or gum spirits of turpentine (also known as “oil” of turpentine, in traditional jargon, or more commonly, simply “turpentine”), or something more exotic, such as lavender oil or spike oil (which also are solvents, not oils, following an ancient naming convention, although some makers may fraudulently refer to their solvent oil varnish as “oil” varnish because of the prejudice against solvent/spirit varnish on violins), or even modern solvents—lacquer is essentially a spirit varnish of modern synthetic resins in modern solvents. One easy-to-understand spirit-type varnish (though for obvious reasons it would never be used to varnish something) would be sugar, dissolved in water.

Spirit varnishes are often brushed on, but to do so requires skill and control. The varnisher has to resist the temptation to touch the wet surface until it completely dries, and that means that if a mistake is made it must be left, not played with in a futile attempt
at improvement. Even the overlapping of brush strokes is perilous. Not all resins act the same, and some combinations are more resistant to softening by subsequent coats than others, whereas some resins redissolve immediately.

Subsequent coats will usually disguise a small error, or it can be slightly sanded to lessen it, after the coat has dried. Spirit varnishes are usually brushed on in a large number of highly dilute coats, so each coat, and each mistake, might represent 5% or less of the total effect and blend in, finally. The easiest and safest way to apply spirit varnishes is by spraying with a spray gun or airbrush. Retouching and repairs to old violins are always executed with spirit varnishes that are specifically compounded to be easily removed, if necessary by subsequent restorers.

Many resins dissolve in a number of different solvents (rosin is one) and some only in certain solvents (shellac dissolves efficiently only in alcohol, of the most common solvents, and isn’t touched by turpentine). There are many solvents of modern origin, mostly petroleum-derived, but there were many fewer available 300 years ago. In the most ancient types of oil varnishes, the solvent is the oil; the most common oil varnish solvent, turpentine, is more recent, and functions more as a diluent to improve working characteristics of oil varnishes than as the primary solvent. Some other interesting possibilities exist—for instance, shellac and many other resins and varnishes can be dissolved in an alkaline water solution—this is the way waterproof drafting inks are made (because of this characteristic of alkaline solutions, lye stripping is also one process for stripping furniture).

**Oil Varnish**

As opposed to spirit varnishes, oil varnishes depend on a different process and a different solvent—a vegetable oil that has the characteristic of hardening with time. The dried oil is not easily resoluble once it hardens by oxidation and polymerization (which happens over hours and days, after any additional solvent in the varnish has evaporated), and thus subsequent layers do not disturb previous ones, allowing multiple layers of varnish to be easily applied, with plenty of application time and fussing. This is the same way that familiar house paints and oil painting paints are made, for the same reason. Traditionally, linseed and walnut oils were used for violin varnishes, though tung oil, poppy oil, and modified soy oils also are used in various other trades for the same purpose. Some of the resins used are specific to oil varnishes (amber would be an example); some resins are never used in oil varnish because oil doesn’t dissolve them (shellac fits this category); and some resins work equally well in either oil or spirit varnishes (mastic and rosin, for instance).
Because they are not easily removed, oil varnishes are never used for restoration and repair, but for violin varnishing they offer distinct advantages. Against the disadvantage of slow drying, oil varnishes offer ease of use. Whereas spirit varnishes are sensitive to subsequent layers and offer virtually no working time, oil varnishes harden very slowly without affecting previous layers. For the person doing the work this is an immense advantage because it allows as much time as needed for applying and smoothing the varnish, and if something goes wrong—for instance, if the color immediately seems wrong—the fresh, wet coat can easily be removed without affecting previous layers, and immediately tried again.

**Color**

Varnish colors can come from many sources. First, there are colored resins. Unrefined shellacs have quite a bit of color, so much so that the original use of shellac was to extract the red color for dyeing fabrics. A number of other resins have color, some more or less stable (usually less). Dragon’s blood is one commonly-mentioned example with a poor reputation for color stability, which is understandable when you consider the origin: The dragon and the elephant fight. The dragon delivers a fatal bite to the elephant, which falls and crushes the dragon. Their bloods mingle, forming the resin. Obviously this is a material with problems. When dragon's blood fades it turns to a particularly ugly green.

One of my favorite colors might be considered a resin, and that’s asphalt. I use roofing tar, taken from next to one of those stinking, smoking trailers that roofers bring to a job. The stuff in the stinking trailer is usually pure asphalt, direct from out of the ground with few additives. Break off a piece about the size of a walnut shell, and drop it in about six ounces of turpentine. Stir it often until the tar is fully dissolved, then let the dust settle to the bottom. When mixing your color, just a couple of drops of this goes a long way towards adding a transparent darkness to your varnish and canceling any tendency towards pinkness. If you use too much, your varnish won’t dry, but it doesn’t take more than a couple of drops to accomplish what you need. One of my favorite colors is a few drops of tar mix into a tablespoon of varnish, with just enough madder red or alizarine crimson added to cancel the greenish cast of the tar without going over into pink or red. To me, this is the perfect violin color.

There are also many sources of color from stains that can be extracted from organic materials via solvents, often either alcohol or water, and then used either directly as a stain in the varnish, or to stain a solid base, resulting in a “lake” pigment. Pernambuco wood was originally imported into Europe as a dye wood—violin bows were a side issue at the time, and French bow makers were able to go to the docks and choose the best bow wood from an immense selection brought in for dye. Its color can easily be extracted from its sawdust, and used either as a stain or made into a lake pigment (the origin of this
use of the word “lake” is from the “lac” in shellac, the source of color for the original lake pigment.) There is a vast number of similar materials—a large number of other woods, some insects, and a variety of plants.

Though making a color into a lake pigment can make it more permanent, this is not a fixed rule; in order for it to work, the original color should have some permanence on its own. The common spice annatto (the red coloring on the surface of muenster cheese) makes a very beautiful, totally fugitive stain. As a lake it's not one whit better, and fades within a day in strong ultraviolet light.

Another option is pigments, most characteristically painter’s pigments—either from the tube mixed into oil varnish, or as dry pigments ground in alcohol for spirit varnish or turpentine and oil for oil varnish. These can be either natural from plants, such as the lake pigments derived from the madder plant, synthetic, or mineral compounds, the most common modern category of pigments including natural earths, and metal-derived pigments such as lead white and various iron reds. The modern tendency in painting has been to move away from less consistent and more expensive natural materials towards ones that can be made in the lab, consistently, with even most of the “earth” colors being manufactured synthetically.

Generally, pigments for varnish are chosen from the more transparent ones, whereas painters usually prefer them to be opaque most of the time. Paint manufacturers are helpful resources for information about transparency and permanence. Modern painting pigments have a problem for recreating traditional violin colors, in that painters prefer colors in which the mass color and undertone are as identical as possible—that is, a thick coat and the thinnest coat of a pigment will have essentially the same color. Classical violin varnish turns redder as it becomes thicker, and finally moves into black, but varnishes made from modern paints have the potential to start as one color, and become opaque in that same color (becoming a full coat of paint) without changing darkness or color. Though most of the commercial pigments have this defect, home made lake colors often do not.

