PIANO TECHNICIANS
Journal
FEBRUARY 1990

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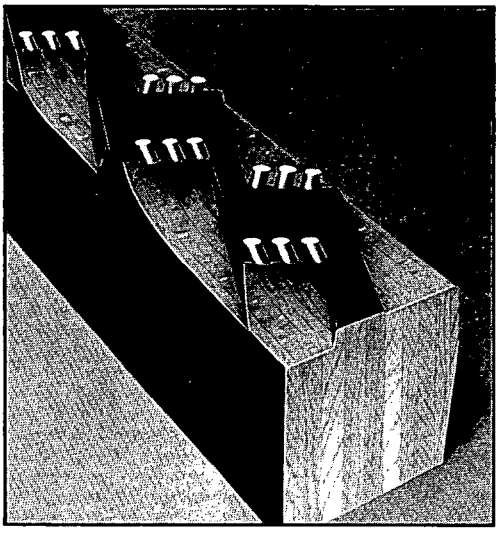

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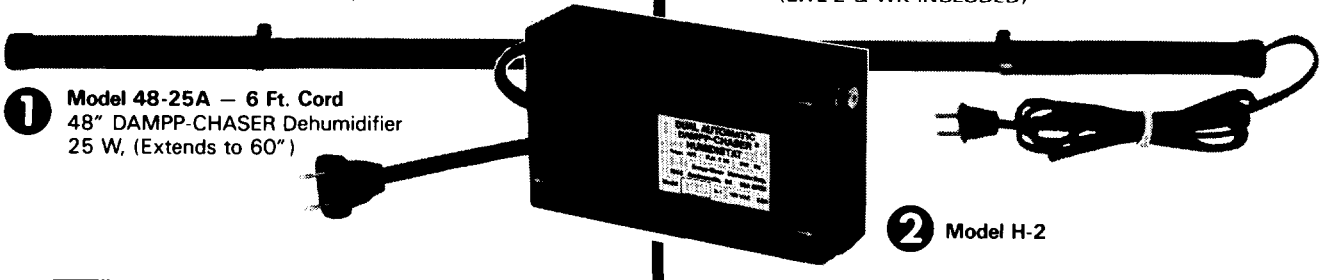

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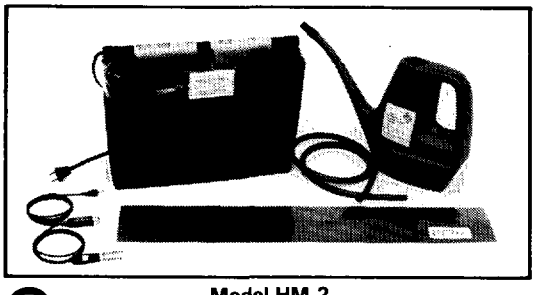

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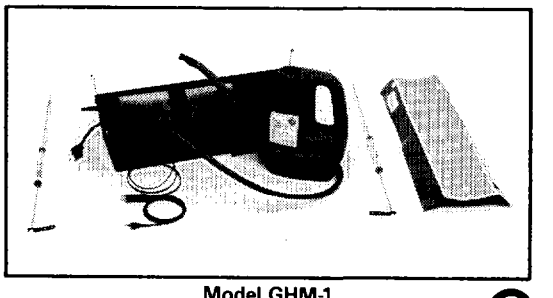

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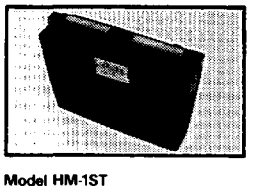

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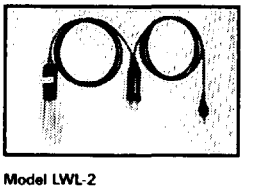

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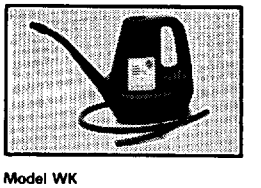

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PIANO TECHNICIANS
Journal

FEBRUARY 1990 — VOLUME 33, NUMBER 2 OFFICIAL PUBLICATION OF THE PIANO TECHNICIANS GUILD, INC.

ABOUT THE COVER:

The recent San Francisco earthquake caused a number of piano-related problems. See this month's "Technical Forum," which begins on page 10.

The Piano Technicians Journal (ISSN 0031 9562) is the offical publication of The Piano Technicians Guild, Inc., 4510 Belleview, Suite 100, Kansas City, MO 64111. The *Journal* is published monthly. Second class postage paid at Kansas City, MO., US ISSN 0031 9562 foreign and domestic. POSTMASTER: please send address changes to: *Piano Technicians Journal*, 4510 Belleview, Suite 100, Kansas City, MO 64111.

Annual subscription price: $85 (US) for one year; $155 (US) for two years; $7.50 (US) per single copy. Piano Technicians Guild members receive the *Piano Technicians Journal* for $45 per year as part of their membership dues.

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President's Message

Traditionally Speaking

Ronald L. Berry, RTT
President

There are many traditions associated with PTG. There are traditions of PTG's ideology, traditions for the whole organization, and traditions within chapters. PTG has a long-standing tradition of being open to qualified technicians and I found it open to me even before I was qualified. While there is some discussion about membership for non-RTTs, I think it is fair to say that PTG has a tradition of being friendly and helpful to anyone who comes to it. PTG has a tradition of being more like a family than just an organization. People continue coming to meetings even after they are retired from doing piano work just because they want to see their friends in the organization. PTG has a strong commitment to the education of its members. Just the number of seminars that take place each year makes that obvious. Besides these seminars are chapter meetings and personal exchanges of information that take place on a regular basis.

PTG has many organizational traditions. We have an annual convention in a location that moves around the continent. This meeting covers four aspects of the organization. It is first an educational meeting with an institute made up of the finest instructors in North America. It is a political meeting which includes Board meetings, a Council meeting, committee meetings, and many other meetings necessary to running an efficient organization. It is a trade show in that we have a large number of exhibitors including piano manufacturers, tool and parts suppliers, accessories, and educational materials. It is also a social event where friends from across North America can get together once a year. The convention is where awards are given to those who have contributed in a special way. Besides all of PTG's meetings the PTG Auxiliary has its own meetings to carry out the important support they give to PTG.

PTG has a tradition of dedication to a high standard of excellence. Our tests have been improved constantly since I have been associated with PTG. As PTG has done a better job of teaching its members, it can demand more of them for certification.

PTG has a tradition of encouraging and preserving a craft that we feel is important. PTG has had the attitude, "I'll teach you with the understanding that you will then teach someone else later." This makes an association of competitiors far more friendly than one based on competition alone.

Chapters have their own traditions. My chapter always has a pitch-in picnic in September to start the year off and a Christmas party in December to provide some relief and sharing during that busy season. We have had a long standing volleyball competition with the Cincinnati chapter. Even though this is planned strictly as a social event, you know how piano technicians are when they get together. Discussion of pianos is always prevalent. Some chapters have their own awards, usually in memory of an important chapter member. Some have formal banquets where these awards are given.

Whatever traditions your chapter may have, traditions add importance to those activities and make people look forward to them. PTG has accomplished much in its 33 years of existence and will continue its traditions into the future.

From The Home Office

Taking Stock

Larry Goldsmith
Executive Director

Now that we've presumably survived the holidays, we can get down to the business of surviving the '90s. The next decade and beyond it, the next millennium, stretch out ahead of us. What will they bring, aside from a spate of "millennium-in-review" features in our newspapers and electronic media?

For those who write regular columns and features, one of the hardest temptations to resist is the "New Year's Resolution" column, followed closely by the "Year in Review" column and the "What Will the Next Year/Decade/Century/Millennium Bring Us?" column. Having thrown a number of half-baked, half-serious predictions at the last topic in January, I hereby resolve to try to resist the temptations of the other two. Besides, it's February. It's old news.

Still, it doesn't harm us to stop for a moment at life's milestones, catch our breath, look both ways and try to get ready for the bumps and potholes that lie ahead. It's a time to take inventory of ourselves, our skills, our progress in the last year and decade, and our goals and aspirations.

Income-tax time is another of those milestones, and it's coming up fast. Perhaps, when you have all your financial information in one place, it might be good to go back and review some of the excellent information the Guild's Economic Affairs Committee has presented in these pages — articles on analyzing your business and gathering information on economic trends you need to make intelligent business decisions.

How's business? Maybe it's time to make some changes in the way you operate — develop new specialties, open up new markets, adjust your fees, purchase equipment you need to stay on top of things. If you don't have the information you need to make those decisions, figure out what you need and get it. No matter how organized we are, we all procrastinate, especially on big decisions in areas with which we're unfamiliar. Perhaps now is the time to take the initiative.

Perhaps this is the year you'll attend a Guild convention. This year's Institute includes 90 different class topics — something for everyone. It's a good way to get business as well as technical information, or just talk over your business problems with someone who's been over the same road.

I hope the 1990s bring you success and happiness.

PTG's Texas Roundup

Let Us Put Our Brand On You!

The past couple of *Journals* have had information with convention dates, travel, registration cost, etc. on our upcoming PTG Annual Convention in Dallas, TX. Now let's talk about the Institute and some good things in store for you this summer. We will be offering two special classes this year. One will be held in the Cotton Bowl Room starting the third period on Monday afternoon and continuing through Tuesday. The name of this class is "Soundboard Replacement," and the instructor is no stranger to us because we have been reading his articles in the *Journal* for a few years. It's none other than Nick Gravagne, RTT, of the New Mexico Chapter. He will show you how to get a piano ready for a new soundboard with all the right measurements, including the pin block. Nick will be assisted by Jim and Dave Geiger for some of the piano teardown and setup. Jim and Dave are father and son and part of our piano moving crew at each convention. Yes, you will actually see how an old soundboard is removed and a new one put back with the necessary fit, glue and clamps. This will be a first for this type of class at a PTG Convention and Institute. There will be a limit of 50 people for this one-time special class, so sign up early!

Our second special class will be a two-part presentation with Brent Fisher, RTT, of the Dallas Chapter instructing on "Refinishing." This will include some hands-on from time to time. Brent is sponsored by Tyson Piano Store. The other half of this class will be, "Polyester Touch-Up," with Dwight Pile of the Toronto, Ontario Chapter, doing the instructing. Dwight is sponsored by Schaff Piano Supply. This is a one-day class and will be offered once on Sunday and again on Tuesday. Because of the hotel fire code the class will be held in Tyson's Piano Store, in their nearby piano shop. Transportation will be provided to class and back to the hotel. This will be a limited class of 24 each day, so sign up early when you receive your convention registration form. Don't forget: first come first served!

You can help PTG. If you know of anybody getting into the piano trade, please get his or her name, address, zip, and phone number and send it to the PTG Home Office to be put on the mailing list. We want to let everyone know about our PTG Annual Convention in Dallas.

Next month we will talk about a new concept for part of the Institute called, "Workshop classes." Well, so long for now, partner, and plan to attend the PTG Texas Roundup and let us put our brand on you!

Dick Bittinger, 1990 Institute Director

A Taste Of Texas

Now folks, I'm not a native of Texas by any means, but I've lived here for 20-odd years after migrating from the great state of Maryland. You'd think the fact that I'm originally a "Yankee" might taint the Texas-type information in this article, but on further thought, a Yankee immigrant might be just the person to clue you in on what to expect on your trip to the Lone Star State at the Dallas 1990 PTG Convention.

Texas is like another country with its own language ranging from sounding quite difficult to understand to "as clear as the man on the six o'clock news." But all versions contain to a greater or lesser extent, that wonderful, warm Texas drawl. You might notice it as you leave a store in Dallas and the clerk tells you to "Come baaaaack!" or when a group of tuners might be addressed as "Y'all." (For you die-hard Yankees, "Y'all" means "You guys.")

You might notice on your Texas trip how kind and hospitable the people are. I believe Texas folks could receive some kind of congeniality award. Their warmth and approachability impressed me when I first ventured here.

From the onset, you will become aware that Texans are very proud of their cowboy heritage and carry the tradition and lifestyle on to this day. The Mesquite Rodeo just outside of Dallas showcases some of the finest athletes I have ever seen and all of them are true-blue, real-life cowboys and cowgirls. Indeed, the first thing my visiting brothers wanted to do was buy a pair of boots, a hat, and go out and get a thick steak!

Which brings us to food. Dallas has some fine steakhouses, or you might want to mosey on over to Fort Worth around the stockyards for a steak.

Billy Bob's in Fort Worth boasts of being the world's largest Honky Tonk, complete with a huge bar, shops, games, amusements, and an indoor rodeo. In Texas, you'll taste such delicacies as deep-fried catfish, chicken-fried steak with cream gravy, refried beans and fantastic Tex-Mex cusine. The Mexican culture has made a welcome and indelible mark on the face of Texas, and you'll taste it in the food. The jalapeño pepper (pronounced *ha-la-peen-yo*) reigns supreme in Texas. You will find its *hot* distinctive flavor a real conflagrative culinary experience. After sampling tacos, enchiladas, burritos, chalupas and guacamole, don't forget there are plenty of places to try a bowl of Texas red chili, or maybe some barbecued beef or ribs.

So make those plans to scoot down here in July '90, and we'll all get indigestion together! See you then!

Will Neiberding, Dallas Chapter

Soundboard Evaluation; Scrapers; Pianos In Earthquake Country

Susan Graham
Technical Editor

The soundboard of a piano is the object of a great deal of concern. There is an almost-universal misapprehension among the public that a crack in a soundboard is fatal to the piano. This is not so. As far as the function of the board is concerned, cracks are only serious as indicators of other problems. If the crack is associated with delaminated ribs, for instance, there is likely to be buzzing and perhaps structural weakness. If accompanied by serious loss of crown or lack of sustain, cracks may indicate a board which has neared or reached the end of its useful life. Cracks running close to bridges may allow the bridge to tilt or roll, creating termination problems on the bridge surface.

When inspecting a soundboard, then, look beyond cracks for more serious conditions. Pay attention to the overall condition: "boom" the board by pounding on the bridge in a few places with your fist and listening for a drum-like resonance which indicates life in the board. As you inspect the board, watch for the grayish color which spruce develops as it reaches terminal old age: coupled with other signs of weakness, this is a yellow or perhaps red light for putting work into that piano/soundboard.

If the board is otherwise healthy and intact, cracks are a cosmetic concern. We owe it to the public (and to each other) to continue in our struggle to pass on this information; somewhere along about the 500,000th time you deliver your "cracks are not serious if there is no other trouble" speech you may find your patience with the issue wearing a litle thin, but please bear up.

Cosmetic value is real and important in a piano (especially so in a grand, where the cracks are likely to be visible). Technicians must pay attention to the marketability of a particular instrument, particularly when proposing major work. At the very least, our customers should be able to recoup the cost of any work as immediate added value (with the possible exception of antique or heirloom instruments). If the soundboard has cracks through which one can read the daily paper, even if they have no functional effect and the action is exquisitely rebuilt, the customer will have a difficult time selling that instrument. Our responsiblity as technicians includes dealing effectively with this circumstance.

This brings us to evaluation skills. Even if action, damper or other problems are the "identified patient" (the source of complaint) the board must be evaluated to be sure other work is not wasted.

We utilize a number of indicators in evaluating soundboards. Some are visual clues: the much-fussed-about cracks, rib delamination (which can occur with or without cracking of the board), crown, and the previously mentioned bridge configuration and color. Measuring bearing and sustain help to round out the picture of the health of a board.

For sighted technicians, the visual inspection is the simplest. This should be done from underneath as well as above the piano; you can see the entire board, unobstructed by plate and strings. Since it's necessary to get under (or behind) the piano to check crown, use the opportunity to look for cracks and delaminating ribs. If cracks are apparent, run a finger across the crack to see if the board has lifted on one or both sides. It may not always be possible to see the beginnings of rib delamination but this lifting is very easy to feel. Compression ridges — multiple cracks close together — may result in some unevenness or raising of grain without actual rib delamination; they are less serious but are among the more difficult cosmetic problems. If the board shows signs of glue failure or structural weakness, also check carefully around the perimeter where it should be tightly glued to the inner rim.

Crown is measured (or, at least, observed) with the aid of a piece of string. The standard instruction is to stretch the string alongside the longest rib, with the ends of the string touching the board where the case, the rib and the board intersect. Sitting under a piano and holding a string in this fashion is simple if your armspan is about eight feet. For the rest of us, fasten the string to a length of hammer shank simply by sliding a shank repair sleeve over the end of the shank with the string trapped underneath. The repair sleeve can be pinched flat to hold the string and clipped diagonally so it can reach into tight places.

The string, held up against the board and stretched tightly from end to end, forms a straight line next to the rib, just under the board. If the board still has crown there will be a gap between the string and the board, since the belly of the board causes it to arch upward.

How much of a gap is like how much bearing: several other factors and a certain amount of experience are necessary to analyze this information accurately. Any may be enough: I like to see at least 1/8" in the dry season. Watch for flat boards with no sustain, or those in which the board has "oilcanned" downward, reversing its crown so the string cannot touch the board at the ends without being displaced by the sagging belly in the middle. Also watch for the roller coaster effect, where crown is present in small sections but the board has dipped or distorted (usually under bridges) elsewhere.

