SOUNDBOARDS, AND OLD WIVES' TALES

I have read some of the strangest stuff many years ago about finishes; lacquer, varnish, and shellac, and the "proper" historically correct way to restore the soundboard. I am also reading again about the "proper" finish for the soundboard, and how one should never use lacquer on a board. All this, after I had mistakenly thought that the scientific study made at MIT or at least published as I recall in about 1979 put all of this to rest, as to whether or not a piano soundboard "moved."

Back in Dr. Hickman's day with the Ampico Corporation, he was discovered under a piano with an electric hand drill and was promptly corrected by an old timer piano technician, who told him, "Never use an electric drill on a piano– it will destroy the tone." The man slid under the piano and showed Dr. Hickman the proper way to drill– using a "hurdy-gurdy."

If you don't think that a few professional rebuilders have some strange ideas all their own, all you have to do is read them. And what is so funny about this is how it seems to never die, regardless of all the research one can accumulate.

For example, Much research was done on soundboards in the early 20's and throughout the manufacturing of pianos. They are always on the lookout for a composite that could take the place of a spruce board, for some reason. The Kimball Co began building plywood boards out of Southern poplar which would not get cracks, as most boards tend to do.

When sensitive electronic equipment was applied to the question of soundboards and how sound was radiated through the board, it was discovered that a soundboard did not radiate sound like a speaker cone, by moving up and down. The old ideas that though the movement was very small, it was still there and that it could be measured very precisely turned out to be, well, wrong!

There is no physical movement in the board– as you think of physical motion. Only a vibration transmitted longitudinally through the board in all directions– a molecular wave, which might appear as raindrops in a pond. In other words, the soundboard conducts vibration just like the ocean. Does the ocean "move" as a result? Well of course, it's molecules have to move, but that isn't called physical movement, so you can say absolutely that the ocean doesn't move to transmit sound. The sound transmitted in the ocean is spherical in nature, unless the transducer is directional, but the ocean quickly re-conducts that directed sound throughout, so it's difficult to focus a ray of sound in the ocean. Double-ditto a solid like a soundboard.

If the ocean as a liquid doesn't move to conduct sound (the wave just compresses and rarifies molecules while the surface remains the same), then it would stand to reason that a solid wouldn't, either. Now there are exceptions, such as resonant points with the mass of the board, but these are undesirable movements that we don't want, so these resonances are removed by designing the bridges to either damp out such resonances, or to desensitize that area of the board to prevent it happening.

The most important features of a soundboard are its elasticity and it's mass. Whatever changes these two all-important parameters will affect the power of the radiated sound. The ribs under a soundboard are, of course, part of the radiating mass of the board. They cross the grain lines to hold the board together and to give it strength against the pressure of the strings. A slight crown aids in maintaining the upward resistance of the soundboard to the string weight.

It was discovered in the middle 20's by Dr. Hickman and others that a soundboard having zero downward string weight tension produced up to 4 times as much tonal power as a heavily

preloaded soundboard. Now you may ask, “Then how do you get enough downbearing to hear the tone of the strings?” The answer is, all you need is a good contact between the bridge and the string, and that contact may be made sideways instead of vertically.

Now there are engineering tradeoffs to this “ideal” situation. The fact is, the ideal cannot be met because of a number of different factors, primarily, holding perfect tolerances over the course of generations of use being just one of them. But at least we have the principle. So now the idea would be to lessen the downbearing to the point that we safely maintain good contact pressure everywhere along the bridge.

Why does string weight lessen the resonance of a soundboard? Simple. It compresses it, and a compressed board has less elasticity overall. Also, it adds mass. You have to now add a greater percentage of the mass of the string to the overall weight of the board. Elasticity and mass. Whatever changes this ratio or product, changes, in a major way, the radiation capability of a soundboard.

Well then, if that’s the case, ask yourself, “What happens then when I coat my soundboard with shellac? Or varnish? Or lacquer? Suppose the varnish is more flexible than the lacquer. Does that mean my soundboard is more free to vibrate up and down? Is that why the finest manufacturers always used varnish instead of lacquer on a soundboard?”