The final possibility for coloring is chemical. Some resins turn desirable colors on their own when cooked at high temperatures into varnish. Some makers have success cooking iron salts into their varnishes. These alternatives are less well-documented and explored.

Color preference is personal, but there is a definite range of usually-acceptable colors for violins. Generally, violin colors are in the yellow/orange/brown range. True pure reds are uncommon, and when they are used, they are usually in the form of dark colors drifting towards purple. Bright reds, and especially pinks, are common signs of inexperienced work. Pink is anathema for violin making: one of the worst things someone can say about
the color of your violin is “it looks a bit pink.” Careful observation of real instruments will help, and it’s always nice to have a sample on hand to match, which will make formulating a color much easier. One strategy is to start with a light yellow, move it through orange as it gets darker, and on through dark brown with a red tinge. This can be done using single colors for which this is a natural progression, or by subtly modifying successive layers to move gradually in the desired direction.

_Making a Lake Color_

Lake colors are interesting to make, and not too hard. I find them fun because they’re complex and there are several points in the process where the materials suddenly change into something else that are a bit magical. The process is simple, requiring only lye from the grocery store, alum from a camera store’s darkroom section, a good scale, and a colorant. There are a lot of choices of colorants, and one of the most useful is madder root. Madder was the source of the red for the British army’s “red coats” in the American Revolutionary war, and a very important crop in Europe at the time, specifically as a red pigment source. Its use is ancient, but it’s easily available. I get mine from Kremer Pigments, a German company with a branch in New York (http://kremerpigments.com/).

Start by breaking up the madder root. I use a little coffee grinder, grinding up a couple of ounces at a time until I have a cup or two. Put the chopped madder in a jar with a quart of water and 3gms of lye. Though the madder is pretty uninteresting up to this point, lye forms the red color, and you can see it immediately. Let this soak for a week or two at least—the longer the better, soaking more and more color from the root, and I have had a jar going under my bench for years. With time the color seems to mellow and become warmer and less harsh.

When you’re ready to make the pigment, mix 15gms of alum in a quart of warm water. Drain the madder, first by decanting, then filtering the remaining liquid through a stocking or coffee filter. Pour the alum water into the madder/lye water, slowly, while constantly stirring. When the two mix you’ll see something cloudy and definitely solid forming in the liquid. This is the pigment. At this point it’s a colloidal solid, like hide glue, loaded with water, and takes up quite a bit more physical space than the final pigment will. If you walk away now, when you come back the next day the pigment will have settled out of the water, and you’ll have a couple of inches of color on the bottom of the jar.

The proportions of lye and alum that I specified are computed to lead to a complete reaction—neither one will remain in excess when the two are mixed—all will be converted into the pigment base. One of the problems with lake pigments is efflorescence—a white powder forming on the dried pigment which is excess lye or excess alum from
the reaction, and you won’t have this if you follow my recipe. One important part of other recipes is washing the pigment before drying it, by letting it settle and decanting it several times until all of the excess chemicals are washed away. You don’t have to worry about that with this recipe, and so rather than settling the pigment overnight, you can go directly to filtering it out by pouring it through a large Melitta coffee filter. This will go slowly because the pigment will clog the filter nearly immediately. Don’t be tempted to pick up the filter, since it will disintegrate, but you can take a spatula and scrape the inside without moving the filter, which will speed things up. Eventually you will be able to filter the whole thing, and should have about a half cup or less of what looks like pigment, darker than in the water because it’s been concentrated. Leave it in the filter until you have a gel instead of a liquid, and then you can pull out the filter, rip it on the seam, and scrape the pigment into a pile in the center. I dry this on the filter, on a piece of cardboard, for a few days in a place where it won’t be disturbed. When you come back, your half-cup of colloidal gel will have dried out into a thimbleful of concentrated pigment, which will appear almost black.

Aside from the efflorescence issue, there’s another thing I haven’t mentioned, and that’s the ratio between color and chemicals. If you do it as I’ve suggested you should come out OK. If you have too much madder for the amount of chemicals, you will find that after both solutions are poured together colored water will still remain. You can see this by dripping a corner of paper towel into the water. If color remains in the water, what wicks up into the paper by capillary action will stain the paper; if all of the color has been removed, the paper will remain unstained. Too much color is a waste, that’s all, and it gets poured off later. On the other hand, you may feel that you’ve exhausted the color before you’ve blended both solutions completely—you still have some alum, but the water looks clear. The paper towel confirms this. You have removed all of the color, but you have more chemicals to mix. Go ahead, don’t worry. You’ll get some unstained pigment, but no efflorescence, which is more important. If you wish, you can modify my recipe for your next batch, using more or less madder root.

This opens an interesting topic. Let’s say you make a weak pigment, short on madder. You’ll need more to get the color you want, but another thing can happen. If you have a very weak pigment and you mix it with varnish, you may almost end up with a putty rather than a varnish. In polishing later you will find that this putty doesn’t wear off as easily, and the varnish will flatten without specking from the color being cut through. This is an asset, not a liability. Second, as the varnish settles in drying later, you may notice a rougher texture, from the higher content of pigment to varnish. If you get a chance to go to the Ashmolean Museum in Oxford and see the “Messiah” Strad, you’ll see this same texture on parts of the ribs and the sides of the scroll—areas which aren’t usually touched and retain more of their original texture. It’s something to think about.
Anyway, that’s all there is to it, but now you have to grind it for use. In 16th century painters’ workshops this was the job for the 12 year old apprentice, because it’s tedious. A common mortar and pestle works best, and an hour of grinding will be about right. The next step is to thoroughly mull the pigment into a bit of oil, using a pigment muller on a ground glass plate until you’re sure you’ve moistened every bit of the pigment, and that the pieces are broken down into a smooth paint. This is, at this point, oil paint of the painterly type, and you have to slowly add a little varnish and continue mulling until you’re sure it’s broken up enough to stir into your varnish. That’s the entire process.

**Magic**

There are many varnish recipes floating around. An early assumption was that the desirable optical characteristics of Cremonese violin varnishes were the result of some magical and possibly complex combination of resins. Experimentation based on this idea went in several directions. One school followed the theory that the essential resin was rare, or lost, or hidden, or that it was complexly difficult to utilize properly, and required complex treatments bordering on alchemy. Another direction supposed that common resins were used, but in great variety, to be combined just right. This resulted in long recipes and the use of every imaginable resin, but not with exceptional results. Chemical analysis by Raymond White of the National Gallery in London seems to have greatly simplified the issue, indicating the use of linseed or walnut oil in combination with some sort of softwood resin, and not much else, on some classical Cremonese instruments. For me this is a clue that whatever magic may be apparent in the appearance of Cremonese violins, it’s not because of the varnish. Restorers confirm this, saying that if a violin has lost only its original varnish, with an intact ground remaining, retouching with modern materials can be very successful.