Bearing refers to the relationship

between the bridges and the strings. If the piano had no bridge, the strings would form a straight line from hitch pin to front termination. When we look for bearing, we are really asking if the bridges are displacing the strings from this straight line, sufficiently for there to be adequate transmission of energy and solidity of termination.

A number of bearing gauges are available to "read" this condition. I use the simple rocker type with feeler gauges to measure the gap under the back (hitch) leg of the gauge as it stands with the front leg resting on the speaking length of the string and the middle leg standing on the string on the bridge. Bearing will vary greatly, from piano to piano, section to section and season to season. In general, we look for the most in the highest treble (typically, around .030"), diminishing toward the middle of the long bridge (frequently down to .010 or less) and increasing slightly on the bass bridge.

Experience has taught me not to analyze bearing just by numbers (or even degrees). It too is only one of several bits of information to be considered as a whole. Crown is another; the remaining one is sustain.

Sustain is measured by plucking strings, rather than striking them with the hammer (this eliminates any effect of hammer condition, regulation, etc.). Pluck an undamped string and time how long it rings until it completely fades out (past what we would consider useful musical tone). Do this at least once in each section, paying particular attention to the five to six octave (first capo) section. We like to see sustain in this area of at least 15 seconds, which usually indicates a very good piano. For some reason, many of the grands I encounter run to 12 seconds and quit. These pianos function well as they are: some improvement may be possible by manipulating other factors in rebuilding. If bearing and crown are both good, a sustain much less than 12 may mean that the instrument will be weak in the treble, regardless of what is done.

The high treble will not have this length of sustain; tenor and bass should go much longer. There is variation in the nature of the sustaining note as well: some start loud and fade but then seem to recoup and strengthen and then gradually die. This, in my experience, is also the mark of a fine, resonant board.

These factors occur in so many combinations it would be impossible to suggest an analysis of them all. Some of the more common are:

Poor bearing, minimal crown, good sustain. This is typical in older boards: the board has sunk over the years, causing the bridges to drop and the bearing to weaken. This has lessened the load on the board, however, so if there is still enough positive bearing for transmission of energy, the board is very free to sing. These pianos often lack power but are quite sweet and resonant. Increasing the downbearing may boost the power but it might also lose some of the sweetness and overload the board, hastening its demise.

The opposite may occur in the piano with *lots of crown, heavy bearing, short sustain*: a punchy, aggressive sound but not a lot of "sing," since the board is somewhat bound up with all that downbearing and stress of crown. Such a piano may benefit from a reduction in bearing pressure but it may lose its character.

As a final example, there is the instrument with *good crown, weak bearing, weak sustain.* Most likely, the lack of bearing is causing poor energy transmission into the board; resetting the bearing (which usually involves lowering the plate) may do miracles, although care must be taken not to overload the board.

These are simplified examples, meant to complicate our thinking. The point is that experience is the most reliable judge of soundboard condition. Routinely analyze boards in good pianos and bad: put the results in your personal information bank for future reference. Don't hang up on numbers or gadgets — if they help you, use them. If they don't, use what does.

Although the skills of soundboard replacement have become more common among field technicians, it is still more usual that, when we rebuild a piano, we retain the old board. The ability to repair and refinish are still important, and I'd like to go into some of those procedures in the remainder of this article.

The pertinent data has been recorded and the piano disassembled (include removing nose bolts — your knuckles will thank you — make a reference mark or measurement first to speed reinstallation). Vacuum, brush, shovel or whatever to remove loose dirt and debris. Then wash the board; this can be done with Murphy's oil soap and warm water, followed by rinsing and drying (don't let the board stand wet for any longer than necessary. I use a scrub brush on the tops of the bridges, quickly followed by rinsing and compressed air to dry them.

Some technicians object to water on the board, since it may seep into cracks, carrying dirt with it or causing temporary swelling. For them, wiping the board down with naphtha or paint thinner seems a better procedure.

The purpose is to clean the board so any damage is easily visible, and also to remove dirt which would otherwise grind into the exposed bare wood when the board is shimmed, scraped, etc.

If there is damage to repair — cracks to shim and/or ribs or edges to reglue — I heat the board first. Two or three Dampp Chasers are installed under the board, and an electric space heater is placed just under the bellyrail or front edge of the board. I cover the piano with moving pads and blankets — not plastic or synthetic dropcloths, which would hold moisture. Cover the board and arrange the draping so it hangs down to the floor around the case. The object is to create a tent which will retain heat under the board. The board should feel noticeably warm to the touch, although without hot spots which may scorch (and watch the finish on the legs...). If shim stock is to be used, put that on top of the board and let it cook as well.

How long? Yet another judgement call. If there are cracks, draw a pencil line across the ends before cooking the board, and watch to see if the cracks lengthen — if they do, continue to cook until the lengthening stops. Some technicians claim they wait until the cracks have doubled in width. Others use moisture meters. Most of us wait a week or so, see that the cracks have lengthened and widened, see that the crown has dropped (after the usual initial increase in crown when stringing pressure is released) and figure it's time to get on with the job. I leave the Dampp Chasers on and running the entire time we work on the board, and the shop is dehumidified to about 45 percent.

Now, I don't mean to be obnoxious, particularly since I know this will

come out when my friends in the east and midwest will be in slush up to their eyebrows, but the climate in the Bay Area is so mild and stable that we see very few cracks in soundboards. Pianos simply are not subjected to the extreme swings in humidity which cause the alternate swelling and shrinking of wood which leads to soundboard cracks in the first place. In fact, technicians out here speak (smugly, I'm afraid) of "California pianos" (which, having spent their entire lives in this area, have clean, intact boards with good crown and no cracks) and "East Coast pianos" which are in rather different condition.

I'll be the first to admit that the shimming and rib repair skills I worked so hard to gain during my years in Cleveland have suffered. This also means I have no suitable subjects to photograph in order to get drawings for these articles! However, I did have a little Knabe come through with some rib separation, even though there were no cracks or compression ridges in the board.

If there are such rib (or edge) repairs needed, they should be done first, before any shimming or refinishing. Delamination associated with a crack usually results in one or both edges of the board lifting. It must be returned to an intact joint with the rib (and thereby leveled): shimming first would do nothing but interfere.

The problem of rib regluing is clamping. For wood glue to work, sufficient clamping pressure must be applied. One method is to put a screw, with a soundboard button as a washer, through the board into the rib. This is sometimes finished by removing the screw (once the glue has dried) and putting in a dowel, possibly capped with a spruce plug. If well-fitted, this repair can be perfectly acceptable although it is visible.

The soundboard toggles we can buy are best used only in quick-fix, no-show situations, such as old uprights with delamination occuring under the plate, where screws cannot be inserted from above. The toggles require drilling rather large holes and the use of a washer to prevent punching the toggle right through the board. They, too should be removed and a dowel inserted when the repair has dried.

Some clever technicians have solved the problem of under-the-plate clamping by making small air bladders out of bicycle tire tubes, inserting them between the board and plate (and bracing the ribs by wedging against backposts). The bladders are then filled with air, providing clamping pressure as they are forced against the plate.

Another system is "derricks." These are blocks of pinblock material, cut to an L-shape. A tuning pin is installed into the vertical part of the L (sticking out above and parallel to the lower leg of the L) and a screw is inserted into the block to which a piece of music wire is firmly anchored. This anchor point should be roughly in the same plane as the hole in the tuning pin. Small holes are drilled through the soundboard on both sides of the rib where delamination has occurred. The loose end of the music wire goes through one hole, around the rib *with adequate heavy leather padding to prevent cutting through the rib* and up the other side back to the derrick, where it is inserted into the tuning pin. Turning the pin will tighten the wire, forcing the board and rib together. The blocks don't have to be huge, but they must be wide enough to keep from tipping over, and thick enough to give good purchase for the tuning pin.

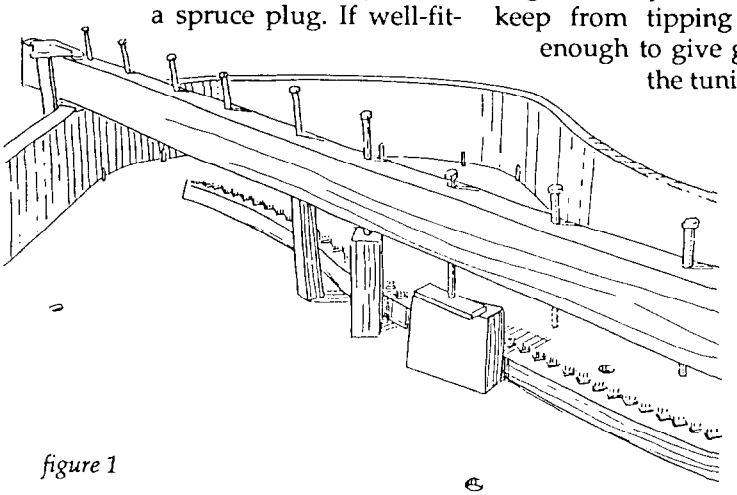


figure 1

Go-bars can be used, if the ceiling has a conveniently located beam which will withstand the pressure. Sheetrock is not adequate. Pictured here is a 2 x 4 and T-nut arrangement which I use (figure 1). The T-nuts are inserted in the bottom side of the beam and bolts run down from the top. The beam is clamped to the case and the bolts run down onto padded blocks of wood. The ribs are braced from underneath with wedges against the posts. In the case of this job, there were no cracks so I did need to drill tiny locator holes next to the delaminated ribs, but usually this procedure can be done leaving no visible marks on the board. If the 2 x 4 had some sort of inflexible metal cap it would work best, since the beam does flex upward as the bolts are tightened, requiring several rounds of retightening.

As I've said, my shimming skills are not quite as current as I'd like them to be. Therefore, I won't go into shimming, saving it for a time when I've been doing some and the topic is fresh. Instead, I'll skip to soundboard refinishing.

Most of the work of refinishing an old board is in removing the old finish and re-preparing the surface. Some of us have become adventurous and started using chemical strippers; others have gone mechanical and are using one of the multitude of sanders on the market. I still do the bulk of the work by hand with a scraper.

Why? Primarily because I'm afraid to use stripper on boards, worrying that an adverse effect on glue joints would wipe out any time advantage. I don't care for sanders in the initial stage of finish removal, partly because of the noise and dust (even with those darling little collector bags) and especially because a grit coarse enough to cut most finishes is also entirely too coarse to use on spruce. The sandpaper grit and the particles of old finish get caught under the sander and leave deep, pronounced swirls. Although these can be sanded out working with the grain by hand, it is laborious and usually results in uneven sanding, leading to uneven finish absorption, etc., etc. I find that a little care taken right at the beginning not to gouge or scratch the board pays off in the long run with greatly reduced sanding time. After all, the board was sanded smooth once before the original finish was applied; the object is to remove the finish and rediscover that nicely sanded surface.

The trick of using scrapers is to find one — or several — that you like

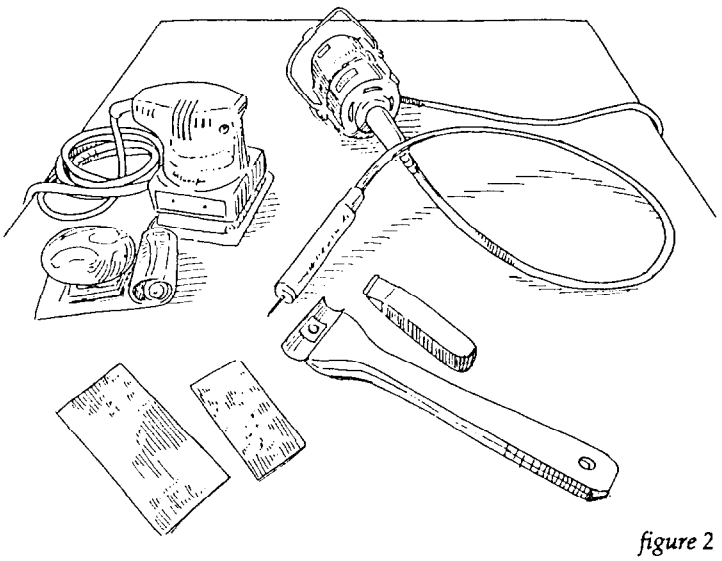


figure 2

(figure 2). Sometimes a rigid scraper seems to work best: a plain cabinet scraper, a handled paint-type scraper, or a homemade tool fashioned from a plane iron.

My preference is usually for the flexible cabinet scraper, which looks pretty much like a steel index card. To be properly used, it is grasped at the edges and flexed in the middle by thumb pressure (figure 3); although it is normally pushed, it can also be pulled toward you, tilting the scraper so the working edge grabs.

Bridges are most easily done with a small hook or paint scraper. As stated a few months ago, I use a small conical cutting burr in the Foredom to scrape betwen bridge pins, cleaning up this critical termination area and yielding a very clean-looking bridge. I like to do this first, and then use the hook scraper to smooth the notch as I scrape the remaining finish.

Flat cabinet scrapers (either flexible or rigid) are among the easiest tools to sharpen. Instead of a bevel, the edges are customarily sharpened square and then a wire edge is drawn with a burnisher. Hook scrapers are only slightly more difficult, since one edge is beveled. If the cutting edge has become deeply gouged or chipped (gremlins working in the shop at night), you may need to begin by "nosing" off the edge on a grinding wheel so it is once again an unbroken straight line, at right angles to the sides of the tool. Keep the edge cool when grinding by quenching it in water. If you see the metal change color, you've removed the temper from the edge and it must be retempered — or discarded.

After the basic shape is established, continue with sharpening. If you were to magnify the edge at this point, it would be very jagged, almost like a serrated knife. What we now need to do is gradually reduce the size of those serrations.

In the case of scrapers, begin with a file. Clamp your work and use a moderate-to-fine flat file. Keeping the file at a right angles to the sides, file material off the narrow edge of the scraper (figure 4a). Continue to do this until you can see (by the shiny new metal exposed) that the whole edge is being contacted by the file, and you can feel a wire edge on both sides of the surface you are filing.

Feeling a wire edge is the trick to sharpening. It helps to have fingernails, which most of us rarely do. The wire edge is the tiny curl of metal which will form along the edge you are sharpening. As you file, some metal is removed, but some is pushed out to the side and will eventually curl over and can be felt. You want to continue filing until you can feel a continuous wire edge along both sides of the scraper.

At that point, switch over and file the sides (figure 4b). This works the wire edge back up the other way; it will now begin to develop on top, on that narrow edge you were just filing. Here, too, it can be felt, and the sides should be worked until it is continuous.

It should be apparent that wobbling the file across the edges will destroy what we are trying to do, which is to form a sharp, square edge. Keep the file absolutely parallel to the surface being worked.

In the initial stages, the wire edge will be very uneven. You will find that in order to have any wire at all in some places, it builds up quite heavily in others. As you alternate between sides and top, the wire edge will become finer and more uniform. When this happens,

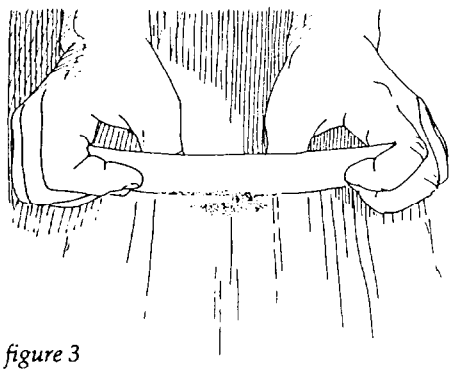
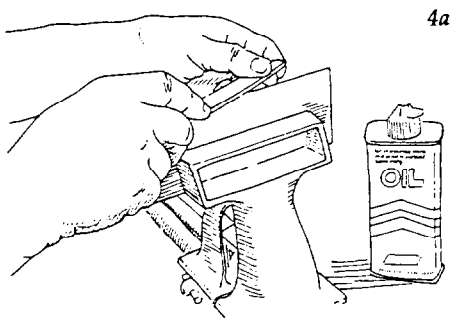


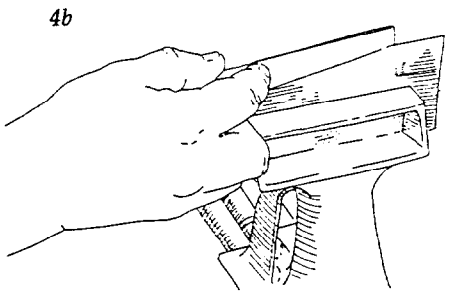
figure 3

switch to a finer sharpening tool.