The truth of course is simple: The purpose of a finish is to prevent moisture from entering and leaving the board. If you can protect the glue joints and the wood itself, then you will have a more stable board. Moisture in a board can become a large percentage of the board’s mass, and therefore can change it. For example, a 6%-8% moisture content means, “that is the percentage of weight that moisture takes up in your soundboard.”

Moisture also changes the elasticity constant and by entering and leaving the board, compresses the fibers of wood, making it more and more vulnerable to dimensional changes, according to the humidity extremes. This can actually change the tuning. So temperature excursions, even with constant humidity in a room, will change the tuning, because of the vapor pressure changes going on in the soundboard. Remember this– it is moisture and little else which causes a piano to sound different.

Of course, you can always redesign the piano sound by merely changing the placement of the supporting ribs– which make up a tremendous percentage of the tonal change you are allowed, without any changes being made to the bridge, or the top surface of the board. Dr. Nicholas Giordano of Purdue is presently doing some sound research and discovered this very important connection to a good-sounding board. He says nothing about the finish, however.

Were you to scrape all of the old finish off a soundboard , you would have a little pile of dust in a cup, right? Were you to put this Dixiecup full of dust on one side of a balance scale and the entire soundboard, ribs and all (plus an empty Dixiecup) on the other, you would have an accurate relative measure of the degree in which the finish was restricting the board’s movement. So we can’t say it’s zero, can we? But I think we can say that were we to saw off about 2 inches of the shaved end of a rib to weigh against it, that little piece would outweigh our finish dust. So the comparison is inane and ridiculous.

Now, as to whether one finish is more or less “flexible,” please keep in mind that as hard and brittle as glass itself happens to be, we still make fiber optic cables with it! So what was it they demand about having a “flexible lacquer” or a varnish?

These claims are downright silly when viewed in the light of common sense and the conclusive research that has already been done, decades ago. Don’t get distracted with old wives’

tales about the magical qualities of soundboard varnish. Any instrument dependent on a soundboard is ten-thousands more times' dependent on the ***humidity*** it is being subjected to and the rather permanent effects of air moisture moving through the wood and joints, cracking them and crushing them. Using carpenter glue to glue soundboard planks and ribs together when building a new board has a far more deleterious effect on the final sound than what it is to be finished with! New grands use an epoxy resin finish that's quite thick! They have no complaints.

Use a finish that prevents all moisture from entering or leaving a board, and you have the best soundboard that instrument can possibly have. Don't worry about "flexibility." And remember that oil-based varnish (as claimed) is a porous finish, created by its own polymerization as the long links pick up oxygen. On the other hand, lacquers merely dry by evaporation, and so have fewer microscopic holes. Therefore, lacquer can be a much better sealant for wood, applied correctly and using the right materials, than varnish ever could.

Today however, the terms "varnish" and "lacquer" are used interchangeably, because while varnish used to be a self-polymerizing oil finish and lacquer a drying resin finish, chemists have since gone far past these limitations and have created lacquers which polymerize with catalysts and acid-based chemicals to create something that becomes impervious in just a few month's time. The best soundboard finish is airtight and watertight, and won't discolor with age.

Varnish was used on soundboards by the top piano manufacturers in this country long before any research was done, but powdered egg albumen, or a kelp seaweed gelatin solution (or other stabilizers as well) was first applied to the board to stabilize it and prevent excess moisture from entering and leaving. This coating can still be found on some old boards (not all, of course) after they've been stripped. You may notice that it has to be sanded off. It doesn't strip off cheerfully. So it was *this stabilizer* which made a perfectly tight skin over which it could then be finished, and not the varnish, which actually protected the board the most. The varnish was there mainly to look pretty.

Isn't it just amazing how simple and clear the facts make any issue when compared to all the unbelievable baloney we're subjected to day and night? But never fear– the people who teach nonsense seldom say, "I stand corrected." They base their reputation on the fact that they have never been corrected! But just between you and me, modern day lacquer or varnish is still just fine. Use whichever you like. You won't be able to hear or see any difference, and neither will anybody else.

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