Discarding magical varnish as an option, another modern line of thinking has postulated a magical undercoat. Early experimenters tried everything except the traditionally known methods (the logic being that a non-secret method obviously cannot give special results) and this, after decades of approaches similar to what occurred with varnish—secrecy and complexity being the banners leading the way—has culminated in the recent development of mineral grounds. This, also, is the result of modern laboratory analysis, but for various specific reasons a number of makers having firsthand working familiarity with the restoration of classical Cremonese instruments consider the analysis flawed, and acceptance in the violin making community is uneven. Specific complaints against thick mineral grounds center on restorers’ direct observations as they have worked on these instruments: there's no indication of any thick (supposedly invisible) layer on Cremonese instruments. For whatever it’s worth, even with this latest twist, the unique physical appearance and tonal qualities of the classical Cremonese violins still remain as unapproachable goals. Other frontiers remain.
For those who wish to track through the history themselves, a good place to start for an
historic understanding of the materials involved is in painter’s references. Mary P.
Merrifield and Charles Eastlake both published encyclopedic texts on ancient methods in
the 1800s, and both are available in cheap modern reprints and even on the internet.
Modern woodworking books are of less value, as are recent artists manuals, both of
which center more on modern materials. The most comprehensive and useful
contemporary manual is Ralph Mayer’s, and for content of lesser scope, but more
technical, Gettens’ and Stout’s. Persistent masochists can work their way through almost
120 years of STRAD magazine back issues, in which numerous crackpots have voiced
their theories on all aspects of violin construction, not limited to varnish. Issues from the
years between roughly 1920 and 1960 are particularly fertile to a sometimes-humorous
degree, but inspiring in a way, since violin experimenters have covered a lot of unlikely
territory in their pursuit of the “Cremonese” varnish.

Varnish Making

Spirit Varnish

As you now know, there are two basic types of varnish: solvent varnishes and oil
varnishes. The procedures to make each are completely different. For a solvent (spirit)
varnish, all you need to do is weigh out the appropriate solvents, stir them up in the right
solvent, and wait, stirring once in a while. There’s no heating required, and the order in
which you do things doesn’t matter. You can dissolve each in a separate container, and
mix them by proportion, or throw them all in a big jar—it doesn’t matter. After
everything that will dissolve has dissolved (resins always contain parts that won’t and
you shouldn’t work to get these into solution—they need to stay behind) let the dirt settle
(a lot of the cloudiness will also, if you wait long enough) and decant the clean varnish
off the top.

That’s really all there is too it. As the Wizard of Oz might have said, what you really
need is The Recipe! There are hundreds of them, maybe thousands. For nearly 200 years
violin makers thought that the secret to making a varnish that made your violin look like
it had come from Cremona was a varnish with the right stuff: the magic combination of
obscure ingredients. Varnishes were compounded like cleaning supplies: a little of this
for hardness, some of this for surface, something for brushability, something for smell, a
dab of softness and warmth, something to keep the vampires away...you get the idea. If
you look around you’ll find lots of recipes.

If you want to just cut to the chase, though, you can use Stradivari’s own, according to an
old legend. It’s called 1704, and you can even buy it pre-made. Here’s the recipe:
• 45 g Seedlac
• 7.5 grams gum elemi (optional)
• 200 ml Alcohol
• 9 ml. Lavender Oil Spike

You could do worse. It’s most certainly not Stradivari’s, but it does work, and a lot of violin makers use it successfully.

Oil Varnish

Oil varnish is more complex. It’s based on the idea that many resins, properly prepared, will dissolve in linseed oil, with no other solvent. Solvents are added only to thin the varnish to a nice working consistency. Similarly to spirit (solvent) varnish, for a long time the solution to the Cremonese puzzle was considered to be a secret varnish of magical quality, achieved by a unique and special combination of many different components. Again, if you look around, you’ll find hundreds of different recipes using all the possible combinations of the many potential materials. Ah, if we could only run to the web and download Stradivari’s oil varnish, as I just did for his spirit version, but that one doesn’t exist.

Making oil varnish first depends on making the resin you use soluble in oil. That’s done by melting the resin all by itself to a very high temperature, and then adding oil that you’ve previously heated to a very high temperature which results in oil which is both thicker and dries much more quickly. The problems here are environmental: cracking the resin is a smoky, dirty job that you don’t want to be doing in your house, and your neighbors don’t want you to be doing outside. Heat-bodying linseed oil is just flat-out dangerous. The oil gets heated to a temperature near it’s burning point, and it will sometimes catch fire. A friend of mine who went to the state violin making school in Germany told me that the ceilings over the stoves in the kitchens of apartments rented by violin making students—in the buildings which are still standing—are coated with the results of varnish explosions. Once started, this fire is nearly impossible to put out, and the flames can rise up three feet above your pan. How do I know this for sure? Don’t ask.

Anyway, once again we need to tap the Wizard for a magical recipe, and here it is: buy your oil varnish. I have been thinking of trying something from the hardware store, something that’s mostly natural products, if such a thing still exists. I checked several manufacturers and there appear to be possibilities. If you want to act more esoteric, all of the violin making supply places sell “violin oil varnish” in little expensive bottles. I have
heard rumors that the stuff in these bottles once was in large cans labeled the same as some of the cans I’m thinking of buying at the hardware store. Certainly, when you start looking at recipes, there’s nothing special about violin varnish, historically. The closest thing to a modern oil varnish by recipe is what used to be called coach varnish, for varnishing coaches (and this was the original auto paint, also). The special thing about it is that it was durable, and this is the problem with many things sold currently as violin varnish: they’re much more durable than the original Cremonese stuff.

If I haven’t dissuaded you yet, here’s another option: buy Joseph Michelman’s book *Violin Varnish* and try what he says, or better yet, look for a copy of William Fulton’s pair of little books, *Turpentine Violin Varnish*, and do what he says. That’s a great book on the entire process of varnish making in small quantities for violin makers, with tons of useful general information about violin varnish making.

If you’re really intent on doing something yourself, here’s a recipe I used for the first few years. It worked fine, wore nicely, and when I see the violins I did then, it looks even better now.

Damar Violin Varnish:
Buy one pound of damar resin and a pint of the best quality artist’s linseed oil. I get mine from Utrecht Art Supplies (http://www.utrechtart.com/), the same people my brushes come from.

Weigh out eight ounces of damar resin and heat it in a quart sauce pan until it’s melted, then turn the temperature up until it starts smoking profusely. You will want to do this outside when the neighbors are away. Allow it to smoke for about 15 minutes to a half hour, until you have about half what you started with. The temperature for this will be quite a bit hotter than the melting temperature, and the resulting resin will appear to be burned black, but in varnish layer thickness it will hardly be dark at all.