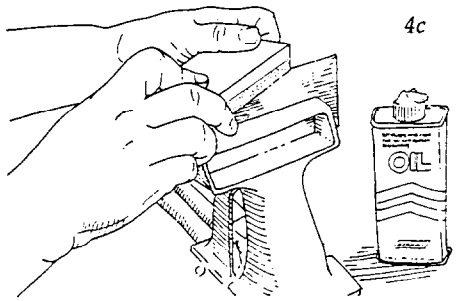
I use the medium side of a combination sharpening stone (figure 4c). The procedure is the same, although a stone is used with a swirling movement instead of a straight push as with a file. This is done so the entire surface of the stone is utilized, extending its life and keeping the surface level. In this instance, an oil stone is being used: sharpening stones are meant to be used with either oil or water as a lubricant. The lubricant keeps the metal particles from



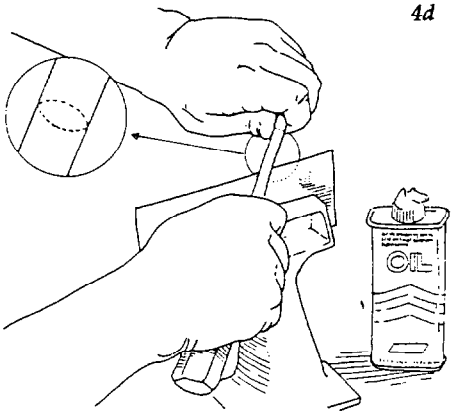
4a



4b



4c



4d

clogging the stone, which would glaze it and render it ineffective. Wipe off the oil from time to time and reapply.

After raising up and knocking off the wire edge several times with the stone, you may be ready to finish off with the burnisher. Ordinarily, the sharpening procedure would continue to at least one more stage, with a finer stone. If this were a knife, chisel or plane, the edge would still be too coarse. If the scraper were to be used to smooth hardwood, it would also need further, finer sharpening. In this case, however, we are concerned with finish removal: the slightly coarser, jagged "teeth" will help bite into the finish. (Have you ever noticed that a slightly dull knife will cut through the skin of a tomato better than a sharp one? Same principle.) Spruce is too soft to scrape to a smooth surface: it bubbles and tears under scraper pressure. It will have to be sanded: as long as the scraper is not so coarse it scratches the board, it will be more effective if left a little short of razor-sharp.

The final step is to recreate the wire edge with a burnisher. The tool pictured (figure 4d) is an oval burnisher — a heavy smooth blade like an overgrown papercutter. I make my final pass with the stone on the sides of the scraper, so the wire edge it leaves is on the narrow top surface. Then I make two passes with the burnisher, holding it level across the top, bearing down as hard as I can and running it along the surface. This actually squashes the edge, causing a slight mushrooming. Then I tilt the burnisher at about a 30° angle and run it along both sides of top surface, resulting in a wire edge (figure 4e). At this point, since the scraper has been sharpened, the wire edge forced by the burnisher is surprisingly strong and uniform — it can be easily seen and felt. This is the cutting edge — this little curl of metal is what gives the scraper its bite.

A similar procedure can be done with blades for hook scrapers. One edge is usually beveled; it will be the "top." Maintain the bevel as you sharpen, working the wire edge back and forth (in cross section, this edge is pointed rather than square as on a cabinet scraper). When the edge is sufficiently sharp, use the burnisher to curl the wire edge away from the bevel. When using the burnisher on a hook scraper blade, try not to round off the corners — let up on pressure on the burnisher just as you reach the corner of the blade.

Next month the Forum will be the annual NAMM show review, so I'll pick up with this in two months.

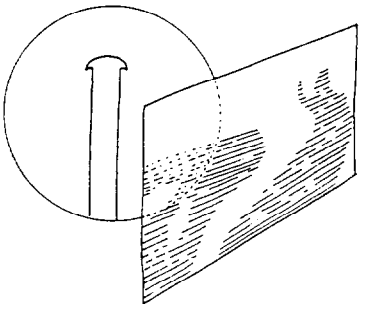
More on drum repetition:

I'd like to make a few comments about the response to my October 1989 "Drum Repetition" article that appeared in the January 1989 Journal.

Apparently the writer has not seen any new Steinway D's, but has had the occasion to deal with repetition problems in several new Steinway B's. I, too, have encountered the problem in new B's, but not nearly as acutely as in three new D's I have serviced regularly. I do not have as much experience with the smaller, new Steinways (S, M, L) but, as with the anonymous author, found the ones I have seen to exhibit no intractable repetition problems.

The author's analysis of the problem poses some interesting questions (please read for specifics), but I don't think his/her proposed solution of changing repetition springs would have been a guaranteed cure for the kind of repetition idiosyncracies I had to deal with in my problem pianos. For one, I have hung New York Steinway hammers in pianos into which I have also installed Renner shanks and wippens (B's and D's), and experienced no repetition problems. In fact, a D on one of our performance stages here at Oberlin has this action configuration, and performers frequently comment on the responsiveness of the action and its quick and positive repetition. So why, then, as the author observed, do the new S, M, and L models with their "all American" actions repeat better than the new B and D models with their amalgamated actions of Renner action parts and New York Steinway hammers — especially since I have had success with rebuilt versions of the latter?

I believe the answer lies in a combination of factors. For one, the smaller pianos inherently behave better during drum repetition than the larger. Their shorter keys have less mass and, subsequently, exhibit less inertia during rapid acceleration/deceleration of the key, permitting movement of the key more conducive to good drum repetition than the longer keys in larger pianos. Also, the shorter key inherently provides for higher checking than the longer, thus helping drum repetition. To visualize this, see the accompanying drawing. It should be obvious that the shorter key travels over a greater arc and has more movement per unit of key length. Therefore, at a point which is a constant distance behind the capstan with two keys of different length (but the same key ratio), the shorter will travel more; the backcheck position is such an area in grand pianos. The end result is that higher checking for the shorter key is possible because the backcheck does not have to be inclined toward the hammer as much to realize a specific checking height. In the piano with longer keys, the hammer will rub against the backcheck sooner as the backcheck is regulated toward the front of the key for higher checking. This is because it does not travel as much. The check on the shorter key also moves forward (toward the front of the key) more than the longer; this is because of the greater arc of the shorter key and further helps checking.

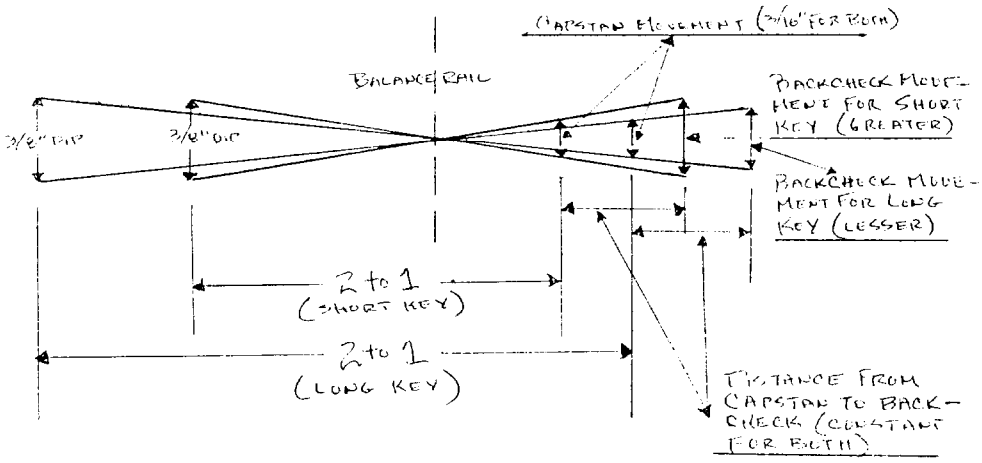


4e

In regard to the Renner shanks being suitable for good repetition, I have found them more problematic than New York parts; but, overall, the quality control embodied in their manufacture makes them more suitable for me. I believe that repetition quirks arise in using them because of the greater distance between their action center and knuckle core than the New York-made shanks. They require more key travel per unit of shank movement thus detracting from the quick, cyclic movements of the key and hammer necessary for fast repetition. However, with actions that are set up properly and with the use of good regulating techniques (see my article for specifics), they are very functional parts.

In closing, I think the anonymous author was wise to focus on the repetition spring as being part of the repetition problem outlined in my article. Its proper tension is indeed critical to the fast and positive return of the jack underneath the knuckle, a necessity for good repetition. But further support for my focusing on a poor relationship between the string height and the action as being the problem occurred when I installed the first hammer extended with tail. Without changing the repetition spring tension for the note, I discovered that the rise of the hammer upon the release of the key was still sufficient and that the increased checking height of the hammer had completely cured the drum repetition problem.

Ken Sloane, Cleveland Chapter



Oh, yes, about the cover:

After the Bay Area staged an earthquake for the national sports audience (as an A's fan, I suspect the Giants, who were clearly desperate), many of you called or wrote. Our phone lines were troublesome and things were generally disrupted, so I didn't get back to everyone. The concern was touching and greatly appreciated, however. Yes, I felt it; it came through my back yard in literal, visible waves, strong enough to knock me off my feet. By pure dumb luck, I had just crawled out from under my house, which would have been a rather terrifying place to be (insulating floors—technical editor never rests). By further pure luck, I had no significant damage to house or shop and can report that our colleagues around the area survivied similarly. LaRoy Edwards (who lives quite close to the epicenter) lost all the mortar out of one chimney on his house, although the bricks remained in place. His new store in Santa Cruz also survived with minimal damage.

The effect on pianos was noticeable. Since there is tremendous variation in the degree of shaking depending on structure, soil, distance from epicenter, etc., the effect varied. Many pianos went out of tune, as if they had been shaken in a truck. Others sustained damage such as shown on the cover; that is the leg off a Steinway A. Fortunately, the piano didn't fall; since the dowel in the center was not broken, the leg was easily repaired by pulling it completely apart, gluing and clamping.

Plenty of instruments weren't so lucky. I know of one Steinway grand which danced across a 25-foot living room and flipped onto its side. Others had bookcases, walls, ceilings, and other home debris fall on or into them. Uprights tipped over, breaking action rails. There were some amazing things: Larry Riley tells me of a piano which moved about three feet and remained intact while the rug it had been standing on moved out from under the piano and into a different room. And, of course, there were tragedies—heirloom instruments in collapsed and burning apartments in the Marina. All in all, it was an experience I hope not to repeat, but as those of you who have survived such things know, life does go on. It's never the same, but it is life, and we just take it as it comes. Thanks again for the concern. ≣

TUNING UP

Temperament

Rick Baldassin
Tuning Editor

This month we have a letter from Albert Stanley, of the Detroit-Windsor Chapter. It came so long ago (March 1988) that I am almost embarrassed to print it. It was this letter which prompted the column which appeared in June 1988, on temperament. I had received this letter the day before I left on a business trip to Hawaii. I knew that I would have to write my column the day I arrived home, so I read the letter, and set it aside while I was gone. As it turned out, my stay in Hawaii was prolonged, and I ended up writing the column in Hawaii. Of course, I didn't have the letter, but remembered it was about the temperament. Somehow when I returned home, the letter got buried, but surfaced the other day, and deserves attention now. I am sure Albert has found the answers he was looking for by now, but I am sure others may have the same questions. Albert writes:

I wish to be brief as possible and to the point. I am so thankful for this wonderful guild of professional tuners. My problem is in temperament. I always seem to have a poor fifth in the nest. Usually it is G up to D, or G# up to D#. Not only that, but I am sure my tuning is unstable, and wanders after the first week. This makes me unhappy. These inaccurate fifths seem to show more on spinets or cheaper pianos. I realize that some pianos tune up easier than others, but I also know this: Other tuners do a better job than I can, even on junk. So where am I going wrong?

One major fault which I have already found is hammer technique. Jerking too hard surely does not pay. You have to make moves in very small increments.

I also realize that you have to hear very well and make good comparisons and checks. But after all is said and done, and you abide with all the rules the best you know how to, and you still aren't that good, I wonder if some people are natural-born tuners with very high technical skills, while others may never make it. I have hoped never to be in that category. My goal is to be very good, but sometimes wonder if I am fighting a losing battle. For this reason, I am purchasing an Accu-Tuner, which some technicians still don't agree will answer the question or my problem. Their answer is only a lot of experience. Do you agree? Please be honest, because I believe in you.

My new Young Chang baby grand is giving me an awful time with the pins. They are stiff as a board, and twist before they turn. They also jump up or down in pitch a lot before the pins even move. Other pianos don't react this way. What then is the best way to deal with the tight pins and make sure the tuning is solid? I have heard some technicians say that they like the piano, and that it is easy to tune, and they do a good job. I would appreciate your comments and help. With very fine respect, I close with sincere appreciation.

Albert was correct in pointing out that the smaller, less expensive pianos do not tune up as easily. The main reason for this is the scaling on these pianos is not as refined. Quite often, they have wound strings present in the temperament octave. The inharmonicity on these wound strings usually drops suddenly, causing problems with the temperament tuning. I am sure we have all encountered instruments where to make one interval sound good, one or more others sounded bad, and there was no solution to the problem. In addition, on these smaller instruments where the strings are shorter and the piano is at a lower tension than it should be, there tends to be a pronounced beat in the fifth at the 6:4 level. The beat in the fifth that we are supposed to listen to is at the 3:2 level. This additional beat is an octave higher, and is beating faster and louder than the beat we are supposed to listen to. It is pretty hard to ignore, and there is really nothing you can do about it, except learn to like it. It isn't your fault it is there, so don't feel bad that you can't make it go away.

Knowing there are two beats present, you can now focus in on the proper beat at the 3:2 level. Real problems can result if the 6:4 beats are tuned at the beat rates that the 3:2 partials should be tuned. Since the 6:4 partials are an octave higher than the 3:2 partials, the beat rates are about twice as fast. If the 6:4 partials beat at the 3:2 speed, the fifths are not as contracted as they should be. If you tune a circle of fifths, most of which are not as contracted as they should be, the last fifth takes up all the slack.

Albert did not state what temperament sequence he was using. So many sequences require that many notes be tuned before you can tell whether errors have been compounding. For this reason, you should look for a temperament that allows you to verify the tuning of the initial notes in a small number of steps. It is a lot easier to discover you made an error after four notes than 13.

Albert was also correct in observing that pin movements must be made in small increments. The thing which is hard to realize, at first, is sometimes small pin movements do not necessarily yield small pitch changes. In general, the tighter the pin, the more the pitch has to change, for even the smallest pin movement. This is why less experienced technicians have trouble tuning pianos with very tight tuning pins — they become unnerved trying to make small adjustments. They also make the mistake of trying to alter the pitch too much and fine tune at the same time. In the final pass of a tuning, hardly anything should be moved much, at all!

A short time ago, another technician observed me tuning for a symphony

concert. Though the piano was not far out of tune, I explained that the instrument would not stay in tune for the concert unless I went through it an additional time, first to get it very close, and finally to fine tune it. During the second pass she commented, "You certainly don't overshoot very much." I responded I didn't want to, I shouldn't have to, and I couldn't if I wanted the piano to stay in tune for the concert. The final tuning should include only the smallest movement in pitch. At the conclusion of my final pass, which consisted of the most minute adjustments on very few notes, I looked up and told her, "This last pass is what they pay me for." Don't make the mistake of moving too many strings around too much on your last pass.

I believe some people are more inclined to this profession than others, just as some pianists are more gifted than others. But there are a lot of good pianists out there who got to where they are with a lot of hard work. Don't get me wrong, the really gifted pianists have to work hard, too, because more is expected of them. To be really good requires hard work, practice, and experience. Part of the hard work includes learning all of the "rules" which Albert referred to. These include proper hammer technique, listening skills, aural tests, and so on. The more knowledge you are equipped with, the better off you will be. No amount of technical knowledge, however, will substitute for experience. On the other hand, a lot of experience not knowing what you are doing doesn't amount to much, either.

I know some people feel electronic aids are simply crutches for people who didn't learn the way they did — the hard way. And they certainly can be crutches to those who care no more than to watch and stop the lights. To a student who is intent on learning and improving, the electronic aid can be an invaluable teacher. The electronic aid demonstrates graphically things like stability, and that pianos don't go flat uniformly. In addition, by carefully listening while using an electronic aid, one can actually learn what good octaves are supposed to sound like, what differing amounts of stretch sound like, and so on. Without a human teacher available, the student can do his best job tuning aurally, then check to see how he did with the machine. You determine what you will get out of it. If your goal is to use the machine as a shortcut to get you into customer's homes for a buck, that is about as far as it will go. If your goal is to use the machine to help teach you to be as good as you can be, the results will be more positive.

On the question of the tight pins, I recommend that you read "Tuning Stability" by Peter Wolford, which appears in this issue. It talks about pianos with tight pins. My experience is pianos with tight pins are a pain if they are very far out of tune. Once the time is invested to get them in tune, they seem to hold well.

Finally, acquire and maintain good tools. The tough jobs are even harder with poor tools. One of the best investments I made was in an expensive tuning hammer early in my career. I was amazed at how much easier the job became with a good tuning hammer. Continue your quest for knowledge and experience. I know you will make it.

Our next letter comes from Charlie Huether, RTT, of the New Jersey Chapter. Charlie writes:

Just wanted to tell you how much I enjoy your interviews with concert artists. I hope you will have more of them. The interplay between artist and technician is excellent. The insights into the different approaches to the instrument and its condition are valuable to everyone including most of us who do limited concert work, if any at all. We can all benefit from these interviews by interpolating them into our everyday work situations. The information as well as the "art" of extracting that information from the piano user (professional or amateur) are important work skills which can make one's day go more smoothly, besides helping to develop the image of a great diagnostician and problem solver.

I have had so much positive response on the interviews that I intend to continue them as long as the opportunity presents itself. The common thread that I have seen woven between those I have interviewed reminds me somewhat of the recent events in Europe. I sense that the "walls" which have existed between artists and technicians are coming down, because both sides want them to. Because of the nature of the mutual dependence between artist and technician, good friendship, mutual respect, and cooperation are in everyone's best interest.

This month, Michael Travis' article deals with the temperament as it relates to the tuning examination. As temperament was Albert Stanley's question this month, I feel it appropriate to print a few temperament systems here, some of which Michael refers to in his article. Remember that the end goal of each system is the same — to produce equal temperament on the modern piano. Try a few, and see which system, or combination of systems, works best for you.

Sanderson Two-Octave "A" Temperament

The two-octave "A" temperament is tuned from the outside in. That is, the widest intervals are tuned first in order for tuning problems with the piano to show up at the earliest possible stage when they are easy to correct with minor compromises. The three A's are tuned first to establish octave and double octave widths compatible both with each other and with the scale of the piano. Then this span is subdivided into six equal parts with the tuning of six contiguous major thirds that rise perfectly. Finally, the three notes within each major third are equally spaced primarily by the tuning of fourths and thirds.

Tuning wide intervals first and then subdividing them is inherently more accurate than the usual process of building up from narrow to wide intervals. Furthermore, it is a foolproof way of building a temperament because the narrow intervals are forced to be compatible with the wider ones. Also, the skeleton framework of six thirds can always be tuned to rise smoothly all the way. This virtually guarantees rising thirds in the completed temperament unless there are very serious scale problems with the piano.

1. Tune A4 to 440.

2. Tune A3 from A4 as a 4:2 octave, 1/2 beat wide (M10 1/2 beat faster than M3).

3. Tune A2 from A3 as a 6:3 octave, 1/2 beat wide (m3 1/2 beat slower than M6).

4. Check A2-A4 double octave, no more than one beat in the 4:1 partials (M17 no more than one beat faster than M3). If too wide, compress both octaves slightly to get acceptable double octave.

5. Tune C#3 and F3, dividing the A2-A3 octave into three equal parts. Done correctly, this gives beats in the ratio of 4:5 in both pair of contiguous thirds. That is, A2-C#3 gives four beats in the same time period as is required by five beats of the C#3-F3 third. Similarly, C#3-F3 beats four times for five beats of F3-A3, and can be checked by comparison of tempos without paying any attention to the beats per second of either.

6. Tune C#4 and F4, dividing the A3-A4 octave into three equal parts. Use 4:5 beat ratio check as before. Then check that all six M3rds rise with the same 4:5 beat ratio, and make adjustments to both C#'s and F's until they do, because this result can be achieved on all pianos, regardless of existing scale problems.

7. Check that the three M10ths formed by these seven tuned notes also rise in the ratio of 4:5. Check the two new octaves, C#3-C#4 and F3-F4, with the M3-M10 and m3-M6 tests. Scale problems with smaller pianos will show up here, and it may be necessary to compromise the perfectly rising set of thirds to get satisfactory octaves and tenths.

8. Fill in the notes between F3-A3 and A3-C#4 (six untuned notes) to get a nine note "mini-temperament," tuning up a fourth, down a M3rd (or down a fourth, up a M3rd as you prefer). Do not touch F3, A3, or C#4, which have already been tuned, and should not be moved. With just nine notes to worry about, it is always possible to get five perfectly rising M3rds and four perfectly matched fourths no matter how bad the scale is. One way to tune this sequence is as follows:

a. Tune A#3 up a fourth from F3. Tune F#3 down a M3rd from A#3, rising with respect to F3-A3. Tune B3 up a fourth from F#3 to match F3-A#3 fourth.

b. Tune G#3 down a fourth from C#4. Tune C4 up a M3rd from G#3, falling with respect to A3-C#4. Tune G3 down a fourth from C4 to match other fourths.

c. Test that the G3-B3 M3rd is halfway in beat speed between F#3-A#3 and G#4-C4. If not, the fourths are wrong. Proceed as follows:

d. Expand (or contract) both the F#3-B3 and G3-C4 fourths, keeping them matched to each other, until the G3-B3 M3rd is correct, retuning only G3 and B3.

e. Retune F#3 and A#3 in such a way as to match the two affected fourths, and to place the F#3-A#3 M3rd halfway in beat speed between its two adjacent neighbors.

f. Retune G#3 and C4 so as to match the two affected fourths, and place the G#3-C4 M3rd halfway between its two adjacent neighbors.

g. Test that there are five perfectly rising M3rds and four virtually identical fourths.

9. Tune in both directions away from the mini-temperament, checking both thirds and fourths. The beat rate of each new third can be obtained from that of its previously tuned contiguous third, above or below. Fit each note in using both intervals, (and others as they become available), until the entire two octave span has been tuned.

10. Final test: Rising thirds all the way, all fourths acceptable, fifths nearly pure.

Foli-Baldassin F To F Temperament

This system is like tuning a banjo or guitar. You start with the outside notes, and the other notes must fit between. The system begins by tuning a chain of contiguous thirds from F3 to F4. The position of the second chain is determined by the tuning of contiguous fourths, both up from F3, and down from F4. Linking the chains of contiguous fourths together with the second chain of contiguous thirds cements the foundation, and determines the position of the remaining two chains of contiguous thirds. This system attacks the temperament in three stages. During each stage, adjustments are made until everything is in order, then the notes are left untouched for the duration.

1. Tune A4 to 440 Hz, using note F2 as a reference note.

2. Tune A3 to A4 using the M3-M10 test.

3. Tune F3 from A3. Make a guess as to the speed (approximately seven BPS).

4. Tune C#4 from A3, such that the beat rate is in a 5:4 ratio with FA.

5. Tune F4 from F3 using the M3-M10 test.

6. Test C#4-F4 M3 to see if it fits in the 5:4 progression FA-AC#-C#F. If C#F is too fast, then FA and/or AC# are too slow. If C#F is too slow, then FA and/or AC# are too fast. Adjust F3, C#4, and F4 until the 5:4 progression if contiguous thirds are good, including F4-A4.

7. Tune A#3 from F3. Make a guess as to the speed (less than one BPS). Test A#F fifth.

8. Tune D#4 from A#3, slightly faster than FA#.

9. Tune C4 from F4, about the same speed as A#D#. Test FC fifth.

10. Tune G3 from C4, about the same speed as FA#. Play parallel fourths FA#-GC-A#D#-CF.

11. Tune B3 from G3. GB must fit between FA and AC#.

12. Test B3-D#4 M3. It must fit between AC# and C#F, and be in a 5:4 ratio with GB. Play parallel M3rds FA-GB-AC#-BD#-C#F. If BD# is too fast, then fourths were tuned too wide. If BD# is too slow, fourths were tuned too narrow. Repeat Steps 7-11 until Step 12 is satisfied.

13. Tune F#3 from A#3. It must fit between FA and GB, and F#B fourth, F#C# fifth, and F#D# sixth must sound good.

14. Tune D4 from A#3. It must fit between AC# and BD#, be in a 5:4 ratio with F#A#, and AD fourth, GD fifth, and FD sixth must sound good.

15. Tune G#3 from C4. It must fit between GB and AC#, and G#C# fourth, G#D# fifth, and G#F sixth must sound good.

16. Tune E4 from C4. It must fit between BD# and C#F, be in a 5:4 ratio with G#C, and BE fourth, AE fifth, and GE sixth must sound good.

Now that all temperament notes have been tuned, test all parallel M3rds, fourths, fifths, and M6ths. Since all these intervals have been tested along the way, all progressions should sound good. Make any minor adjustments as necessary, bearing in mind all tests used in the step the note was originally tuned.

As you may have noticed, in this system M3rds and fourths are tuned, testing with other thirds, fourths, fifths, and sixths. Because the M6th is a M3rd plus a fourth, the M6th progression is fairly well controlled. Because no fifths are tuned, every fifth in the temperament is the result of notes which have been tuned via other intervals. For this reason it is important to listen carefully to each fifth as the instructions indicate to ensure good sounding fifths.

This system also requires listening to parallel intervals in a slightly differ-

ent fashion than usual. It begins by listening to the progression of Major thirds which are four half-steps apart (contiguous), then two half-steps apart (whole tone), and finally one half-step apart (chromatic). With practice, it can be as easy to predict the contiguous and whole tone progressions as it is the chromatic progression.

Coleman A To A Temperament

1. Tune A4 440 Hz using tuning fork and F2; F2-fork = F2-A4.

2. Tune A3 to A4 octave such that F3-A3 3rd is .5 BPS slower than F3-A4 10th.

3. Tune F3 to A3 approximately seven BPS wide. Metronome 104 x 4 beats.

4. Tune F4 to F3 octave such that C#3-F4 10th is .5 BPS faster than C#3-F3 third. F4-A4 should be approximately 14 BPS wide.

5. Tune C#4-F4 3rd to balance with A3-C#4 3rd; the ratio of each of the four thirds should be 4:5. If F3-A3 is too slow and A3-C#4 is too fast, the F3 must be lowered along with F4, and C#4 must be raised, but not so much that C#4-F4 is too close to the beat rate of F4-A4. Time spent at this point pays rich dividends later. Approximate beat rates are: F3-A3 = 6.93; A3-C#4 = 8.73; C#4-F4 = 11; F4-A4 = 13.86.

6. Tune D4 to A3 fourth (approximately one BPS) on wide side of zero. Check to see that F-D sixth is one BPS faster than F-A third.

7. Tune A#3 to F4 fifth (approximately six BPS) on the narrow side of zero. A#3-C#4 should be almost one BPS faster than C#4-F4 and C#3-A#3 sixth should be approximately one BPS faster than C#3-F4 10th. Then A#3-D4 third (9.25 BPS) should beat slightly faster than A3-C#4 (8.73 BPS). This is the first check on steps five and six. Correct if necessary now.

8. Tune F#4 to C#4 fourth (approximately 1.26 BPS) on the wide side of zero. See that A3-F#4 sixth is 1.26 beats faster than A3-C#4 third. D4-F#4 should be 1.06 times faster than C#4-F4. This is an additional check on steps five and sixth.

9. Tune C4 to F4 fourth (approximately 1.33 BPS) on the wide side. See that C4-A4 sixth is slower than F4-A4, and about the same as D4-F#4.

10. Tune E4 to A4 fourth (approximately 1.6 BPS) on wide side. Also, A3-E4 fifth should be about .six BPS on the narrow side. Test C4-E4 third to be slower than C4-A4 sixth. Compare parallel fifths A3-E4 and A#3-F4.

11. Tune G#4 to C#4 fifth less than one BPS on the narrow side of zero. See that E4-G#4 third is slower than F4-A4 and faster than D4-F#4.

This completes the tuning of the primary fourths and fifths. Up to this point each fourth or fifth was tuned directly from one of the original balanced pivot tones A, C#, F, A. This eliminates the accumulation of minute errors. The three remaining secondary fourths and fifths with their corresponding checks will complete the temperament.

12. Tune B3 to F#4 fifth (approximately .83 BPS) on the narrow side of zero. See that B3-D4 M3rd is faster than D4-F#4 M3rd. B3-F#4 should be faster than A3-E4 and slower than C#4-G#4. The B3-E4 fourth (approximately 1.1 BPS) should compare well with its neighbors.

13. Tune D#4 to A#3 and balance D#4 to G#4 such that B3-D#4 equals the beat rate of A3-F#4 and is faster than A#3-D4, and is slower than C4-E4.

14. Tune G4 to D4 such that C4-G4 fits between B3-F#4 and C#4-G#4. A#3-G4 should fit between A3-F#4 and B3-G#4 sixths. D#4-G4 should fit between D4-F#4 and E4-G#4 thirds.

All major thirds should now fit into a smooth ascending progression from A3-C#4 to F4-A4. The same with sixths A3-F#4 to C4-A4. The fourths and fifths should not exhibit noticeable change in beat progression.

Defebaugh F To F Temperament

The faster beating intervals are favored in this system to give a more musical sound. The object is to create a nice progression of M3rds and M6ths, with no objectionable fourths and fifths.

1. Tune A4 to 440 Hz, using note F2 as test note, F2-fork = F2-A4.

2. Tune A3 to A4 as a wide 4:2 octave (M3<M10).

3. Tune F3 to A3 at approximately seven BPS (metronome = 105 x 4 beats).

4. Tune D4 to F3 at approximately eight BPS (metronome = 120 x 4 beats).

5. Tune A#3 to D4 at approximately nine BPS (metronome = 136 x 4 beats).

6. Tune C#4 to A3, slightly slower than A#3-D4 M3rd.

7. Tune G#3 to C#4 at less than one BPS.

8. Tune C4 to G#3, slightly slower than A3-C#4 M3rd. Test F3-C4 fifth.

9. Tune F#3 to A#3, slightly faster than F3-A3 M3rd. Test F#3-C#4 fifth.

10. Tune D#4 to F#3, slightly faster than F3-D4 M6th.

11. Tune B3 to D#4, slightly faster than the A#3-D4 M3rd. Test F#3-B3 fourth.

12. Tune G3 to B3, to fit in the chromatic progression between F#3-A#3 and G#3-C4 M3rds. Test G3-C4 fourth and G3-D4 fifth.

13. Tune E4 to G3, slightly faster than the F#3-D#4 M6th. Test C4-E4 M3rd, B3-E4 4th, and A3-E4 fifth.

14. Tune F4 to G#3, slightly faster than the G3-E4 M6th. Test C#4-F4 M3rd, C4-F4 fourth, A#3-F4 fifth, and F3-F4 octave.

Test all parallel M3rds, M6ths, fourths, and fifths. Finally, test with the inside third-outside sixth test. These should be equal beating. Play G3-B3 M3rd, followed by the F3-D4 M6th. Move up a semi-tone and repeat, etc. Complete the test by playing all four notes at once, F3-G3-B3-D4, and listen for sonority. Move up a semi-tone and repeat, etc.

Three of the above temperaments are mentioned in Michael Travis' article. You will notice certain similarities between the systems, but each has its own twist as to filling in the blanks. I am sure that if you are looking for a temperament system, you will find one of these to be suitable.

Until next month, please send your questions and comments to:

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At Large

Music Center Memories

Norman Neblett
Los Angeles Chapter

Editor's note: September 1989 marked the 25th anniversary of the opening of the Los Angeles Music Center. The inaugural concert featured violinist Jascha Heifetz performing the Beethoven Violin Concerto with the Philharmonic Orchestra. Norman Neblett served as Chief Piano Technician for the first 10 years of its operation. He was responsible for the servicing of 18 pianos located in three theaters. The following are his personal vignettes from this period.

Piano Covers

The Dorothy Chandler Pavilion was the largest of the three-theater complex comprising the Los Angeles Music Center. It was a general purpose hall seating over 3000, and home of the Philharmonic Orchestra and Civic Light Opera. There was a formal restaurant on the top floor, plus a smaller informal restaurant and a coffee shop on the street level. The entire Music Center was guarded 24 hours a day by uniformed armed guards.

The Chandler backstage area was enormous with an understage technical storage area, plus the orchestra green room, and many dressing rooms. There were two elevators, pit and center stage, to handle properties from stage to storage. The original concept was to store the two concert grands under the stage, rotating them back and forth by center stage elevator. This soon proved too cumbersome, and it was decided to store the pianos offstage. Two heavy quilted covers were purchased for their protection.

As the understage area was not air conditioned, this proved to be a better alternative for piano tuning stability. However, a problem soon developed with the covers. At least twice per week, they were found off the pianos and piled in a corner of the stage. Good natured accusations began to take place among the backstage crew about the roving covers. Rumors spread that we had acquired a ghost, who lived in the catacombs of the theater, and used the covers to keep warm at night.

It all came to a logical conclusion early one morning. The Property Master had come to work at 4:30 a.m. to make some emergency repairs. He found the covers off the two pianos. Looking around, he spotted them over in the corner. But this time, the scenario was different.

Occupying the covers was the local area security guard who was entertaining one of the attractive coffee shop waitresses. Not known for his diplomacy, the Property Master shouted, "Hey! What the hell's going on here?" With frantic urgency, the young couple grabbed their personal things and fled the stage. Thankfully, the cover mystery was solved, and we could all relax knowing that there was no "Phantom" living in the opera house.

Lighting

The Music Center was a union house. This meant that nothing moved backstage without an official call. This included light switches. Therefore, only union labor could turn on the light board or any master switches. Many times, the piano technician needed to be there during off hours when the stage was pitch dark.

Management was not about to pay an electrician to turn on lights for the piano tuner. Appealing to the head electrician, I convinced him to help me. He responded, "All right, I will make a plug hot under the console and leave you a 100 foot extension cord. However, if anyone asks, you know nothing about the plug or the cord, and you never touched a switch." Much relieved, I agreed to these terms.