Take four ounces of linseed oil and heat it in a pan, outside on an electrical hot plate (no flame!) until it starts to smoke a bit. Heat it thusly until a drop, when cooled, is somewhat thicker in viscosity than what you started with. This will probably take an hour, or maybe two. Since linseed oil burns on its own at around 500 degrees F, you will probably want to say below that ten degrees or so. A good thermometer will help that.

When you have that, reheat the resin until it melts, pour in the hot oil, and continue to cook the two at a high temperature until a cooled drop when touched with your fingertip and your finger is pulled away spins off into a thin spider web of a fiber at least six inches long. Somewhere in the 490 degree F range is good for this part of the process, too.
That’s your varnish. Cool it until it’s still warm but not hot, and stir in some turpentine to thin it up a little. The amount isn’t critical, but don’t over do it—you still want it too thick to use. Later you will dilute it with more turpentine and color to a usable varnish.

I stopped using this varnish after about five years. One of the problems I had with it was that it wasn’t very clear. I didn’t know until a bit later that it really does need more than that to become clear. After it cleared it was really quite nice, and I do recommend it. I’ve tried to make it sound easy to make because it is easy to make. The only real problem I had making it was the day the oil caught fire. That was my best batch, and I don’t know if it was the burning that made it dry so well, or the chemicals from the fire extinguisher that was the only way to put out the flames.

Mastic Varnish:
For the person who fears fire, or who lives in the city, as I do, here’s the recipe I currently use. Purchase a pound of mastic and a pint of finest artist’s linseed oil. Fill a small jar with a measured weight of mastic, and just cover the mastic with turpentine. Do not at any point use heat—even the heat of the sun—to speed this part up: stir and shake it for a week or so, until most of it has dissolved and there’s a layer on the bottom of something that just won’t dissolve. You don’t want that part. Decant off the liquid, and mix it with a weight of the linseed oil equal to the weight of dry mastic you started with. Mix the two. That’s it.

This is a varnish that shouldn’t work, from several different angles. The reason you can make this as an uncooked oil varnish is because mastic is the only resin that dissolves in oil without being cracked, and which combines chemically with oil without cooking. It works with uncooked (raw) linseed oil because mastic is such a strong drier that it has been used as one in oil painting. Additionally, mastic has been used as a brushing additive, and this varnish brushes out really beautifully. The combination of mastic and oil is a very old combination for oil painters. The disadvantages of this recipe is that the varnish is soft, easily damaged, and prone to yellowing and degradation. To me, when I read this, it sounded like a good description of Cremonese varnish and what it does, so I settled on this recipe. You may not want a varnish that has these flaws.

On the other hand, the first, damar varnish, is a traditional recipe, more or less. The resin and oil need to be cooked together for it to work. When they’re cooked there’s a chemical bond between them that won’t separate, and they dry together. Similar varnishes can be made with copal and some other resins. There’s also an amber version which is slightly more complicated. As I realized that simple varnishes could do the job, I lost interested in the more complex ones that didn’t seem to offer anything that I wasn’t already getting.
What if you want the real Cremonese violin varnish? I’d probably work along the lines suggested by Raymond White—rosin and oil. This is a dangerous varnish to make, as rosin directly from the tree is unstable and reactive. If not done correctly, it breaks up into ugly mud crack type degradation with time, which doesn’t show up for a year or several. I haven’t used this varnish, but I do know that it’s important to stabilize the resin, either by neutralizing the acidity or by extensive cooking. Other people have experimented with this and there are recipes that work, but I haven’t used them. One common version used by modern makers combines mastic and rosin with linseed oil.

**Varnishing Schedules**

There are a number of different possible ways to varnish a violin, but a typical approach might be as follows. First the naked wood surface is prepared—smoothed and cleaned. Modern tradition considers this to be the job of scrapers, and until recently it has been assumed that the old makers of the 1700s did not have sandpaper, and scraped the wood as the finishing step. Some speculation, without too much solid evidence, suggested some mild abrasives, including (from Sacconi) dogfish skin, and horsetail. It seemed likely that they did not, however, have sheet abrasives as we know them from the hardware store.

Some schools of making have taught that transparency in the finish is enhanced by scraping. In the last few years or so, however, restorers have noted the presence of scratches in the wood of old Italian violins suggesting an abrasive of a more modern sort. At this point, no one has concrete suggestions of what that could be. My own experiments indicate that the transparency of a finish can be affected by sanding, but is not necessarily--much depends on the particular varnish (or undercoat/ground) used, and sandpaper does not inevitably cause a lack of transparency.

Generally, however, sandpaper leaves a different texture to the wood from what's usually seen on the best violins, especially on the spruce top, so many makers do avoid its use. Even without harming transparency, it can wipe out the desirable corduroy texture of spruce, and reveal a swirling structure within the spruce itself as seen on lower quality factory violins which shouts “sanded!” As with many other finer points in violin making, I regard the corduroy texture as necessary because it's seen on fine old instruments in pristine condition; violins of lesser schools often do not show it. Choose the school you wish your work to be associated with by knowledgeable observers, and act accordingly. Please consider that in matters of taste, one's initial uninformed response is not always the correct one, and taste needs to be educated.

On maple, sanding is much less noticeable and doesn't lead to obvious defects. I'm going to recommend scraping the whole violin, with the exception of the neck and heels, as a safe course to follow.
After smoothing, the wood is sealed—either before or after it has been slightly colored to remove its bare whiteness. There are several reasons for sealing. One is that wood responds to oil varnish much as a sponge would—it can soak up a huge amount of varnish, filling the wood, and even soaking through and coming out of pores on the inside, before a layer begins to build on the surface. This can be tonally undesirable, as well as complicating the varnishing process because of uneven penetration: certain areas will be building substantial thickness of varnish on top of the wood before others are filled. Second, on violins the color comes not from color in the wood, but from color in the varnish. If color is allowed to enter the wood, either alone, or via the varnish, the wood takes on a stained look that is considered undesirable (often referred to as “burned”), hence the need to keep the colored varnish out of the wood, or at least to assure minimal and equal penetration.

A number of sealers are traditionally used, including glue, uncolored or lightly colored spirit varnishes (which don’t soak in as deeply as oil varnishes) and other substances (egg white is a traditional sealer for painters that some violin makers use). Some oil varnishes soak in less than others, too—tests will reveal this if you wish to try this direction.

Once the wood is sealed, colored varnish is applied until the desired depth of color is reached, hopefully before becoming too thick, and then a layer or two of clear varnish is used to protect the colored layers from being easily damaged in the final polishing steps. Finally the violin is polished to remove varnish defects and make a pleasant gloss, and that’s it.

**Procedure**

**Final Smoothing**

Before varnishing, the violin has been completely assembled, with nut and board in place, but without a saddle, which will be added later, in the setup phase. All contours and surfaces are finished, and get scraped or sanded close to the desirable degree of finish—the body as soon as assembled, and the neck and scroll subsequent to the neck setting and carving. The final scraping cleans up any accumulated dirt and fingerprints and re-establishes the final details that might have gotten rubbed down from handling.