One morning at 6:00, I arrived to find the extension cord missing. Knowing where the light board master was, I flipped on the switch. Immediately, the stage lights came on full force. Proceeding to tune the piano, I was interrupted by the stage union representative. "Say, did you turn on those lights?" he snarled. "No sir," I lied, "They were on when I got here." Muttering to himself, he left the stage.

Upon completion of the tuning, I decided that I had better look around. Seeing no one, I grabbed my tools, flipped off the lights, and headed for the elevators. As I approached the elevator, the union rep appeared, as if out of nowhere. "Who turned off those lights?!" he shouted. "Damned if I know," I replied, "They were off when I left."

PRACTICALLY SPEAKING

Key Bushing Revisited

Bill Spurlock
Sacramento Valley Chapter

With this article I begin a new series which will focus mainly on shop work, rather than on in-home service. I have been a workshop addict for as long as I can remember, starting with play time in kindergarten where we were allowed to hammer and saw on scraps of wood from the local lumber yard scrap bin. This early introduction encouraged me to move into my father's workshop, where I spent untold hours dulling his chisels, bending screwdrivers, and running saws into the bench top. Eventually I gained some proficiency with tools and became hooked on the satisfaction of working wood and metal into useful objects. In this series, I hope to share my enthusiasm for shop work with others. I will be presenting techniques for getting the most out of simple power and hand tools to do quality piano repair in an efficient manner.

In August 1988, Fern Henry and I presented an article on key rebushing which covered the principles of proper cloth and glue, sizing the bushings through use of accurately made cauls, and proper keypin condition. Also covered were step-by-step procedures for removing the old and installing the new bushings, emphasizing efficient tool usage and precision results. Here I will present a collection of additional tips that can make the work even easier and further refine the job.

Removal Of Old Bushings

In our original article, we recommended use of a small plastic travel steam iron that sits directly on the keys; we gave a Sears catalog number for one but have since found that it is no longer available. I suggest checking the appliance sections of local thrift stores; we have purchased at least ten from area Goodwill and Salvation Army stores (they're usually sitting next to the electric carving knives and fondue pots). The most common brand name is "Steamstress," made by Osrow. This unit emits steam only; the base does not get hot and so does not burn the key wood. The only similar device I have seen that is currently available must be held upright and emits steam from the top; this is not nearly as convenient since you have to hold the keys up in front of it.

In some cases steaming may not be the best means to remove old bushings. When steam is applied to the bushings the balance hole usually closes up, sometimes severely. This effect may be desirable if the balance holes are too loose; however, other times these holes are not too loose and steaming them only adds more work to the job since you must spend additional time easing the holes afterward.

In such cases it may be more efficient to use small wedges cut from supply house hammer scrap felt, soaked in a water/wallpaper remover solution and plugged into each mortise, to soak the bushings loose. This felt comes already wedge-shaped in long strips; you need only cut the strip lengthwise to about one inch tall and slice up into individual wedges about 3/8" wide. This method is fast since you can plug them into the keys and do other work while they soak for a half hour or longer. With old hide glue, the bushings should then come loose easily and no balance hole easing will be required. Some types of glue, including the white glues used in many old and new pianos, are slow to release with soaking alone. I find it most efficient to soak these bushings with the felt wedges to thoroughly soften the glue, and then add steam. Here the supply house electric key bushing remover (a soldering pencil fitted with a metal bushing caul tip) can be inserted into the pre-soaked bushings to create steam right where it's needed with minimal effect on the balance holes.

Improving Poor Mortises

Our goal in key bushing is to obtain a neat, consistent job with bushings that fit the pins with a minimum of easing. Toward this end, we can carefully select cloth of proper thickness and use bushing cauls accurately made for the key pin size in question. However, several variables remain. The worst of these is variation in mortise size from key to key, causing our bushing cloth and cauls to fit too loose in some keys and too tight in others. As a result we can only choose cloth thickness for the best average fit, and some keys will need easing while others may even come out a little too loose. Another problem with some keyboards, especially in the balance rail, is a mortise that is shorter (front to back) than the width of a standard bushing caul. Usually these mortises have round ends, but their flat sides may only be 5/16" long.

Both of these problems can be improved by use of the mortise file shown in figure 1. This tool consists of two four inch flat bastard files, sandwiched together with a paste-type epoxy and a piece of veneer between, and mounted in a file handle. The thickness of this assembly should be .225" - .230" when used for mortises having .146" keypins. After coating one side of each file with thick epoxy, sandwich them lightly to the veneer, making sure they are lined up one above the other. With your micrometer, squeeze the thickness down to .230", checking at both ends. Before the epoxy hardens completely, recheck the thickness of the bottom end. When well cured, grind a slight bevel on the bottom end and drive a file handle onto the tang.

To use this broach, allow the keys

to dry out after bushing removal, then plunge it once into each mortise. Those mortises that are already the correct size will not be affected, while any that are too narrow or have scalloped sides will be enlarged and smoothed. For mortises that are too short, plunging the tool in and rocking it fore and aft will compress the rounded ends, effectively making them longer. Some European keys, including some Renner keys in American grands, have very short mortises that are not rounded; special bushing cauls made very short are necessary for these.

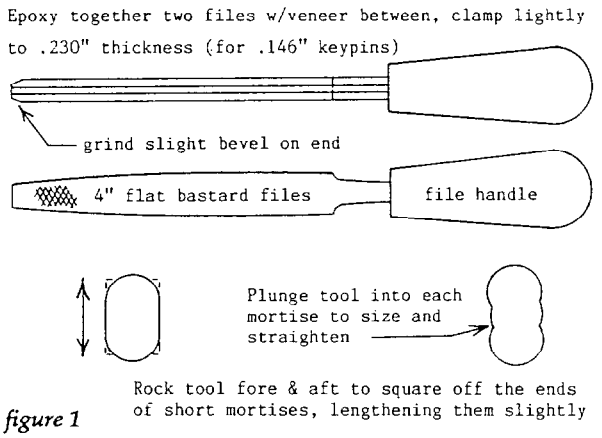


figure 1

A problem with some front mortises is an inadequate recess in the bottom of the key for the shoulder of the bushing, leaving the cloth protruding below the bottom of the key and causing key dip to feel spongy. In many cases the original recess appears to have been formed by compression during the factory bushing process; these dents then partially or entirely disappear when moisture is used to remove the old bushings, leaving little or no recess.

A new recess can be easily machined into the bottoms of the keys, prior to rebushing, with a table mounted router. (You might as well buy one now and get it over with! This is one of my favorite tools and I'll be describing many of its uses in piano work in future articles.) Use a standard 3/8" straight bit, set to protrude above the table a distance equal to the thickness of your new bushing cloth. Adjust the fence so the bit aligns with the mortise (set for naturals first, then re-set for sharps). Hold two or three keys together at a time and push them over the bit, backing them up with a scrap block so the router bit does not chop out the side of the last key as it exits. This operation takes very little time and makes for a much nicer bushing job than does slicing the protruding bushings flush with a razor blade.

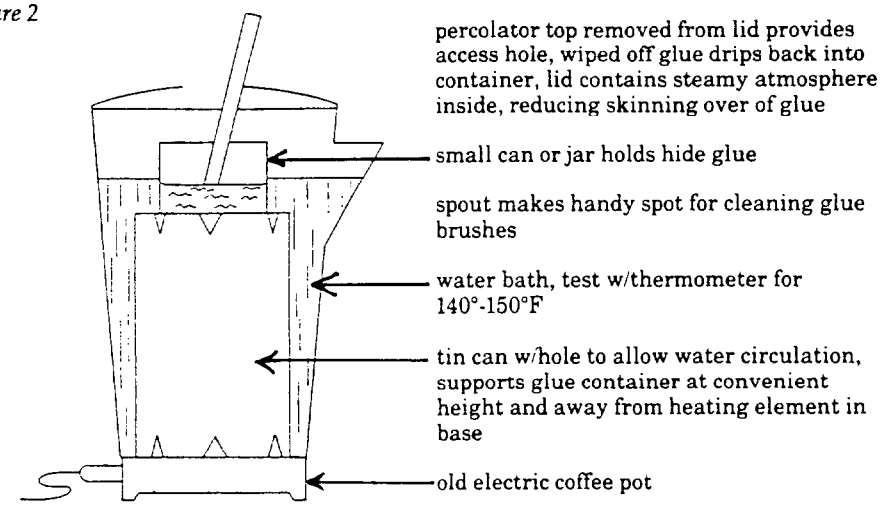
Glues

In our original article we discussed the attributes of hot hide glue that make it our choice for key rebushing and most other piano work. Here I would like to present a few additional tips for working with hide glue, and differences in result that might occur with other glues.

In my experience, once someone learns how to use hot hide glue, it usually becomes their favorite. Its advantages of quick gel time, high strength, and ease of future removal make it a trusted friend in the shop. Occasionally I hear comments like, "I don't like to go to all the trouble of mixing up hot hide glue." My response is, "What trouble?" Just put some dried glue in a small can, cover with water, place it in the water bath in the glue pot and plug it in. After 15 minutes just stir it up and start gluing. Another frequent comment is, "I've never invested in a glue pot." My response is that I haven't either, and see no reason to. Figure 2 shows our glue pot made from an electric coffee maker ($5.95 at a Salvation Army store near you), which does everything a commercial glue pot does and more. Successful use of hide glue requires a little understanding of its characteristics. Hide glue hardens in two stages. First, it will change from a liquid to a gelatin-like state as soon as it cools appreciably, usually less than a minute after it is applied to a surface. This means that it has a short assembly time, since once it gels it will not grab the other surface well. The second stage occurs much more slowly as the water leaves the glue and it actually dries. The glue will have some holding power as soon as it gels, but will not develop full strength until after drying completely. Most problems with hide glue are probably related to the glue gelling before the parts are assembled, or to trouble maintaining correct glue consistency in the pot.

Quick gelling can be a problem any time there is a lag between spreading the glue and assembling the parts, and is worse at cooler temperatures. Many are not aware that the gelling time of hot hide glue can be adjusted by the addition of urea (a nitrogen fertilizer, available at garden supply stores) to the glue. The addition of 1/2 teaspoon of urea per tablespoon of dry glue granules will slow gelling time noticeably. Amounts of one or 1 1/2 teaspoon urea per tablespoon of glue may be necessary

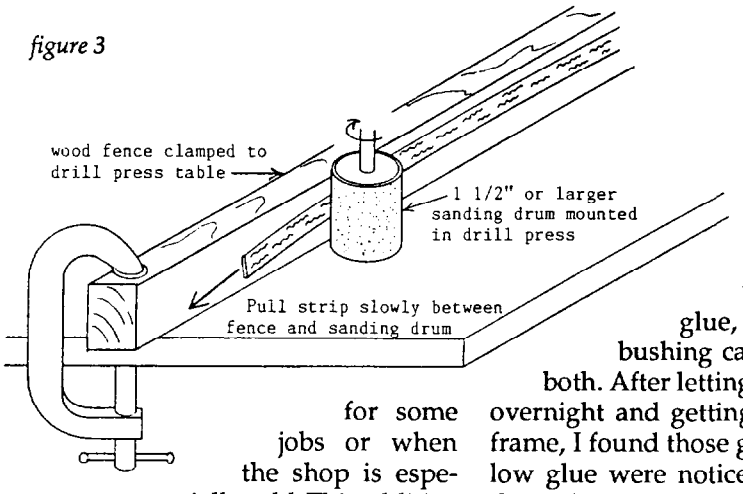
figure 2



Hot hide glue is the glue of choice for many piano jobs. It is easy to use once one becomes familiar with it; we include some basic tips here.

- add enough water to just cover dry glue crystals and plug in glue pot, stir occasionally.
- when glue is dissolved add warm water if necessary to achieve desired consistency.
- glue will gradually thicken as moisture evaporates during extended use so add more water as needed.
- glue can be reheated several times but since strength declines, it should be mixed fresh for critical jobs such as hammer hanging.
- for more on hide glue see Fine Woodworking magazine #57, March/April 1986

figure 3



for some jobs or when the shop is especially cold. This additive will not decrease the strength of the glue; on the contrary, it ensures high strength by delaying gelling until the parts are positioned and clamped. I almost always add some urea to my hide glue unless the shop is very warm. When gluing on felt, it gives me time to carefully spread the glue and position the felt. When hanging hammers, it allows enough working time to adjust alignment without shearing a partially set glue joint. If enough urea is added, you eventually end up with cold hide glue, which is not suitable for most of our work since it stays liquid for a very long time, soaking in and hardening felt.

Gel time also varies according to the grade of hide glue. Lower, less refined grades are usually darker in color, may not smell too appetizing, and gel more slowly. Higher grades are lighter in color, more clear, and quicker to gel. Higher grades are stronger, but even the lowest grade of hide glue makes a wood joint that is stronger than the wood.

Anyone who has tried to use hide glue in a large open glue pot will have noticed that the glue continually thickens and forms a skin on top, making it lumpy and hard to use. This does not occur with the coffee pot setup shown in figure 2, since the lid contains a steamy atmosphere over the glue inside. Those using a commercial glue pot can get the same result by setting it up as a water bath and fitting a lid with a small hole for brush access.

Some technicians prefer to use aliphatic resin glue (Titebond or Elmer's yellow carpenters' wood glue) for key rebushing. This glue meets the requirements for the job in that it thickens fairly quickly and is easily removable later on with moisture and heat. However, the fit of the bushings may come out looser with yellow glue than with hide glue. I tried installing half the key bushings on each rail of an action with yellow glue and the other half with hot hide glue, using the same bushing cauls and cloth for both. After letting the cauls stay in overnight and getting the keys to the frame, I found those glued in with yellow glue were noticeably looser than those done with the hide glue. This is not necessarily a problem; were I to use yellow glue again I would compensate by choosing a slightly thicker bushing cloth when testing for dry fit. I suspect the reason for this looser fit might be that the yellow glue soaks deeper into the cloth, so that when the cauls are later removed there is less free cloth to spring back. The less a glue penetrates the cloth, the more the cloth will recover from the compression of the cauls.

Bushing With Leather

In some heavy use situations key bushings will wear out in only one or two years, such as in certain churches where the pianists seem to wage Holy War against the piano. In contemplating this wear problem, I noticed that the leather bushings found in some European pianos seem to wear much slower than bushing cloth. I was reluctant to try leather at first, because I thought it would be too hard to find material that was the right thickness and of uniform thickness. However, after a little experimenting I discovered that leather, as well as bushing cloth, can be sanded to any desired thickness quickly and easily with no more than a drill press and a $2.50 hardware store drum sander. As shown in figure 3, a sanding drum with 80 - 100 grit paper is mounted in a drill press. The table is brought up close to the drum, and a fence (straight piece of wood) is clamped to the table close to the drum. With the drum turning 1000 - 1500 rpm, a strip of leather or cloth, held straight by each end, is lowered into the gap between fence and drum and slowly pulled through against the direction of rotation of the drum. The gap between sanding drum and fence is varied by trial and error until the correct thickness is obtained, then as many strips as needed are run through. Caution: Hold the starting end with pliers, not fingers, so your fingers can't get pulled between the fence and drum. For the smoothest surface on leather, orient the nap in the same direction as the drum is turning. A vacuum hose clamped to the table is helpful for controlling the dust. This method results in a remarkably consistent thickness of material, as good or better than regular bushing cloth. It is fast to set up and run, and solves the problem of never having quite the right thickness of bushing material on hand.

It is hard to measure the thickness of a soft material such as bushing cloth or leather with an ordinary micrometer because you never know just how far to tighten the spindle. Samples of two different materials can be compared by folding them up into 10 layers of each, so any difference is magnified. However, the best and easiest method is to use a spring loaded dial micrometer (e.g. Sears Tool Catalog, Pocket Thickness Gauge #9BT4615, $64.99). Instead of a spindle that you screw down against the material, this tool has a spring loaded anvil that rests on the material with a consistent force every time. Different materials can be accurately compared, and the consistency of any material can be measured by sliding it through the gauge while watching the dial. About the size of a pocket watch, this tool is very useful for measuring backrail cloth, action cloth, etc. (to choose replacements that match the original); it works equally well for things like centerpins, piano wire, and keypins.

Leather for key bushing should be firm and tough, not spongy and easy to tear, with a fine nap. If one surface is smooth, that surface should be sanded for good glue adhesion. Or, place whichever side turns out with the finest nap toward the keypin. I have used cowhide, buckskin and kangaroo skin with good success. The kangaroo seems ideal since it is already close to the right thickness, has a fine nap, and is quite tough but still soft. Check at your local Tandy's or other leather supply house; most have scrap barrels where you can pick out lots of leathers ideal for a variety of piano work.

Installing leather key bushings is similar to working with bushing cloth, with a couple of exceptions. First, I have found that the bushings come out tighter than with cloth, so I adjust the thickness by sanding until the dry fit is slightly looser than I might use for bushing cloth. I suspect the reason for this could be that

the glue barely penetrates the dense leather, so that any compression of the leather by the cauls then springs back, causing a snug bushing. Another characteristic of leather is that it has more friction against the keypin than does bushing cloth, which may be why some makers use leather on the balance rail only, where friction is not felt as readily as at the front of the key. When extreme wear is a problem, chances are that a little extra friction will be an acceptable price for greatly extended bushing life.

Cutting Your Own Leather And Cloth From Bulk

Most pre-stripped key bushing cloth is cut 3/8" wide or wider, while many mortises are 3/8" or less. When the cloth is as wide or wider than the mortise, it is harder (slower) to insert. If too wide, the job looks sloppy and the cauls are hard to insert since the cloth wraps around the ends of the mortise. For these reasons I prefer to cut my own bushing cloth (or leather) strips to match the width of my bushing cauls, using an Olfa Rotary Cutter or equivalent. This is an inexpensive tool sold at most fabric or sewing supply stores. It looks like a pizza cutter, with a plastic handle and a very sharp blade that cuts as you roll it along. Get the one with the 1 3/4" diameter blade. For cleanest cutting and best blade life, purchase one of the plastic cutting boards to go with it. To retain all of your fingers for future use, *keep them out of the path of the blade.*

Supply houses sell bulk bushing cloth by the yard. A 1/3-yard piece will be 54" wide and 12" long, just right for cutting 12" long strips of bushing cloth. Lay the cloth (or hide) out on the cutting board and lay a straightedge one bushing caul's width from the edge. The best straightedge for this purpose is a wooden ruler with coarse sandpaper glued to the bottom side; the sandpaper will help to grip the cloth and keep it from squirming as you cut. Keep pressure down on the straightedge as you roll the cutter along. This tool is excellent for cutting all kinds of felt and action cloth.

Bushing The Balance Rail

In our original article we discussed two ways of forming the balance rail bushings; the flush-cut type where the bushings are trimmed flush with the top of the key button, and the shoulder type, where the bushing cloth lays over the top of the button much like a front bushing (August 1988 *Journal*, pg. 22, figure 4). Many newer pianos come with the shoulder-type balance rail bushings, and I normally rebush this way, even if the originals were flush-cut. I find it easier and faster to cut the cloth by slicing down, against the broad wood surface of the key button, rather than to lay the knife flat against the button and cut sideways against the caul. Since the cloth is sometimes a little wider than, or not perfectly lined up with, the caul, a single cut may leave the cloth hanging by a thread, requiring a second cut. Also if your cauls are metal, your knife or razor blade will be constantly dulled. The shoulder-type bushing avoids these problems; besides, I like the way the bushings look. However, bushing in this way requires that the cauls be inserted far enough that the shoulders of the cauls clamp the cloth down against the tops of the key buttons. This is not possible with some keys where the opening in the key under the button is smaller than, or not lined up with, the mortise in the button, preventing full insertion of the cauls. In these cases the flush-type bushings must be used.

To make a flush-cut bushing without having to cut sideways against the cauls, I suggest the following procedure: If using single-shoulder cauls, insert the caul with the flat (without a shoulder) side toward the cloth. While still holding the cloth slightly taut, put a little sideways pressure on the caul with one finger to clamp the cloth in the mortise, angle the knife slightly away from the caul at the bottom and cut downward with a slicing motion. Angling the knife makes the cut just to one side of the mortise, leaving a 1/16" tab of bushing cloth sticking up. Bush the other side of each mortise in the same manner. If you are using methods which bush both sides of the mortise at once, insert the caul only part way, so the shoulders do not clamp down, then trim downward against the key button. After the cauls have stayed in the mortise for several hours, remove them and trim the bushing cloth "ears" flush with the key buttons, either with a sharp knife or by clipping them off with a sharp pair of centerpin flush cutters. I find the end-cutting-type nippers do a quick, neat job there. After all are trimmed flush, any glue residue that might have gotten on the key buttons can be removed with a light sanding.

Knives And Sharpening

I find that a comfortable knife is much more efficient than a razor blade for doing bushing work because with a razor, I cannot get my fingers in close to the bushing cauls. Also, I can hold a knife back in the palm of my hand and still use that hand to insert bushing cauls. However a knife, like any other cutting tool, is only as useful as it is sharp. There are a variety of sharpening methods available, including the Japanese water stones. These do an excellent job on knives, but since they are so soft they quickly become dished, requiring flattening before using them again on chisels or plane blades. I have found that the most convenient tool for sharpening knives is the ceramic rod type sharpener sold at hardware and sporting goods stores. These consist of a small wooden base which holds two round or triangular ceramic abrasive rods standing in a "V" shape. Usually these have two grey colored rods for initial sharpening and two white rods for a fine edge. The knife is simply held with the blade vertically and stroked against one rod and then the other as though you were taking slices off the rods. Although this tool looks mickey-mouse compared to your sophisticated Japanese sharpening sys-

tem, it does a better job because you are more likely to use it regularly. The best way to sharpen a knife is to touch it up a little bit often, rather than to get it really dull and have to bring it back from scratch. With this tool sitting permanently out on your work bench, you can easily give your knife 10 or 20 swipes a couple of times during the job to maintain a permanent sharp edge. No skill is required to use this tool; It will make a sharpener out of those who insist that they are no good at sharpening.

Dry Fit And Cloth Selection

As discussed in our original article, our goal is to end up with key bushings that fit the pins with a minimum of easing. The basic method of achieving this is to use precisely made bushing cauls together with a water soluble glue, leaving the cauls in place until the glue is fully hardened to mold the bushings into a correct and stable shape. Ideally, this process results in bushings that fit the pins perfectly when the cauls are removed. In the real world, however, several variables affect the final bushing size, so that in most cases there will be some fitting necessary. Keypin dimensions vary; for a given nominal size, such as .146", we may encounter pins measuring from .142" to .148" on different pianos or even in the same piano. I have a keyframe in the shop right now with front pins ranging from .142" to .147". No matter how precise our bushing cauls are, they will be made to correspond to the nominal size and will not be exactly right for such odd-sized keypins. Another variable is mortise size. We will choose one thickness of cloth to use for an entire rail, so it may not be exactly right for each key; the mortise file previously discussed will help here. The spring-loaded dial micrometer will reveal that bushing cloth is not always uniform in thickness along a given strip. As already discussed, different glue types and consistencies can affect the final fit. Another variable is the final angle of the keypin in the mortise; bending keypins to square or space keys leaves them angled, not vertical, which reduces bushing clearance.

Finally, some keys just respond differently than others, even if you try to use exactly the same cloth fit, bushing procedure, etc. for each set. This may be due to differences in key woods and the way they react to the moisture in the glue, or to how much crushing of wood cells might have been done during past key easing.

The point is, we must realize that when bushing keys we are dealing with felt and wood, not precision steel bearings. We should do what we can to make the results as predictable as possible, but still expect to always custom-fit each key to its pins. The main variable that we do have control over is bushing cloth thickness, which we choose by checking the dry fit of a keypin or bushing caul in several mortises. Normally, this dry fit should be just snug; when checking with a bushing caul, you should be able to lift the key up by holding on to the caul, but if you shake your hand once, the key should fall off. However, if the keypins in question are a couple of thousandths smaller than normal, you might compensate by choosing a thicker cloth, and vice versa. Likewise if the piano is going to see exceptionally heavy use you might choose a tighter dry fit to ensure that all bushings start out with minimal clearance so the bushing job will last longer.

Next month I'll take a look at some ways to upgrade one of our most useful shop tools, the drill press. ≡

EXAMINATIONS

Learning To Pass The PTG Tuning Exam: Part IV

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Part 4: Temperament

Having driven a familiar route over the years, it's all too easy to forget the names of the roads, as we sometimes learn trying to direct another the same way. Likewise, one of the hardest things for many piano technicians is to write directions for a repair or tuning with enough detail to engender a successful attempt by a reader. Seemingly, the more familiar the process, the easier it is to forget a detail or two — the signposts you observe but forget to mention — and something gets lost in communication. Temperament tuning can be like that, easier to do than to write about, though I sincerely hope this won't be too obvious here. In this article, we'll consider temperament in the context of the tuning exam, and will follow next month with a review of some midrange aural tuning checks that everyone taking the exam should be familiar with. But first, I forgot to mention a few things in last month's article, "Pitch," so bear with me now as I take a few paragraphs to summarize and catch up.

More On Pitch

The directions I gave for aurally setting pitch may be summarized as follows: while sounding an accurate A440 pitch source, solidly tune A4 on the piano, and check your result using the 17th test (tune A4 so the beat rate of the M17 F2-A4 equals the beat rate of F2-A440); recheck this setting at least once more later to make sure it is stable.

I should now add that, when using a visual-display electronic tuning aid (VDTA) in combination with a stretch calculator to tune the midrange, always check to be sure that the value you use for tuning A4 (second partial) produces an A4 fundamental at A440. If necessary, offset the instrument so it does. For example, if the stretch number you measure gives a chart value for A4 of 1.7 cents, but the second partial of A4 when the fundamental is A440 is actually 2.0 cents, offset the instrument to +0.3 cents before proceeding, or add that much to all the numbers on the chart. See your owner's manual for instructions on offsetting pitch. (See also September 1989 *Journal*, pp 22-26, "Aural Fine Tuning for Electronic Tuners" for additional information on refining stretch calculator tuning.)

Pitch can be a problem if you use faulty equipment, such as a miscalibrated or low-quality fork, or poor technique, such as not allowing it to come to the proper temperature, as I noted last month. I also reviewed several other common mistakes in aural pitch transfer which can occur using the best of equipment, such as using the wrong test note (F3 instead of F2), the wrong transfer note, (A3 instead of A4) or the wrong fork partial. Unfortunately, I forgot to mention what may be the single most common mistake: not using any reference note to check your pitch setting — attempting to tune a clean unison to the fork with no other beat rate checks. There is a blank on the tuning exam scoreform for the examinee to write down the pitch note (e.g., A4, C5) and test note normally used. If the number of times the "test note" blank stays blank on aural exams is any indication, this mistake is all too common, even though it's possible to be off by two to three cents this way. That could certainly ruin your exam day, so why take a chance? Use the 17th test!

Also somewhat troublesome for examinees is the use of non-standard (non-A) tuning fork notes. I concede that it may be marginally better to use a non-standard fork correctly than to use an A440 fork wrong; on a well-scaled exam piano the discrepancy at A4 due to otherwise setting pitch properly with an "accurate" non-A fork that provides the correct theoretical frequency calculated for the equal-tempered scale of which A440 is a member is not alone sufficient to affect your pitch score significantly. However, please note the word "theoretical" in the previous sentence. Without going into detail, you should understand that real pianos do not follow tables of theoretical frequencies, and using anything other than an A440 pitch source can introduce a small error at A4 which, when combined with other small, perhaps random errors, or with one of the mistakes previously mentioned, can indeed affect your pitch score.

In this and most other areas of the exam, we score results, not procedure; if you get A4 within 3.0 cents of A440 you will meet the minimum RTT standards for pitch, no matter how you do it. Nevertheless, my advice is to use an accurate A440 pitch source, or at least have one available as a secondary check on whatever your primary pitch note is.

Personally, I am reluctant to condemn those who start with some pitch other than A440 since I used a Deagan F# 369.99 for years, and probably own the only customized Accu-Fork with an F# on it. Why F#? Because the man that got me started in life as well as the profession thought it produced a more musical-sounding tuning. Though I cannot speak to that, tuning with an F# fork did not hurt my pitch score any time I've taken the exam. But my F# days are over, and now, nestled in my Sanderson Accu-Tuner case is an accurate A440 steel fork, should I ever need it. And though I do a lot of what I call "aurally verified electronic tuning" these days, I put the SAT completely aside from time to time and tune aurally only, just for fun. As a matter of fact, I wouldn't feel qualified to write this article otherwise.

I also noted last month that piano technicians as a group have been vigilant over the years of this century in "umpiring" the music world's pitch (and catching hell for it sometimes, too!); but to be up-to-date I should add that this didn't stop with the 1963 PTG Council resolutions. Recently, (1986) we changed the PTG tuning exam so that the examinee's pitch score depends only on how close A4 is set to A440, and discarded a specific allowance for fork calibration error; I believe an element of this decision was to provide more encouragement for the use of accurate A440 forks. More recently, the 1987 PTG Council (Toronto) passed another resolution recognizing A440 as our pitch standard.

One more point I'd like to add on pitch before continuing with temperament concerns the question of calibrating your pitch source. (I will not get into the specific procedures for calibrating various pitch sources, which should be the subject of a separate article). It is important that you check your calibration from time to time (especially if your fork gets dropped and/or damaged somehow), and I suggested last month you find someone with an Accu-Tuner to check your A440. To go one step further, here's what you can do to check any visual display instrument capable of 0.1 cent resolution which you can then use as a reference for calibrating your aural pitch sources. At about five minutes before the hour, turn the instrument on and set it up near a phone to read A4 on octave four with 0.0 cents deviation. Call time and set your watch accurately, and then call the FCC station WWV in Boulder, Colorado, at 303-499-7111, dialing the number at one minute past the hour. An extremely accurate A440 frequency standard usable for checking calibration comes on the line at the second minute past the hour for about 42 seconds. Hold the phone earpiece to the instrument mike and measure the tone. If it reads anything but A440 (0.0 cents deviation) note what it is so you can compensate for the deviation until you can get the instrument properly calibrated. Properly compensated or calibrated, the VDTA can then be used to check other A440 pitch sources. (Thanks to Larry Bowen, RTT for this information — and for contacting the FCC to straighten out a problem with the signal).

Of course, if you're in France, just pick up any phone; the dial tone is A440. The USA dial tone is a pure third, F4-A4, and the A4 is fairly accurate, (making the F4 sharp) but I doubt that your phone company would guarantee it to 0.1 cent. In the Washington, DC area, it seems to vary a little but generally is within 0.1 to 1.0 cent of A440. I wonder, could PTG get together with musicians' groups and lobby the government and/or phone companies for a guaranteed A440 dial tone, thus making the pitch standard immediately available? Time to move on.

I began this discussion observing how easy it is to forget important details when talking about familiar subjects, and went from there to some of the details I forgot to mention last month. Another example of an area where's it's easy to forget a crucial detail or two is our current subject. Bearing all this in mind, forgive me if the present article seems less than satisfying, or not what you expected upon reading the title. (It's not what I expected after typing the title!) However, I hope to cover my bases in advance by first referring you to a brief list of *Journal* articles on temperament (see end, "References"). Indeed, it is because these fairly recent temperament articles are still readily available for study that I don't feel it's necessary to go into great detail here. I don't have much to add, but do have a different slant on the question — one that has perhaps stimulated more discussion in these pages than any other: How do you set a temperament? Or, to pose the exam-room version of this question, how would you set a temperament without your Accu-Tuner (or other visual aid)? Where would you start, and how would you proceed?

If you don't have any idea, how are you going to pass the exam? Let's get practical: no matter how sophisticated your approach may have become over the years, at some point in the current version of the PTG Tuning Exam you are going to have to sit alone at the piano with nothing but an aural pitch source and a tuning hammer, and prove you can do it at least in the midrange once and up to minimum RTT standards. How will you do that? I'd like to offer a few suggestions, but first we'll take a closer look at how temperament fits into the exam, and then try to arrive at a concept of how to score well in this section by adopting more efficient techniques.

Temperament In The Exam

In exam terms, the temperament is the group of any 13 consecutive notes entirely in the range of C3 to B4 that the examinee chooses to have scored as such. Measurements of these 13 notes provide the basis for calculating the Pitch Correction Number (PCN), which in the scoring procedure corrects your tuning for overall pitch level. In this way, pitch transfer errors do not automatically snowball, and pitch can be scored in relative isolation from the other sections. In absence of examinee preference of a temperament octave for scoring, examiners may use the default, F3 to F4.

The temperament section is the second scored area of the exam after pitch. Penalty points in this section are weighted in such a way that it is about as difficult to achieve a passing score in temperament as it is in any other section. Your score here depends on how closely your temperament octave notes match the corresponding notes of the master tuning. Penalty points accrue at the rate of one per 1.0 cent difference, and are converted to percent score by the formula 100 minus (2.5 x points).

An advantage to you in having your temperament scored is that you get to see how well you did in the area where you perhaps did your most careful tuning. If you are one of the many who do not confine themselves to a one-octave temperament, you may wish to select an octave for scoring in the middle of your actual temperament to represent it.

Tempering With Reality

In terms of a real tuning, what is a temperament? There are two common usages of the word "temperament," one involving the whole piano and the other involving a limited range in the middle of the scale. Ideally, if we achieve what we call "equal temperament" on a well-scaled piano, all adjacent intervals of the same class, (perfect fourth, single octave, M3, etc.) and hence all key signatures sound relatively the same; consonant intervals sound consonant (clean-sounding octaves and double-octaves, and no objectionable beating in fourths and fifths), and intervallic beat rates

change gradually all across the keyboard. The group of notes most of us call a "temperament octave" is distinguished from the others only by virtue of the fact that we more or less arbitrarily started our fine tuning from here, and expanded it outward to the rest of the scale.