Scraping is an operation much like gouging and planing, in that the direction of the wood grain must be considered, especially in the final finishing stage. Already you will have figured out you can’t scrape against the grain of spruce, but now, for the final surface, this becomes much more important. Especially difficult are the areas near the purfling at the top and bottom of the top, and the scraper must be constantly repositioned to take
advantage of the direction of the grain being scraped. In some few places, the only way to scrape will be gently sideways at a slight angle. In the final scraping, a deadly-sharp scraper with a very minimally turned edge (or even only freshly sharpened without a turned edge) is an asset, since it requires much less pressure than a crude, dull one. In general, a turned edge is more aggressive and less fine, and better only for rough work, not for the finest final scraping.

Large areas can be scraped with large flexible scrapers, but you'll find smaller scrapers necessary in tight spots—for instance, I have a several tiny scrapers, some made of pieces of common hacksaw blade, for edges and parts of the scroll, and I also use some of my knives for this. Don't forget to do the ribs, using the same small rectangular scraper as before, but freshly sharpened and more gently. The best plan is to have the whole body of the violin scraped nicely before the neck is set, to be able to do spots which will be hard to reach with the neck in place, and then rely on touch-up scraping in accessible areas for the final scraping before varnishing. Therefore, the tips I'm including now are applied equally as part of the final body assembly, before setting the neck, and as part of the finishing process. Scraping is a tedious job at best, and it's also the time to define sharp edges and contours to perfection, so a couple of hours doing it won't be mis-spent, nor is it unnecessary to do it once before the neck is in place with the idea that it will all have to be done again afterwards.

This scraping step is the point where much of the personality of the woodworking is defined. Some people prefer knife-sharp edges on things like scrolls and edgework, where others prefer a softer look. Sandpaper tends to make softer edges, and the crispest look is the result of careful scraping. Early makers followed a large range of practice in this regard, some leaving anything outside the purfling direct from the gouge, others carefully defining edges, and others softening everything after scraping. In general, varnish buildup tends to soften things a bit, and wear from use does the same. Consequently, very few 250 year old instruments show much of what the maker's original intent was. The treatment of edgework is one way of identifying whole schools of makers, and one of the more important aspects of a violin's personality, so it's good to give it a lot of thought.

I begin by scraping large areas with larger scrapers, up to the purfling, removing all bumps and rough spots, refining the arch around the edges, and finally bringing the area inside the purfling as closely as I can to finished with more careful scraping. While I’m working on large internal areas, I’m careful not to touch and damage the edge outside of the purfling with the scraper, so the outer rim of the top and the back appear a bit crude at this point. Also, it's important to take care around the edges of the f-holes so as to not disturb relationships there that were carefully established earlier.
After the center is finished, I concentrate on perfecting the edge. This is the point where you might discover that you haven’t scooped your edges deeply enough, with enough approach to the crest of the edge. You might now have to go back and deepen the scoop and rework things. I usually find that I need to do the areas just outside of the corners deeper at this point—the big flat area inside the corner has fooled me into thinking it’s deeper than it is. The final scrapings are where these types of things float into your attention; you will eventually discover what your own personal flaws are, and perhaps learn to compensate for them ahead of time.

Some makers scrape the rounded edge of the plates. I’m going to suggest that this is too much work, with too little reward, and these areas should be left sanded as they were from rounding the edge previously. It you don’t believe me, and want to dive in at the worst spot, start with the armpit areas of the c-bout of the top. If you can patiently manage that spot, move on to scraping the rest of the outer edge. Water affects the grain of the wood, and it can be advantageous to very lightly wet everything (with a damp paper towel) and re-scrape it all after it dries completely, several times, to ensure a smooth surface.

The final scraping is your last chance to remove everything that doesn't belong: the tiniest error or rough spot only becomes magnified under varnish—it won’t disappear. Especially problematic are clusters of raised fibers on the top, areas that look just a tiny bit fuzzy, usually in the more difficult scraping spots. Extra attention to these, tedious though it may be, will be rewarded later, when dark varnish doesn't collect around projecting fibers leading to dirty, dark specks in the varnish. For these final smoothings, a freshly sharpened scraper with an unturned edge is the best tool to use. For this, the scraper should be threateningly, shaving sharp.

**Pre-staining**

Varnishing over bare white wood doesn’t look nice. The resulting job is pasty and cold, and you can’t expect much help from the effects of the years ahead because wood doesn’t age and darken much when it’s under varnish. If you try to build the darkness into the varnish, instead of starting with the wood, as the varnish chips or wears paper white wood becomes revealed. Consequently, makers usually do something to stain or darken the wood before they start varnishing.

There’s (possibly—you’ll discover the problems) a right way to do this, and many, many wrong ways. A few years ago someone (XXXwho?) gave a speech at a VSA convention outlining many of the possible methods, and the core message about them all was that they really didn’t work all that well. The specific problems involve the way that stains can affect the top wood, working more on the soft grains between the dark grain lines and
darkening them to a color darker than the dark grain lines, an effect called “grain reversal”. The other, similar, problem is a result of how spruce end grain absorbs things more quickly than side grain, resulting in dark staining in patches over the top. This type of staining is characteristic of virtually any colored material painted on the wood, including any dye stain, such as coffee or tea, diluted alcohol stains, pigment washes—anything at all with its own color, when used strongly enough to result in the right depth of color to be really useful.

There aren’t too many ways to stain both the hard and soft parts of the top wood and keep the darkness relationship between them. As far as I know all of the useful methods are chemical, not from the addition of color from outside, but by developing the color potential of the wood. Many of these methods darken the dark grain lines of the top in a desirable way, but they still can be vulnerable to excess staining of soft grains and end grain. The most traditional, and easiest, with the best results, is sun tanning. This involves leaving the violin in the sun for some weeks until the wood has darkened attractively and naturally. It’s easy to do this, and the only down side is the time involved. This works just as well inside the varnish drying UV cabinet. This process can be speeded up a bit, and a nice color added, by mixing just a couple of drops of linseed oil in an ounce of turpentine and brushing that over the whole violin. With time, the oil darkens and yellows, too, along with the wood. Though soaking wood with oil can result in undesirable tonal changes, just a couple of drops over a whole violin won’t affect anything.

If you’re in a hurry (and production violin makers are always in a hurry) there are some chemical methods that have been used with more or less success over the years.

There’s an old rumor that J.B. Vuillaume baked his wood during a certain period, resulting in weakened violins that disintegrated. From the ones I’ve seen, this is not true; it appears that he did what a lot of his contemporaries tried, something common in bow making (which may be where he picked it up), and that is to treat violins with nitric acid. The visual effect of this is really nice. The wood darkens and picks up an attractive yellow color, and the dark grains of the top darken disproportionately, as one sees on many old instruments. It seems like a process with no downside, but history tells a different story. Through time the acid works through the wood, destroying its structure and making it very fragile.

I once worked on a French cello from the same year as me, 1949, and it was in much worse condition than I. It had obviously been stained with nitric acid, and still gave off the characteristic and easily-recognized odor of acid-burned wood. The top was filled with cracks, and as I fixed them others opened up from the stress of pulling the first ones closed. Getting it out the door intact was a nightmare. A friend who’d worked in France told me that some of his French friends followed the acid with a lye or ammonia wash to
neutralize the acid. He commented that the neutralized chased the acid through the wood, but could never catch up, and the result was clearly not better, since alkaline treatments have their own problems. I do not recommend nitric acid.

A couple of decades ago some Americans got the idea to use what they called “ozone”, building ozone-generating spark boxes to treat their instruments. I believe some makes still do this. The “ozone” is generated by a neon lighting transformer, with two wires leading into an airtight box, placed just near enough together that a constant spark jumps between them. The problem here is that it isn’t ozone that’s being produced: it’s nitric oxide, which when it meets moisture in the wood is turned into nitric acid within the wood. The effects, both visual and physical, are identical to nitric acid, and I have a colleague who destroyed a full year’s production by this method (and who spent the next three years or so replacing various disintegrating instruments and parts. I made two instruments stained this way. I smashed both, one in front of another maker who was claiming to me that nitric acid was harmless, and the wood was the texture of toast and it broke easily in any direction, regardless of grain direction.

Another thing that doesn’t work is alkaline treatments. Direct liquid application of ammonia, lye or carbonate solutions color the wood similarly to what you can do by fuming the violin in ammonia. The result is a greenish-grey color which isn’t unattractive when it’s under varnish, but the green tinge is a cue to its use. Wood which has had an alkaline treatment becomes, over time, like cardboard. It’s soft in texture, and thuddy in sound. Once again, as always seems to be the case, the people who do this say it doesn’t harm the wood.

Another chemical treatment dates to the end of the 1800s, in Naples. Many Neapolitan instruments of the era have dark wood, not looking too bad, with a distinct green cast. This is the result of potassium or ammonium dichromate. These chemicals are harder to get now, being classes as carcinogenic, but they are still used in some archaic photography and printing processes, and are available from photo supply catalogues that specialize in old processes. I haven’t messed with this process too much. I know that the strength used is relatively weak—around two or three percent, by weight, in water. The solution is brushed on, and then the color develops in UV light. The result can be not horrible, but is definitely identifiable as being non-traditional.

Early on when I was experimenting with color, someone told me rough directions for a stain that supposedly originally came from the Carl Becker shop. After some messing around with the proportions, I finally arrived at this recipe. I don’t know how close it is to the original, but it works:

- Saturated potassium dichromate solution, 1 part
- Saturated boric acid solution, 3 parts
• 1:10 dilution of 68% fuming nitric acid solution, 3 parts  
• Water, 3 parts

This is painted on the violin carefully, no runs, every spot covered quickly, then left to dry in the sun or a UV box. Having just read my invective against nitric acid, you are wondering what it’s doing in this recipe? It’s only there to kick off the potassium dichromate’s work, nothing else, and you can leave it out of the recipe. If you do, more exposure to UV light is required for complete color to develop. The purpose of the boric acid is to moderate the effect of the dichromate, and the result is a more pleasant, yellow-brown color, without the green of dichromate used alone. The only down side of this recipe is that it doesn’t develop to a very dark color. If you make multiple applications, the color will get darker, and you run the risk of progressively more end grain burning.

Finally there’s a third option that some makers are experimenting with: sodium nitrite. This has been used by gun stock makers and is just spreading to the violin world. A three percent solution is painted on the violin, followed by a day in the UV box. The color developed and its depth depends a lot on the wood and its age, and is unpredictable, as is the amount of end grain staining. It looks like it has promise, but no one that I’m aware of has got it fully under control. As with most other methods, just as you begin to approach the degree of darkness you would prefer to have, staining sets in.

Sealing

The issue of violin undercoats, or grounds, is a complex one, filled with a lot of legend, superstition, fundamentally bad ideas, and things that just simply don’t work well. If your object is to replicate the look of a fine old violin, you’ll need more advice than I can give you. I can tell you, though, that a lot of that look hinges on the first varnish-like thing that touches the wood, which is never the varnish itself. The optical interaction between the wood and what’s in direct contact with the wood is where the important things are happening. The materials of a Cremonese ground are an unsolved problem, I think, though you will find lots of people who think they are sure they know what to do. The most popular idea currently is that it is a mineral soup of fine particles, sort of a small gravel, suspended in a varnish-like material. If you want to find out more about this, there’s lots of information available. Look on the web for research under the names of Claire Barlow and Jim Woodhouse.

I don’t find this plausible for several reasons that I won’t get too deeply into except to say that this undercoat is supposed to be both thicker than the colored varnish layer and undetectable, which I don’t find plausible, especially since this doubt gets a lot of support from restorers who have actually worked with restoring the originals. Second, this undercoat was supposedly found on instruments other than Cremonese, which in my mind precludes it being the thing that makes Cremonese violin ground special. Finally,
neither I nor the restorers I have shown the electron microscope photos of this ground that accompany the research agree with the reading of the layers that the researchers give.

There have been a lot of other ideas over the years as to what this ground could be. Most people with close experience with many Cremonese instruments agree on a certain set of things:

- the ground is not present on all Cremonese instruments; when the ground is missing the results may not be all that special (there are some Strads around 1707 which appear never to have had a ground, and the resulting varnish job is not particularly attractive—was he having a hard time getting the ground material at that time?)
- the ground is not the same thickness on all instruments of the Cremonese school, and the thickness variations can be characteristic of different makers in different periods. (Peter Guarneri of Mantua instruments sometimes appear to be entirely ground, thickly laid on, with just a skin of bright red color, resulting in an interesting orange effect; late del Gesù often have very obviously thick grounds)
- the ground is what is responsible for the wonderful visual effect of Cremonese varnish; with it a restorer can plausibly revarnish areas and maintain the original visual effect; without it they can’t
- the ground is often called yellow, or honey-colored, but really doesn’t have too much color in normal thickness—it’s more of a color cast.
- the ground appears to be tougher than the colored varnish over it, and resists wear much better. Often violins with no original colored varnish can have a large amount of ground remaining.
- the ground soaks into the wood a bit, and so when it wears it fades, not developing a patchy look of missing/there/missing, with defined boundaries

Many different grounds have been used by makers over the last few centuries, including (in order of their solvents) a hide glue wash, egg white, casein, alkaline water/resin solutions; gamboge, shellac, spirit varnishes of all kinds; rosin oil; oil varnish; oil, rosin oil, or spirit varnish combined with plaster, pumice, diatomaceous earth and various other mineral aggregates; natural cements, such as pozzuolana, or plaster alone.

As widely varied as these materials appear to be (and you should notice that they appear to encompass most possibilities) they all have one thing in common: none of them give a really convincing Cremonese appearance.