No one could come up to a piano we just tuned and play a few chords and identify what our temperament octave might have been, though if they listened carefully, the existence of an acceptable equal temperament might be heard. As past PTG President Charles Huether sagely observed, "Actually it is a misnomer to refer to that octave as a 'temperament'. The old term of 'bearing' is more appropriate. We are setting our bearings, reference points, from which we develop our temperament, which is the tuning of the whole instrument. If a piano is properly tuned, one should be able to measure any tenor area octave as the 'temperament octave' and pass."

However, in tuning aurally I suppose you have to go set something after setting pitch, and we've called it a temperament for so long that the name will probably stick. It's a way of getting your tuning organized. We give you a score here so you'll find out if you got started on the right track, though we recognize that for many tuners, it may only be a redundant look at one octave of the midrange of no special significance.

If you use a VDTA, then the temperament score in part one of your exam, where you use your instrument, may not mean much to you. It may in fact be a redundant look at one octave out of the midrange which you actually didn't spend any more time on than any other octave in the midrange. However, it is necessary for scoring purposes, and everyone has to pass this section to keep the exam equally difficult for all. If you do a good job in the midrange, then chances are the temperament section won't hurt you, even if it doesn't help you.

Whether you call it "setting the temperament," or "laying the bearings," the specific point of departure for this discussion is what Carl Root, among others, has aptly referred to as "temperament sequences." Please take the time to sit at a piano with Carl's March 1981 *Journal* article, "Evaluating Temperament Sequences" on the music desk and follow the logic. When you've finished that, may I suggest the four-part Michael Kimbell "Encyclopedia," and any of the other articles listed as references. I've always found it easier if not always necessary to read tuning articles like this, no matter how well-written they are, while sitting at a keyboard, often with a tuning hammer and a couple of free hours. Perhaps I'm a slow learner, but I prefer to believe, to paraphrase Susan Graham, that it's due to the "innate perversity of temperament subjects" rather than an author's inability to convey in print what is best learned in practice. Suffice it to say, these authors have put a lot of time into this writing, and their only payment for the most part is to know that you have read, understood and benefitted from what they've said, especially if it challenges a cherished procedure of yours. Light reading it ain't, so grab a pick and shovel and go to it the best way you can.

Hint #15: If you are unfamiliar with aural temperament tuning techniques, you should learn at least one aural temperament tuning sequence and associated aural beat-rate checks and practice tuning until you are comfortable and fairly proficient with it.

And this is a good time to interject another important point:

Hint #16: Don't experiment with unfamiliar temperament sequences in the exam room. If you achieve good results with your regular temperament procedure, do not be overly concerned when somebody says you can't do it that way, or that your way is somehow deficient. You will not be scored on what sequence you use to set a temperament and tune the midrange, but rather only on the results.

This reiterates in principle what you may have read in these pages before, by Rick Baldassin, who wrote in his June 1988 *Journal* article, "Setting The Temperament" (p. 18), "I guess we each need to be in search of a system which helps us individually achieve consistent, good-sounding results in a reasonable length of time. Certainly this order or sequence of tuning will vary from individual to individual. This is not to say that any one sequence is better than another.... If the end result is acceptable, it justifies the means."

A Useful Temperament Sequence

What is it we look for in a temperament sequence? I quote Carl Root, from the above-mentioned article: "My aim is to achieve the highest degree of accuracy possible with maximum efficiency. That is, I hope to determine the proper tempering of each interval tuned without altering each note an unnecessary number of times."

The temperament sequence which for me best meets this and other criteria Carl mentions is the Sanderson two-octave temperament (March 1983 *Journal*, p.34). This approach is well-documented, and in the form presented by Dr. Sanderson, still only involves 13 notes, and so presumably could be tuned as quickly as any temperament over a single octave. This is the one I think you should start with if you are looking for a temperament that is relatively easy to apply (and remember!) as well as accurate.

In this procedure, you first get the "big picture" with pitch setting and octave stretching by tuning A4, A3 and A2, next filling in the contiguous M3 notes and octaves (C#'s and F's) and then finally executing a "mini-temperament" sequence in the limited range that lays nicely in the middle among these established bearings. I refer you also to Michael Kimbell's October 1987 *Journal* article, which on p. 28 documents a sample temperament which starts the same way (see "Stage 1: Contiguous Thirds Over Two Octaves").

After setting up the two-octave contiguous M3 framework to your satisfaction (A2, C#3, F3, A3, C#4, F4, A4), tune the mini-temperament from F3-C#4 in two series as follows:

Series 1: From F3, tune up a fourth to A#3, then down a third to F#3, and up a fourth to B3. Note that the F# and A# are also related by fourths and fifthsto the F3-F4 octave and the C#3-C#4 octave already tuned.

Series 2: From C#4, tune down a fourth to G#3, then up a third to C4, and down a fourth to G3. Note that the G# and C are also related by fourths and fifths to the C#3-C#4 octave and the F3-F4 octave already tuned.

Final check: The M3 G3-B3 fits nicely between M3s F3-A3 and A3-C#4.

Keep working over these two series in the mini-temperament sequence until all the intervals are acceptable and there is a smooth beat-rate progression in the thirds from F3-A3 to A3-C#4.

Beyond The Temperament — Parallel Interval Bracketing

If you've gotten this far successfully, the rest of the notes in the two-octave span should fit in nicely. For example, going down from the mini-temperament, let's look at E3. There are a number of powerful tests that virtually lock E3 into place, given the notes already tuned. One of my favorite tests in this area is the "outside sixth-inside third" test. Tune E3 so the M6 E3-C#4 beats the same as the M3 F#3-A#3. Of course you should also check the P4, E3-A3, and the P5 E3-B3 to make sure they are acceptable and about the same width as the adjacent P4 and P5 up from F3. Also indicative for fine-tuning is a little-used member of the family of parallel M3 tests.

Parallel M3 tests all work similarly, and are very useful in moving up or down from our mini-temperament. The note you are tuning combines with a note you have already tuned to make up a M3, and you look for two more M3rds an equal scale distance on either side that you've already tuned to make beat rate comparisons. The trick is always the same; you try to tune your note so that the M3 it is a part of has a beat rate that is exactly midway between that of the M3 above and the M3 below. Working outward from the mini-temperament, but within the Sanderson two-octave span A2-A4, you can always find two M3s that fill the bill. So let's tune a few notes downward to exemplify the pattern:

1. Tune E3: Set E3-G#3 M3 beat rate between C#3-F3 and G3-B3 M3rds.
2. Tune D#3: Set D#3-G3 M3 beat rate between C#3-F3 and F3-A3 M3rds.
3. Tune D3: Set D3-F#3 M3 beat rate between C#3-F3 and D#3-G3 M3rds.

Step three is the familiar chromatic parallel M3 test; consecutive lower notes of this series (C#3, D3, D#3) are related to each other chromatically. Step two is the whole-tone parallel M3 test; consecutive lower notes of this series (C#3, D#3, F3) are related to each other as whole tones. Step one is a test in the same family, (the little-used one) which I suppose we could call the minor-third parallel M3 test since the consecutive lower notes of this series (C#3, E3, G3) are related to each other as minor thirds.

The technique of adjusting the beat rate of a M3 to fit between two known M3rds as in the above examples we can call bracketing. The concept of bracketing also works with other parallel intervals with beat rates we want smoothly changing, such as M6, M10 and M17, but is limited to the range of the scale where you can judge beat rates well enough to extend your contiguous M3 framework. You can readily apply it in the A2-A4 range, and it is thus particularly well-suited for midrange tuning.

Conclusion

To pass the PTG tuning exam, you should learn an aural temperament tuning sequence. Find one you like, preferably containing pitch note A4, and practice until you feel reasonably comfortable with it. Have an experienced RTT check your work from time to time, or if you normally tune with an instrument, see if you can tune aurally and get the same results within a cent. The Sanderson two-octave temperament sequence is one which I find easy to remember and apply, but there are many other possibilities worth investigating, any of which can produce satisfactory results. Setting a good temperament is the foundation of a fine piano tuning. We will build on this foundation next month, as we consider other midrange tuning checks, especially those used during the aural verification part of the exam.

Next month: Midrange

Selected *Journal* References:

Rick Baldassin, "Optimum Size of A3-A4 Octave," March 1988, pp. 20-21.

Rick Baldassin, "Setting the Temperament," June 1988, pp. 17-21; February 1990, pp. 16-19.

Rick Baldassin, "Letters," (W. Guthrie), February 1989, pp. 15-17.

Jim Coleman, "Passing the Tuning Test," August 1988, pp. 31-33; February 1990, pp. 16-19.

Michael A. Kimbell, "An Encyclopedia of Tests for Equal Temperament," part one, June 1987, pp. 24-25; part two, August 1987, pp. 27-29; part three, September 1987, pp. 30-32; part four, October 1987, pp. 25-28.

Carl Root, "Evaluating Temperament Sequences," March 1981, pp. 28-32.

A.E. Sanderson, "A Two-Octave Temperament," April 1983, p. 34; February 1990, pp. 16-19.

GOOD VIBRATIONS

Bridges, Part I: Loose Pins

Nick Gravagne
New Mexico Chapter

Bridges are, of course, major components in a piano soundboard assembly and as such deserve more than a little cosmetic surgery if the best rebuilding job is hoped for. These articles assume that the usual and basic information about bridge construction and function is understood and that the reader is more concerned with symptomatic troubles and their remedies.

In brief, however, it doesn't hurt to remember that bridges, especially the long bridge, can be considered a superhighway which carries not only the "traffic" of the string load, but also directs frequency movement along its length, the off-ramps being the ribs. The piano bridge, like all bridges, must be strong enough to carry a load yet flexible enough to bend without fracturing or breaking. Vibrations in the hard wood of the bridge swiftly pulsate along the bridge as mechanical energy and excite anything they come in contact with. The bridge sits roughly at right angles to all the arched supporting ribs underneath and it can be said that the bridges and ribs are a sort of rapid transit systems delivering rush hour "frequency passengers" to the soundboard — that is, to their place of work where they toil at making the soundboard bounce. In order for these frequency passengers to exit the strings and get on to the bridge they must pass the bridge pin "gates," and it is here where most of the trouble lies.

Most old bridges are cracked at the bridge pin holes and the pins themselves are usually loose in the holes whether cracks are evident or not. In addition, the pins are generally dirty, or rusty; and the little system which is made up of the old darkened strings lying on cracked and blackened wood, and pulled between dirty little comb-like projections is, in the old piano, a horrible thing to see. In the new piano this little system sparkles and is a joy to behold. The mechanical breakdown is simple enough: the old strings have lost most of their kick, and what little kick is left can only be delivered to a spongy target, the loose pin. This is rather like trying to chop a log which is lying on a big fluffy pillow. To both the woodsman and piano tone there is energy wasted as heat and less work is being done for a given exertion. In order for the energy in the axe or in the vibrating string to be most efficiently exploited, it must crash into an immovable target. The little bridge system — strings, wood, notching and pins — must be made tight. Sometimes the bridge, either in full or part, needs to be replaced; other times it can be reconditioned. Let's begin with reconditioning.

In general, reconditioning a bridge means making loose pins tight, closing or filling the cracks with epoxy or other glues, possibly replacing the pins, possibly re-graphiting the top along with renotching, scraping or grinding clean the original notches and finishing with varnish. The completed job should look attractive, but first and foremost, should be mechanically sound. It should be pointed out here that there is a small tribe of rebuilders who considers bridge reconditioning disgusting in any form, especially on something like a Steinway. They say, in fact, that even recapping is second rate (although a very decent second rate) to constructing brand new and complete bridges, preferably the new Baldwin multi-vertical-ply types. But these are value judgements better left alone for the present. Still, I will say this about my own standards. For the most part, new soundboards get new bridge caps. But if the original bridge is being retained, either on the original or a new soundboard, old bridge pins are discarded in favor of new and the notches are re-carved and varnished. If a crack is large enough to "fill" it is too large; a new cap is in order. Loose pins are made tight providing the cracks, if any, are not serious. And the make of piano along with the expectations of the customer are important considerations as is the fee being charged to do the work.

Assuming that some crown exists in the soundboard and that there is sufficient downbearing for the strings to make solid and reliable contact with the bridge, loose bridge pins usually mean false beats, especially in the higher parts of the scale. This is not the only reason for false beats but it is a starting place for the purposes of these articles. As mentioned earlier, loose bridge pins move in couple *with* the vibrating string whereas a tight pin not only resists the vibrations, but directs the energy into the soundboard system where it belongs. But how do pins get loose? And how loose is loose?

Like tuning pins, bridge pins are driven into holes which are somewhat smaller in diameter than the pins. During high humidity seasons, the bridge wood (usually maple) swells and actually crushes around the pin making the pin tighter than ever, but when the drier season comes, the wood fibers at the pin relax to beyond the place where they were originally and the hole is slightly larger. After several seasons of this squeeze-and-relax game, the pin loosens in a too-big hole which is usually accompanied by a crack. Minimizing this process requires that the manufacturer drill the holes in wood which is neither too dry nor too wet; I prefer to drill in maple containing an approximate EMC of six percent (which relates to about 85° F and 35 percent RH for ambient wood environment prior to drilling). Also contributing to loose pins is the ever-present side bearing of the strings; and this, coupled with the fact that there is very little wood available in the spaces between the pin holes, exacerbates everything quite nicely. Then of course the pins may have been loose

right from the start due to poor factory work. In any case, a quarter-sawn cap is less subject to splitting and pin-looseness than a flat-sawn cap, and a horizontally laminated bridge even less yet. New Baldwin-type bridges resist deterioration quite well; but no matter what the species of wood or its grain orientation, the EMC at drilling time is an important factor. Moreover, if it can be assumed that the bridge was properly pinned at either the factory or the rebuilding shop, the best safeguard against looseness and splitting is to maintain a home for the piano where the ambient conditions do not stray too far from 70° F and 40 percent RH.

To determine how loose is too loose the old rule-of-thumb has been to try yanking one out with average size needle-nosed pliers. If you find yourself on the floor, pliers in hand gripping the slender copper tooth, the pin is too loose. On the other hand, if the pliers keep slipping off, or if the pin extracts only with Herculean effort, it is considered tight. Be careful here: pins get mangled and bent and in the worst cases reduced to puny, powdered stubs. Like most rules-of-thumb this one depends on how big one's thumb happens to be, but also like most rules-of-thumb, it is reasonably effective once one has the hang of it. Several random samplings need to be checked but pay particular attention to the pins in the treble areas. In fact, for reasons to be explained later, I usually pull out all the pins in the highest two treble sections (if not in the entire bridge) to make way for re-notching and new pins.

Once the pins have been determined loose, a way to make them tight must be found. For starters I never reuse the old pins (unless there is something unusual about them). I know that many shops simply swab the holes with slow drying epoxy and re-insert the old pin before the glue dries. This doesn't appeal to me. My practice is to remove all offending pins (which sometimes means every single pin) with vise-grips, bore out the existing front-notch holes to a depth of 7/8" using a bit which is usually, but not always, slightly smaller in diameter than the "right" one for a given pin size. The 7/8" depth is for the purpose of receiving one-inch-long new pins, allowing 1/8" to protrude; and the smaller diameter bit lessens the danger of damaging or making oversize the existing hole, while at the same time makes for a very tight pin at the bottom of the hole. In lieu of a set of number-size bits use the original-size bit for a given pin size — I have no complaints with the supply house bridge pin bits — and be very careful to allow the spinning bit to "follow the tunnel" rather than to damage the hole. Actually, I have used a number six bit to elongate a number seven hole, etc. To drill use a small 1/4" or 3/8" chuck electric drill, or better yet, a flexible shaft hooked up to the 1/2" shank of an electric motor. The slower RPMs, the quiet running, and the handiness of the chucked end make this tool a favorite of mine for all bridge drilling or re-drilling. I believe that Foredoms work nicely here as well.

When the front notch holes have been re-drilled, it is time to size all holes and, as the operation suggests, the process is similar to sizing key balance rail holes. Use either slow drying epoxy or, my preference, Garret Wade's 202GF Gap-Filling glue (address at end of this article). Swab the hole — that is, don't fill it in completely — with a wire such as a paperclip or piano wire, cleaning up as you go, and *let dry*. Rear notch holes are not re-bored but are sized and repinned with new 3/4" or 7/8" long pins. Before driving the pins scrape the notches clean with a small scraper and shellac or varnish them with a small brush. Burnish the old graphited top with an old toothbrush and rags. Rub on some new graphite where necessary using a graphite stick. Then dry drive in the new pins: they will be very tight and the appearance of the completed job will be very pleasing.

Why not bore larger holes and repin with the next higher pin size? This may work out fine where the pins are not crowded, such as in the lower parts of the scale or on the bass bridge, for example; but it is generally a bad idea where the pins are close. Too much wood may need to be removed, weakening the area, and the larger-diameter pins may be so crowded that the piano wire may not be able to fit between them.