Since this aspect of violin making almost has the structure of a religion, I recommend that you do some reading and research elsewhere to discover which of the many faiths you wish to follow and pick one to use. My favorite is highly dilute shellac. It meets many of the characteristics of Cremonese ground, and does so in a way that’s not difficult to
manage, with materials which are readily accessible. The visual and tonal results are acceptable.

If you decide to use shellac, you can get Bulls-Eye orange shellac in a small can at many hardware stores. This is essentially the same thing you could make yourself at home from shellac buttons and alcohol, but with the wax removed (which is not that easy at home). Dilute it with alcohol (solvent alcohol is found in the hardware store near the shellac, in with the other paint solvents—rubbing alcohol from the drugstore is not a substitute), using about one part of shellac to four of alcohol. Brush one coat on the violin, relatively wet and quickly. Immediately wipe off the excess with a paper towel. Let it dry for at least several hours, and repeat.

I use, for undercoats and for varnishing as well, a one-inch, filbert-shape brush. For many years I used squirrel-tail brushes from Utrecht Art Supplies, costing about $15. A half-inch one is handy for retouching. I like them because the filbert shape works well for varnish, and the hair is springy without being too stiff. Recently I’ve been using a similar synthetic brush that costs about $30. Either brush, properly cared for, will last nearly forever, so don’t worry about the cost. Brushes are cleaned by rinsing them thoroughly in the proper solvent for what you were using them for. I follow this with a rinse in acetone, which is a good solvent for almost everything, and then a washing with ivory soap and water. If this makes your brushes too dry, you can use something like Dove soap once in a while, but only on natural bristles, not synthetic. Shape the brush carefully after use, and let it dry. Brushes in which you’ve let varnish dry can be revived by soaking in acetone. The acetone will remove the paint from the handle, but won’t hurt anything else. This is probably considered brush abuse by artists, but it’s been a good cleaning routine for me for a couple of decades. Remember, most artists aren’t using the varnishes you are, which can be tough to get out of a brush by normal means.

The first couple of coats will soak right into the wood and virtually disappear. The wood will look better, but appear untreated. After the first two, something will start to build in places. At this point you can be careless and just wipe off the extra; you will need to work with a dryer brush and brush carefully, with no runs and no overlaps. After several coats this way you will start to notice a coating forming on some areas. Figure out which areas are still soaking in shellac, and give them coats alone. The problem areas will be end-grain areas on the top, including the edges, the end grain parts of the scroll and heel, and random areas of the back. The ribs will seal well relatively quickly, with little extra attention. When an area is obviously sealed and has a light skin of shellac on it, don’t add more to that area until you get the others to catch up. Finally after more, perhaps many more, coats, you will have an evenly-sealed violin.

I find that knowing when this state is reached can be a little confusing, so I put on at least
two thin coats more after I’m sure the wood is sealed. You really do not want to be painting colored varnish on to unsealed wood—the color will soak in and the wood will look “burned” or dirty. This is a common characteristic of amateur instruments, and one you will certainly want to avoid.

If you have been careful with the brushing, no additional treatment will be needed at this point. I will often lightly sand with 600-grit, just brushing the surface, to clear away dust and sticking-up wood fibers, making a good ground for the colored varnish. 0000 steel wool is great for this, but it leaves bits of metal all over the violin and you will need to remove every speck of it before you go on—I wash the whole instrument with turpentine a couple of times, and blow out the inside, also. Any steel caught inside will definitely come back to haunt you later, so stay away from the f-holes. I don’t necessarily recommend that you use steel wool, and I don’t use it every time. Tripoli and turpentine might work nicely—I’ve never tried it, but it would be potentially more traditional than the other options. You don’t want to sand through to the wood anywhere, and edges and the top are particularly vulnerable in this regard. If you want to wet-sand, rather than dry, use turpentine as a lubricant, not water. At this point, if you cut through with water, the wood will be stained with a different appearance than the rest, even if you re-coat with shellac.

At the del Gesu convocation at the Metropolitan Museum of Art, in 1995, I was looking at one of the early del Gesus in the display cases near the door, when an elderly gentleman scooted up next to me. We were looking at the ribs of the violin, which were mostly bare of varnish, with only ground remaining, and he pointed and said “that’s shellac, that’s what it is”, and it did look exactly like the color of shellac. Perhaps he was right.

Color Coats

From this point on, I’m going to assume you’re using oil varnish. It’s much easier to handle, especially for a beginner. If you’re set on using a spirit varnish, the quickest way to a good spirit varnish job is with an airbrush or small spray gun. My favorite for overall varnishing of violins is the Paasche H3 or H5, a cheap gun that gets the job done. Don’t worry about being traditional, since spirit varnishes aren’t traditional. There’s a bit of a learning curve that I can’t help you with here. Be aware that you will have to learn the effects of the amount of flow vs how close you are working, and how wet you make the coat (not too wet, or it will run—it’s better to work as close as possible to the margin of where you are spraying powder that dries before it hits and leaves a white frost on the violin, and using a varnish that’s too diluted with alcohol is easier than one that’s too dense.
Color coats are straightforward: mix up a color you want with your varnish, and paint it on until it has become deep enough to make you happy. The only two catches are mixing a good color, and getting it on without streaks and spots. Oil varnish helps with that part, since oil varnish can be pushed around until you like the effect. If you’re getting streaks, wipe it all off with some turpentine, water it down with more varnish so that the color isn’t so strong, or more turpentine so that it’s thinner, and try again until you get it right. A couple of drops of kerosene makes oil varnish spread and level out better, but too much will make the varnish so liquid that it will flow to the bottom of your violin and off.

Color mixing is a matter of taste and preference. First you have to figure out what color you want, and I mean very specifically, not generally. Analyze how much red you really think is in the color you want (usually there is a lot less than you initially think), and what proportion the other colors are in. You will probably go off in the wrong direction on two points: adding too much red, and making a color which is too colorful, lacking darkness. If you’re using tube colors, you might try for an inch of Indian yellow, a tenth of that of blue, and an equal amount of red, for a start. If you’re using my favorite alizarine plus asphalt combination, start with a few drops of asphalt, and add red until the green cast of the asphalt is gone, and not a bit farther. Mix it in with a little varnish, and put a thick drop on the bare neck. Since a droplet is thicker than a coat of varnish, you’ll get to see what several coats of the color you have will look like and know if your on track. Be warned that this drop is going to look better than you have any hope of your varnish looking, so don’t get too excited, but it’s a good general guide. In the same vein, your going to impress yourself when you look at your varnish with fresh wet varnish on. When it dries, it will look worse—less brilliant and less transparent. Give it a week, and it won’t look good at all—less brilliant, and the wood that you thought was so bright and clear and sparkly—well, that was because it was soaked through with solvents that are no longer there. If you’re really lucky, and have done everything right, you may regain some of that look in five or ten years as the varnish dries and clarifies further. As a general rule, the more developed your standards become the more disappointed you will be.

You should aim to accomplish the color you wish in about four to six thin coats (that is, with the varnish in each coat brushed out as thin as possible.) Oil varnish should be brushed out thoroughly in all different directions, with the final strokes in line with the grain or the figure of the wood. If you’re having problems, those couple of drops of kerosene will help a lot, but don’t over do them. I usually start with the ribs, then do the back, move to the top, and do the head last, picking up more skill, confidence, and feel for the varnish as I go along (that order is from easiest to hardest). Be sure not to squeegee varnish into the f-holes along the edges, and watch for big drops forming both on the bottom tips of the lower wings, and on the insides of the bottoms of all the round holes. This risk running later, after you walk away. You won’t notice them until you come back later, and by that time it’s too late to remove them, so be aware and take them
off right away. Likewise with the scroll, where varnish can drool to the bottom of places and form ugly droplets. Some makers go around before they hang up a fiddle and wipe the edges with a fingertip, to highlight them and make them stand out a bit.

I varnish with the board on, as the old makers did. It’s possible to push in varnish pretty well from the sides and below. No player will ever notice that there’s an unvarnished spot under the board, but I keep some pictures around of a Strad top without the board on to show them what I’m trying to replicate.

_Drying Oil Varnish_

Spirit-based varnishes dry by simple evaporation: once all of the solvent has gone, the varnish is dry. Most of this happens nearly immediately, and the greatest proportion of the solvent is gone within a minute or two; within 24 hours most of the rest is gone, but the violin can be safely handled a few hours after each coat. The only special requirement for drying spirit varnish is a place where there aren’t too many flies or blowing dust.

Oil varnishes have solvents in them, but the evaporation of these is not the primary method by which the varnish hardens. While the solvent in oil varnish aids brushing, and the varnish may begin to stiffen up in a couple of minutes, oil varnishes harden by oxidation and polymerization, which are irreversible changes in the state of the oil. These require fresh air and energy in the form of UV radiation.

The traditional method of drying oil varnish is in the sunlight, often outside. Stradivari’s roof-top, open-sided loft may have been the place his varnishing occurred, as well as serving as a place for curing wood. Old English instruments often exhibit varnish defects caused by the slow drying in sunless England and the use of driers to hasten the process. Now it’s not necessary to live in sunny Italy to dry oil varnish: many makers use small closets lined with UV tanning lights which can completely dry oil varnish overnight. This can be as simple as a cabinet just large enough to hold a violin or two, with four two-foot UV tubes in it, and active ventilation to draw off the initial turpentine fumes safely. I made mine large enough for a cello by using four-foot high panels of plywood (for efficient material usage) and adding a peaked roof to give the additional space needed for the height of a cello. It has six tubes, and can dry three instruments at once, but still fits in a small space.

_Finish Coats_

The final coats are easy. Put on two or three layers of your color varnish, without any color in it. The only reason for this is so that when you polish your violin you will not cut through and remove color—all smoothing and polishing will be of the clear layers, only.
Because of the roughness of wood, and the details on the violin, this can happen very quickly, and is always spotty and ugly. Tops, with their rough texture, are particularly vulnerable, and can quickly become very unattractive.

**Polishing**

I like to polish as soon after the last coats of varnish as I think will work without tearing up the varnish. My reason is that the solvents in oil varnish take some time to go away, even after the varnish oil has fully cured. This subsequent evaporation further thins the varnish layer, and the oil will also thin a bit and settle over the coming months. If you polish early, before this settling process gets too far along, you can make a perfect (that does not mean glassy smooth—it means free of defects) surface which then settles and shrinks into a thin surface that telegraphs the texture of the wood through to the surface, as if you’d put on the minimum amount of varnish, but which is more defect-free than if you simply had used less of a different varnish that didn’t settle. If you wait too long, in polishing the surface you will flatten it out, and the result will be too smooth and shiny, but there will be no further shrinkage, and no wood texture showing through eventually. I find that I can usually polish a violin within three to five days after the last coat. I think this probably varies with different varnishes, and you will have to find out what the one you use does in this regard.

There are a lot of different products for polishing out varnish. People immediately think of pumice, but I think that it is too coarse for this type of work. It can have large hunks in it which make deep scratches that you can’t remove, and it can cut through layers of varnish too quickly, cutting into the color before you know it. There are some finer grades of pumice that I have not used—maybe they are OK, but you will see what I like in a minute. Rottenstone is too fine. It’s good for finish polishing, but before you use it the surface has to be entirely polished out, just short of the shine you want. There are quite a few commercial auto polishes that work well, but you need to check them on your own varnish, since some varnishes are vulnerable to the solvents that auto products have, and you can damage your varnish with them. Also, these can mix with the varnish and make it permanently sticky. If this doesn’t happen with the particular varnish that you use, they can be useful. Dupont #7, in a familiar flat green can, is sometimes useful, and you can mix a bit of black ink in with it so that you don’t end up with white specks in all the little hidden places around your violin. It only takes a couple of drops, stirred in.

My favorite polish, though, is light tripoli. It’s uniform, and just coarse enough to do the job, not a bit more. Also, as it wears it breaks down finer, so that as you polish the surface gets shinier and shinier. I think the end result is just about perfect, and I like that it’s a one-step process. Use it on a piece of canvas, with a couple of drops of light mineral oil (unscented baby oil) lubrication. If you have controlled zits as you went along through
the various layers, by the time you get to the end you won’t have to smooth any of those out before using the tripoli. If they’re small, tripoli will get them out, but if not you may have to do a bit of sanding with steel wool, first. I sometimes have to shave off some bumps with one of my knifes, too.

Polishing is simple—just keep rubbing until you like the way the violin looks. Be careful not to go back and forth over the same spot without using a fresh area of the canvas—if there’s a bit of something on it and you keep grinding, you might put a groove in. This warning particularly applies to the edges where it’s too easy to go around over and over on top of the purfling without thinking. Be sure to do the hidden spots—in the underedge, around the deepest parts of the scroll. Don’t be so eager that you cut through your layers of clear, and start cutting through color: that is a real risk, and a guaranteed disaster.

The object of polishing is not to flatten the varnish. The surfaces of old violins have a lot of nice texture, including strong corduroy on the top. You are not making a guitar or a bartop, so you have to develop of feel for how to get the varnish looking nice without going to far and ruining the texture. The purpose of polishing is only to remove defects in the varnish—orange peel texture on the maple, often, and dust zits everywhere, and to make the shine something you like. Usually varnish without polishing looks both too rough, and too shiny, the total effect being “cheap”.

When you’ve achieved something you like, wipe off as much oil and tripoli as you can with a dry paper towel. You’ll still have a slightly unrealistic shine from the oil, and if you know how to French polish you can do a little of that with a mix of alcohol and water on a paper towel to remove the last bits of oil. Another option, safer, is to rub down thoroughly with water on a paper towel.