Driving bridge pins sounds easier than it actually is. Although the technique is simpler to master than eating with chopsticks, it does require a few words here. First, a small, preferably round-faced hammer is necessary. The striking surface of the hammer should not be too convex (as is that of the usual ball peen hammer) or many blows will glance off the pin delivering a healthy dent to the bridge. Sometimes this dent will have been perfectly located in what was a nice, sharp neighboring termination. When pinning or repinning bridges it is a good idea to have handy a plugged-in soldering iron and a wet rag. Dents can be almost completely "swelled out" by placing the wet rag over the wounded area and applying heat. Pins should be driven in sequence from the center of the bridge out so as to avoid obstruction from the previously driven pin. Hammer blows should be controlled and uniform and the direction of the blow should be in line with the angle of the pin. Finish off by "leveling" the pin protrusions with a large steel punch. I never file the pin tops when repinning: the mechanical reciprocating movement of the file along with the heat generated in the pin could loosen the pin. And after so much work, such an outcome could cause rebellion and vomiting.

Next month we'll talk more about cracks and about the techniques of re-notching.

Garret Wade's Glue: 161 Avenue of the Americas; New York, NY 10031 or (800) 221-2942.

At Large

Tuning Stability

Peter Wolford
San Francisco Chapter

Countless articles appear in our *Journal* about tuning temperaments, tuning intervals, tuning octaves, tuning minor thirds — well, you get the picture. What about tuning stability and hammer technique? We encounter this regularly, yet it is rarely mentioned in print. There was a little hint about it in the December *Journal* when someone said that left-handed tuning of uprights was an essential skill to master.

All the intellectualizing about what to listen to and for is of no value if the tuning you are doing doesn't stay where you put it. In the early fifties, I was talking to George Wielan, one of the best tuners I have known. He was the shop foreman of the Baldwin store here in San Francisco. Some of us remember that Baldwin was the first company to install tight tuning pins, then came Kawai years later with even tighter ones. Nowadays, tight pins are commonplace, but back then, after tuning three Acrosonics in succession, you felt like giving up the profession.

I was having trouble setting pins on a Baldwin concert grand at the Conservatory, where I maintained the pianos for 18 years, and I asked George what his technique was for tight pins. He said he pulled the string slightly sharp, so that when he relaxed the lever, there would be a very slow beat above the pitch he wanted, then he would spring the pin to get the final wave out. George used to travel with Jose Iturbi, who was a Baldwin artist, as his personal technician when Iturbi was on tour, but that's another story.

I argued how every book ever written on tuning condemned "springing" and I rejected his advice. Some time went by before I realized that I had misinterpreted what George meant, and was actually doing a form of springing, without knowing it. Actually, proper springing is essential, but bending the pin, without torsion involved is what is condemned.

I have known many tuners with super ears whose tunings would not be stable under fortissimo playing. You must tune with enough force to exceed that which the strongest concert pianist uses. If your fingers don't ache a bit after a tuning, you haven't done your job. I don't mean brutal pounding, but strong blows on the key. For heaven's sake, don't make a quick, accelerating, snapping blow, as that is the kind of playing that breaks strings. Also, make sure you don't use this technique on those older spinets with yellow plastic elbows, which shatter under the slightest test force. Hit the key hard, and let your finger linger on it — bottom it out. Also, use common sense on when to apply this technique to older or delicate pianos.

I will try to draw a word picture of how I go about tuning, setting the pin, equalizing the tension of the string over its entire length. Hopefully, it will help a lot of you who don't get a chance to get to the conventions, where these subjects are talked about occasionally.

Verticals

The handle of your tuning lever should be about 11 o'clock (this is where the left hand comes into play). Use a 15° short head, with a #3 tip. Jerk the lever towards 12 o'clock until you either feel or hear a little "tick" indicating the pin has actually turned (never mind if the beats are racing). Now put reverse pressure on the lever, and, holding the thumb of your right hand gently at the middle section of your middle finger, strike the key firmly with the tips of your ring and middle fingers until the unison is beatless. This spreads the shock over a wider surface. Now listen to what you have done with a very gentle blow. (Tune hard, listen soft). What you are doing is equalizing the tension over all the bearing points on the string.

Grands

The handle of your tuning lever is pointed straight out away from you at 12 or 1 o'clock, same 15° head and #3 tip. Switch from right-handed tuning to left at about the beginning of the last treble section. This saves body contortion, as does left-handed tuning on uprights. Avoid staring fixedly at the tuning lever, and keep your neck limber, without tension, moving your head a lot. Also, drop your tuning arm frequently, and relax it. You will thank me in your later years.

For people with sensitive joints or finger tips, make yourself a tool consisting of joining and gluing two big bass hammers together (at the wooden ends). In use, one felt fits nicely in the palm of your hand and the other end strikes the key. Turning it slightly when tuning the sharps lessens the chance of missing the key. This tool can also be used for banging on the keyframe when fitting the frame to the keybed while listening for knocking.

I trust you have already come to the conclusion that consistency in this technique is mandatory. The original pitch must be set in the above manner so that it won't change when tuning the unisons. This is not a once-per-note test blow thing, but a system of settling each string in the piano so the pitch stays where you put it.

Let's recap! Stand (or sit) as relaxed as possible. Jerk (nudge) the tuning pin until you have just passed the null spot, listening for little ticking sounds, indicating rotation of the pin. Relax the lever, and hear if you are beyond the null. If not, give it one more tick. Now put reverse pressure on the lever and strike the key several times until you have a pure unison with the tension equalized. If the string is sharp, hit the key and see if you can drive the pitch down. You might not even have to turn the pin; or nudge and strike simultaneously. If it's in tune, hit the key and see if it's solid. Good luck!

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Coming Events

Feb. 16-18, 1990	**California State Conference** Irvine Hilton, Orange County Contact: Austin Mason, 25842 Avenue, Cabrillo, San Juan Capistrano, CA 92675 (714) 661-1416
Mar. 2-4, 1990	**South Central Regional Spring Seminar** Hilton Hotel, Santa Fe, NM Contact: Joanie Wagoner, Rt. 4, Box 50-C, Santa Fe, NM 87501 (505) 984-8179
Mar. 29- Apr. 1, 1990	**Pennsylvania State Convention** Warrendale Sheraton Hotel Contact: David Barr, 524 Jones Street, Verona, PA 15147 (412) 828-1538
April 3-5, 1990	**Pacific Northwest Conference** Spokane, WA Contact: Scott Colwes, 1315 Coeur D'Alene Avenue, Coeur D'Alene, ID 83814 (208) 667-3393
April 7, 1990	**East Tennessee One-Day Seminar** Heritage Music, Inc., 7212 Kingston Pike, Knoxville, TN Contact: Tom E. Graves, 228 Hillcrest Drive, Knoxville, TN 37918 (615) 688-0916
Apr. 20-22, 1990	**Michigan State Conference** Lansing, MI Contact: Les Jorgensen, 4201 Wabaningo, Okemos, MI 49964 (517) 349-5959
Apr.26-29, 1990	**NELCRO Seminar** Hotel Auberge Des Gouverneurs, Québec, Canada Contact: Roland Bessette, C.P. 364 SNCC, Brossard, Québec, J4Z 3N3 Canada, (514) 444-1135 or (514) 465-8076
Apr. 26-29, 1990	**Central West Regional Seminar** Henry the 8th Hotel, St. Louis, MO Contact: Liz Baker, 4136 Botanical, St. Louis, MO 63110 (314) 664-4914
May 18-19, 1990	**Intermountain Seminar** Provo, UT Contact: Jack Reeves, 486 N. 300 W., Orem, UT 84057 (801) 225-1757
July 7-11, 1990	**33rd Annual PTG Convention & Technical Institute** Hyatt Regency Dallas at Reunion Contact: Piano Technicians Guild, Inc., 4510 Belleview, Suite 100, Kansas City, MO 64111 (816) 753-7747

Auxiliary Exchange

President's Message

It is just days before New Year's as we prepare this copy to announce to our readers the names of new members who joined PTG Auxiliary back in Portland, OR, July 1989. We send a warm welcome to *Mary H. O'Banion* of 12034 Corona Lane, Houston, TX. Here's a welcome back to *Wilda Fries* of 2001 East 8th Street, Vancouver, WA. Our third new member is *Corrine A. Drost* of 1052 South Fork Drive, River Falls, WI. She is a member of the Twin Cities Chapter. Our fourth new member is *Susan Snyder* who hails from the capitol area of New York where her husband, Stephen, is the Guild Chapter President. Her address is RD #2, Box 320, Salem, NY. Welcome to all of you and we hope to see you in Dallas.

In the coming months it is hoped that more will join our ranks and especially those non-technician spouses from the Lone Star state. Texas, whose state flower is the Bluebonnet, and state bird is the Mockingbird, has for its motto, Friendship. With that warm gracious word to describe the southern hospitality of Texas, we are sure to have a most delightful time at our 33rd Annual Convention in Dallas.

Look for articles on Dallas in future issues of the *Journal*. They are designed to peak your interest and encourage your attendance. There will be programs and events for all. For a little Texas flavor we will mention the names of a few famous Texans. Mary Martin, star of stage and screen — remember "South Pacific," "One Touch Of Venus," "Peter Pan." Then there's the great comedic TV star, Carol Burnett; also Howard Hughes, industrialist and movie maker. In your youth you heard of the "Bowie Knife," named after James Bowie, who although born in Georgia, later migrated to Texas. He joined a group whowas opposing the Mexican Government, became their leader and was one of the heroes killed at the Alamo in 1836. Texas also lays claim to the illustrious Sam Houston, Admiral Chester Nimitz and that well known Speaker of the House of Representatives, Sam Rayburn.

Ginny Russell urged in our December 1989 *Newsletter* that we begin making plans to attend the convention well in advance of July. We will be better able to budget our funds, take advantage of lower airline rates and lower registration costs. Our technicians generally plan tunings six to twelve months in advance; four months' advance planning cannot be too soon. We look forward to seeing all of you in Dallas.

Agnes Huether, President

Mea Culpa (My Fault)

The Editor regrets that a grave omission occurred in the December issue. The Editor neglected to indicate that the following members contributed generously to the Piano Technicians Guild Auxiliary Scholarship Fund: Ginger Bryant, Kathryn Snyder and Miriam Snyder. Did you enjoy the January account of Paul Cook's trip to Asia and his feelings about traveling with a large group of technicians who do spend a good deal of time discussing pianos and the relative merits of those instruments made in the U.S.A. or Europe or Asia? At first Paul hesitated about writing a piece for the Auxiliary since he is a fairly new member, but he did come through with flying colors. Thanks loads. As a brief supplement to Paul's account, the following was lifted directly from the log of Flight 805: "Plane #8649 departed San Francisco Internat'l Arpt. at 1421 hrs. on 5/25/89. The couple were united in marriage as they crossed the International Date Line at an altitude of 37,000 feet; 28'00 N. Latitude, 180,00 E. Longitude at 497 knots." Signed, Captain John Gordon, and First Officer Peter Chiaro.

Editor

Waste Not ... Want Not

The end of year appeal letters are just beginning to die down when this is being written. Everyone with an appeal seems to send their requests, pleas and problems during the Christmas-New Year-Tax Return awareness period which happens to be the end of the year. If your correspondence has been like ours, you must have received a number of appeals for contributions to various organizations whose principle goal is environmental protection. The Wilderness Society, Sierra Club, Audubon Society, The American Littoral Society, The Environmental Defense Fund are a few who work on a national basis. There are many others whose focus is on a particular area, region or cause.

What have these organizations to do with our piano and music orientation?

The most dramatic and critical is the disappearance of the Sitka Spruce Forests in the Pacific Northwest. The last remaining virgin forest, whose trees are hundreds of years old, is in danger of being clear cut. You may have read something about this situation in your newspaper or news magazine. Beyond this, and related to it, is the general wholesale cutting of Sitka Spruce all along the Pacific coast, making this essential "musical" wood scarcer and scarcer. Wholesale buyers from overseas are paying premium prices for logs, making it impossible for domestic saw mills to compete for their necessary raw materials.

Spruce, in general, besides its essential use as sounding board material, is otherwise considered pretty much of a "junk" wood, and is largely used for paper making. Our newspapers are grinding up tons of trees every day! Those piles of "junk mail" that you tear up and throw away every day are our environment and its trees! Recycling of newspapers and even all papers is a necessary activity. Just think of all the paper that is now being used in our "Computer Society." If you use a computer you must realize just how wasteful of paper it can be. Think of all those pages spewing out of your printer as "lost soundboards!"

Conservation of our environment has to begin with each one of us. It is not sufficient to point to someone else, as guilty as they may be, of wasteful practices. Fingerpointing is fine, but make

sure that no one can point a finger in your direction. (We would like to recommend to our readers the January 1990 issue of *Audubon — Speaking For Our Nature* the article "War In The Woods II: West Side Story" cites several ways to look at a forest.)

In a real sense, in our technicians' work of piano service they are conservators. The piano has a remarkably long life and the longer it can be maintained, provided it still can do what it was originally made to do, that is, produce beautiful sounds, our technicians are doing their bit to protect our environment. There is nothing in our "throw-away society" like the piano. Indeed we can apply that to music in general, and that may be the very reason why it is not given the support and encouragement that it needs and deserves. Our field of interest, piano care and its maintenance and in general music, thrives mainly on developing individual interest and personal achievement. Modern marketing of everything else is oriented around not "using," but "consuming."

It is ongoing, up-hill, tough work making a living at a business which has its base rooted in personal achievement. It is also uniquely satisfying to the technician to do so. Those of us whose careers and livelihood are based on such a business need all the help and support they can get from friends, colleagues and spouses. Discouragement is sometimes as frequent as success. They need the support of everyone in their personal "network." The Piano Technicians Guild Auxiliary is a substantial and important part of that "network," and if it is not part of yours, dear reader, it should be. As we achieve success, that success and satisfaction is shared by all our "network."

If you are a PTG member reading this, encourage members of your "network" to join the PTGA. Encourage your "network" to join you and come to Dallas in July. If either or both of you have never experienced a PTG Annual Convention, this is a wonderful time to try it. Learn how PTG and piano service, in its own context, is far ahead of almost everyone else in conserving our environment. Find out how others support and encourage their PTG member, husbands, wives, friends... and share in a real way their successes and satisfaction. Expand your network to include people all over the world. PTG and the PTGA is truly international. Promote the piano, promote music, promote personal achievement as well as the Auxiliary Scholarship Fund, and promote conservation.

Why Go To Convention, Or, Better Yet, Why Join PTGA?

Now is the time for you to dust off that cookie jar on the top shelf (you've been on a perpetual diet and haven't needed the cookie jar) and start putting left-over change, grocery money (because you didn't buy that extra cheesecake for the family diet!) and extra paper money (because you didn't buy that magazine subscription from the salesman at the door.)

Why let it go until June and take it all out of one month's salary? You'll have a nice nest egg if you start now, and you really should be there next summer in Dallas with your mate.

Just think, it's moral support to have you there. It means you care what your mate does for a living. And I mean this for male spouses too. Not all Auxiliary events are planned for females. The big event is the mid-week bus tour of the host city. We always learn and see so much about the city we're visiting that you would not see on your own. And of course we have the camaraderie on the bus which makes the trip ever so much fun. (Ginny Russell and Julie Berry wouldn't know much about that — or would they??)

You know if your spouse is a full-time tuner, his/her trip (i.e. air fare, hotel, meals and convention fees) can be written off as a business expense on your income tax. So the cost of a double room is only about $10.00 more than a single. And, of course, you're going to stay on that diet during the convention, except for the banquet and all the parties (Steinway, Yamaha, Baldwin for example) so meals won't cost much, and if you work that cookie jar starting now, you'll have air fare or automobile gas by next July.

So what's standing in your way? Oh, yes, Auxiliary membership. Well you see, it's cheaper to go to convention for a PTGA member. And think of all those friendships not only in the U.S.A. but our wonderful neighbors to the north — Canada — who I look forward to meeting every year.

And when you're a member, you have a voice in our organization. You count. I'm writing this today on November 7th (Election Day) which means we all count. We are free to nominate the candidate of our choice here in America. You really do make a difference.

So, see you in Dallas. You have no excuses now!

... From the 89th key, *Phyllis K. Tremper*

Some Notes To Enjoy

Non est ad astra mollis e terris via. The trip from the Earth to the stars is not easy. *Seneca*

Indvidus absit. Banish envy from your mind. *Virgil*

Necessitudo etiam timidos fortes facit. Necessity makes even cowards brave. *Sallust*

Venter praecepta non audit. The stomach does not hear advice. *Seneca*

Pares autem cum paribus congregantur. Birds of a feather flock together. *Cicero*

Felicitations To Our February Birthday Celibrants

Sara Hess	KS	1st
Patricia Nemecek	OR	10th
Laurie Snitchler	MI	15th
Miriam Snyder	PA	17th
Mary Adams	CA	18th
Martha Ellis	CA	22nd
Joyce Helzner	PA	23rd
Martha Strong	IN	23rd
Mimi Drasche	FL	24th
Lois Connelly	PA	28th

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